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NAS CECIL FIELD
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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5 AND 6 (OU3) (OU4) (OU5) (OU6) VOLUME I NAS CECIL FIELD FL

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ABB ENVIRONMENTAL

VOLUME I

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY WORKPLAN

OPERABLE UNITS 3, 4, 5, AND 6

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Unit Identification Code (UIC) No. N60200

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FOREWORD

The Department of the Navy developed the Installation Restoration (IR) program to locate, identify, and remediate environmental contamination from the past disposal of hazardous materials at Navy and Marine Corps installations. The Navy's IR program follows the Department of Defense's environmental restoration program mandated by the Superfund Amendments and Reauthorization Act (SARA) of 1986 to address waste sites that may pose a threat to human health or the environment.

The Navy's IR program consists of Preliminary Assessment and Site Inspection, Remedial Investigation and Feasibility Study (RI/FS), and Remedial Design and Remedial Action at sites where hazardous materials were possibly disposed. The Preliminary Assessment and Site Inspection identify the presence of pollutants. The RI/FS analyzes the nature and extent of contamination and determines the optimum remedial solution. The Remedial Design and Remedial Action complete the implementation of the solution.

Previous investigations have determined that Naval Air Station (NAS) Cecil Field has 19 sites that may pose a threat to human health or the environment. Therefore, an RI/FS will be performed at each site to address the extent and magnitude of contamination.

This document presents the workplan, sampling and analysis plan (SAP), and health and safety plan (HASP) for conducting the RI/FS for Operable Units 3, 4, 5, and 6, which include Sites 7, 8, 10, 11, 14, and 15. The workplan discusses the history and environmental setting of the sites, and presents the RI/FS rationale and scope of work. The SAP focuses on the field investigative procedures, analytical methods, and quality assurance and quality control (QA/QC) procedures. The HASP outlines the health and safety procedures for all field tasks.

Questions regarding this report should be addressed to the Commanding Officer, Code 00B, P.O. Box 111, NAS Cecil Field, Jacksonville, Florida 32215-0111.

PREFACE

The planning documents prepared to support the Remedial Investigation and Feasibility Study (RI/FS) activities for operable units (OUs) 3, 4, 5, and 6 at Naval Air Station (NAS) Cecil Field consist of the following three volumes:

- Volume I, Workplan;
- Volume II, Sampling and Analysis Plan (incorporating both the Field Sampling Plan and the Quality Assurance Project Plan); and
- Volume III, Health and Safety Plan.

Together, the three volumes present the scope of the RI/FS activities. The workplan (Volume I) describes the features of each site, provides a record of the facility and site history, describes the environmental factors, details previous investigative results, provides an initial evaluation of each site, presents the RI approach, details the RI/FS tasks, and outlines the project schedule.

The sampling and analysis plan (SAP; Volume II) focuses on the field investigative procedures, analytical methods, and quality assurance and quality control (QA/QC) procedures. The SAP provides a project description, describes site management and field methods, details the technical approach and sampling plans, and describes the QA/QC requirements for sample collection, sample handling, sample analysis, data assessment, corrective action, and reporting.

The Health and Safety Plan (HASP; Volume III) outlines the health and safety procedures for all field tasks. The HASP includes material safety data sheets for chemicals that may be encountered at each site and provides emergency information and telephone numbers.

Volumes I through III of the RI/FS planning documents for OUs 3, 4, 5, and 6 have been prepared by CDM Federal Programs Corporation (CDM Federal) and ABB Environmental Services, Inc. (ABB-ES), under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) contract (contract number N62467-89-D-0317). The format and scope of these documents are in compliance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (U.S. Environmental Protection Agency [USEPA], 1988a) and *Navy/Marine Corps Installation Restoration Manual*, (Department of the Navy [DON] 1992), as well as other applicable USEPA and DON guidance documents.

The RI technical approach developed for each site comprising OUs 3, 4, 5, and 6 are based on several considerations including: (1) the physical characteristics and geographic location of the site, (2) the history and previous use of the site, (3) the results and conclusions of previous investigations, and (4) site reconnaissance. The primary objectives of the RI are to collect sufficient data to: characterize and quantify the nature and extent of contamination, assess potential risks to human health and the environment posed by contaminants of concern, support an FS at sources of contamination where remedial action is warranted, and support a Record of Decision (ROD) for each operable unit addressed. The FS is designed to screen and evaluate potential remedial alternatives, and to conduct treatability studies to evaluate the suitability of remedial technologies to site conditions and problems.

Note that the Base Conversion and Redevelopment Commission is developing a reuse plan for NAS Cecil Field in anticipation of the DON releasing the property. Simultaneously, the Base Realignment and Closure (BRAC) Cleanup Team (BCT) is developing a strategy to address environmental issues at the facility. The BCT strategy integrates the activities under the Installation Restoration (IR) program (including this RI/FS) with the operating compliance program and the closure compliance program. The BCT strategy supports full restoration of NAS Cecil Field. The DON is the lead agency in implementing this strategy; however, decisions regarding the BCT strategy are being made jointly by the DON, USEPA, and the Florida Department of Environmental Protection (FDEP).

EXECUTIVE SUMMARY

Naval Air Station (NAS) Cecil Field is located in the northeastern part of Florida, approximately 14 miles southwest of Jacksonville, Florida. Based on the U.S. Environmental Protection Agency's (USEPA) evaluation of data collected during previous investigations, the NAS Cecil Field has been listed on the National Priority List (NPL) for Uncontrolled Hazardous Waste Sites, according to Title 40, Code of Federal Regulations, Part 300 (40 CFR 300, August 30, 1990). The NPL was initially promulgated as Appendix C of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) on September 8, 1983.

Based on previous investigations, USEPA, Florida Department Environmental Protection (FDEP), and the Navy have determined that NAS Cecil Field has approximately 19 Potential Sources of Contamination (PSCs) or sites (hereinafter, the investigative areas will be referred to as "sites") to be investigated under the Federal Facility Agreement that may pose a threat to human health or the environment. Remedial Investigation and Feasibility Studies (RI/FS) are being planned and conducted at NAS Cecil Field to assess the extent, magnitude, and impact of any confirmed contamination at these sites, and to develop appropriate remediation for sites that are determined to pose a threat to human health and/or the environment. Most of these sites have been initially grouped into (operable units) OUs based on the types of potential waste disposed at each site, the common chemical characteristics of the suspected contaminants, and shared potential migratory pathways or potential receptors. This workplan addresses the RI/FS activities to be conducted for OUs 3, 4, 5, and 6, which consist of the following six sites:

- OU 3 Site 7, Old Firefighter Training Area;
  Site 8, Firefighter Training Area, Boresite Test Range, and Hazardous Waste Storage Area;
- OU 4 Site 10, Rubble Disposal Area;
- OU 5 Site 14, Blue 5 Ordnance Disposal Area;
  Site 15, Blue 10 Ordnance Disposal Area; and
- OU 6 Site 11, Pesticide Disposal Area.

The results of the previous investigations indicate that various media at these six sites may be contaminated with hazardous substances. The primary constituents identified during the previous investigations at these sites include the following:

- Site 7, metals (cadmium, chromium, and lead) and volatile organics (benzene and methylene chloride);
- Site 8, metals (lead) and volatile organics (1,1,1-trichloroethane and methylene chloride);
- Site 10, metals (chromium, lead, and mercury), extractable organics (bis(2-ethylhexyl)phthalate), and volatile organics (trichloroethene and trans-1,3-dichloropropene);

- Site 14, volatile organics (1,1,1-trichloroethane);
- Site 15, metals (lead) and extractable organics (polynuclear aromatic hydrocarbons); and
- Site 11, metals (chromium, lead, and arsenic), volatile organics (1,1,1-trichloroethane, toluene, and methylene chloride) and pesticides and herbicides (1,2-dibromo-3-chloropropane, parathion, alpha-benzene hexachloride (BHC), gamma-BHC, 2,4-dichlorophenoxyacetic acid, and toxaphene).

The purpose of the RI/FS process is to gather, as quickly and cost effectively as possible, enough information about the site to support an informed risk management decision regarding which remedy appears to be most appropriate for the site. Given the information contained in the existing database, the following list of general data requirements was developed for completion of the RI/FS for each of the six sites comprising OUs 3, 4, 5, and 6:

- the nature and extent of soil contamination resulting from previous activities at each site;
- the nature and extent of groundwater contamination resulting from previous activities at each site;
- the nature and extent of surface water and sediment contamination in the tributaries and drainage ditches at Sites 8, 10, 14, and 15 resulting from previous activities at these sites (surface water and sediment are not found at Sites 7 and 11);
- the nature and extent of contamination in tissues of ecological receptors resulting from previous activities at each site; and
- the shallow and intermediate aquifer system characteristics at each site including the groundwater flow directions and hydraulic gradients onsite and offsite, hydraulic properties (i.e., hydraulic conductivities), contaminant transport properties (i.e., distribution coefficients), and the groundwater and surface water interactive flows at streams located near the sites.

Once these data are obtained, a baseline risk assessment can be performed, and the development of a technologically sound and cost-effective alternative for remediation of each OU can be achieved.

The scope of work for this RI/FS is divided into the following nine major tasks.

- Field Investigation includes performance of all field activities including installation of monitoring wells; soil boring; sampling and analysis of soil, sediment, surface water, and groundwater; aquifer testing and measurement; soil testing; and ground surveying.
- Sample Management and Validation includes the management, analysis, and validation of samples collected during the field investigation.

- <u>Data Evaluation</u> includes analyses of data collected during the field investigation (once they have been verified for acceptable accuracy, completeness, and representativeness) to describe the nature and extent of contamination, transport processes and mechanisms, physiographic conditions, and receptor locations.

- <u>Baseline Risk Assessment</u> includes assessment of the potential impacts on public health, welfare, and the environment from actual contaminant releases resulting from past activities at the sites.

- <u>Treatability Studies Planning</u> includes evaluation of candidate technologies and the need for pilot- or bench-scale studies to determine the feasibility of these technologies.

- <u>Remedial Investigation Reports</u> are the documentation of the RI results and conclusions in an RI report.

- <u>Remedial Alternatives Development and Screening</u> is the assembly and selection of appropriate remedial alternatives to undergo full evaluation.

- <u>Detailed Analysis of Alternatives</u> includes full analyses and comparisons of the screened alternatives.

- <u>Feasibility Study Report</u> is the documentation of the FS results in an FS report.

The format and scope of this RI/FS workplan is in compliance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a) and *Navy/Marine Corps Installation Restoration Manual* (DON, 1992).

TABLE OF CONTENTS

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

TABLE OF CONTENTS (Continued)

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

TABLE OF CONTENTS (Continued)

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

LIST OF FIGURES

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

LIST OF TABLES

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AIMD	Aircraft Intermediate Maintenance Department
AQUIRE	USEPA Aquatic Information Retrieval database
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AWQC	Ambient Water Quality Criteria
BCT	BRAC Cleanup Team
BESD JAX	Bio-Environmental Services Division, City of Jacksonville
BHC	benzene hexachloride
bls	below land surface
BRA	baseline risk assessment
BRAC	Base Realignment and Closure
CAD	cartridge activated devices
CAMUs	Corrective Action Management Units
CDM Federal	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action, Navy
CLP	Contract Laboratory Program
COPCs	contaminants of potential concern
CSFs	cancer slope factors
DOD	Department of Defense
DON	Department of the Navy
DQOs	Data Quality Objectives
°F	degrees Fahrenheit
E	endangered
EBS	Environmental Baseline Survey
ECPCs	ecological contaminants of potential concern
EPC	exposure point concentration
ERA	ecological risk assessment
ELCR	excess lifetime cancer risk
EM	electromagnetic
ESP	Environmental Services and Permitting
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FFA	Federal Facility Agreement
FGS	Florida Geologic Survey
FID	flame ionization detector
FNAI	Florida Natural Areas Inventory
FTA	firefighter training area
ft/day	feet per day
gpd/ft	gallons per day per feet

GLOSSARY (Continued)

HASP	Health and Safety Plan
HEAST	Health Effects Summary Tables
HHCPCs	human health contaminants of potential concern
HHRA	human health risk assessment
HI	hazard index
HLA	Harding Lawson Associates
HQ	hazard quotient
HRS	Health and Rehabilitative Services
HSA	hollow stem augering
IAS	Initial Assessment Study
IR	Installation Restoration
IRIS	Integrated Risk Information System
LANTARPLX	Land Target Complex
LZS	lower zone of surficial aquifer
LD_{50}	lethal dose (50)
MCLs	maximum contaminant levels
MCLGs	maximum contaminant level goals
mg	milligrams
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
meq/ℓ	milliequivalents per liter
msl	mean sea level
μg/ℓ	micrograms per liter
μg/kg	micrograms per kilogram
N	north
NAAS	Naval Auxiliary Air Station
NACIP	Navy Assessment and Control of Installation Pollutants
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NE	northeast
NFD	Naval Fuel Depot
NGVD	National Geodetic Vertical Datum
NPL	National Priority List
NSF	National Sanitation Foundation
NSPS	New Source Performance Standards
NTU	nephelometric turbidity unit
NW	northwest
ODEX	reverse circulation
OLF	Outlying Landing Field
OU	operable unit
PAH	polynuclear aromatic hydrocarbons
Pb	lead
PCBs	polychlorinated biphenyls
POTWs	publicly owned treatment works

PSC	potential source of contamination
PVC	polyvinyl chloride
QA/QC	quality assurance and quality control
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RfDs	reference doses
RFI	Resource Conservation and Recovery Act (RCRA) Facility Investigation
RGO	remedial goal options
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RTVs	Reference Toxicity Values
S	south
S2	imperiled in State because of rarity (6 to 20 occurrences or less than 3,000 individuals) or because of vulnerability to extinction due to some biological or manmade factor
S3	either very rare and local throughout its range (21 to 100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction because of other factors (ESP, 1990)
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SE	southeast
SJRWMD	St. Johns River Water Management District
SMP	Site Management Plan
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SQL	sample quantitation limit
SSC	species of special concern
SVCs	Screening Criteria Values
SVOCs	semivolatile organic compounds
SW	southwest
T	threatened
TAL	target analyte list
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
tetryl	trinitrophenyl methylnitramine
TIC	tentatively identified compound
TKN	total Kjeldahl nitrogen
TNT	trinitrotoluene
TOC	total organic carbon
TPH	total petroleum hydrocarbon
T(S/A)	threatened due to similarity of appearance

TSDFs	treatment, storage, and disposal facilities
TSS	total suspended solids
TUs	Temporary Units
UCL	upper confidence limit
UIC	Unit Identification Code
UR1	under review for Federal listing, with substantial evidence in existence indicating at least some degree of biological vulnerability and/or threat
UR2	under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking
UR5	still formally under review for listing, but no longer considered for listing because recent information indicates species is more widespread or abundant than previously believed
USC	United States Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USEPA	U.S. Environmental Protection Agency
USN	U.S Navy
UZH	upper water-bearing zone of the Hawthorn
UZS	upper zone of surficial aquifer
VFR	Visual Flight Rules
VLF	very low frequency
VOCs	volatile organic compounds
W	west
WSW	west southwest

1.0 INTRODUCTION

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), and as directed in Executive Order 12580 of January 1987, the Department of Defense (DOD) is conducting an Installation Restoration (IR) program for evaluating and remediating problems related to releases and disposal of toxic and hazardous materials at DOD facilities. The Navy Assessment and Control of Installation Pollutants (NACIP) program was developed by the Navy and has been modified to implement the IR program for all naval and Marine Corps facilities.

The NACIP program was originally conducted in three phases: (1) Phase I, Initial Assessment Study; (2) Phase II, Confirmation Study (including a Verification Step and a Characterization Step); and (3) Phase III, Planning and Implementation of Remedial Measures. The three-phase IR program was modified in 1987-88 to be consistent with CERCLA and SARA. The updated nomenclature for the Remedial Investigation and Feasibility Study (RI/FS) process is as follows:

- Preliminary Assessment and Site Inspection,
- Remedial Investigation,
- Feasibility Study, and
- planning and implementation of remedial design.

In addition to these programs, military facilities are subject to regulations promulgated by the 1976 Resource Conservation and Recovery Act (RCRA) and the 1984 Hazardous and Solid Waste Amendments. Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) has the responsibility for administration of the Navy IR program in the southeastern United States.

Naval Air Station (NAS) Cecil Field is located in the northeastern part of Florida, approximately 14 miles southwest of Jacksonville, Florida. Based on the U.S. Environmental Protection Agency's (USEPA) evaluation of data collected during previous investigations, the NAS Cecil Field has been listed on the National Priority List (NPL) for Uncontrolled Hazardous Waste Sites, according to Title 40, Code of Federal Regulations, Part 300 (40 CFR 300, August 30, 1990). The NPL was initially promulgated as Appendix C of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) on September 8, 1983.

Based on previous investigations, 19 potential sources of contamination (PSCs) or sites (hereinafter, the investigative areas will be referred to as "sites") to be investigated under the Federal Facility Agreement (FFA) at NAS Cecil Field that may pose a threat to human health or the environment have been identified. RI/FSs are being planned and conducted at NAS Cecil Field to assess the extent, magnitude, and impact of any confirmed contamination at these sites, and to develop appropriate remediation for sites that are determined to pose a threat to human health and/or the environment. Most of these sites have been initially grouped into operable units (OUs) based on the types of potential waste disposed at each site, the common chemical characteristics of the suspected contaminants, and shared potential migratory pathways or potential receptors. This workplan addresses the RI/FS activities to be conducted for OUs 3, 4, 5, and 6, which consist of the following six sites:

- OU 3 Site 7, Old Firefighter Training Area;
  Site 8, Firefighter Training Area, Boresite Test Range, and Hazardous Waste Storage Area;

- OU 4 Site 10, Rubble Disposal Area;

- OU 5 Site 14, Blue 5 Ordnance Disposal Area;
  Site 15, Blue 10 Ordnance Disposal Area; and

- OU 6 Site 11, Pesticide Disposal Area.

The results of the previous investigations indicate that various media at these six sites may be contaminated with hazardous substances. The primary constituents identified during the previous investigations at these sites include the following:

- Site 7, metals (cadmium, chromium, and lead) and volatile organics (benzene and methylene chloride);

- Site 8, metals (lead) and volatile organics (1,1,1-trichloroethane and methylene chloride);

- Site 10, metals (chromium, lead, and mercury), extractable organics (bis(2-ethylhexyl)phthalate), and volatile organics (trichloroethene and trans-1,3-dichloropropene);

- Site 14, volatile organics (1,1,1-trichloroethane);

- Site 15, metals (lead) and extractable organics (polynuclear aromatic hydrocarbons); and

- Site 11, metals (chromium, lead, and arsenic), volatile organics (1,1,1-trichloroethane, toluene, and methylene chloride), and pesticides and herbicides (1,2-dibromo-3-chloropropane, parathion, alpha-benzene hexachloride [BHC], gamma-BHC, 2,4-dichlorophenoxyacetic acid, and toxaphene).

The results of the previous investigations are discussed in more detail in Chapters 2.0 and 3.0.

The purpose of the RI/FS process is to gather, as quickly and cost effectively as possible, enough information about the site to support an informed risk management decision regarding which remedy appears to be most appropriate for the site. The RI serves as the mechanism for collecting data to characterize site conditions, determine the nature of the waste, assess risk to human health and the environment, and conduct treatability testing as necessary to evaluate the potential performance and cost of the treatment technologies being considered. The FS serves as the mechanism for development, screening, and detailed evaluation of alternative remedial actions. The various steps, or phases, of the RI/FS process are briefly described below.

- Scoping is the initial planning phase of the RI/FS, including the preliminary assessment and site inspection.

- Site Characterization is the definition of the nature and extent of contamination, identification of applicable or relevant and appropriate requirements (ARARs), and development of the baseline risk assessment.

- Development and screening of alternatives includes identification of potential treatment technologies, screening of these technologies, assembly of the technologies into alternatives, and screening of the alternatives.

- Treatability investigations are bench- or pilot-scale tests to assess the feasibility of a technology.

- Detailed analysis of alternatives is the further refinement of the alternatives, analysis of the alternatives with respect to nine evaluation criteria, and comparison of the alternatives against each other.

The RI and FS are usually conducted concurrently so that data collected in the RI influence the development of remedial alternatives in the FS, which in turn affects the data needs and scope of the treatability studies and any additional field investigations (USEPA, 1988a).

The primary objective of this RI/FS is to collect the additional data needed to support a risk assessment and provide a basis on which to recommend a subsequent remedial action plan for each OU, if necessary. The specific goals of this RI/FS include the following:

- identifying the nature of, and the areal and vertical extent of contamination (contaminant types, concentrations, and distributions) in soil, sediment, surface water, and groundwater at each of the six sites comprising OUs 3, 4, 5, and 6;

- estimating the hydraulic characteristics and contaminant transport mechanisms of the surficial and intermediate aquifers at the six sites;

- evaluating the potential migration rates and pathways of site contaminants;

- assessing public health risks and environmental impacts associated with the site contamination (i.e., performing a baseline human health and ecological risk assessment);

- identifying current Federal and State ARARs for site remediation;

- developing the remedial levels for contaminants found at the six sites;

- identifying technological options for cleaning up the site contamination and/or preventing further migration of contaminants offsite;

- performing bench or pilot scale treatability studies, as necessary, to evaluate the applicability of potential treatment technologies;

- assembling the technologies into remedial action alternatives and screening the alternatives to identify those that appear to be most promising with respect to effectiveness, implementability, and cost; and

- evaluating the screened remedial action alternatives in a manner that is consistent with the NCP and other regulatory requirements.

The scope of work for this RI/FS is divided into the following nine major tasks.

- Field Investigation includes performance of all field activities including field screening of surface soil, subsurface soil, and groundwater; installation of monitoring wells; soil boring; sampling and analyses of soil, sediment, surface water, and groundwater; aquifer testing and measurement; soil testing; and ground surveying.

- Sample Management and Validation includes the management, analysis, and validation of samples collected during the field investigation.

- Data Evaluation includes analyses of data collected during the field investigation (once they have been verified for acceptable accuracy, completeness, and representativeness) to describe the nature and extent of contamination, transport processes and mechanisms, physiographic conditions, and receptor locations.

- Baseline Risk Assessment includes assessment of the potential impacts on public health, welfare, and the environment from actual contaminant releases resulting from past activities at the sites.

- Treatability Studies Planning includes evaluation of candidate technologies and the need for pilot- or bench-scale studies to determine the feasibility of these technologies.

- Remedial Investigation Reports are the documentation of the RI results and conclusions in an RI report.

- Remedial Alternatives Development and Screening is the assembly and selection of appropriate remedial alternatives to undergo full evaluation.

- Detailed Analysis of Alternatives includes full analyses and comparisons of the screened alternatives.

- Feasibility Study Report is the documentation of the FS results in an FS report.

These tasks are described in more detail in Chapter 5.0. The format and scope of this RI/FS workplan is in compliance with *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988a) and *Navy/Marine Corps Installation Restoration Manual* (Department of the Navy [DON], 1992).

2.0 BACKGROUND AND PHYSICAL SETTING

Before the activities necessary to conduct an RI/FS can be planned, it is important to compile the available data that have been previously collected for the six sites comprising OUs 3, 4, 5, and 6. These data can be used to identify the additional work to be conducted and avoid duplication of previous efforts. A more focused RI/FS can then be performed, which allows a more efficient use of resources. This chapter briefly summarizes the available data with regard to the physical setting of the NAS Cecil Field OUs and past operations.

2.1 FACILITY AND SITE DESCRIPTION. The following paragraphs provide background information on the location, physical features, demography, and surrounding land and water uses of NAS Cecil Field, as well as the six sites comprising OUs 3, 4, 5, and 6.

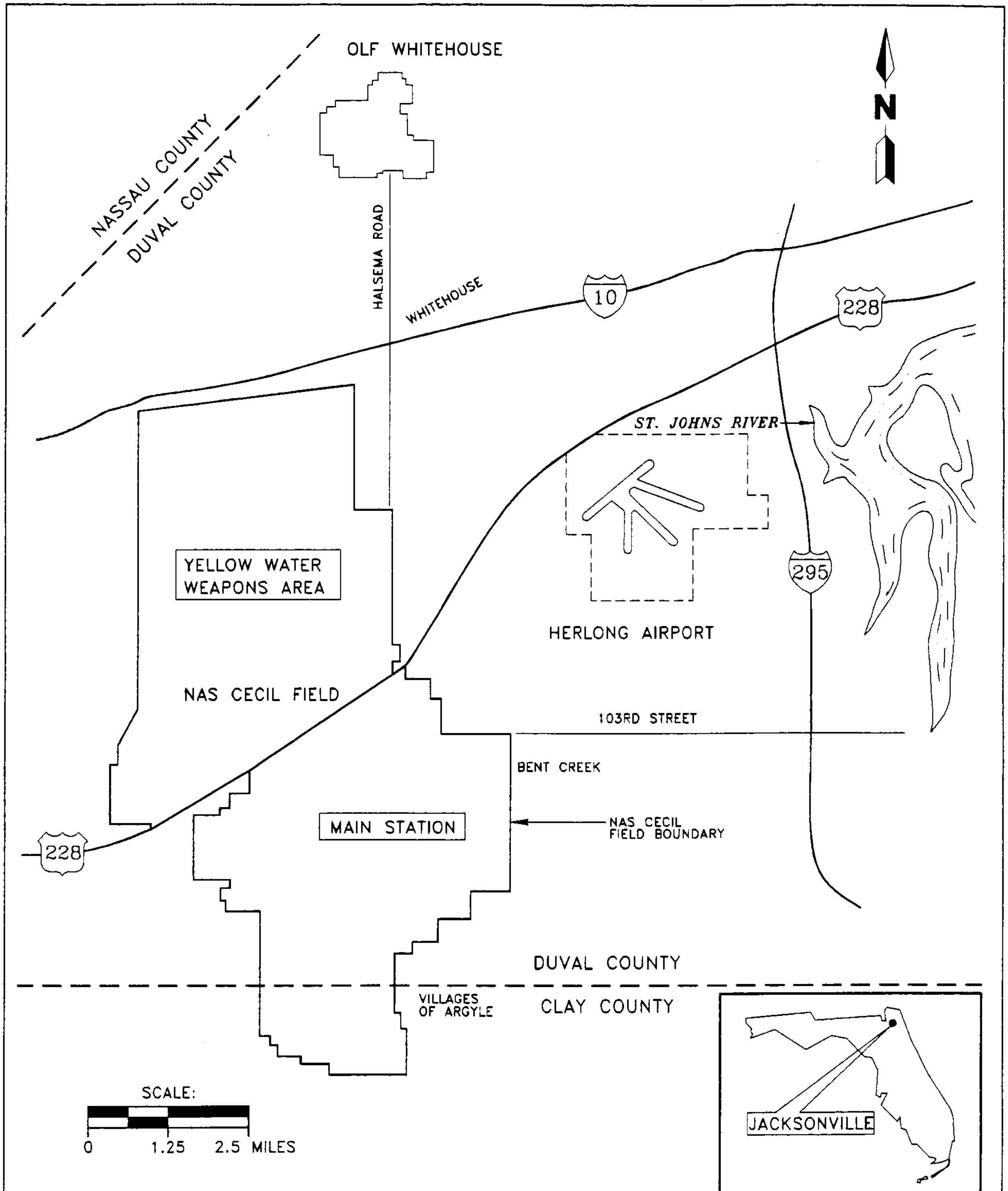
2.1.1 Location NAS Cecil Field is located in the northeastern part of Florida, primarily within Duval County with the southernmost part in Clay County. Downtown Jacksonville lies approximately 14 miles northeast of the facility's main entrance. The Georgia State line is located approximately 15 miles north. A general location map of NAS Cecil Field is provided in Figure 2-1. A site location map for the six sites comprising OUs 3, 4, 5, and 6 is provided in Figure 2-2.

NAS Cecil Field occupies more than 31,000 acres and can be divided into four distinct areas: the main station (NAS Cecil Field), which occupies 9,516 acres; the Yellow Water Weapons Area, which occupies 8,091 acres; Outlying Landing Field (OLF) Whitehouse, which occupies 2,587 acres; and the 11,072-acre Land Target Complex (LANTARPLX) Detachment Astor, which includes Pinecastle Electronic Warfare Range, Stevens Lake, Lake George, and Rodman ranges. The contiguous main station and Yellow Water Weapons Area are bisected by State Road 228. OLF Whitehouse lies approximately 7 miles north of the main entrance. OUs 3, 4, 5, and 6 are located in NAS Cecil Field and the Yellow Water Weapons Area. OLF Whitehouse and LANTARPLX are not included in this RI/FS program and, therefore, are not discussed further in this workplan.

2.1.2 Physical Features Site maps for the six sites comprising OUs 3, 4, 5, and 6 are provided in Figures 2-3 through 2-8. As can be seen in these figures, the sites contain the following physical features.

- Site 7 consists of two former burning pads and one former unlined burning pit. An asphalt runway apron was constructed over most of the area and, thus, the locations of the pads and pit are not visually evident. Three monitoring wells installed during a previous investigation are also located at this site. The well construction details for these wells are provided in Appendix A.

- Site 8 consists of three unlined, bermed, burning pits. The site also contains a large backstop that was previously used to stop bullets during the testing of aircraft gunnery. In addition, a concrete runway covers part of the site. Four monitoring wells installed during a previous investigation are also located at this site. The well construction details for these wells are provided in Appendix A.



SOURCE: ADAPTED FROM ENVIRODYNE ENGINEERS, 1985

FIGURE 2-1
FACILITY LOCATION MAP

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REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

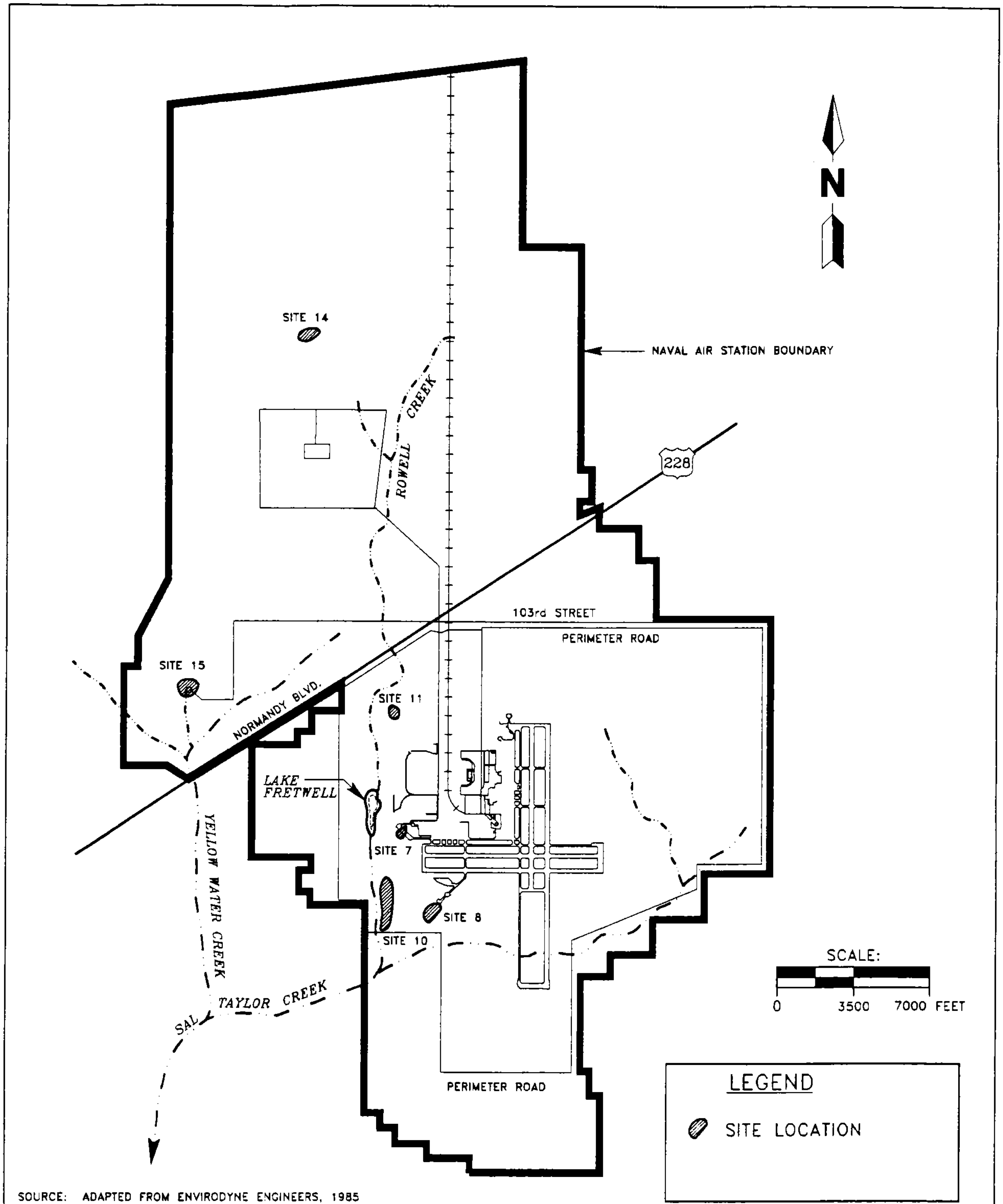

FIGURE 2-2
SITE LOCATION MAP

CDM\RISWP2\GLC\11-11-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

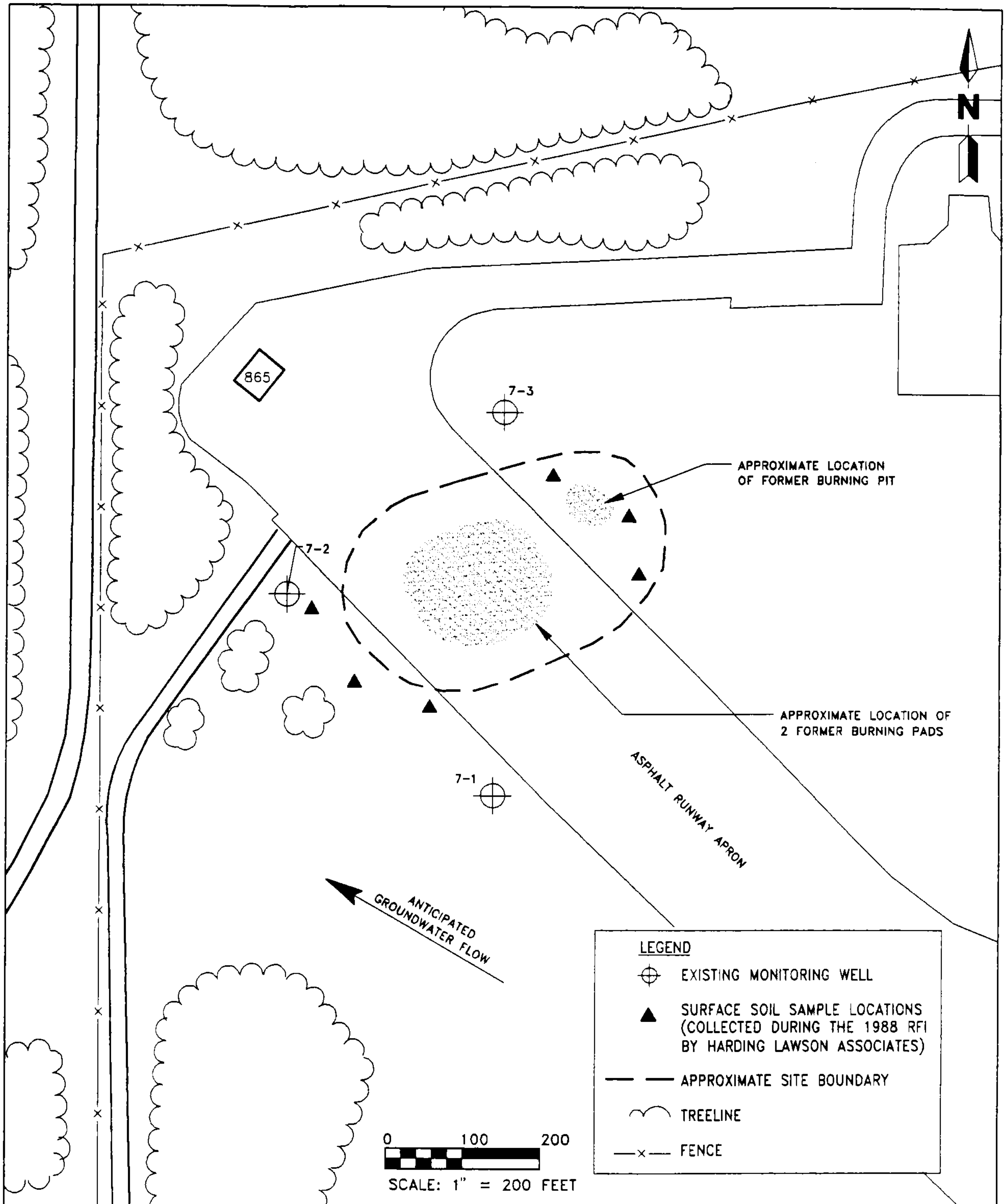

FIGURE 2-3
SITE 7 LAYOUT

CECIL\RISTE7\NP-GLC\11-11-94

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

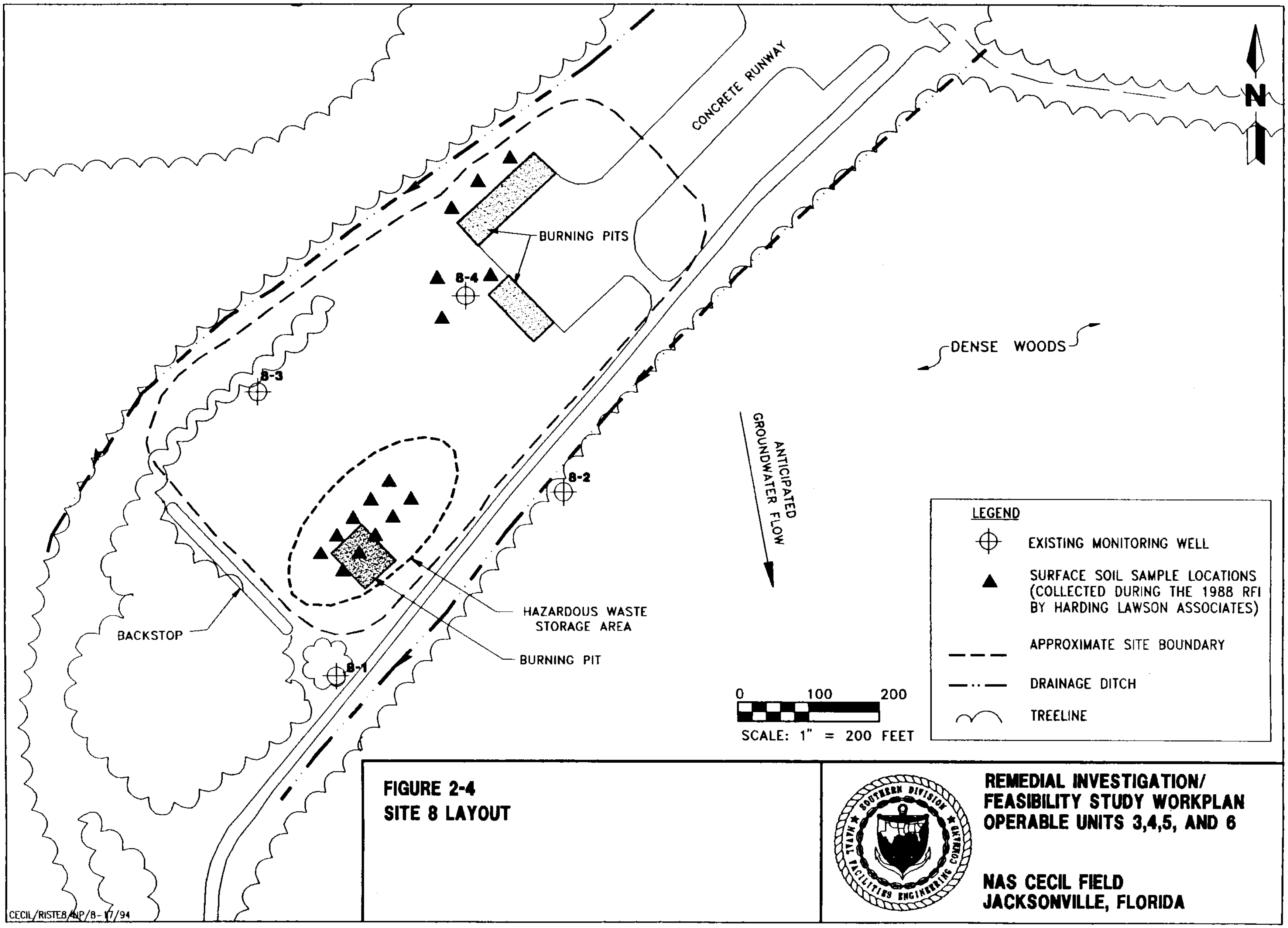

FIGURE 2-4
SITE 8 LAYOUT

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

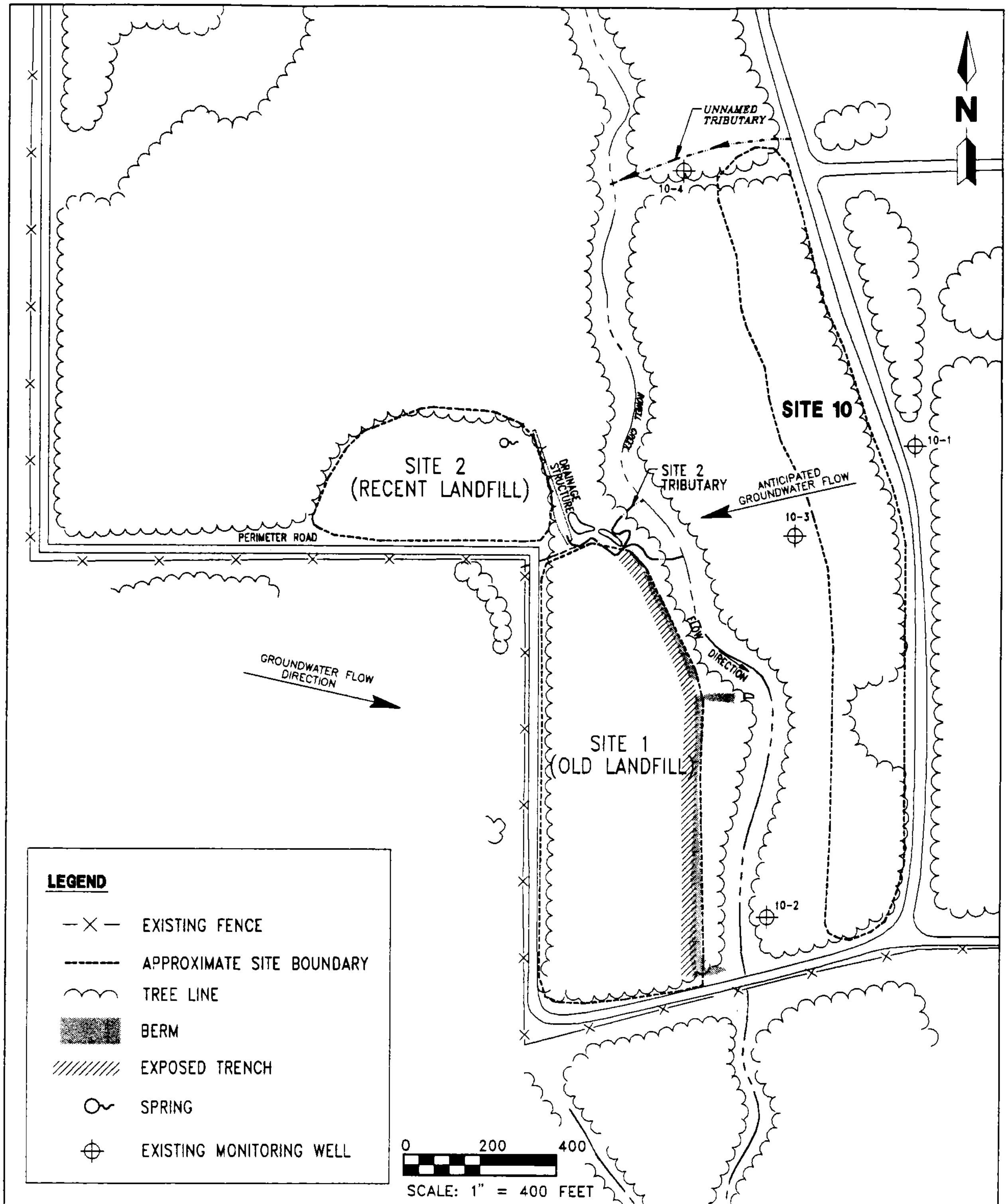

FIGURE 2-5
SITE 10 LAYOUT

CECIL/RISTE10/NP/8-12-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

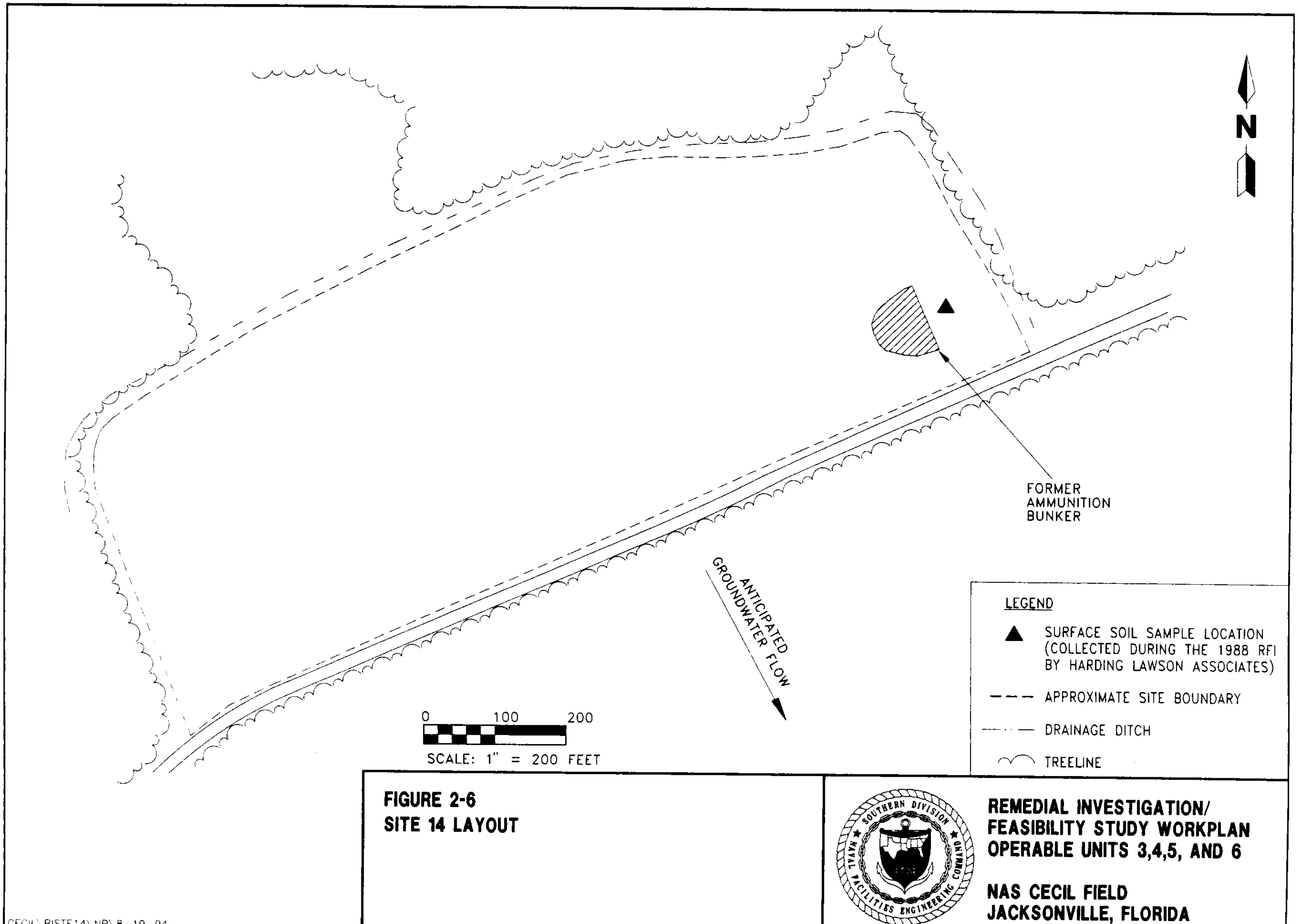

FIGURE 2-6
SITE 14 LAYOUT

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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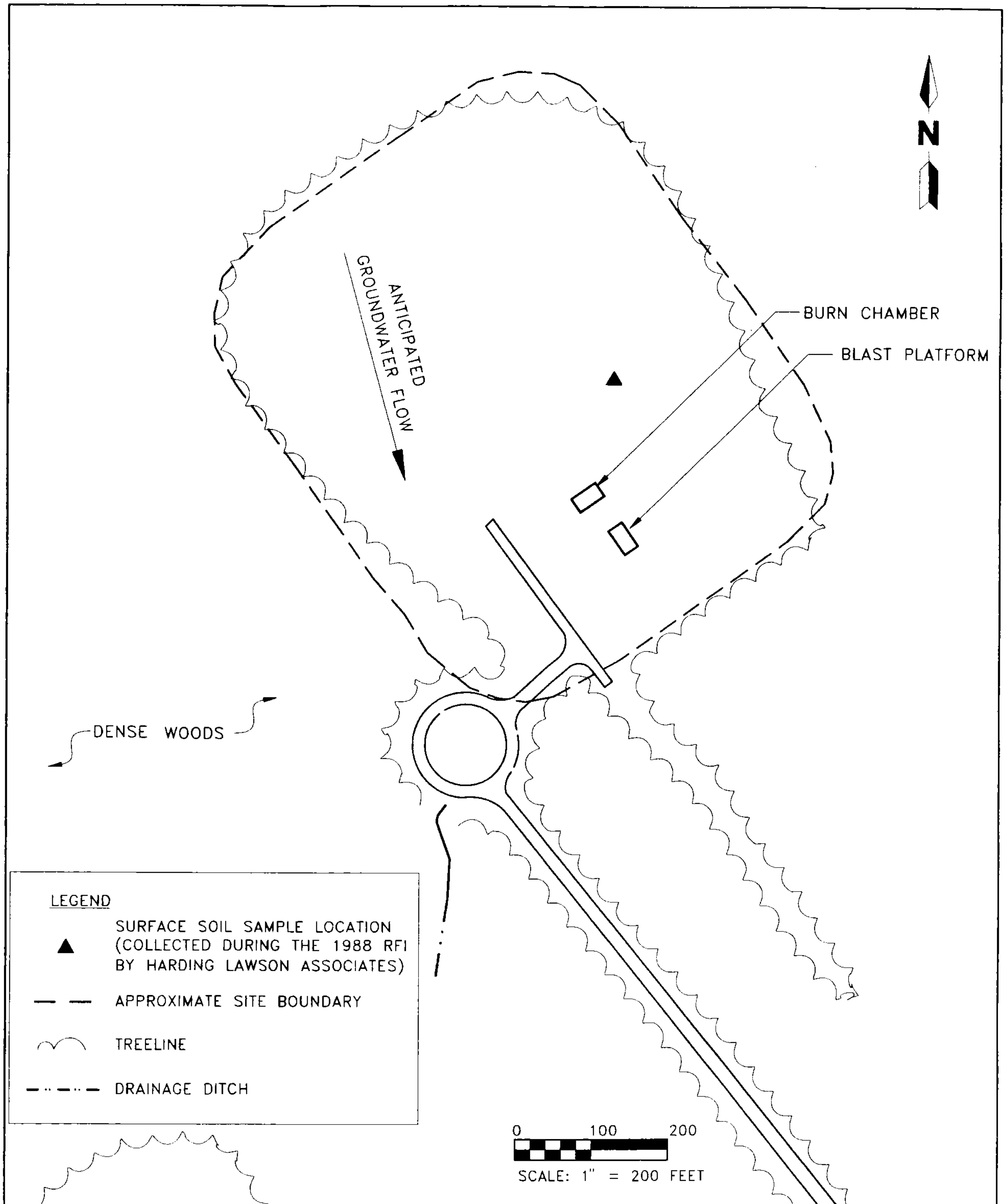


FIGURE 2-7
SITE 15 LAYOUT

CECIL\RISTE15\NP\8-12-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

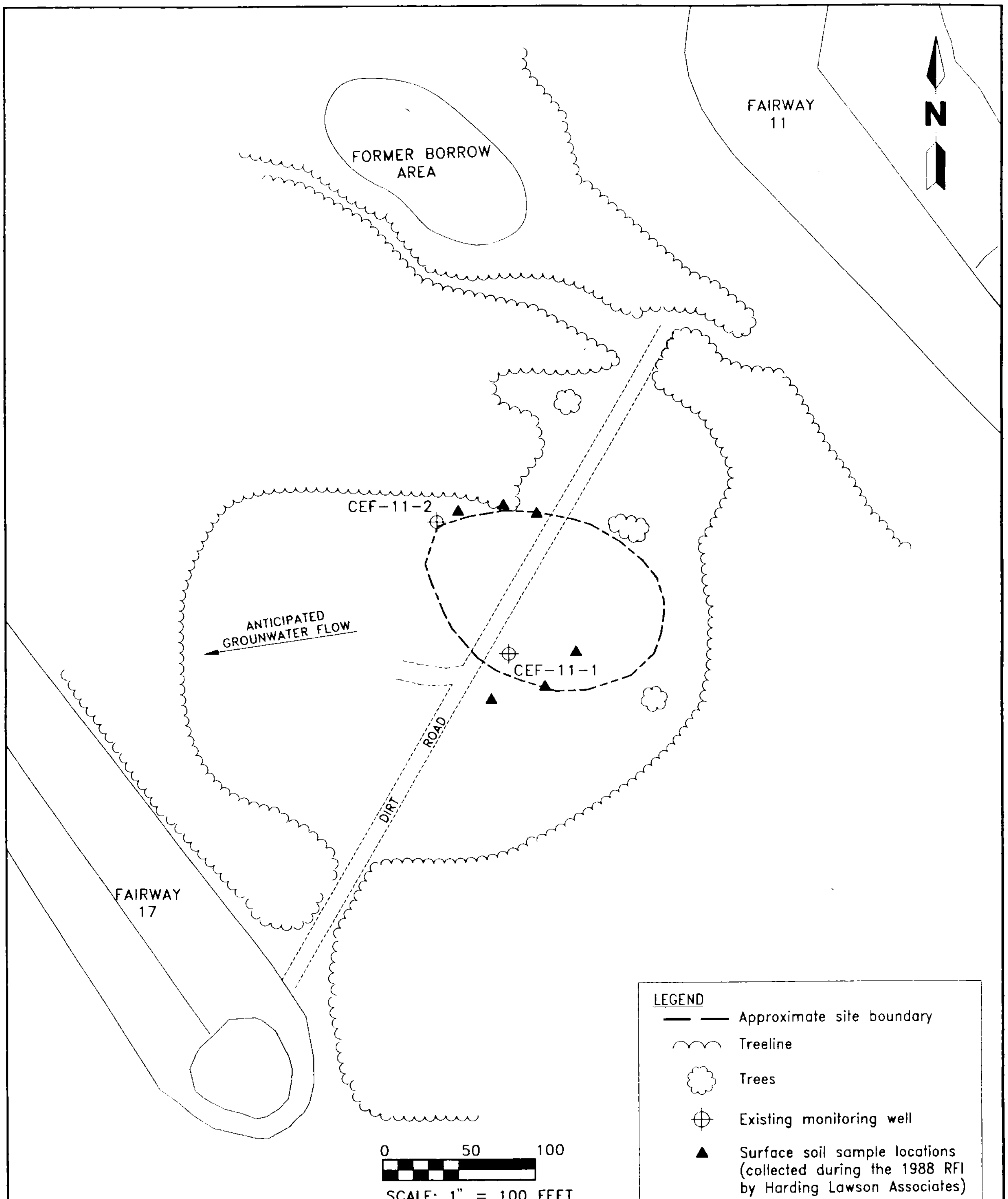


FIGURE 2-8
SITE 11 LAYOUT

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

CECIL/RISTE11/NP/8-9-94

- Site 10 is an approximate 6.5-acre demolition rubble disposal area. Visually apparent demolition debris, roadway concrete and asphalt, scrap metal, and furniture are present at this site. The site is currently overgrown with moderately dense, tall, vegetation. Four monitoring wells installed during a previous investigation are also located at this site. The well construction details for these wells are provided in Appendix A.

- Site 14 is an approximate 4-acre open field previously used for disposal of ordnance by detonation. A small bunker used formerly to store ordnance is located at this site. The site is overgrown by low-level vegetation.

- Site 15 is an approximate 2.5-acre open field previously used for disposal of ordnance by burning. A former metal burn chamber is located onsite. The site also contains a blast platform used to hold rockets for ignition. The site is overgrown by low-level vegetation.

- Site 11 is an approximate 5-acre wooded area previously used for disposal of pesticides. Contaminated soil is currently stockpiled near the center of the site along with overpack drums used to contain pesticide containers uncovered during a recent removal action. Most of the low-level vegetation has been cleared from the site and stockpiled along with scrap metal moved to conduct geophysical surveys. The remaining vegetation consists primarily of widely spaced tall trees. Two monitoring wells installed during a previous investigation are also located at this site. An Interim Remedial Action is planned for Fiscal Year 1995. The well construction details for these wells are provided in Appendix A.

2.1.3 Surrounding Land Uses The area immediately surrounding the base is rural in character and sparsely populated. The only major city within the area is Jacksonville, Florida. Surrounding land use is primarily forestry with some light agriculture and ranching use. Small communities and scattered dwellings associated with these activities are located in the vicinity. A small residential area on Nathan Hale Road, which abuts the NAS Cecil Field property to the west, is an example of these rural communities. The closest incorporated municipality is the town of Baldwin, which is centered approximately 6.4 miles to the northwest of the main station entrance.

To the east, the rural surroundings grade into a suburban fringe bordering the major east to west roadways. Low intensity commercial use, such as convenience stores and low density residential areas, characterize the land use. Herlong Airport lies approximately 4.5 miles northeast of NAS Cecil Field along State Road 228. The region becomes more urbanized as the city of Jacksonville is approached. A development called Villages of Argyle consisting of seven separate villages or communities, is located to the southeast of NAS Cecil Field. To the east, a golf course and residential area also border the base.

Land west and north of the base is characterized as rural and is predominantly forested. Cary State Forest is 5 miles to the northwest. The rural community of Whitehouse is nearly adjacent to OLF Whitehouse and is approximately 2 miles northeast of NAS Cecil Field. The rural community of Halsema is approximately 1.8 miles south of NAS Cecil Field.

The main station consists of intersecting north to south and east to west runways bracketing the flightline and support facilities. The activities occupy approximately 1,000 acres in the northwest quadrant of the station. The remaining acreage of the main station is mostly undeveloped.

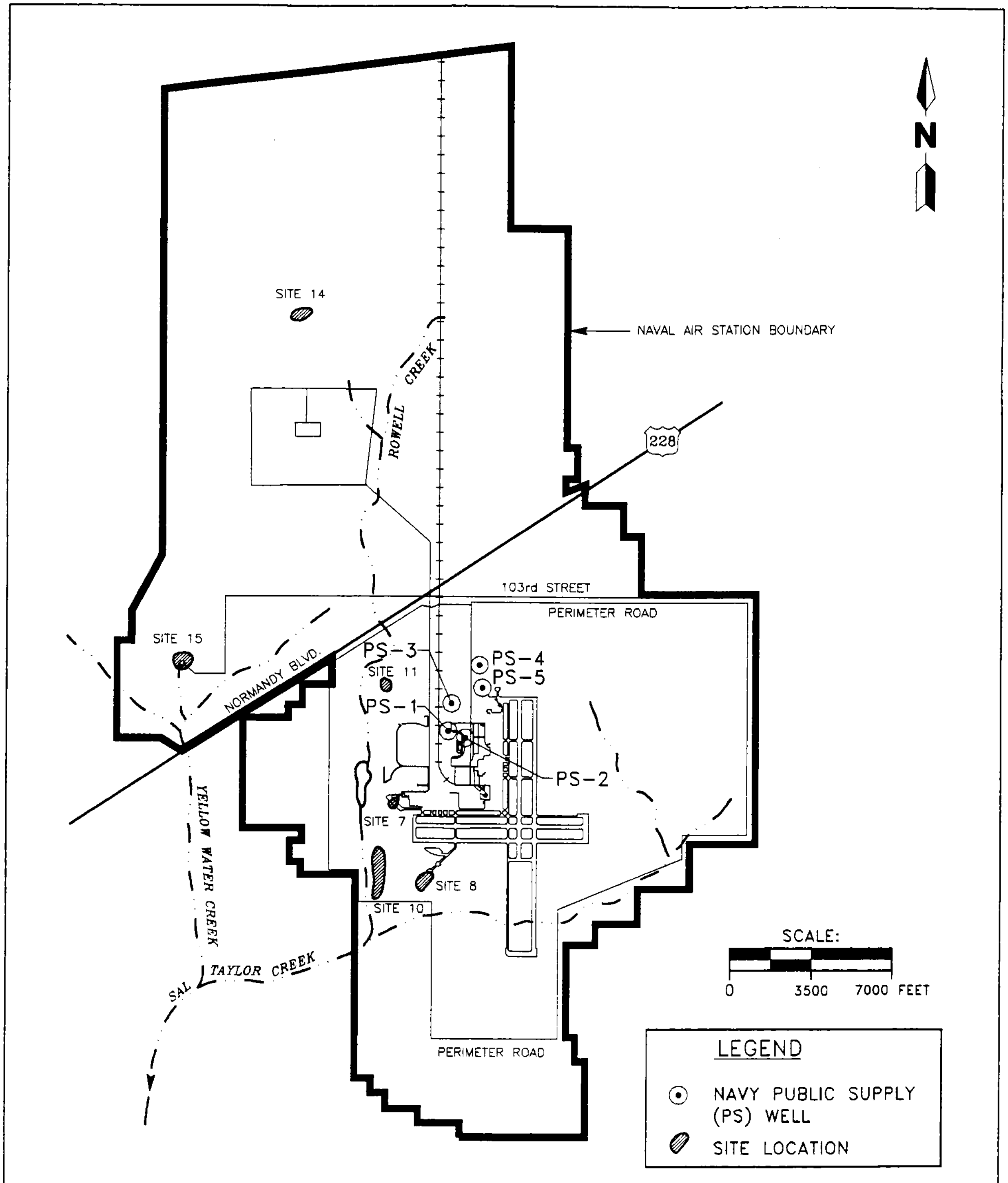
The Yellow Water Weapons Area activities are concentrated on about 500 acres in the center of this 8,091-acre area immediately north of Highway 228. The surrounding areas are mostly undeveloped except for housing located in the southwest quadrant.

2.1.4 Surrounding Water Uses NAS Cecil Field obtains its potable water from five supply wells screened within the Floridan aquifer system (described in Subsection 2.2.6). The locations of these wells are shown in Figure 2-9. These wells are screened at depths ranging from 400 to 800 feet below land surface (bls) (SOUTHNAVFACENGCOM, 1989a). Water is extracted from these wells and stored in reservoirs and elevated water tanks. There is one 500,000-gallon reservoir, one 200,000-gallon reservoir, and two 250,000-gallon elevated water tanks at NAS Cecil Field. The five wells have a combined capacity of approximately 4.8 million gallons per day (Envirodyne Engineers, 1985). Water from these wells is used for potable, industrial, and heating purposes. Treatment consists of chlorination and aeration. In addition, phosphate is added to boiler plant water. There has been no reported incidence of groundwater contamination in any of the wells at NAS Cecil Field tapping the Floridan aquifer system. The most recent analytical information from these wells indicates no detection of contaminants. There are no backup supplies of potable water. The Floridan aquifer system is one of the most productive aquifers in the world, and is also the primary source of water in Jacksonville for all uses.

Other wells on NAS Cecil Field reportedly tap the intermediate aquifer system (described in Subsection 2.2.6) (Geraghty & Miller, 1983). These wells are not a part of the NAS Cecil Field water supply system and are not used for drinking water. These wells are used as individual nonpotable water supplies along the outlying areas of the base that are not served by the main water system. Water from these wells is used for flushing toilets and irrigation (Envirodyne Engineers, 1985).

At least 50,000 homes in the Jacksonville Area also obtain water from private wells screened in the intermediate aquifer, which lies immediately below a clay and dolomite aquitard, separating it from the surficial aquifer. In addition, the Florida Department of Health and Rehabilitative Services estimates that there are approximately 75 private wells located within a 2-mile radius of NAS Cecil Field that are screened within the intermediate aquifer. Two potable supply wells are present in a small unincorporated community on Nathan Hale Road, immediately west of NAS Cecil Field and south of Normandy Boulevard (State Road 228). These two private wells are 64 and 125 feet deep (Geraghty & Miller, 1983).

Some wells in the Jacksonville area also obtain water from the surficial aquifer system (described in Subsection 2.2.6), which extends from land surface to the clay and dolomite aquitard. This water is primarily used for lawn irrigation and domestic purposes, including heat exchange units in heating and air conditioning systems. The yield of the wells is typically between 30 and 100 gallons per minute and water use estimates for the surficial aquifer system are approximately



SOURCE: ADAPTED FROM ENVIRODYNE ENGINEERS, 1985

FIGURE 2-9
POTABLE WATER SUPPLY WELLS AT NAS CECIL FIELD

H:\CDM\FIG2-9\GLC\11-11-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

10 to 25 million gallons per day for the City of Jacksonville (Jacksonville Planning Department, 1990).

Major surface water bodies in the area of NAS Cecil Field (Lake Fretwell, Brandy Creek, Sal Taylor Creek, Rowell Creek, Yellow Water Creek, Black Creek, and the St. Johns River) are classified by the Florida Department of Environmental Protection (FDEP) as Class III waters and, as such, are designated for recreation, propagation, and management of fish and wildlife, but are not used as drinking water resources (Jacksonville Area Planning Board, 1980). Lake Fretwell, located in the main station, is approximately 8 acres in size and is stocked with bass for sportfishing. A recreational complex has been developed along its northeastern shoreline (SOUTHNAVFACENGCOM, 1989b).

2.1.5 Demography In the Resource Availability Inventory Report distributed by the St. Johns River Water Management District (1990), the population of Duval County was reported to be increasing with time and continued growth is projected through the year 2000. The military personnel at NAS Cecil Field and surrounding military bases such as NAS Jacksonville, Naval Station Mayport, and Naval Fuel Depot (NFD) Jacksonville contribute significantly to this population. NAS Cecil Field is a subordinate command under the Commander Strikefighter Wings, Atlantic Fleet. The facility supports a workforce of approximately 10,000 civilian and military personnel and can accommodate approximately 3,500 residents in base quarters and housing.

No housing is present in the immediate vicinity of OUs 3, 4, 5, and 6. The OUs are located within the controlled access part of NAS Cecil Field and the Yellow Water Weapons Area and security passes are needed for admittance into these areas. However, the OUs are accessible once entrance to these areas have been attained as no fences have been constructed around the OUs.

2.2 ENVIRONMENTAL SETTING. This section presents a description of the environmental characteristics of the study area. Discussion of the environmental characteristics is divided into the following sections: climatology and meteorology, topography, hydrology, geology, soil, hydrogeology, and ecology.

2.2.1 Climatology and Meteorology The Jacksonville area has a climate approaching the semitropical range as it lies near the northern limit of the trade winds or the prevailing easterly breezes that moderate summer and winter temperatures. This influence is pronounced along the coast but decreases in the vicinity of NAS Cecil Field. Prevailing winds are generally northeasterly in the fall and winter and southwesterly in the spring and summer. Wind movement, which averages slightly less than 9 miles per hour, is usually 2 to 3 miles per hour greater in the early afternoon hours.

The annual mean temperature is 68 to 70 degrees Fahrenheit (°F) with an average summer maximum temperature of 82 to 83 °F. Between December and February the temperature averages 56 to 57 F°. Summer highs are in the middle to upper 90 °F and winter lows reach to the upper teens, although temperatures seldom drop below freezing.

The region experiences an average of 53 to 54 inches of rainfall per year, most of which accumulates during frequent summer rain showers. At times, 2 or 3 inches of rain may fall within 1 hour. Extended periods of dry weather may occur in any season but are most common in spring and fall. The relative humidity averages 87 percent, and the average annual sunshine is 62 percent of the maximum. Flying conditions are usually excellent, with NAS Jacksonville reporting 86 percent Visual Flight Rules (VFR) and NAS Cecil Field reporting 90 percent VFR. Table 2-1 provides a compilation of local climatological data.

Winds of hurricane force (75 miles per hour and above with resulting damage) can be expected once in 5 years with significant deviations from the average. Most occur in August, September, and October, although the 6-month period from June 1 to November 30 is considered the Atlantic hurricane season. On an average of once a year, NAS Cecil Field is in the predicted path of a hurricane.

2.2.2 Topography The topography of Duval County's 840 square miles is controlled by a series of ancient marine terraces that have been dissected and modified by stream erosion. These terraces were formed during Pleistocene times when the ocean stood at higher levels. As the sea dropped to a lower level, the sea floor emerged as a terrace marked by a low scarp. A gently undulating topography is formed by these north to south paralleling terraces. Generally, these terraces are interspaced with poorly drained areas and sizeable swamps (Jacksonville Area Planning Board, 1980).

NAS Cecil Field is located in the western part of Duval County. The terraces in the western part of the county range in elevation from 30 to 199 feet. The land surface there is irregular, consisting of hills, high plateaus, and some relatively steep scarps. Elevations at NAS Cecil Field range from 40 to 92 feet above mean sea level (msl). From the highest elevation of 199 feet above msl near the western extremity of Duval County, the land surface slopes gently eastward toward the ocean. A majority of the land area in the county has a slope of less than 1 percent (Jacksonville Area Planning Board, 1980).

2.2.3 Hydrology All surface water in Duval County is derived from rainfall within the county, except for a small amount of inflow from neighboring Baker County to the west (Anderson, 1972).

Surface drainage in Duval County consists of many short streams that serve as tributaries to four major water courses: the St. Johns River, the St. Marys River, the Nassau River, and the Intracoastal Waterway. Along the divides between the major drainage divisions, erosion has not been pronounced and, as a result, relatively wide and flat swampy areas remain. The flat swampy areas make delineation of some drainage areas difficult.

NAS Cecil Field lies mostly within the St. Johns River basin with a small part lying in the St. Marys River basin. Because of the extremely low gradient, the surface water divide between the St. Johns River basin and the St. Marys River basin is mobile, being dependent on severity and location of recent rain events.

Drainage at NAS Cecil Field consists of sheet flow across areas of low topographic relief combined with streams and canals of low order (having few to no tributaries). The surface runoff from NAS Cecil Field is conveyed by a system of storm sewers and vegetated ditches to the receiving streams bordering the facility, as shown in Figure 2-10. In the St. Johns River basin, from west to east, these streams include Yellow Water Creek, Rowell Creek, and Sal Taylor Creek. Sal Taylor Creek drains the eastern part of the facility, whereas Rowell Creek takes drainage from the central part and flows into Sal Taylor Creek in the

Table 2-1
Climatological Data

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Month	Air Temperature (°F)			Precipitation (inches)		Humidity (percent)		Wind Speed (knots)			Mean Number of Days:			
	Normal		Average Monthly	Normal Total	24 Hour Maximum	7:00 a.m.	1:00 p.m.	Mean Speed	Prevailing Direction	Maximum Speed and Direction	Clear	Partly Cloudy	Cloudy	Fog
	Maximum	Minimum												
January	67	45	56	2.45	3.02	87	56	7.5	NE	34 S	9	9	13	5
February	69	47	57	2.91	3.84	86	52	8.6	WSW	45 NE	9	7	12	4
March	73	51	62	3.49	3.21	85	49	8.5	NW	38 W	9	10	12	3
April	80	58	69	3.55	4.88	84	47	8.3	SE	42 SW	10	10	10	2
May	86	65	76	3.47	5.09	83	48	7.8	WSW	44 East	10	12	9	2
June	91	71	81	6.33	5.93	85	55	7.6	SW	66 NE	6	12	12	1
July	92	73	83	7.68	10.09	87	57	7.0	SW	43 SW	4	15	12	1
August	91	73	82	6.85	7.93	90	59	6.7	SW	3 NE	5	16	10	1
September	88	71	79	7.56	10.17	90	62	7.8	NE	71 N	5	11	14	1
October	80	62	71	5.16	6.66	90	57	7.8	NE	63 East	11	8	12	3
November	72	51	62	1.69	4.21	88	55	7.5	NE	52 S	12	8	10	5
December	67	45	56	2.22	2.51	88	57	7.2	NW	54 N	9	9	13	5

Notes: Table adapted from NAS Cecil Field Master Plan (SOUTHNAVFACENGCOM, 1989b).

°F = degrees Fahrenheit.
NE = northeast.
S = south.
WSW = west southwest.
NW = northwest.
W = west.
SE = southeast.
SW = southwest.
N = north.
SOUTHNAVFACENGCOM = Southern Division, Naval Facilities Engineering Command.

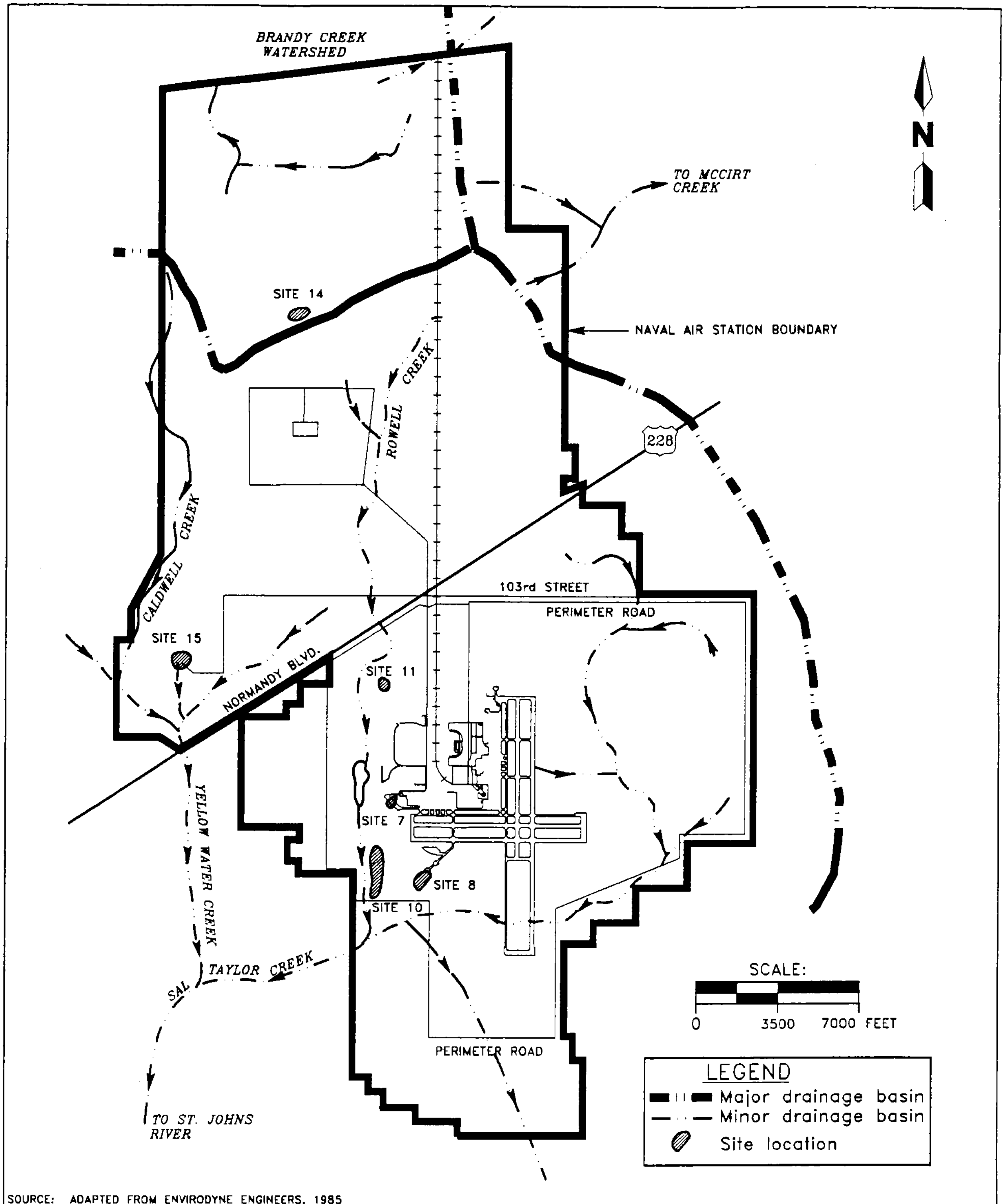


FIGURE 2-10
SURFACE WATER DRAINAGE SYSTEM AT NAS CECIL FIELD

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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south central part of the facility. Sal Taylor Creek then flows west into Yellow Water Creek, which flows southward eventually joining Black Creek, which is a tributary to the St. Johns River. The St. Johns River drains to the Atlantic Ocean with the lower section influenced by tides.

In the St. Marys River basin (the northern part of the Yellow Water Weapons Area), sheet flow and swampy areas eventually drain into the Brandy Branch, which is a tributary of the St. Marys River.

Sal Taylor Creek has the lowest channel slope in the area (approximately 5 feet per mile), whereas Rowell Creek (approximately 8 feet per mile) and Yellow Water Creek (approximately 7 feet per mile) both have significantly larger average channel slopes. In their upper reaches, the major streams (Yellow Water, Rowell, and Sal Taylor) tend to have relatively low slopes (approximately 5 feet per mile) and slightly incised stream beds whereas downstream slopes tend to be greater (approximately 10 feet per mile) and stream beds are much more deeply incised. At the point these streams increase in slope, they begin to form swampy floodplains. This moist condition, combined with known surficial water table elevations, suggests that the creeks begin to gain base flow from the surficial aquifer system, while the erodability of floodplain sediment is increased by saturation. This greater base flow would increase the stream's ability to cut into its bed and transport the sediment downstream, while the valley floor's erodability is increased.

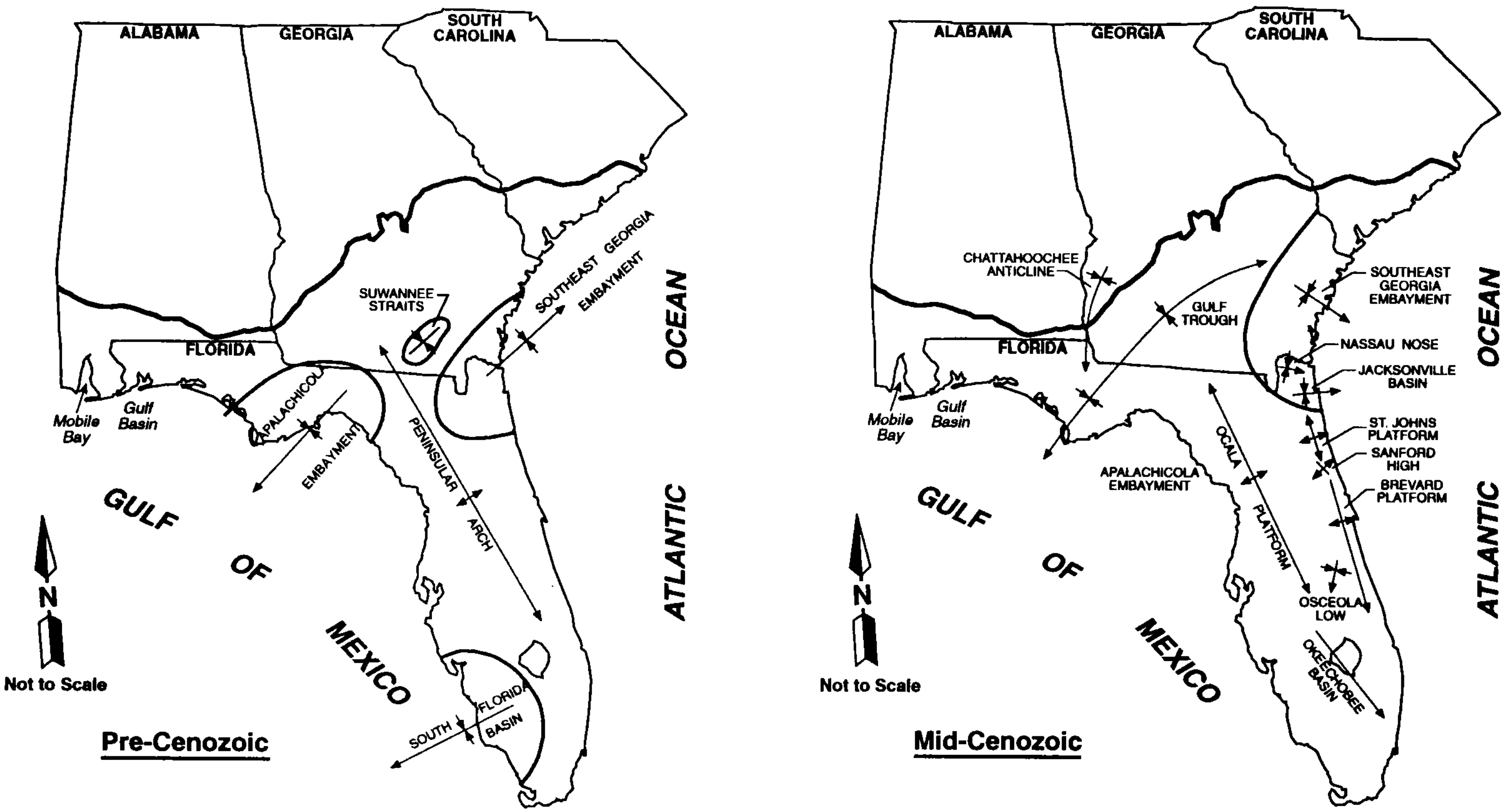
In the southern half of NAS Cecil Field, swampy areas in the uplands areas (which are probably perched on locally occurring clayey lenses) are drained by high slope (approximately 40 feet per mile), first order unnamed streams that flow directly into the major creeks. The direction of these streams are highly dependent on local topographic conditions. The effects of minor changes in local topography on streamflow direction are clearly shown by the occurrence of stream pirating of these first order streams as minor alterations to local conditions favor a new drainage path over an existing one.

<u>2.2.4 Geology</u> Based on study conducted by the Florida Geological Survey (FGS, 1991), all of Florida, parts of southeast Georgia, and the Bahamas are all part of a thick platform of sedimentary rock formed over igneous and metamorphic basement rock.

The basement rock underlying all of the Florida platform is derived from a fragment of the African plate that was sutured to the North American plate during the Allegheny Orogeny, which raised the Modern Appalachian Mountains in the Pennsylvanian some 300 million years ago. When the African plate was rifted away approximately 200 million years ago (during the Jurassic), the fragment became part of the North American plate.

Folding of this basement rock formed surface features including the Peninsular Arch, the Suwannee Straits, and the Southeast Georgia Embayment (see Figure 2-11). These irregularities affected the deposition of overlying sediment. These depressed features (such as the Southeast Georgia Embayment) collected greater thicknesses of sediment than the mounded sections such as the Peninsular Arch.

Approximately 60 million years ago in northeast Florida and southeast Georgia, a combination of features contributed to the characteristics of sediment being



Source:
Florida Geological Survey Special Publication No. 32.

LEGEND

Approximate Updip Limit and Area Underlain by the Floridan Aquifer System

Axis of Positive Feature

Axis of Negative Feature

FIGURE 2-11

REGIONAL GEOLOGIC STRUCTURES MAP

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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deposited. This area lay in the Southeast Georgia Embayment, a deep water feature that was actively producing and depositing carbonate sediment. It was protected from receiving significant clastic sediment from the north and northwest by the scarcity of sediment from the heavily eroded ancestral Appalachian Mountains and by the Suwannee Straits, which transported away what little sediment was being shed to the southeast. The carbonate sediment was occasionally interrupted as sea level fell and deposits of anhydrite and halite (salt) formed. These evaporites and the less-porous carbonates interbedded with them to form the lower confining beds of the Floridan aquifer system.

Essentially pure carbonate deposition on a shallow carbonate bank continued for approximately 30 million years, forming the bulk of the sediment that would become the Floridan aquifer system.

Approximately 24 million years ago, renewed uplifting of the Appalachian Mountains greatly increased the supply of clastic sediment from the north and northwest, filling the Gulf Trough and slowly encroaching on the carbonate bank. In northeast Florida, a structural low known as the Jacksonville Basin led to the collection of approximately 350 feet of sediment, the lower carbonate-rich section forming the upper part of the Floridan aquifer system and the later clastic sediment (with locally interbedded carbonate and sand beds) forming the intermediate aquifer system and confining unit, which includes the locally persistent "rock" or "secondary artesian" aquifer.

Extreme glacial-interglacial fluctuations in sea level in the last 5 million years have deposited a complex mix of marine terrace and shallow marine sediment at and near land surface to form the surficial aquifer. These diverse units range from locally occurring limy lenses to widely present water-bearing sand and clay beds.

Figure 2-12 provides a general stratigraphic section for NAS Cecil Field. Within NAS Cecil Field, the uplands are remnants of the Wicomoco marine terraces (70 to 100 feet above msl), whereas the creek beds may be remnants of the Penholoway (42 to 70 feet above msl) Pleistocene marine terraces (Leve, 1966).

The undifferentiated sediment consists of mostly quartz sand with some clayey sand and clay. At NAS Cecil Field they form part of the surficial aquifer system.

Locally, the rest of the surficial aquifer system is formed in the Pliocene-Pleistocene Nashua Formation. Scott (1978) describes the Nashua as a fossiliferous, variably calcareous, sometimes clayey quartz sand. The fossil content is variable from a shelly sand to a shell hash. The dominant fossils are mollusks.

At NAS Cecil Field, the intermediate aquifer system or confining unit consists of sediment of the Miocene Hawthorn group. In addition to its clay rich sediment, the Hawthorn includes near its top a locally continuous carbonate rich unit of dolostone or shell hash that forms the historical "rock" or "secondary artesian" aquifer, a water-bearing unit often used near NAS Cecil Field as a private drinking water source. In the NAS Cecil Field area, the unit is approximately 20 to 25 feet thick and occurs at a depth of 60 to 120 feet bls. Total thickness of the Hawthorn group exceeds 300 feet in this area (FGS, 1991).

TIME (Million years ago)	STRATIGRAPHIC UNITS	APPROXIMATE ELEVATION (Feet, Mean Sea Level)
		50
1.8	UNDIFFERENTIATED PLEISTOCENE AND RECENT SEDIMENTS	
	Nashua Formation	
5		
	HAWTHORN	
	Coosawatchie Formation (Charlton Member)	20 (20 to −10)
	Marks Head Formation	−110
	Penny Farms Formation	−200
24		
	OCALA Limestone	−350
	AVON PARK Formation	−700
	OLDSMAR Formation	< −1000
55		
	CEDAR KEY	< −1200
62		−1700

SOURCE: FLORIDA GEOLOGIC SURVEY. Special Publication No. 32, 1991; and Scott, 1989

FIGURE 2-12
GENERAL STRATIGRAPHY AT NAS CECIL FIELD

CDM/FIG2-14/GLC/11-15-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

Below the Hawthorn group is a series of carbonate rich units that form the Floridan aquifer system. At NAS Cecil Field, these units are (from oldest to youngest) the Oldsmar Formation, the Avon Park Formation, and the Ocala Limestone. The lower part of the Hawthorn Formation, which forms the intermediate aquifer and confining zone, unconformably overlies and confines the Floridan aquifer system.

The Middle to Late Eocene Ocala Limestone is a homogeneous sequence of permeable, hydraulically connected, marine limestone containing a few hard, less transmissive dolomite or limestone beds that restrict the vertical movement of water. Sediment from this unit is some of the most permeable in the Floridan aquifer system, especially when secondary porosity has been increased by dissolution. Due to the development of karst topography in many places outside the area of this report, the surface and thickness of the Ocala Limestone tend to be quite variable. In the NAS Cecil Field area, the top of the Ocala Limestone occurs at approximately 350 feet below msl (FGS, 1991).

The Middle Eocene Avon Park Formation consists almost entirely of interbedded hard, relatively impermeable but somewhat vuggy dolostone confining beds and soft permeable fossiliferous limestone. At NAS Cecil Field, the top of the Avon Park Formation occurs at approximately 700 feet below msl (FGS, 1991).

The Lower to Middle Eocene Oldsmar Formation consists of limestone interbedded with vuggy dolostone. Dolomitization tends to increase towards the base of the unit, where pore-filling gypsum and thin beds of anhydrite reduce the permeability of the Floridan aquifer system. At NAS Cecil Field, the top of the Oldsmar Formation occurs at more than 1,000 feet below msl.

The Paleocene Cedar Key Formation consists mostly of dolostone and evaporites. The upper part of the unit is permeable enough to form the lowest part of the Floridan aquifer system, whereas the lower part of the unit is significantly less porous and evaporite rich and forms the lower confining unit for the Floridan aquifer system. At NAS Cecil Field, the top of the Cedar Key Formation occurs at more than 1,200 feet below msl and the base is at approximately 1,700 feet below msl (FGS, 1991).

2.2.5 Soil According to the *Soil Survey of the City of Jacksonville, Duval County, Florida* (U.S. Department of Agriculture [USDA]), Soil Conservation Service, 1978), soil is classified based on characteristics in the upper 80 inches bls of sediment. Soil is discussed in Subsection 2.2.5.1 below. Unwetted sediment between this level and the water table is considered the vadose zone, and is discussed in Subsection 2.2.5.2 below.

2.2.5.1 Upper Zone Soil According to the soil survey (USDA, 1978), the soil in Duval County is divided into the following four groups:

- soil of the sand ridges,
- soil of the flatwoods,
- soil of the hardwood and cypress swamps, and
- soil of the tidal marsh.

NAS Cecil Field, located in southwestern Duval County, is on the soil of the flatwoods, which is nearly level, poorly drained soil that is either sandy throughout or sandy to a depth of 20 inches, and loamy below 20 inches. Creek beds are either sand or muck. Sandy soil tends to have high permeability (20+ inches per hour), a relatively low cation adsorption capacity (less than 10 milliequivalents per liter [meq/ℓ] per 100 milligrams [mg] of soil), and low total organic carbon (approximately 1 percent). Muck is mostly organic material, being composed of decayed and partially decayed plant fragments, and has a somewhat lower permeability (approximately 10 inches per hour), relatively high cation absorption capacity (much greater than 10 milliequivalents per 100 mg of soil), and a very high total organic carbon content (more than 20 percent).

Flatwoods soil is comprised of the Leon-Ortega, Leon-Ridgeland-Wesconnett, and Pelham-Mascotte-Sapelo map units; however, only the Leon-Ridgeland-Wesconnett series and the Pelham-Mascotte-Sapelo series are present at NAS Cecil Field. Some isolated areas of the Leon-Ortega are present in southwestern Duval County, but these areas lie to the east of NAS Cecil Field.

The soil survey (USDA, 1978) has further divided the Leon-Ridgeland-Wesconnett and the Pelham-Mascotte-Sapelo into specific soil types based on soil characteristics. These characteristics include the inclination of slopes formed by the soil, the permeability of the soil, and the composition (e.g., sandy, loamy, etc.) of the soil horizons present. Eight specific soil units have been identified at OUs 3, 4, 5, and 6. These specific soil units include:

- Aquic Quartzipsamments (Sites 7 and 8),
- Arents (Site 10),
- Albany fine sand with 0 to 5 percent slopes (Site 10),
- Wesconnett fine sand (Site 10),
- Sapelo fine sand (Site 11),
- Olustee fine sand (Site 14),
- Ridgeland fine sand (Site 15), and
- Leon fine sand (Site 15).

2.2.5.2 **Vadose Zone** Unwetted sediment above the water table is considered the vadose zone. In all areas of NAS Cecil Field, except some areas of wetlands and creek beds, the vadose zone consists of fine sand with up to 10 percent clay and silt. Some organic matter coatings are apparent in certain areas, leading to a higher cation adsorption capacity and immobilization of metal ions. In most of the area, there is little to no vadose zone between the bottom of the above described soil horizons and the water table.

<u>2.2.6 Hydrogeology</u> At NAS Cecil Field there are three water-bearing systems. According to the Florida code of hydrostratigraphic nomenclature as described in FGS Special Publication 28 (FGS, 1986) these units, from most shallow to deepest are: the surficial aquifer system, the intermediate aquifer system and confining unit, and the carbonate-rich Floridan aquifer system.

At NAS Cecil Field, there are two zones within the surficial system; these zones will be referred to as the upper zone of the surficial system (UZS) and the lower zone of the surficial system (LZS). The historical "rock" or "secondary artesian" aquifer is included here as a zone within the intermediate aquifer system and will be referred to as the upper water-bearing zone of the Hawthorn (UZH) Formation.

2.2.6.1 **Surficial Aquifer System** The surficial aquifer system at NAS Cecil Field includes two separate water bearing zones, the UZS and the LZS. The two zones belong to the Nashua Formation and undifferentiated sediment described in Subsection 2.2.4.

The upper zone is under water table conditions (unconfined) and is a relatively clean, very fine quartz sand with up to 10 percent silt and clay. It extends from just below land surface (3 to 8 feet) to the top of a less permeable clayey sand, sandy clay (or rarely, clay) zone, which, where present, is at a depth of approximately 25 feet. Where this unit is not present, the waters of the UZS and the LZS are indistinguishable. The LZS is more heterogeneous than the UZS, ranging from a clean, very fine quartz sand to a clayey sand. Where the less permeable clayey zone separating the UZS from the LZS is present, the LZS is confined.

Based on slug tests conducted at OU 1, the average hydraulic conductivities of the UZS and LZS are estimated to be 2.3 and 4.4 feet per day (ft/day), respectively (ABB Environmental Services, Inc. [ABB-ES], 1994a).

The potentiometric surface (the elevation to which water will rise in a properly constructed well) in the lower zone is generally higher than the water table in the upper zone. This gives the potential for upward leakage of water from the lower zone to the upper zone. This is particularly true near creeks, where topographic relief accentuates this head difference.

The upper zone of the surficial aquifer is recharged by local rainfall and discharges to area streams. The direction of flow in the UZS, thus, generally follows the topography. The lower zone is also recharged by local rainfall where the intervening confining zone is absent, and from leakage from a zone in the underlying intermediate aquifer system. Its flow direction varies from site to site but is generally the same or similar to the direction of flow in the UZS. The anticipated general directions of groundwater flow in the surficial aquifer (based on groundwater elevations in existing monitoring wells and/or topography) at the six sites comprising OUs 3, 4, 5, and 6 are shown in Figures 2-3 through 2-8.

2.2.6.2 Intermediate Aquifer System or Confining Unit At NAS Cecil Field, the intermediate aquifer system or confining unit consists of sediment assigned to the Miocene Hawthorn group as described in Subsection 2.2.4. The clay rich sediment of the upper part of the Hawthorn unconformably overlies and confines the upper water-bearing zone of the Hawthorn.

Regional groundwater flow in the UZH is to the east (Fairchild, 1972). The potentiometric surface in this unit is generally higher than the potentiometric surface in the lower zone of the surficial aquifer. This encourages upward leakage of water from this unit to the surficial aquifer system. This is particularly true near creeks, where topographic relief and lowering of surficial heads due to gaining streams accentuates this head difference. Based on slug tests conducted at OU 1, the average hydraulic conductivity of the UZH is estimated to be 3.0 ft/day (ABB-ES, 1994a).

2.2.6.3 Floridan Aquifer System At NAS Cecil Field, the Floridan aquifer system is comprised of (from oldest to youngest) the Oldsmar Formation, the Avon Park Formation, and the Ocala Limestone as described in Subsection 2.2.4. The lower part of the Hawthorn Formation, which forms the intermediate aquifer and confining zone, unconformably overlies and confines the Floridan aquifer system.

Geraghty & Miller (1983) report that the transmissivity of the Floridan aquifer system a few miles east of the base is 190,000 gallons per day per foot (gpd/ft). Leve (1966) and Geraghty & Miller (1983) report that groundwater within the Floridan aquifer system flows east-northeast in the vicinity of NAS Cecil field.

The potentiometric surface of the Floridan aquifer system is generally higher than the potentiometric surface of the intermediate aquifer system. This encourages upward leakage of water from this unit to the intermediate aquifer system, but is moderated by the presence of a thick confining bed between the two.

2.2.7 Ecology Information on the ecological setting of NAS Cecil Field is available in the Initial Assessment Study (IAS) completed by Envirodyne Engineers in 1985. This information is summarized in the following sections for aquatic and terrestrial wildlife habitats.

2.2.7.1 **Aquatic Habitat** As discussed previously, small streams, totaling approximately 8 miles, are present on NAS Cecil Field property. These streams include Yellow Water Creek, Sal Taylor Creek, and Rowell Creek, as well as smaller tributaries. Two manmade lakes are located on the facility: Newman Lake and Lake Fretwell. Both lakes are a part of the Rowell Creek drainage area. These waters are classified by the FDEP as Class III waters for recreation, propagation, and management of fish and wildlife.

A total of 19 species of fishes from six families were identified at NAS Cecil Field during the IAS. Eight of the 19 species were representative of the Centrarchidae family (sunfishes) and four were in the Cyprinidae family (minnows). Other families represented in the fish surveys included Catomidae, Cyprinodontidae, Poeciliidae, and Atherinidae.

2.2.7.2 **Terrestrial Wildlife Habitat** Three major terrestrial habitat types were identified at NAS Cecil field during the IAS. These habitats are pine flatwoods association, sandhill communities, and swamp forest associations.

The pine flatwoods associations are the most extensive forest in Duval County. The soil is sandy with a moderate amount of organic matter in the top few centimeters and an acidic, organic hardpan 0.3 to 1.0 meter (1 to 3 feet) beneath the surface. This hardpan reduces rainfall percolation and impedes root penetration during droughts. Thus, standing water is common during the rainy season.

Three major types of pine flatwoods occur in Florida: (1) longleaf pine (*Pinus palustris*) with long leaf pine as the dominant overstory trees in well drained areas, (2) slash pine (*P. elliottii*) flatwoods with slash pine as the dominant overstory species in areas of intermediate wetness, and (3) pond pine (*P. serotina*) flatwoods with the pond pine as the dominant tree species typical in poorly drained areas.

The forestry program at NAS Cecil Field, which began in 1963, has resulted in reforestation of 97 percent of the area with slash pine. Thus, pine flatwoods are the predominant community type for the NAS Cecil Field vicinity. Vegetation characteristics of disturbed locations found within the reforested areas include: fennel (*Eupatorium* sp.), beggar's tick (*Bidens* sp.), greenbriar (*Smilax* sp.), sandbur (*Cenchrus* sp.), and rattlebox (*Sesbania* sp.).

Sandhill communities occur on well-drained white to yellowish sand. Longleaf pines (*P. palustris*) form the overstory and a variety of oaks (*Quercus* sp.) form the understory in mature natural stands. However, due to forestry and prevention of fires, oaks became predominant and prevent the reestablishment of pine. When this situation is perpetuated, the sandhill community becomes similar to a xeric or mesic hammock with a dense stand of oaks and changes in the growth and development of the underbrush. This situation occurs infrequently at NAS Cecil Field. Many of the former sandhill areas are predominated by plant species characteristic of disturbed areas including fennel, beggar's tick, green briar, sandbur, and rattlebox.

The swamp forest association is predominated by deciduous hardwoods that border rivers and streams where the forest floor is saturated or submerged during part of the year. The southern part of Rowell Creek, Sal Taylor Creek, and some of its lesser tributaries to the east are typified by this association at NAS Cecil Field. Red maple (*Acer rubrum*), water oak (*Quercus nigra*), swamp bay (*Persea palustris*), and sweet gum (*Liquidambar styraciflua*) are common along these drainage pathways. Occasional bayheads, scattered about in the pine flatwoods, harbored many of the same species stated above as well as an occasional bald cypress (*Taxodium distichum*).

2.2.7.3 **Wetlands** Wetlands identified at NAS Cecil Field include bay swamp, cypress domes, and hardwood swamp (SOUTHNAVFACENGCOM, 1989b).

Bay swamp wetlands are associated with Sal Taylor Creek to the east of the runways with additional acreage north of 103rd Street and Normandy Boulevard. Bay swamp areas are located at the slower moving headwaters of the various creeks. Some bay swamps on the facility are isolated. These areas include loblolly bay (*Gordonia lasianthus*), sweet bay (*Magnolia virginiana*), swamp bay (*Persea palustris*), and red maple (*Acer rubrum*). Other canopy species include sweetgum (*Liquidambar styraciflua*), Carolina willow (*Salix caroliniana*), Chinese tallow tree (*Sapium sebiferum*), and bald cypress (*Taxodium distichum*). Loblolly bay, sweet bay, swamp bay, red maple, and wax myrtle (*Myrica cerifera*) dominate the subcanopy. Ground cover species include cinnamon fern (*Osmunda cinnamomea*), shield fern (*Thelypteris kunthii*), and elderberry (*Sambucus canadensis*) (SOUTHNAVFACENGCOM, 1989b).

Hardwood swamps are found in association with Rowell Creek and Yellow Water Creek. Dominant canopy species found in the hardwood swamps include tupelo (*Nyssa sylvatica* var *biflora*), red maple (*Acer rubrum*), and sweetgum (*Liquidambar styraciflua*). Other canopy species include bald cypress (*Taxodium distichum*), water oak (*Quercus nigra*), laurel oak (*Quercus lauifolia*), and Carolina willow (*Salix caroliniana*). Along the edges of the hardwood swamp, loblolly pine (*Pinus taeda*) and pond pine (*Pinus serotina*) can also be found. The subcanopy within the swamp is dominated by smaller tupelo, red maple, sweetgum, and wax myrtle (*Myrica cerifera*). The ground cover is dominated by cinnamon fern (*Osmunda cinnamomea*), shield fern (*Thelypteris kunthii*), and elderberry (*Samubucus canadensis*). The main stream channel is vegetated along the edge by such species as pickerelweed (*Ponteria* sp.), alligator weed (*Alternanthera philoxeroides*), spatterdock (*Nuphar luteum*), and lizard's tail (*Saururus cernuus*) (SOUTHNAVFAC-ENGCOM, 1989b).

A series of drainage ditches are connected to the hardwood swamps. These drainage ditches often connect to a low cypress dome or bay swamp. The drainage ditches are vegetated mostly with cattail (*Typha latifolia*), pickerelweed, alligator weed, spatterdock, and lizard's tail (SOUTHNAVFACENGCOM, 1989b).

Cypress domes are scattered across the base. These are generally isolated circular depressional wetlands found among pine trees. They are often dry for part of the year. Dominant canopy species include bald cypress (*Taxodium distchum*), tupelo (*Nyssa sylvatica* var. *biflora*), and either slash pine (*Pinus elliottii*) or loblolly pine (*Pinus taeda*). Other common trees include red maple and wax myrtle. The subcanopy is generally dominated by the same vegetation as the canopy. Ground cover species include cinnamon fern, Virginia chain fern (*Woodwardia virginica*), St. Johnswort (*Hypericum fasciculatum*), and red root (*Lachnanthes caroliniana*) (SOUTHNAVFACENGCOM, 1989b).

2.2.7.4 **Rare, Endangered, and Threatened Species** Rare, endangered, and threatened species identified as potentially residing on NAS Cecil Field are listed in Table 2-2 with corresponding State and Federal designations. The list is based on a review of available information including the IAS (Envirodyne Engineers, 1985); a rare and endangered plant survey report (Environmental Services and Permitting [ESP], 1990); the Technical Memorandum for Supplemental Sampling at OUs 1, 2, and 7 (ABB-ES, 1992); and the OU 1 and OU 2 Baseline Risk Assessments (ABB-ES, 1994a).

2.3 FACILITY AND SITE HISTORY. The official mission of NAS Cecil Field is to provide facilities, services, and material support for the operation and maintenance of naval weapons and aircraft and other units of the operating forces as designated by the Chief of Naval Operations. Some of the tasks required to accomplish this mission include: (1) operation of fuel storage facilities, (2) provision of facilities and performance of organizational level aircraft maintenance, (3) provision of facilities and performance of intermediate level aircraft maintenance, (4) maintenance and operation of an engine repair facility and test cells for designated turbo-jet engines, and (5) provision of special weapons support.

In 1941, to alleviate the training burden on NAS Jacksonville, the Navy purchased 2,600 acres in southwestern Duval County for the development of a new base to prepare student pilots for combat flight operations in World War II. Flight operations began within 6 months of the purchase. In December 1941, the base was officially commissioned as U.S. Naval Auxiliary Air Station (NAAS) Cecil Field, in honor of Commander Henry Barton Cecil, U.S. Navy (USN), who died in the crash of the dirigible Akron in 1933.

When it was commissioned, Cecil Field consisted of a 2,000-foot circular dirigible landing mat with two maintenance hangars and a small number of administrative, housing, and maintenance buildings. To meet the training demands associated with United States involvement in World War II, four 5,000-foot extensions were added to the landing mat. Cecil Field operated at full capacity during the war but was reduced to caretaker status when the war was over. However, Cecil Field became fully operational again in 1948 when it became the homeport for two carrier air groups consisting of approximately 200 aircraft. In January 1949, Carrier Air Group 17, the first jet squadron to be based in northern Florida, arrived at Cecil Field. In February 1949, Carrier Air Group One and Fleet Aircraft Service Squadron Nine reported. When hostilities developed in Korea in 1950, training at Cecil Field escalated.

Table 2-2
Rare, Endangered, and Threatened Flora and Fauna

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Common Name	FGFWFC [1]	FNAI [2]	USFWS [3]	Comments
Gopher tortoise *(Gopherus polyphemus)*	SSC		T	Confirmed resident
American alligator *(Alligator mississippiensis)*	SSC		T(S/A)	Confirmed resident
Eastern indigo snake *(Drymarchon corais couperi)*	T		T	Confirmed resident
Wood stork *(Mycteria americana)*	E		T	Lake Fretwell
Southeastern kestrel *(Falco sparverius paulus)*	T		UR2	Confirmed migrant
Artic Peregrine falcon *(Falco peregrinus tundrius)*	E		T	Confirmed migrant
Bald eagle *(Haliaeetus leucocephalus)*	T		E	Confirmed migrant
Florida gopher frog *(Rana areolata aesopus)*	SSC		UR2	Suitable habitat present
Sherman's fox squirrel *(Sciurus niger shermani)*	SSC		UR2	Possible resident of pine woods. Confirmed resident of similar habitat at NAS Jacksonville.
Florida black bear *(Ursus americanus floridanus)*	T		UR2	Evidence of black bears reported in outlying areas in 1982.
Florida mouse *(Peromyscus floridanus)*	SSC		UR2	Known from Clay County, may range into habitats (sand pine scrub and longleaf pine-turkey oak communities) present at NAS Cecil.
Florida threeawn *(Aristida rhizomorpha)*		S2S3		Widespread in pine flatwoods/pine plantations at NAS Cecil Field.
Florida toothache grass *(Ctenium floridanum)*		S2	UR5	Found at one location at NAS Cecil in ecotone between slash pine plantation and sandhill.
Hooded pitcher plant *(Sarracenia minor)*				
Spoon-leaved sundew *(Drosera intermedia)*	T			Found at one location at Yellow Water Weapons Area in drainage ditch.
Bartram's ixia *(Sphenostigma coelestinum)*	T		UR2	
Variable-leaf crown beard *(Verbesina heterophylla)*			UR1	Found at one location at NAS Cecil Field in sandhill habitat.

[1] Florida Game and Fresh Water Fish Commission (list published in Section 39-27.003-005, Florida Administrative Code).
[2] Florida Natural Areas Inventory (FNAI) list rankings (ESP, 1990).
[3] U.S. Fish and Wildlife Service (list published in List of Endangered and Threatened Wildlife and Plants, 50 CFR 17.11-12).

Notes: NAS = Naval Air Station.
SSC = species of special concern.
T = threatened.
T(S/A) = threatened due to similarity of appearance.
E = endangered.
UR2 = under review for listing, but substantial evidence of biological vulnerability and/or threat is lacking.
S3 = either very rare and local throughout its range (21 to 100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction because of other factors (ESP, 1990).
UR5 = still formally under review for listing, but no longer considered for listing because recent information indicates species is more widespread or abundant than previously believed.
UR1 = under review for Federal listing, with substantial evidence in existence indicating at least some degree of biological vulnerability and/or threat.
ESP = Environmental Services and Permitting.
CFR = Code of Federal Regulations.
S2 = imperiled in State because of rarity (6 to 20 occurrences or less than 3,000 individuals) or because of vulnerability to extinction due to some biological or manmade factor.

In 1950, Cecil Field was one of four bases selected under a plan proposed by Captain R.W.D. Woods for the establishment of a small number of master jet bases. To achieve the status of master jet base, the Navy purchased an additional 2,000 acres of forest land and constructed four 8,000-foot runways in 1951. On June 30, 1952, NAAS Cecil Field was redesignated as NAS Cecil Field. A program of expansion was begun in 1952 and has continued with more than 31,000 acres now occupied by the station. In 1960, Naval Magazine Yellow Water was commissioned as a separate command and in 1961 it was incorporated with Cecil Field as the Weapons Area, Yellow River. In 1967, Hangar 824 was constructed, which greatly increased the station's capabilities with an Aircraft Intermediate Maintenance Department (AIMD) and a multi-million dollar jet engine repair facility (SOUTHNAVFACENGCOM, 1989b). The station now employs more than 10,000 military and civilian personnel and handles approximately 400,000 takeoffs and landings per year.

The first environmental study for the investigation of waste handling and/or disposal sites at NAS Cecil Field was completed between 1983 and 1985 by Geraghty and Miller. This study was followed by an IAS (by Envirodyne Engineers) in 1985 that identified 18 sites that may pose a threat to human health or the environment. The IAS was completed under the Navy's NACIP program. In 1988 an RFI (Harding Lawson Associates [HLA], 1985) was completed and another site (Site 19) was identified during this investigation. The RFI acted on the recommendations of the IAS.

NAS Cecil Field was placed on the NPL by the USEPA and the Office of Management and Budget in December 1989. An FFA for NAS Cecil Field (Sites 1 through 12 and 14 through 19) was signed by the FDEP (formerly the Florida Department of Environmental Regulation [FDER]), USEPA, and the Navy in 1990. Since the signing of the FFA an additional 16 sites have been identified bringing the total number of sites currently under consideration by the IR program to 35. Following the listing of NAS Cecil Field on the NPL and the signing of the Site Management Plan (SMP), remedial response activities at the facility have been completed under CERCLA authority. Remedial response activities are currently underway at Sites 1, 2, 3, 4, 5, 7, 8, 10, 11, 14, 15, 16, and 17.

In 1993 NAS Cecil Field was slated for closure by the Base Realignment and Closure (BRAC) Commission. An Environmental Baseline Survey (EBS) was completed as the first step in the closure process. The EBS identifies parcels of land for sale, lease, or investigation depending on the condition of the parcel. Several determinations (to sell, lease, etc.) have been identified. Activities are currently underway to gather the needed information.

2.3.1 Hazardous Material Activities The following paragraphs describe the hazardous material activities conducted at the six sites comprising OUs 3, 4, 5, and 6.

2.3.1.1 Site 7 This site is a former firefighter training area (FTA) where military personnel were trained in aircraft fire-fighting techniques. Site 7 was active from the 1950's until fire-fighting activities ceased in 1975. The area was most active during the Vietnam conflict. An estimated 200,000 gallons of mixed liquid waste containing waste fuel, oil, chlorinated and nonchlorinated solvents, hydraulic fluid, enamel paint, epoxy paint, and/or paint strippers were reportedly used to ignite airframes in one pit and on two pads located at the site. The chemicals used to ignite the airframes were brought in drums from the fuel farm, squadrons, public work shops, and the AIMD. The IAS document reports that the fires were contained and extinguished with water and a biodegradable and nontoxic protein foaming agent, composed of naturally occurring proteinaceous materials such as fish meal, feather meal, and horn and hoof meal (Envirodyne Engineers, 1985).

The unlined pit was used from the mid-1960's until closure in 1975. During 1965-75, the unlined pit and both fire pads were lit simultaneously for fire-fighting training. From the mid-1950's until the mid-1960's, however, only the two pads were used for fire-fighting training (HLA, 1988). Following discontinuance of fire-fighting training at this location, the pit was filled with soil. Hence, the location of the pit is not visually distinguishable.

2.3.1.2 **Site 8** Similar to Site 7, this site is a former FTA. However, it was also used for storage of unlabeled drums containing hazardous wastes (up until 1980), and as a boresite testing area for aircraft gunnery (HLA, 1988).

Site 8 contains three visually distinguishable unlined FTA pits. A fourth pit has possibly been located on historical aerial photographs of Site 8, but the location of this pit is not visually distinguishable at the site. The pits were used from 1975 through 1984. Approximately 145,000 gallons of mixed liquid wastes containing waste fuel, oil, chlorinated and nonchlorinated solvents, hydraulic fluid, enamel paint, epoxy paint, and/or paint strippers were reportedly used to ignite airframes in the pits from 1975 through 1979. After 1979 only waste jet fuel was used as an ignitor. The fires were extinguished with water and aqueous film forming foam, with protein foam being used from 1975 through 1979 (HLA, 1988).

The drummed wastes stored onsite possibly contained waste solvents, paint, and paint strippers. Some drums are reported to have deteriorated and leaked at the site. Other drums are reported to have been punctured by bullets fired toward the backstop. Drums were also reportedly spilled on the ground. As many as 100 unmarked 55-gallon drums were reported to have leaked or spilled at the site (HLA, 1988).

It is also possible that lead may be present from bullets shot during testing of aircraft gunnery. This lead may migrate into groundwater or surface water at the site, and may also pose an ecological risk to birds eating the lead salts.

2.3.1.3 **Site 10** This site is an estimated 6.5-acre rubble disposal area for demolition debris, roadway concrete and asphalt, scrap metal, and furniture, which was used from the early 1950's through the 1960's. Reportedly Site 10 was used as a disposal site for the demolition debris from WWII buildings removed to accommodate new runway construction. Surficial debris observed at the site includes file cabinets, bricks, chairs, and pipes. White phosphorous shells were also found during HLA's geophysical survey, but have since been removed. While the possibility of ordnance being present still exists at this site, no other ordnance has been observed in the debris. The quantity of debris dumped was not reported.

2.3.1.4 **Site 14** This site was used to detonate ordnance from 1967 through 1977. Usually 300 to 400 pounds were detonated at a time. The types of ordnance disposed included fuses, 100-pound bombs, munitions, and explosives. Explosives used for detonation probably included trinitrotoluene (TNT), trinitrophenyl methylnitramine (tetryl), and cyclotrimethylenetrinitramine (RDX). Detonation residuals may include metal oxides, which include mainly aluminum and lead-based oxides, and organic residues.

2.3.1.5 Site 15 This site was used to burn ordnance from the mid-1960's through 1977. Approximately 700,000 pounds of small arms munitions, parachute and distress flares, Mark IV signal cartridges, rocket propellants, rocket ignitors, and cartridge activated devices (CADs) were burned. Some ordnance was burned inside a heavy metal chamber located onsite and the ashes and residue metal were spread over the area. Rocket propellant was spread on the ground and ignited. Burn residuals may include metal oxides, which include mainly aluminum and lead-based oxides, and organic residues.

2.3.1.6 Site 11 From the early 1970's until 1978, this site was used to discard empty and full pesticide containers. Containers were reportedly buried in a pit approximately 40 feet wide by 40 feet long. Previous studies indicated that approximately two to four empty, unrinsed, 5-gallon containers were discarded at the site each month. The containers were allowed to accumulate for several months before being crushed with a front-end loader and buried. Approximately 200 to 450 containers were ultimately buried in the pit.

In 1978, a new pesticide facility (Building 397) was built as part of the golf course maintenance complex. Once the new facility was operational, Site 11 was no longer used for disposal of containers. Upon completion of the new facility, 2 to 3 full 30-gallon containers of unused pesticides and approximately 10 to 15 full or partially full 5-gallon containers of pesticides were discarded and buried at the site because the contents were no longer considered usable. At least one of these containers was reported to contain Nemagon™, a pesticide that is now banned within the United States. The active ingredient of Nemagon™ is 1,2-dimobro-3-chloropropane.

A source control study is currently being conducted at Site 11 as part of an Interim Remedial Action (see Subsection 2.3.2.6). The purpose of this Interim Remedial Action is to remove the source of contamination to soil and groundwater at Site 11; namely, the hazardous debris and pesticide contaminated soil found at the site. This cleanup, however, is not intended to be the final action at Site 11.

2.3.2 Results of Previous Investigations A variety of environmental programs have assessed conditions at NAS Cecil Field in recent years. Studies that addressed potential contamination of soil and groundwater include investigations of fuel spills, State required investigations of landfills, studies for the Navy IR program, and investigations to satisfy RCRA permit requirements. One study examined the stormwater system and provided data on surface water flows. The activities conducted during these studies relevant to OUs 3, 4, 5, and 6 are discussed in the following paragraphs and summarized in Tables 2-3 and 2-4. A summary of the relevant analytical data (maximum concentrations) collected during these previous studies is provided in Table 2-5. All analytical results relevant to OUs 3, 4, 5, and 6 are provided in Appendix B. RFI soil sample concentrations in Table 2-5 and Appendix B cannot be correlated to sample locations (for sites where more than one soil sample was collected) because the sample locations were not numbered on the 1988 HLA RFI report figures.

Table 2-3
Summary of Previous Studies

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Year	Month	Contractor	Title
1983	October	Geraghty & Miller	Hydrogeologic assessment and groundwater monitoring plan.
1984	June	Geraghty & Miller	As-built groundwater monitoring network.
1985	July	Geraghty & Miller	Year-end report of groundwater monitoring.
1985	July	Envirodyne Engineers	Initial assessment study of Naval Air Station (NAS) Cecil Field.
1985	November	Seaburn and Robertson	Stormwater master plan.
1986	March	Geraghty & Miller	Results of sampling of NAS Cecil Field potable water wells.
1988	March	Harding Lawson Associates	Resource Conservation and Recovery Act Facilities Investigation (RFI) report.
1994	January	ABB Environmental Services, Inc.	Focused Feasibility Study report for Site 11, Operable Unit 6, source control remedial alternatives.

Table 2-4
Summary of Field Work from Previous Investigations

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Site Number	Field Reconnaissance	Geophysical Survey	Monitoring Wells Installed	Groundwater Samples Prior to 1987	Groundwater Samples after 1987[1]	Surface Water Samples[1]	Sediment Samples[1]	Soil Samples[1]	Soil Samples[2]	Product Samples[2]
7	Yes	Yes[3]	3	0	3	0	0	2	0	0
8	Yes	Yes[3]	4	0	4	1	1	7	0	0
10	Yes	Yes[3]	4	[5]4	4	0	0	0	0	0
11	Yes	Yes[3,4]	2	0	2	0	0	2	1	6
14	Yes	No[3]	0	0	0	0	0	1	0	0
15	Yes	Yes[3]	0	0	0	0	0	1	0	0
QA/QC	NA[6]	NA	0	0	1	1	1	1	0	0
Base production wells[7]	No	No	0	[8]5	0	0	0	0	0	0
Totals	6	6	13	9	14	2	2	14	1	6

[1] Harding Lawson Associates (HLA), 1988.
[2] ABB Environmental Services (ABB-ES), 1994b.
[3] Magnetometer and very low frequency (VLF), HLA, 1988.
[4] Magnetometer and electromagnetic (EM), ABB-ES, 1994b.
[5] Well CEF 10-1 sampled four times (quarterly) by Geraghty & Miller, 1984 and 1985.
[6] Not applicable.
[7] Base production wells installed prior to Geraghty & Miller.
[8] Geraghty & Miller, March 1986.

Notes: Quality assurance and quality control (QA/QC) samples include duplicate samples, equipment blanks, and trip blanks in accordance with QA/QC plan for chemical analyses.

HLA = Harding Lawson Associates.
ABB-ES = ABB Environmental Services, Inc.

Table 2-5
Summary of Maximum Measured Concentrations

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Site	Chemical	Concentration
Site 7, Old Firefighter Training Area	Benzene (groundwater)	6 μg/ℓ[1]
	Cadmium (groundwater)	6 μg/ℓ[1]
	Chromium (groundwater)	61 μg/ℓ[1]
	Lead (groundwater)	50 μg/ℓ[1]
	Methylene chloride (soil)	53 μg/kg
	Cadmium (soil)	17 mg/kg
	Lead (soil)	14 mg/kg
Site 8, Firefighter Training Area, Boresite Test Range, and Hazardous Waste Storage Area	Chromium (groundwater)	28 μg/ℓ
	Lead (groundwater)	20 μg/ℓ[1]
	Methylene chloride (soil)	80 μg/kg
	1,1,1-Trichloroethane (soil)	82 μg/kg
	Chromium (soil)	16 mg/kg
	Lead (soil)	47 mg/kg
	Chromium (sediment)	6.2 mg/kg
	Lead (sediment)	4.7 mg/kg
	1,1,1-Trichloroethane (sediment)	16 μg/kg
Site 10, Rubble Disposal Area	bis (2-Ethylhexyl) phthalate (groundwater)	46 μg/ℓ
	Chromium (groundwater)	145 μg/ℓ[1]
	Lead (groundwater)	60 μg/ℓ[1]
	Mercury (groundwater)	0.8 μg/ℓ[1]
	Trichloroethene (groundwater)	1.6 μg/ℓ
	Trans-1,3-Dichloropropene (groundwater)	0.1 μg/ℓ
	Acetone (surface water)	9 μg/ℓ
	Chloroform (surface water)	1 μg/ℓ
	Aluminum (surface water)	601 mg/ℓ
	Barium (surface water)	20 mg/ℓ
	Chromium (surface water)	4 mg/ℓ
	Manganese (surface water)	21.2 mg/ℓ
	Acetone (sediment)	44 μg/kg
	Methylene chloride (sediment)	2 μg/kg
	Barium (sediment)	6.3 mg/kg
	Cadmium (sediment)	1.5 mg/kg
	Nickel (sediment)	3.4 mg/kg
Site 11, Golf Course Pesticide Disposal Area	Chromium (groundwater)	332 μg/ℓ[1]
	Lead (groundwater)	573 μg/ℓ[1]
	1,2-dibromo-3-chloropropane (soil)	160 μg/kg
	Parathion (soil)	330 μg/kg
	Toluene (soil)	16 μg/kg
	Methylene chloride (soil) (25 μg/ℓ in QA/QC samples)	24 μg/kg
	1,1,1-Trichloroethane (soil) (11 μg/ℓ in QA/QC samples)	39 μg/kg
	Lead (soil)	8.3 mg/kg

See notes at end of table.

Table 2-5 (Continued)
Summary of Maximum Measured Concentrations

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Site	Chemical	Concentration
Rowell Creek upstream of Site 10[2]	2,4,6-Tribromophenol	47 µg/ℓ
	Aluminum	4,060 mg/kg
	Aroclor-1254	180 µg/kg
	Arochlor-1260	140 µg/kg
	Barium	62.4 mg/kg
	Copper	24.5 mg/kg
	Iron	2,570 mg/kg
	Lead	25.7 mg/kg
	Magnesium	179 mg/kg
	Manganese	25.7 mg/kg
	Selenium	0.45 mg/kg
	Silver	2.1 mg/kg
	Vanadium	4.5 mg/kg
	Zinc	75.9 mg/kg
	bis(2-Ethylhexyl)phthalate	510 µg/kg
Site 11, Golf Course Pesticide Disposal Area (continued)	Aluminum (soil)	1,690 mg/kg
	Arsenic (soil)	46.6 mg/kg
	Barium (soil)	3.4 mg/kg
	Chromium (soil)	4.6 mg/kg
	Copper (soil)	1.2 mg/kg
	Iron (soil)	623 mg/kg
	Magnesium (soil)	5.0 mg/kg
	Zinc (soil)	6.0 mg/kg
	alpha-BHC (product)	85 µg/kg
	gamma-BHC (product)	60 µg/kg
	2,4-Dichlorophenoxyacetic acid (product)	47,000 µg/kg
	1,2-Dibromo-3-chloropropane (product)	340,000 µg/ℓ
	Toxaphene (product)	73 µg/ℓ
Site 14, Blue 5 Ordnance Disposal Area	1,1,1-Trichloroethane (soil)	11 µg/kg
Site 15, Blue 10 Ordnance Disposal Area	(Soil sampling)	
	Acenaphthene	6,600 µg/kg
	Anthracene	25,800 µg/kg
	Benzo(a)anthracene	176,400 µg/kg
	Benzo(a)pyrene	192,000 µg/kg
	Benzo(b)fluoranthene	352,800 µg/kg
	Benzo(ghi)perylene	103,800 µg/kg
	Benzo(k)fluoranthene	176,400 µg/kg
	Chrysene	202,500 µg/kg
	Fluoranthene	238,800 µg/kg
	Fluorene	3,000 µg/kg
	Indeno (1,2,3-cd) pyrene	108,900 µg/kg
	Naphthalene	5,700 µg/kg
	Phenanthrene	108,900 µg/kg
	Pyrene	275,100 µg/kg
	Lead	599 mg/kg

[1] Exceeds groundwater standards for Chapter 17-550, Florida Administrative Code, maximum contaminant levels, 1989.
[2] These are the maximum measured concentrations for RC-SD-3, RC-SD-4, and RC-SD-5.

Notes:
µg/ℓ = microgram per liter.
µg/kg = microgram per kilogram.
mg/kg = milligram per kilogram.
mg/ℓ - milligrams per liter.
QA/QC = quality assurance/quality control.
BHC = benzene hexachloride.

2.3.2.1 **Groundwater Monitoring Plan** In 1983, NAS Cecil Field initiated a groundwater monitoring program for the inactive sanitary landfills (now Sites 1 and 2). Six monitoring wells and one surface water monitoring station on Rowell Creek were installed in March 1984 (Geraghty & Miller, 1984) and were sampled quarterly for 1 year (Geraghty & Miller, 1985). One monitoring well, formerly designated as SA-2, was incorporated into the sampling program at Site 10. SA-2 was re-designated as CEF 10-1 in 1987.

In four rounds of sampling of CEF 10-1 by Geraghty & Miller, lead was detected once at a concentration of 39 micrograms per liter ($\mu g/\ell$), mercury was detected three times at a maximum concentration of 0.8 $\mu g/\ell$, trans-1,3-dichloropropane was detected once at a concentration of 0.1 $\mu g/\ell$, and trichloroethylene was detected once at a concentration of 1.6 $\mu g/\ell$.

2.3.2.2 **Initial Assessment Study (IAS)** An IAS was performed at NAS Cecil under the NACIP program (Envirodyne Engineers, 1985). The IAS identified 18 sites (Sites 1 through 18) that may pose a threat to human health and the environment. Of these 18 sites, the IAS identified Sites 7, 8, and 11, along with seven other sites, as probable disposal sites recommended for further study. In 1986, the FDEP and the USEPA required further study at four additional sites, including Sites 10, 14, and 15.

2.3.2.3 **Stormwater Master Plan** This plan was compiled by Seaburn and Robertson, Inc., to meet FDEP stormwater regulations. This report, completed November 20, 1985, has information on facility drainage, which was used to identify possible areas affected by the solid waste management units and to understand site runoff pathways of potential contaminant migration.

2.3.2.4 **Potable Water Well Study** In 1986, Geraghty & Miller sampled the five potable water supply wells used by NAS Cecil Field. These wells, PS-1, PS-2, PS-3, PS-4, and PS-5, reportedly tap the Floridan aquifer system. No contaminants were detected in these wells at the time of sample collection.

In August 1989, the Florida Department of Health and Rehabilitative Services (HRS) screened 17 of the private wells in closest proximity to the NAS Cecil Field property line. Contaminants detected exceeding maximum contaminant levels (MCLs) were iron and manganese.

2.3.2.5 **Resource Conservation and Recovery Act (RCRA) Facilities Investigation** Following the IAS, HLA performed a second phase of work under NACIP that fulfilled requirements of the RCRA Part B permit for an RCRA Facility Investigation (RFI) (HLA, 1988). Field investigations were conducted at 14 sites, including those now comprising OUs 3, 4, 5, and 6. The field work included geophysical surveys and soil, surface water, sediment, and groundwater sampling and analyses. The results of these field investigations are discussed below.

<u>Site 7</u>. Three groundwater monitoring wells were installed during the RFI by HLA at Site 7 and the groundwater sampling and analytical results indicated the presence of cadmium, chromium, lead, and benzene at concentrations above Federal and State MCLs. The text of the RFI report indicates that two surface soil samples were collected at Site 7 but shows six sample locations, as seen on Figure 2-3 of this workplan. It is not clear in the RFI report if these six samples were composited to make the two samples reported in the text. The samples contained methylene chloride, cadmium, and lead at concentrations above

detection limits. No surface water or sediment samples were collected at this site. A geophysical survey was conducted at Site 7, but the results were inconclusive due to surface feature interference.

Site 8. Four groundwater monitoring wells were installed during the RFI by HLA at Site 8 and the groundwater sampling and analytical results indicated the presence of chromium and lead at concentrations above detection limits, but only lead was measured at a concentration above Federal and State MCLs. The text of the RFI report indicates that seven surface soil samples were collected at Site 8 but shows 16 sample locations, as seen on Figure 2-4 of this workplan. Again, it is not clear in the RFI report whether these 16 samples were composited to make the seven samples indicated in the text. All samples contained 1,1,1-trichloroethane, four samples contained lead, three samples contained chromium, and two samples contained methylene chloride at concentrations above detection limits. One surface water sample and one sediment sample were also collected from a ditch located adjacent to the site. No chemicals were detected in the surface water sample. The sediment sample contained chromium, lead, and 1,1,1-trichloroethane above detection limits.

A geophysical survey conducted at Site 8 by HLA indicated three areas with measurements interpreted to be above background. They include a large area encompassing the burn pits, and two smaller areas that do not correspond to known site activities. HLA postulated that the anomalies potentially represent contaminant plumes.

Site 10. Three groundwater monitoring wells were installed during the RFI by HLA at Site 10 in addition to the monitoring well installed by Geraghty & Miller. The four monitoring wells were sampled and the analytical results indicated the presence of chromium, lead, mercury, trichloroethylene, trans-1,3-dichloropropene, and bis(2-ethylhexyl)phthalate at concentrations above detection limits, but only chromium, lead, and mercury were measured at concentrations above Federal and State MCLs. No soil samples were collected at Site 10. Surface water samples collected from Rowell Creek west of the site contained chloroethane, methylene chloride, 1,1-dichloroethane, trans-1,3-dichloropropene, manganese, mercury, zinc, and barium above detection limits. Rowell Creek, however, is also bordered on the west side by Sites 1 and 2, and these contaminants could have originated at any of these sites. A geophysical survey was also conducted at Site 10, but the results were inconclusive.

Site 11. Two groundwater monitoring wells were installed by HLA at Site 11 and the groundwater sampling and analytical results indicated the presence of chromium and lead at concentrations above Federal and State MCLs. The text of the RFI report indicates that two surface soil samples were collected at Site 11, but shows six sample locations as seen on Figure 2-8 of this workplan. As with Sites 7 and 8, it is not clear in the RFI report whether these six samples were composited to make the two samples reported in the text. The soil samples contained methylene chloride, toluene, 1,1,1-trichloroethane, and lead at concentrations above detection limits. No surface water or sediment samples were collected at this site. A geophysical survey was conducted at Site 11 and two anomalies possibly representing buried pesticide containers were identified.

Site 14. Only one surface soil sample was collected at Site 14 and only 1,1,1-trichloroethane was found in this sample at a concentration above the detection limit. The soil sample location is shown on Figure 2-6.

Site 15. Only one surface soil sample was collected at Site 15. This sample contained lead and 14 polynuclear aromatic hydrocarbons at concentrations above detection limits. The soil sample location is presented on Figure 2-7. A geophysical survey was conducted at Site 15 and several anomalies were identified. Most of these anomalies were located along the southwest edge of the site. The reason for these anomalies is unknown.

2.3.2.6 Site 11 Focused Remedial Investigation and Feasibility Study (RI/FS)
In 1993-94, ABB-ES conducted a focused RI/FS to evaluate source control alternatives as part of an Interim Remedial Action for Site 11. The focused RI/FS included:

- a geophysical survey to verify the presence and location of buried pesticide containers,
- excavation of test pits to evaluate the contents of each of the anomalous locations identified by the geophysical survey, and
- sampling and analyses of product found in partially full or leaking containers, as well as soil suspected to be contaminated.

The geophysical surveys and test pitting activities characterized approximately 2.5 acres at Site 11 to a depth of approximately 10 feet bls. Despite extending the investigation beyond the original designated site boundary, the reported deposit of 200 to 450 containers was not found. The geophysical survey and test pitting activities identified five anomalies where containers with pesticides were found buried and another six anomalies where miscellaneous debris was located. A total of 41 empty containers and 7 full or partially full containers and three 50-pound bags of powder were found during the investigation. A variety of nonhazardous debris including pipes, concrete, tires, scrap metal, and bottles were also encountered during test pitting.

Pesticides were found in three of the six product samples collected and pesticides and metals were found in the one soil sample collected. The list of pesticides detected in these samples included alpha-BHC, gamma-BHC, toxaphene, 1,2-dibromo-3-chloropropane, parathion, and 2,4-dichlorophenoxyacetic acid. The metals detected in the soil sample included aluminum, arsenic, barium, chromium, copper, iron, magnesium, and zinc.

3.0 INITIAL EVALUATION

The information collected during the previous investigations and summarized in Chapter 2.0 was used to develop conceptual site models, identify potential ARARs, and identify potential remedial technologies and appropriate response actions for OUs 3, 4, 5, and 6 at NAS Cecil Field. The results of these activities are described below.

3.1 CONCEPTUAL SITE MODELS. The purpose of a conceptual site model is to determine sampling and/or data collection needs and to identify potential remedial technologies. Information on the waste sources, pathways, and receptors is used to develop a conceptual understanding of the site to evaluate potential risks to human health and the environment. Conceptual site models include known and suspected sources of contamination, types of contaminants and affected media, known and potential routes of migration, and known or potential human and environmental receptors (USEPA, 1988a).

Conceptual site models developed for Sites 7 and 8 (OU 3), Site 10 (OU 4), Sites 14 and 15 (OU 5), and Site 11 (OU 6) at NAS Cecil Field are presented in Figures 3-1 through 3-6, respectively. These figures present flow diagrams of the known or potential transport pathways and receptors for each of the six sites. The primary potential transport pathways include:

- vertical migration of contaminants into the groundwater;
- horizontal migration of contaminants in groundwater to downgradient water supply wells, surface water, and sediment;
- runoff of contaminants from soil to surface water and sediment;
- suspension of contaminants into the air via dust generation; and
- infiltration and percolation of contaminants from source into soil.

The potential exposure pathways tentatively identified for human and ecological receptors are shown in Figures 3-1 through 3-6. As shown, the potential exposure pathways for human receptors include:

- potential ingestion of contaminants in groundwater, surface soil, subsurface soil, surface water, sediment, and fish;
- potential inhalation of volatile organic compounds (VOCs) released from groundwater, and dust released from contaminated surface soil; and
- dermal contact with potential contaminants in groundwater, surface soil, subsurface soil, surface water, and sediment.

Potential exposure pathways for ecological receptors include:

- potential ingestion of contaminants in surface water and sediment;

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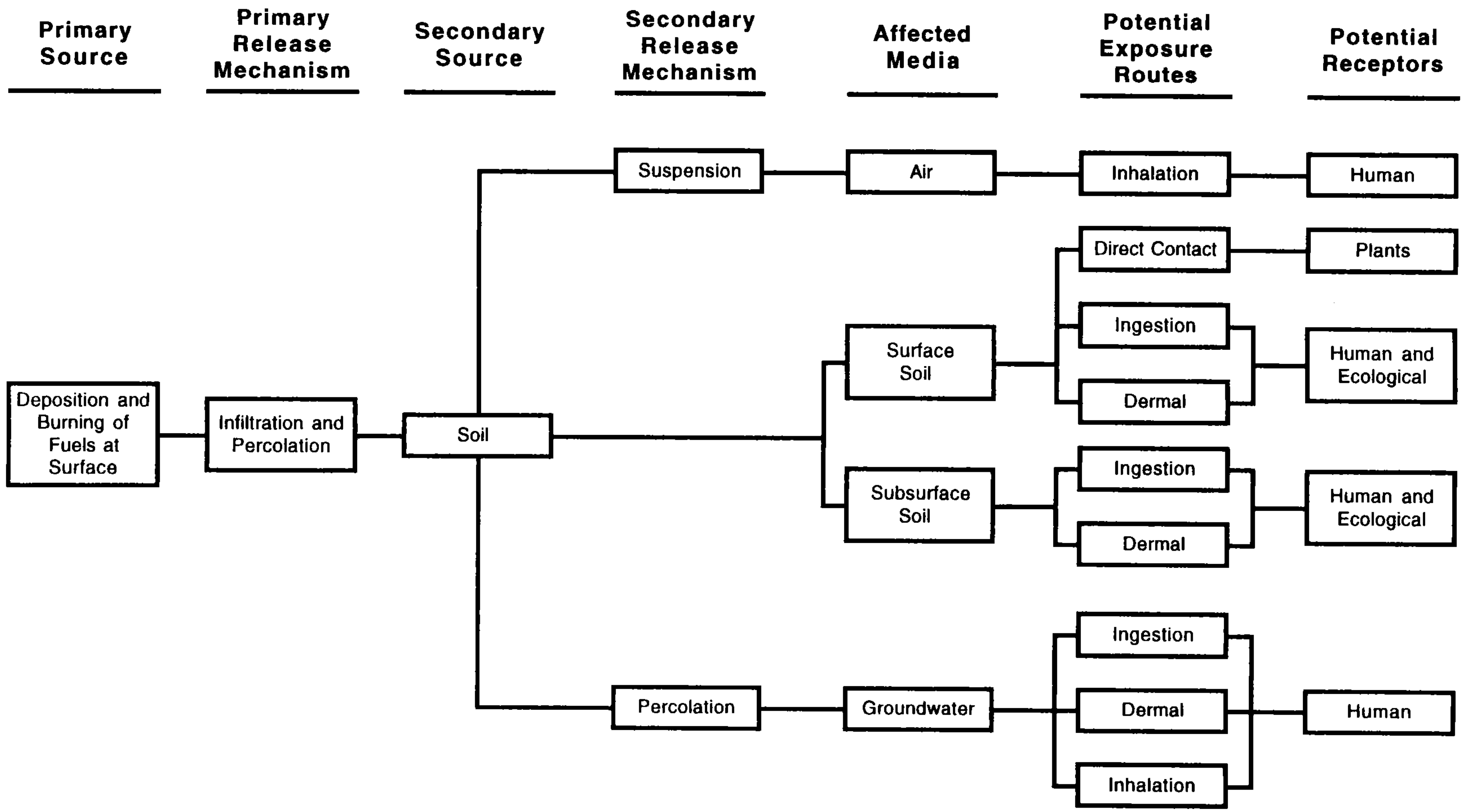

FIGURE 3-1

CONCEPTUAL SITE MODEL FOR SITE 7

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

8520-21 941115WEM

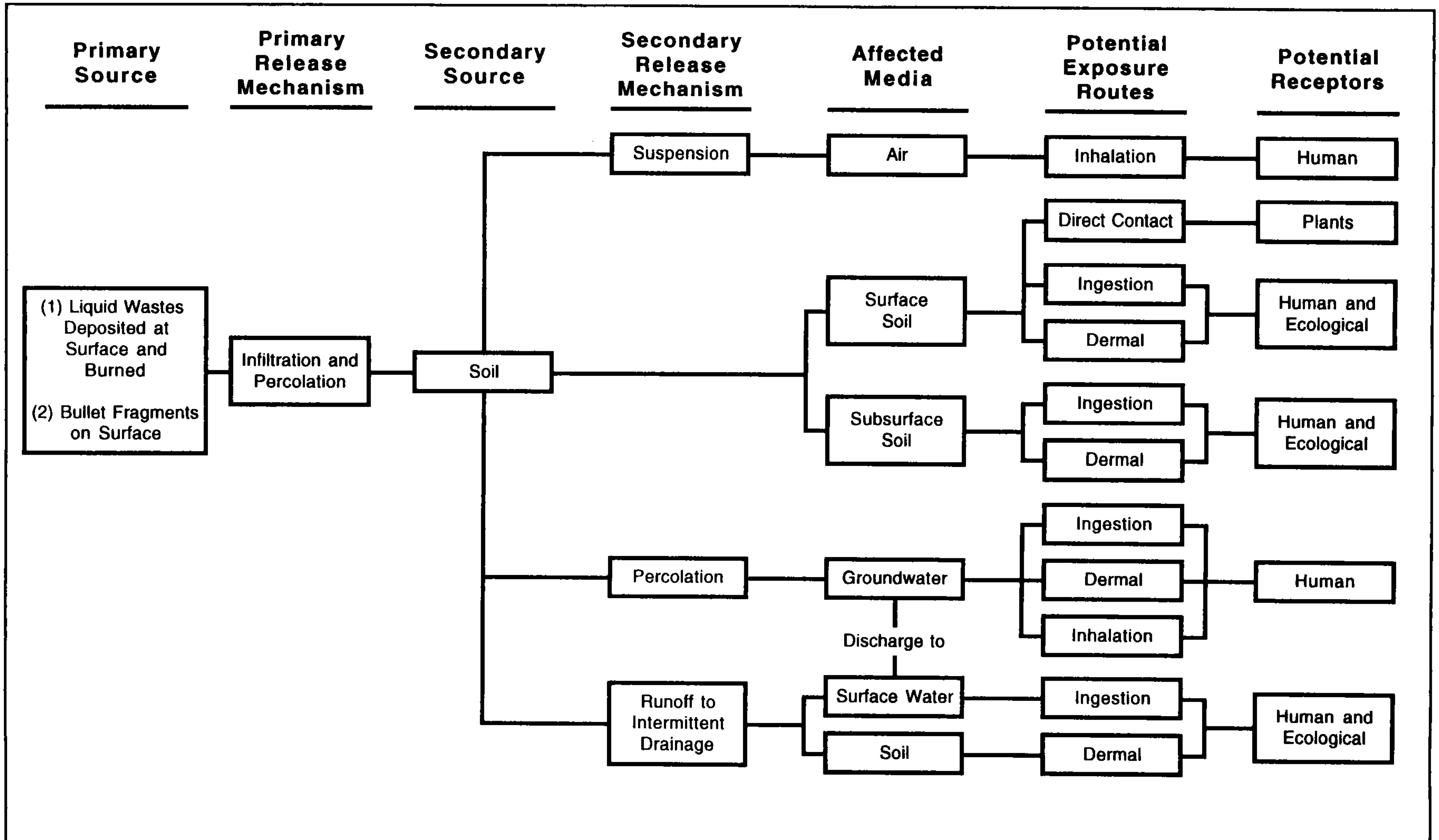

FIGURE 3-2

CONCEPTUAL SITE MODEL FOR SITE 8

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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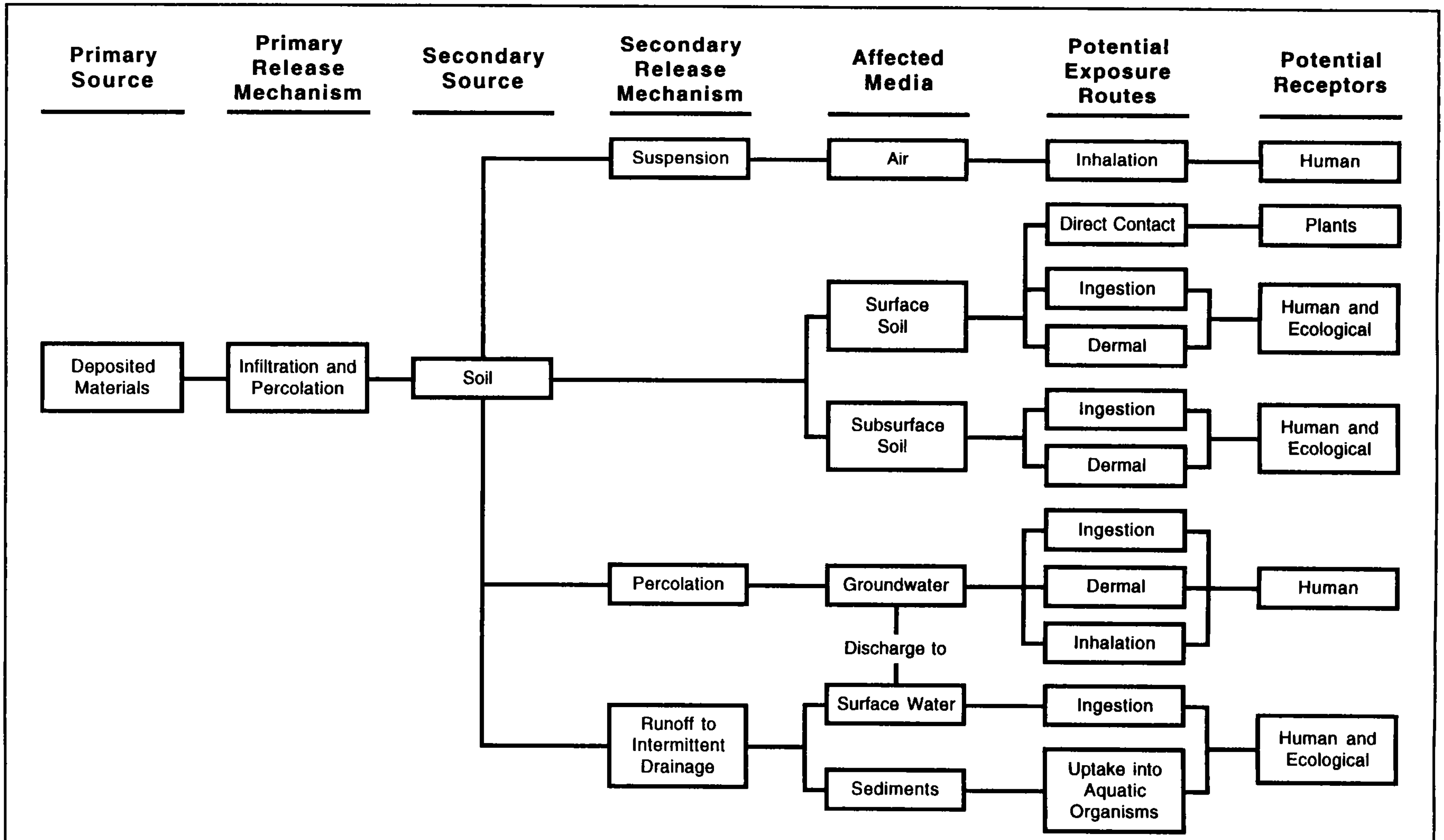

FIGURE 3-3

CONCEPTUAL SITE MODEL FOR SITE 10

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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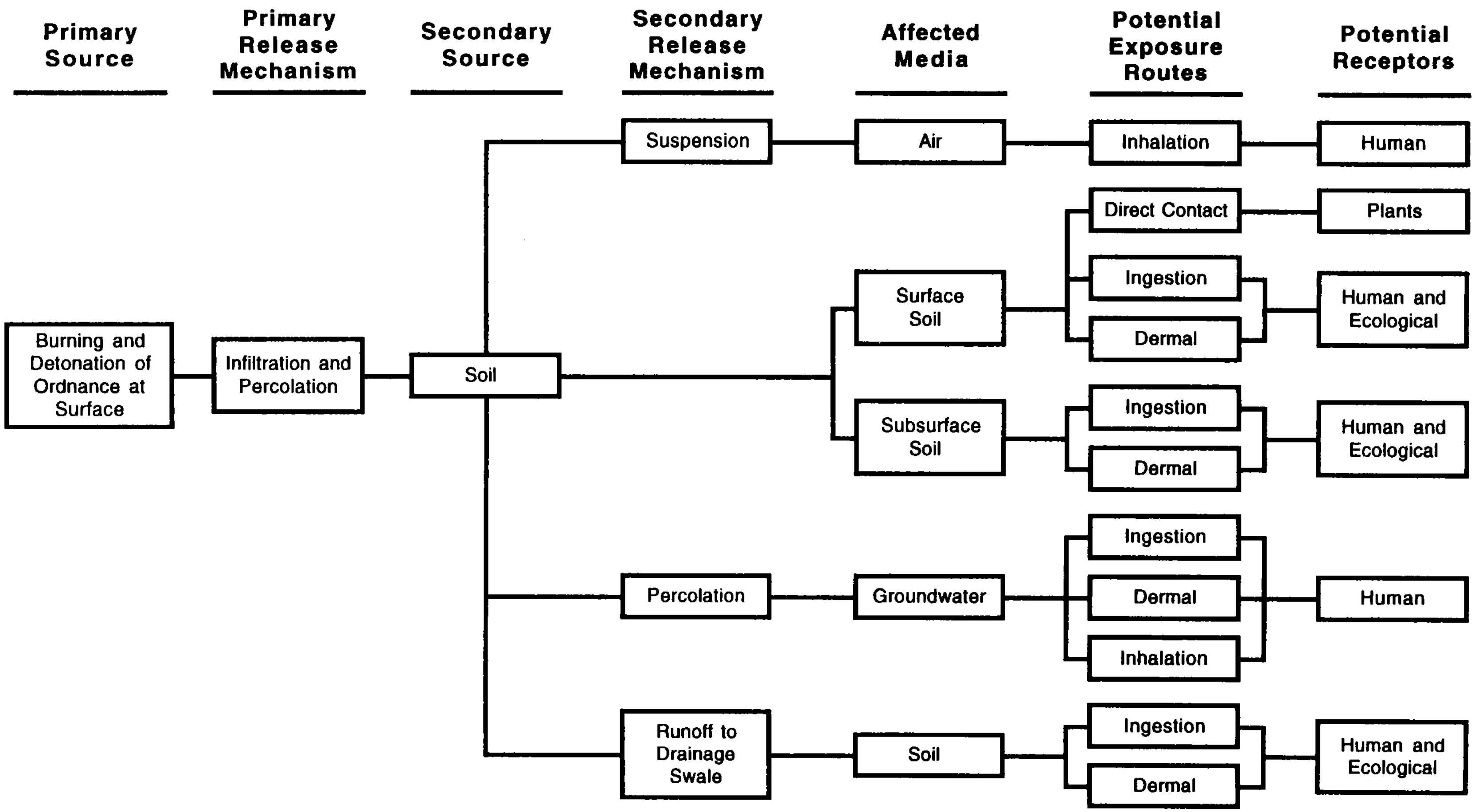

FIGURE 3-4

CONCEPTUAL SITE MODEL FOR SITE 14

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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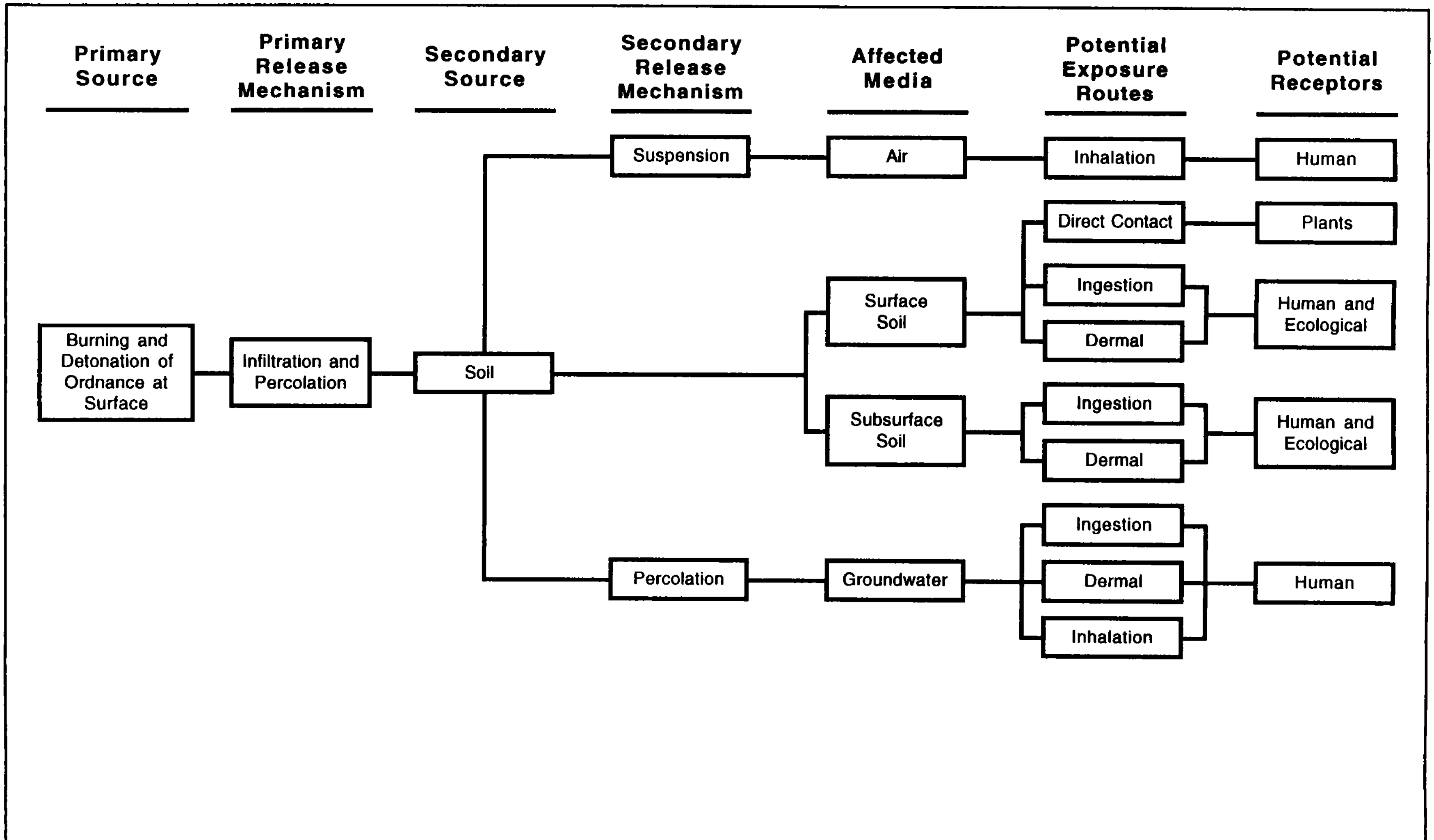

FIGURE 3-5

CONCEPTUAL SITE MODEL FOR SITE 15

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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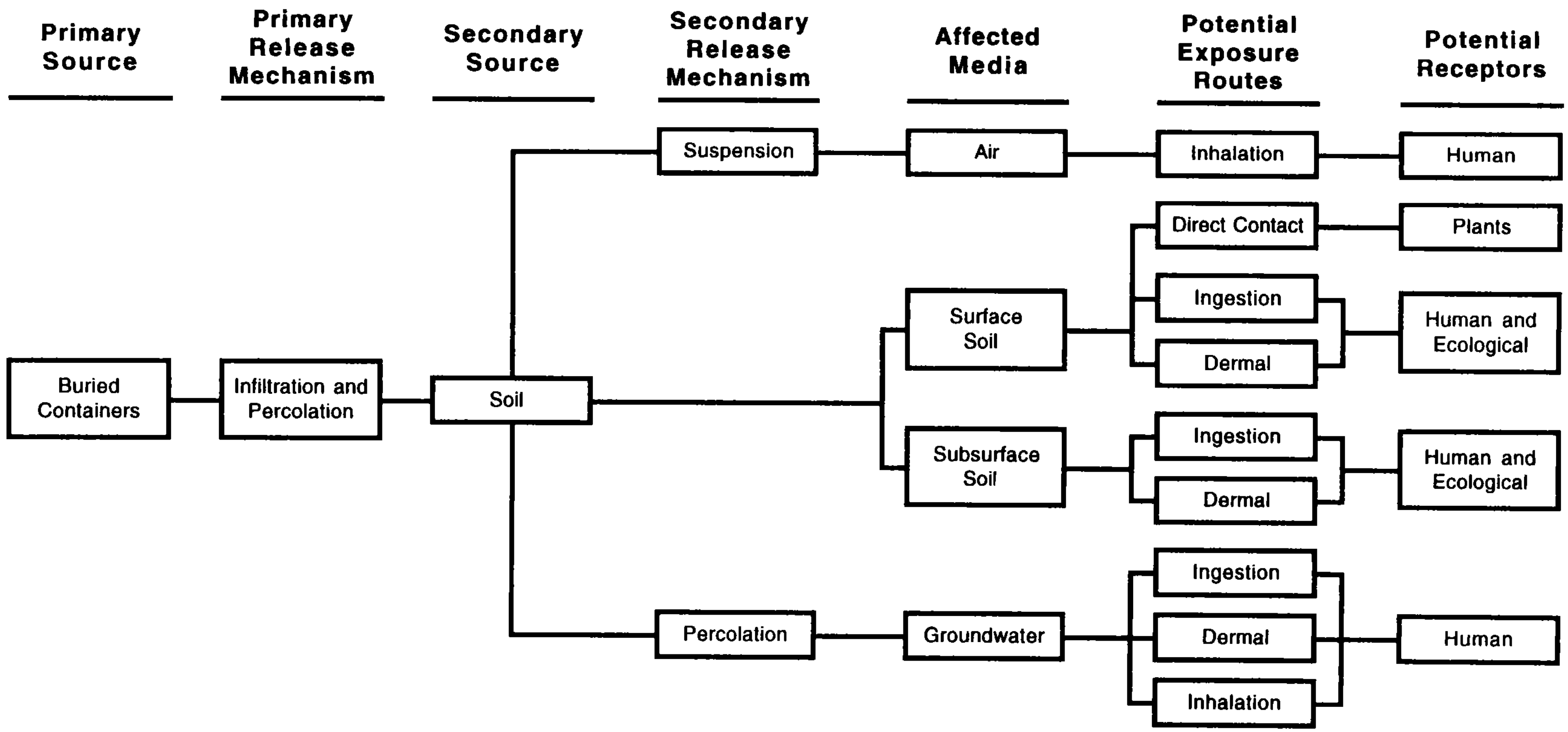


FIGURE 3-6

CONCEPTUAL SITE MODEL FOR SITE 11

REMEDIAL INVESTIGATION FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

8520-21 941117WEM

- direct contact with potential contaminants in surface soil, surface water, and sediment;

- incidental ingestion of soil; and

- ingestion of aquatic and terrestrial plants and animals that have accumulated contaminants from surface water, sediment, and/or soil.

Transport pathways for groundwater at Sites 7 and 11 to surface water of Rowell Creek have not been included in the conceptual models (Figures 3-1 and 3-6) due to the slow estimated migration velocity time (approximately 50 years) of groundwater from Sites 7 and 11 to Rowell Creek. For Site 7, this assumption has been verified with groundwater field screening results in which contamination has been observed only 500 feet downgradient of the source area. Transport pathways for sediment via surface water runoff to Rowell Creek is not anticipated at Sites 7 and 11 due to the long distance (approximately 1,000 feet) in which surface water would have to transport sediment over land with the absence of developed surface water drainageways. If in the future it appears that migration of contamination from these sites to Rowell Creek and Lake Fretwell is detected, the conceptual models will be revised to include groundwater to surface water and sediment to surface water pathways.

Surface water and sediment pathways have not been included in the conceptual models for Sites 14 and 15 because, technically, surface water and sediment are not present. The water present at Sites 14 and 15 is represented by standing water in drainage swales that are not connected to perennial surface water bodies. Therefore, as the drainage swale is not an aquatic habitat, exposures for aquatic receptors will not be evaluated. The soil in the drainage swales will be evaluated not as sediment but in the same manner as for surface soil.

<u>3.2 PREVIOUS CONTAMINANTS DETECTED</u>. The nature of contamination at OUs 3, 4, 5, and 6 at NAS Cecil Field is not well defined. Based on the results of the previous sampling investigations described in Chapter 2, however, contaminants that have been detected at OUs 3, 4, 5, and 6 at concentrations above background concentrations at NAS Cecil Field include the organic and inorganic compounds listed in Table 3-1.

Because additional contaminants may be present, complete target compound list (TCL) and target analyte list (TAL) analyses and analyses of other chemicals that may be associated with the sites will be performed on several samples collected in this RI/FS (see Chapter 4). The results of these analyses will be used to fully define the nature and extent of the contamination and to determine the contaminants of potential concern (COPCs) for each site in the baseline risk assessment (BRA). Risks associated with the COPCs will also be evaluated in the BRA.

<u>3.3 PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND OTHER GUIDELINES</u>. CERCLA compliance policy requires that any Superfund remedial action comply with all Federal standards, requirements, criteria, or limitations that are determined to be legally ARARs. Also, State ARARs must be met should they be more stringent. Preliminary identification of potential ARARs and other guidelines helps to initially identify remedial

Table 3-1
Contaminants Previously Detected Above NAS Cecil Field Background Concentrations

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Site	Groundwater	Soil	Sediment	Product
Site 7, Old Firefighter Training Area	Benzene Cadmium Chromium Lead	Cadmium Methylene chloride	Not present	None sampled
Site 8, Firefighter Training Area, Boresite Test Range, and Hazardous Waste Storage Area	Lead	Lead Methylene chloride 1,1,1-Trichloroethane	1,1,1-Trichloroethane	None sampled
Site 10, Rubble Disposal Area	bis(2-Ethylhexyl)phthalate Chromium Lead Mercury Trichloroethene trans-1,3-Dichloropropene	None sampled	Acetone Methylene chloride Barium Cadmium Nickel	None sampled
Site 14, Blue 5 Ordnance Disposal Area	None sampled	1,1,1-Trichloroethane	Not present	None sampled
Site 15, Blue 10 Ordnance Disposal Area	None sampled	Acenaphthene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(ghi)perylene Chrysene Fluoranthene Fluorene Indeno(1,2,3-cd)pyrene Naphthalene Phenanthrene Pyrene Lead	Not present	None sampled
Site 11, Golf Course Pesticide Disposal Area	Chromium Lead	1,2-Dibromo-3-chloropropane Parathion Toluene Methylene chloride 1,1,1-Trichloroethane Arsenic	Not present	alpha-BHC gamma-BHC 2,4-Dichlorophenoxyacetic acid 1,2-Dibromo-3-chloropropane Toxaphene

See note at end of table.

Table 3-1 (Continued)
Contaminants Previously Detected Above NAS Cecil Field Background Concentrations

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Site	Groundwater	Soil	Sediment	Product
Rowell Creek upstream of Sites 7, 8, and 10	Not applicable	Not applicable.	Copper Iron lead Magnesium Manganese 2,4,6-Tribromo-phenol Aluminum Aroclor-1254 Aroclor-1260 Barium Selenium Silver Vanadium Zinc bis(2-Ethylhexyl)-phthalate	Not applicable

Note: BHC = benzene hexachloride.

alternatives and, thus, allows better planning of field data collection activities. Due to the iterative nature of the RI/FS process, ARAR identification proceeds throughout the entire RI/FS as the conceptual site model and remedial action alternatives are refined. ARARs may be categorized as follows (USEPA, 1988a):

- chemical-specific requirements that define acceptable exposure levels and, therefore, can be used in establishing preliminary remedial goals;
- location-specific requirements that set restrictions on activities within specific locations such as floodplains or wetlands; and
- action-specific controls or restrictions for particular treatment and disposal activities related to the management of hazardous wastes.

As part of development of this workplan, Federal and State ARARs were identified in relation to the results of previous sampling investigations at the sites, using *Handbook of Applicable or Relevant and Appropriate Requirements for Navy Sites Within the State of Florida* (ABB-ES, 1993). These ARARs, for the combined four OUs addressed in this workplan, are provided in Tables 3-2 through 3-4 and include State and Federal ARARs classified, respectively, as chemical specific, location specific, and action specific. These ARAR lists will be updated as appropriate to new criteria, site characteristics, and response activities as this RI/FS proceeds.

3.4 PRELIMINARY REMEDIAL ACTION ALTERNATIVES DEVELOPMENT. Preliminary remedial action objectives and general response actions have been developed to assist in the identification of remedial technologies potentially appropriate for remediation of the six sites comprising OUs 3, 4, 5, and 6. The purpose of identifying potential remedial technologies at this stage is to help ensure that the data needed to evaluate them are collected as early as possible. In addition, the early identification of technologies will allow early analysis as to the need for treatability studies. This identification is not meant to be a detailed investigation of alternatives. Rather it is intended to be a more general classification of potential remedial actions based upon the initially identified routes of contaminant transport and exposure and associated receptors. Technologies that may be appropriate for treating or disposing of wastes are identified. In addition, to the extent practicable, a preliminary list of broadly defined alternatives are developed that reflects the goal of presenting a range of distinct, viable options to the decision maker for remedial action at the site (USEPA, 1988a). Note, however, that the remedial technologies and alternatives identified in this section may not be all inclusive. As additional information is gathered during the RI, this list may be modified or expanded.

Tables 3-5 through 3-8 present the preliminary remedial action objectives, general response actions, technology types, and process options that are applicable to OUs 3, 4, 5, and 6 at NAS Cecil Field, respectively. Preliminary remedial action objectives are based on protecting human health and the environment. General response actions are developed from the remedial action objectives. Technologies are based on the response actions and comprise the preliminary remedial action alternatives. The alternatives developed at this stage will be refined throughout the RI/FS process.

Table 3-2
Preliminary Chemical-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Federal			
Safe Drinking Water Act (SDWA)			
National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs)	40 Code of Federal Regulations (CFR) Part 141	Establishes enforceable standards for specific contaminants that have been determined to adversely affect human health. These standards, MCLs, are protective of human health for individual chemicals and are developed using MCL goals, available treatment technologies, and cost data.	Relevant and appropriate.
Maximum Contaminants Level Goals (MCLGs)	40 CFR Part 141	Establishes drinking water quality goals at levels of no known or anticipated adverse health effects with an adequate margin of safety. These criteria do not consider treatment feasibility or cost elements.	Relevant and appropriate.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes welfare-based standards for public water systems for specific contaminants or water characteristics that may affect the aesthetic qualities of drinking water.	To be considered
Clean Water Act			
Ambient Water Quality Criteria (AWQC)	40 CFR Part 131	AWQC are non-enforceable criteria for surface water. AWQC provide levels of exposure from drinking the water and consuming aquatic life that are protective of public health. AWQC also provide acute and chronic concentrations for protection of freshwater and marine organisms.	Relevant and appropriate.
Toxic Pollutant Effluent Standards	40 CFR Part 129	Regulates the concentration of a toxic pollutant in navigable waters and states that a discharge from a site to navigable water shall not result in adverse impacts to aquatic life or to consumers of aquatic life.	Relevant and appropriate.
Occupational Safety and Heath Act			
Occupational Safety and Health Regulations	29 CFR Part 1910, Subpart Z	Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals.	Applicable

See note at end of table.

Table 3-2 (Continued)
Preliminary Chemical-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
State			
Florida Water Quality Standards	Chapter 17-520, Florida Administrative Code (FAC)	Establishes the groundwater classification system for the State and provides qualitative minimum criteria for groundwater based on the classification.	Applicable
Florida Surface Water Standards	Chapter 17-302, FAC	Defines classifications of surface waters, and establishes water quality standards for surface water within the classifications. The State's antidegradation policy is also established in this rule.	Applicable
Florida Drinking Water Standards	Chapter 17-550, FAC	Established to implement the Federal SDWA by adopting the national primary and secondary drinking water standards and by creating additional rules to fulfill State and Federal requirements.	Applicable

ARARs = applicable or relevant and appropriate requirements.

Table 3-3
Preliminary Location-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Federal			
Resource Conservation and Recovery Act			
General Facility Standards	40 Code of Federal Regulations (CFR) Subpart B, 264.10 - 264.18	Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood.	Relevant and appropriate.
Fish and Wildlife Coordination Act	40 CFR Part 302	Requires that the U.S. Fish and Wildlife Services, National Marine Fisheries Service, and related State agencies be consulted when a Federal department or agency proposes or authorizes any control or structural modification of any stream or other water body. Also requires adequate provision for protection of fish and wildlife resources.	Relevant and appropriate.
Floodplain Management Executive Order, Executive Order Number 11988	40 CFR 6.302	Actions that are to occur in floodplains should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial value.	Relevant and appropriate.
Endangered Species Act	50 CFR Part 402	Requires action to avoid jeopardizing the continued existence of federally listed endangered or threatened species. Requirements include notification to the agency and minimization of the adverse effects to such endangered species due to planned activities.	Applicable
Archeological and Historical Preservation Act	40 CFR Part 6	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a Federal construction project or a federally licensed activity or program.	Relevant and appropriate.
National Wildlife Refuge System	16 United States Code (USC) 668	Restricts activities within a National Wildlife Refuge.	To be considered
Rivers and Harbors Act, Section 10 Permit	33 USC 403. 33 CFR Parts 320 - 330	Requires a permit for structures that may affect navigable waters. Also requires a permit for work in or affecting navigable waters.	Relevant and appropriate.

See note at end of table.

Table 3-3 (Continued)
Preliminary Location-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Wilderness Act	16 USC 1311	Area must be administered in such a way as will leave it unimpaired as wilderness and will preserve it as a wilderness.	Relevant and appropriate.
Protection of Wetlands, Executive Order Number 11990	40 CFR Part 6	Requires Federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practical alternative exists.	Relevant and appropriate.
National Environmental Policy Act	40 CFR Part 6	Requires an Environmental Impact Statement or a "functional equivalent" for Federal actions that may impact the human environment. Also requires that Federal agencies minimize the degradation, loss, or destruction of wetlands, and preserve and enhance natural and beneficial values of wetlands and floodplains under Executive Orders 11990 and 11988.	Relevant and appropriate.
Coastal Zone Management Act	15 CFR Part 930	Establishes that Federal activities must be consistent with State coastal zone management programs. The lead Federal agencies must supply the State with a consistency determination.	Relevant and appropriate.
State			
Florida Surface Water Standards	Chapter 17-301, Florida Administrative Code (FAC)	Provides criteria for determination of the line demarcating the landward extent of surface waters.	Relevant and appropriate.
Florida Dredge and Fill Activities	Chapter 17-312, FAC	Establishes permit requirements for dredging, filling, excavating, or placing material in or over waters of the State.	Relevant and appropriate.
Florida Wetlands Application Regulation	Chapter 17-611, FAC	Sets requirements for discharge of domestic wastewater to wetlands.	Relevant and appropriate.

ARARs = applicable or relevant and appropriate requirements.

Table 3-4
Potential Action-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Federal			
Clean Air Act			
New Source Performance Standards (NSPS)	40 Code of Federal Regulations (CFR) Part 60	Establishes NSPS for specified sources, including incinerators. The NSPSs limit the emissions of a number of different pollutants, including the six criteria pollutants as well as fluorides, sulfuric acid mist, and total reduced sulfur.	Relevant and appropriate.
National Emission Standards for Hazardous Air Pollutants	40 CFR Part 61	Establishes emission levels for certain hazardous air pollutants.	Relevant and appropriate.
National Ambient Air Quality Standards	40 CFR Part 50	Establishes primary (health based) and secondary (welfare based) air quality standards for carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides emitted from a major source of air emissions.	Relevant and appropriate.
Clean Water Act			
National Pollutant Discharge Elimination System	40 CFR Parts 122 and 125	Requires permits specifying the permissible concentration or level of contaminants in the effluent for the discharge of pollutants from any point source into waters of the United States.	Relevant and appropriate.
National Pretreatment Standards	40 CFR Part 403	Sets pretreatment standards through the National Categorical Standards or the General Pretreatment Regulations, for the introduction of pollutants from non-domestic sources into publicly owned treatment works (POTWs) in order to control pollutants that pass through, cause interference, or are otherwise incompatible with treatment processes at a POTW.	Relevant and appropriate.
Guidelines for Specification of Disposal Sites for Dredged or Fill Materials	40 CFR Part 230	Applies to all existing, proposed, or potential disposal sites for discharges of dredged or fill material into United States waters, including wetlands.	Relevant and appropriate.
Department of Transportation Rules for Transportation of Hazardous Materials	49 CFR Parts 107, 171, 173, 178, and 179	Establishes the procedures for packaging, labeling, and transporting of hazardous materials.	Applicable
Federal Insecticide, Fungicide, and Rodenticide Act Regulations	40 CFR Part 165	Provides procedures for the storage and disposal of pesticides, pesticide related wastes, and their containers.	Relevant and appropriate.

See notes at end of table.

Table 3-4 (Continued)
Potential Action-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Hazardous Materials Transportation Act			
Hazardous Materials Transportation Regulations	49 CFR Parts 171, 173, 178, and 179	Provides requirements for the packaging, labeling, manifesting, and transporting of hazardous materials.	Applicable
Resource Conservation and Recovery Act (RCRA)			
Hazardous Waste Management System	40 CFR Part 260	Sets forth procedures that the U.S. Environmental Protection Agency (USEPA) will use to make information available to the public, and sets forth rules that treatment, storage, and disposal facilities (TSDFs) must follow to assert claims of business confidentiality with respect to information submitted to the USEPA pursuant to 40 CFR Parts 261 to 265.	Relevant and appropriate.
Identification and Listing of Hazardous Waste	40 CFR Part 261	Defines those solid wastes subject to regulation as hazardous wastes under 40 CFR Parts 262 - 265.	Applicable
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous wastes that address waste accumulation, preparation for shipment, and completion of the uniform hazardous waste manifest. These requirements are integrated with U.S. Department of Transportation regulations. These rules specify that all hazardous waste shipments must be accompanied by an appropriate manifest.	Relevant and appropriate.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263, Subpart A	Establishes procedures for transporters of hazardous waste within the United States if the transportation requires a manifest under 40 CFR Part 262.	Relevant and appropriate.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264	Establishes minimum national standards defining the acceptable management of hazardous wastes for owners and operators of facilities that treat, store, or dispose of hazardous wastes.	Relevant and appropriate.
General Facility Standards	40 CFR Subpart B, 264.10 - 264.18	Sets the general facility requirements including general waste analysis, security measures, inspections, and training requirements. Section 264.18 establishes that a facility located in a 100-year floodplain must be designed, constructed, and maintained to prevent washout of any hazardous wastes by a 100-year flood.	Relevant and appropriate.

See notes at end of table.

Table 3-4 (Continued)
Potential Action-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Preparedness and Prevention	40 CFR Part 264, Subpart C	Outlines requirements for safety equipment and spill control for hazardous waste facilities. Facilities must be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment.	Relevant and appropriate.
Contingency Plan and Emergency Procedures	40 CFR Part 264, Subpart D	Outlines requirements for emergency procedures to be used following explosions, fires, etc.	Relevant and appropriate.
Manifest System, Recordkeeping, and Reporting	40 CFR Part 264, Subpart E	Outlines procedures for manifesting hazardous waste for owners and operators of onsite and offsite facilities that treat, store, or dispose of hazardous waste.	Applicable
Use and Management of Containers	40 CFR Part 264, Subpart I	Sets standards for the storage of containers of hazardous waste.	Relevant and appropriate.
Surface Impoundments	40 CFR Part 264, Subpart K	Applies to owners and operators that use surface impoundments to treat, store, or dispose of hazardous waste.	Relevant and appropriate.
Waste Piles	40 CFR Part 264, Subpart L	Establishes procedures and operating requirements for both closure and post-closure of waste piles. If removal or decontamination of all contaminated subsoils is not possible, closure and post-closure requirement for landfills must be attained.	Relevant and appropriate.
Land Treatment	40 CFR Part 264, Subpart M	Establishes procedures and operating requirements for both closure and post-closure of land treatment units.	Relevant and appropriate.
Landfills	40 CFR Part 264, Subpart N	Provides requirements for design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for RCRA-regulated landfills.	Relevant and appropriate.
Incinerators	40 CFR Part 264, Subpart O	Specifies performance standards, operating requirements, monitoring guidelines, inspection guidelines, and closure guidelines for any incinerator burning hazardous waste.	Relevant and appropriate.

See notes at end of table.

Table 3-4 (Continued)
Potential Action-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Miscellaneous Units	40 CFR Subpart X, 264.600 - 264.999	These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, and wetlands that may have adverse effects on human health and the environment.	Relevant and appropriate.
Air Emission Standards for Process Vents	40 CFR Subpart AA, 264.1030 - 264.1036	Contains air pollutant emission standards for process vents, closed-vent systems, and control devices at hazardous waste TSDFs. Performance standards for total organic emissions are also established.	Relevant and appropriate.
Air Emission Standards for Equipment Leaks	40 CFR Subpart BB, 264.1050 - 264.1065	Establishes air pollution emission standards for equipment leaks at TSDFs.	Relevant and appropriate.
Interim Status TSDF Standards; Thermal Treatment	40 CFR 265, Subpart P, 265.370 - 265.383	General operating, waste analysis, monitoring and inspection, and closure requirements for thermal treatment facilities are established.	Relevant and appropriate.
Interim Status TSDF Standards; Chemical, Physical, and Biological Treatment	40 CFR 265, Subpart Q, 265.400 - 265.406	The requirements established in this rule apply to owners and operators of facilities treating hazardous waste by chemical, physical, or biological methods in other than tanks, surface impoundments, and land treatment facilities	Relevant and appropriate.
Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	40 CFR Part 266	Deals with both recycling and reuse activities and types of wastes being recycled or reused.	Relevant and appropriate.
Land Disposal Restrictions	40 CFR Part 268	Establishes restrictions on land disposal of untreated hazardous wastes and provides treatment standards for hazardous wastes.	Relevant and appropriate.
Land Disposal Restrictions for Newly Listed Wastes and Hazardous Debris	40 CFR Parts 148, 260, 261, 262, 264, 265, 270, and 271	Provides several treatment options for the management and disposal of contaminated debris.	Applicable
Corrective Action Management Units (CAMUs) and Temporary Units (TUs); Corrective Action Provisions Under Subtitle C	40 CFR Part 260, 264, 265, 268, 270, and 271	Establishes CAMUs and TUs as two options for corrective actions at permitted RCRA facilities.	Relevant and appropriate.

See notes at end of table.

Table 3-4 (Continued)
Potential Action-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Hazardous Waste Permit Program	40 CFR Part 270	Establishes requirements for obtaining permits to treat, store, or dispose of hazardous wastes.	Relevant and appropriate.
Underground Injection Control Regulations	40 CFR Part 143	Establishes minimum program and performance standards for underground injection programs. Also requires protection of underground sources of drinking water.	Relevant and appropriate.
Solid Waste Disposal Act, Criteria for Classification of Solid Waste Disposal Facilities and Practices	42 USC 6901 - 6987, 40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on public health or the environment.	Relevant and appropriate.
Occupational Safety and Health Act			
General Industry Standards	29 CFR Part 1910	Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements.	Applicable
Recording, Reporting, and Related Regulations	29 CFR Part 1904	Provides recordkeeping and reporting requirements applicable to remedial activities.	Applicable
Health and Safety Standards	29 CFR Part 1926	Specifies the type of safety training, equipment, and procedures to be used during site investigation and remediation.	Applicable
State			
Florida Soil Thermal Treatment Facilities Regulations	Chapter 17.775, Florida Administrative Code (FAC)	Establishes criteria for the thermal treatment of petroleum or petroleum product contaminated soils. The rule further outlines procedures for excavating, receiving, handling, and stockpiling contaminate soils prior to thermal treatment in both stationary and mobile facilities.	Relevant and appropriate.
Florida Petroleum Contaminated Site Cleanup Criteria	Chapter 17-770, FAC	Establishes a cleanup process to be followed at all petroleum contaminated sites.	Relevant and appropriate.
Florida Rules on Hazardous Waste Warning Signs	Chapter 17-736, FAC	Requires warning signs at National Priority List and Florida Department of Environmental Protection hazardous waste sites to inform the public of the presence of potentially harmful conditions.	Applicable

See note at end of table.

Table 3-4 (Continued)
Potential Action-Specific ARARs, Criteria, and Guidance

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Standard, Requirement, Criteria, or Limitation	Citation	Requirements Synopsis	Status
Florida Hazardous Waste Rules	Chapter 17-730, FAC	Adopts by reference appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes.	Relevant and appropriate.
Florida Industrial Wastewater Facilities Regulations	Chapter 17-660, FAC	Sets minimum treatment standards for effluent based on water quality considerations and technology. Also establishes general permit requirements for four specific operations.	Relevant and appropriate.
Florida Water Quality Based Effluent Limitations	Chapter 17-650, FAC	States that all activities and discharges, except dredge and fill, must meet effluent limitations based on technology or water quality.	Relevant and appropriate.
Florida Water Well Permitting and Construction Requirements	Chapter 17-532, FAC	Establishes the minimum standards for the location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established.	Relevant and appropriate.
Groundwater Permitting and Monitoring Requirements	Chapter 17-522, FAC	Establishes permitting and monitoring requirements for installations discharging to groundwater.	To be considered
Florida Underground Injection Control Regulations	Chapter 17-28, FAC	Establishes a State Underground Injection Control Program consistent with Federal requirements and appropriate to the hydrogeology of Florida.	To be considered
Florida Rules on Permits	Chapter 17-4 FAC	Establishes procedures for obtaining permits for sources of pollution.	Relevant and appropriate.
Florida Air Pollution Rules	Chapter 17-2 FAC	Establishes permitting requirements for owners or operators of any source that emits any air pollutant.	Relevant and appropriate.

Notes: ARARs = applicable or relevant and appropriate requirements.
TSDFs = treatment, storage, and disposal facilities.

Table 3-5
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 3

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Groundwater and Surface Water	For Human Health:	No action	None	Not applicable
	Prevent ingestion, inhalation, or direct contact with water having carcinogens in excess of maximum contaminant levels (groundwater) and ambient water quality criteria (surface water) or a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls	Deed restrictions (restrict excavation and groundwater use)
			Alternate water supply	Bottled water, or public or base water supply
			Monitoring	Monitoring of contaminated media
		Containment	Capping	Clay, soil, synthetic, asphalt, concrete, and multi-layer
	Prevent ingestion, inhalation, or direct contact with water having non-carcinogens in excess of maximum contaminant levels (groundwater) and ambient water quality criteria (surface water) or a hazard quotient greater than 1.		Vertical barriers	Slurry wall, grout curtain, vibrating beam, sheet piling, liners, and hydraulic mounds.
			Horizontal barriers	Liners, grout injection, and block displacement
			Surface water controls	Diversion and/or pumping
		Collection	Extraction and pumping	Extraction wells and interceptor trenches
		Treatment		
	For Environmental Protection:		In-situ	Sparging, vapor extraction, and bioremediation
			Physical	Flocculation, gravity separation, oil-water separation, filtration, and freeze crystallization
	Prevent direct contact or ingestion in receiving surface water system with contaminants in excess of risk-based remedial levels or applicable surface water standards.		Chemical	Neutralization, precipitation, ion exchange, and ultraviolet (UV) oxidation
		Discharge	Offsite	Transportation and treatment at hazardous waste facility
			Onsite and offsite	Surface water, Navy-owned treatment works, or groundwater (injection wells and infiltration galleries)

Table 3-5 (Continued)
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 3

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Soil and Sediment	For Human Health:	No action	None	Not applicable
	Prevent ingestion and direct contact with soil and sediment having carcinogens in excess of a total excess cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls	Deed restrictions (restrict land use), or fencing
			Monitoring	Monitoring of contaminated media
		Containment	Capping	Clay, soil, synthetic, asphalt, concrete, and multi-layer
			Vertical barriers	Slurry wall, grout curtain, vibrating beam, and sheet piling
	Prevent ingestion and direct contact with soil and sediment having non-carcinogens in excess of a hazard quotient greater than 1.		Horizontal barriers	Liners, grout injection, and block displacement
			Erosion controls	Grading and revegetation
			Dust and vapor suppression	Water, membranes or tarpaulins, and organic agents or foam
			Sediment controls	Coffer dams, curtain barriers, and capping barriers
	For Environmental Protection:	Removal	Surface water controls	Diversion and/or pumping
	Prevent migration of contaminants that would result in groundwater and surface water not meeting remedial action objectives.	Treatment	Excavation	Solids excavation, dredging and dewatering (for sediment)
			In-situ	Chemical, sorption, vitrification, vapor extraction, and bioremediation
	Prevent ingestion and direct contact with soil and sediment exhibiting toxicity to test organisms or associated with adverse effects to growth, reproduction, or survival of terrestrial wildlife species or aquatic receptors.		Stabilize and solidify	Lime-based, Portland cement, and proprietary reagent
			Chemical	Neutralization
			Thermal	Molten solids processing, low thermal desorption, and incineration
		Disposal	Offsite	Transportation and treatment at hazardous waste landfill
			Onsite and offsite	Landfill (onsite or offsite), encapsulation, and backfill
Air	For Human Health:	No action	None	Not applicable
	Prevent inhalation of carcinogens in excess of a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls	Deed restrictions (restrict land use), and fencing
			Monitoring	Monitoring of contaminated media
		Removal	Gas collection	Passive vents, and active gas collection systems

Table 3-6
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 4

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Groundwater and Surface Water	For Human Health:	No Action	None	Not applicable
	Prevent ingestion, inhalation, and direct contact with water having carcinogens in excess of maximum contaminant levels (groundwater) and ambient water quality criteria (surface water) or a total excess cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls	Deed restrictions (restrict excavation and groundwater use)
			Alternate water supply	Bottled water or public or base water supply
			Monitoring	Monitoring of contaminated media
		Containment	Capping	Clay, soil, synthetic, asphalt, concrete, and multi-layer
			Vertical barriers	Slurry wall, grout curtain, vibrating beam, sheet piling, liners, and hydraulic mounds
	Prevent ingestion, inhalation, and direct contact with water having noncarcinogens in excess of maximum contaminant levels (groundwater) and ambient water quality criteria (surface water) or a hazard quotient greater than 1.		Horizontal barriers	Liners, grout injection, and block displacement
			Surface water controls	Diversion and/or pumping
		Collection	Extraction and pumping	Extraction wells and interceptor trenches
		Treatment	In-situ	Sparging, vapor extraction, and bioremediation
			Physical	Flocculation, gravity separation, oil-water separation, filtration, freeze crystallization, and membrane separations
			Chemical	Neutralization, precipitation, ion exchange, and UV oxidation
	For Environmental Protection:		Offsite	Transportation and treatment at hazardous waste facility
	Prevent direct contact in receiving surface water system with contaminants in excess of risk-based remedial levels or applicable surface water standards.	Discharge	Onsite and offsite	Surface water, Navy-owned treatment works, and groundwater (injection wells, and infiltration galleries)

Table 3-6 (Continued)
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 4

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Soil and Sediment	For Human Health:	No action	None	Not applicable
	Prevent ingestion and direct contact with soil and sediment having carcinogens in excess of a total excess cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls Monitoring	Deed restrictions (restrict land use), and fencing Monitoring of contaminated media
		Containment	Capping	Clay, soil, synthetic, asphalt, concrete, and multi-layer
	Prevent ingestion and direct contact with soil and sediment having non-carcinogens in excess of a hazard quotient greater than 1.		Vertical barriers	Slurry wall, grout curtain, vibrating beam, and sheet piling
			Horizontal barriers	Liners, grout injection, and block displacement
			Erosion controls	Grading, and revegetation
			Dust and vapor suppression	Water, membranes or tarpaulins, organic agents, and foam
	For Environmental Protection:		Sediment controls	Coffer dams, curtain barriers, and capping barriers
		Removal	Surface water controls	Diversion and/or pumping
	Prevent migration of contaminants that would result in groundwater and surface water not meeting remedial action objectives.	Treatment	Excavation	Solids excavation, dredging and dewatering (for sediment)
			In-situ	Chemical, sorption, vitrification, vapor extraction, and bioremediation
	Prevent ingestion and direct contact with contaminants in soil and sediment exhibiting toxicity to test organisms or associated with adverse effects to growth, reproduction, or survival of terrestrial wildlife species or aquatic receptors.		Stabilize and solidify	Lime-based, Portland cement, and proprietary reagent
			Chemical	Neutralization
			Thermal	Molten solids processing, low thermal desorption, and incineration
		Disposal	Offsite	Transportation and treatment at hazardous waste landfill
			Onsite and offsite	Landfill (onsite or offsite), encapsulation, and backfill
Air	For Human Health:	No action	None	Not applicable
	Prevent inhalation of carcinogens in excess of a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls Monitoring	Deed restrictions (restrict land use), and fencing Monitoring of contaminated media
		Removal	Gas collection	Passive vents, and active gas collection systems

Table 3-7
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 5

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Groundwater	For Human Health:	No Action	None	Not applicable
	Prevent ingestion, inhalation, and direct contact with water having carcinogens in excess of maximum contaminant levels or a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls	Deed restrictions (restrict excavation and groundwater use)
			Alternate water supply	Bottled water or public or base water supply
			Monitoring	Monitoring of contaminated media
		Containment	Capping	Clay, soil, synthetic, asphalt, concrete, multi-layer
	Prevent ingestion, inhalation, and direct contact with water having non-carcinogens in excess of maximum contaminant levels or a hazard quotient greater than 1.		Vertical barriers	Slurry wall, grout curtain, vibrating beam, sheet piling, liners, and hydraulic mounds
			Horizontal barriers	Liners, grout injection, and block displacement
		Collection	Extraction and pumping	Extraction wells, interceptor trenches
	For Environmental Protection:			
		Treatment	In-situ	Sparging, vapor extraction, bioaccumulation
	Restore groundwater aquifer to acceptable contaminant concentrations.		Physical	Flocculation, gravity separation, oil-water separation, filtration, crystallization, membrane separations, evaporation
			Chemical	Neutralization, precipitation, ion exchange, reduction
			Offsite	Transportation and treatment at hazardous waste facility
		Discharge	Onsite and offsite	Surface water, Navy-owned treatment works, groundwater (injection wells, infiltration galleries)

Table 3-7 (Continued)
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 5

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Soil	For Human Health:	No action	None	Not applicable
	Prevent ingestion and direct contact with soil having carcinogens in excess of a total excess cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls Monitoring	Deed restrictions (restrict land use), or fencing Monitoring of contaminated media
	Prevent ingestion and direct contact with soil having non-carcinogens in excess of a hazard quotient greater than 1.	Containment	Capping Vertical barriers Horizontal barriers Erosion controls Dust and vapor suppression Surface water controls	Clay, soil, synthetic, asphalt, concrete, and multi-layer Slurry wall, grout curtain, vibrating beam, and sheet piling Liners, grout injection, and block displacement Grading and revegetation Water, membranes or tarpaulins, organic agents and foam Diversion and collection
	Prevent direct contact with unexploded ordnance.	Removal	Excavation	Unexploded ordnance removal and solids excavation
	For Environmental Protection:	Treatment	In-situ Stabilize and solidify Physical Chemical Thermal Offsite	Chemical, sorption, vitrification Lime-based, Portland cement, and proprietary reagent Soil washing Neutralization Molten solids processing Transportation and treatment at hazardous waste landfill
	Prevent migration of contaminants that would result in groundwater not meeting remedial action objectives.			
	Prevent ingestion and direct contact with contaminants in soil exhibiting toxicity to test organisms or associated with adverse effects to growth, reproduction, or survival of terrestrial wildlife species.	Disposal	Onsite and offsite	Landfill (onsite or offsite), encapsulation, backfill
Air	For Human Health:	No action	None	Not applicable
	Prevent inhalation of carcinogens in excess of a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls Monitoring	Deed restrictions (restrict land use), and fencing Monitoring of contaminated media
		Removal	Gas collection	Passive vents, and active gas collection systems

Table 3-8
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 6

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Groundwater	For Human Health:	No Action	None	Not applicable
	Prevent ingestion, inhalation, and direct contact with water having carcinogens in excess of maximum contaminant levels or a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls	Deed restrictions (restrict excavation and groundwater use)
			Alternate water supply	Bottled water, or public, or base water supply
			Monitoring	Monitoring of contaminated media
	Prevent ingestion, inhalation, and direct contact with water having non-carcinogens in excess of maximum contaminant levels or a hazard quotient greater than 1.	Containment	Capping	Clay, soil, synthetic, asphalt, concrete, and multi-layer
			Vertical barriers	Slurry wall, grout curtain, vibrating beam, sheet piling, liners, and hydraulic mounds.
			Horizontal barriers	Liners, grout injection, and block displacement
	For Environmental Protection:	Collection	Extraction and pumping	Extraction wells and interceptor trenches
	Restore groundwater aquifer to acceptable contaminant concentrations.	Treatment	In-situ	Sparging, vapor extraction, and bioaccumulation
			Physical	Flocculation, gravity separation, oil-water separation, filtration, crystallization, and membrane separations, evaporation
			Chemical	Neutralization, precipitation, ion exchange, and reduction
			Offsite	Transportation and treatment at hazardous waste facility
		Discharge	Onsite and offsite	Surface water, Navy-owned treatment works, or groundwater (injection wells, infiltration galleries)

Table 3-8 (Continued)
Preliminary Remedial Action Objectives, General Response Actions, Technology Types, and Process Options For OU 6

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Environmental Media	Remedial Action Objectives	General Response Actions	Technology Types	Process Options
Soil	For Human Health:	No action	None	Not applicable
	Prevent ingestion and direct contact with soil having carcinogens in excess of a total excess cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls Monitoring	Deed restrictions (restrict land use), or fencing Monitoring of contaminated media
	Prevent ingestion and direct contact with soil having non-carcinogens in excess of a hazard quotient greater than 1.	Containment	Capping Vertical barriers Horizontal barriers Erosion controls Dust and vapor suppression Surface water controls	Clay, soil, synthetic, asphalt, concrete, and multi-layer Slurry wall, grout curtain, vibrating beam, sheet piling liners, grout injection, and block displacement Grading and revegetation Water, membranes or tarpaulins, organic agents or foam Diversion and collection
	For Environmental Protection:			
	Prevent migration of contaminants that would result in groundwater not meeting remedial action objectives.	Removal	Excavation	Solids excavation
	Prevent ingestion and direct contact with contaminants in soil exhibiting toxicity to test organisms or associated with adverse effects to growth, reproduction, or survival of terrestrial wildlife species.	Treatment	In-situ Biological Chemical Thermal Offsite	Chemical, sorption, vitrification, and bioremediation Compositing, slurry-phase, and landfarming Neutralization, oxidation Molten solids processing, thermal desorption, and incineration Transportation and treatment at hazardous waste landfill
		Disposal	Onsite and offsite	Landfill (onsite or offsite), encapsulation, and backfill
Air	For Human Health:	No action	None	Not applicable
	Prevent inhalation of carcinogens in excess of a total cancer risk of greater than 10^{-4} to 10^{-6}.	Institutional actions	Access controls Monitoring	Deed restrictions (restrict land use), or fencing Monitoring of contaminated media
		Removal	Gas collection	Passive vents, and active gas collection systems

It is possible to eliminate technologies and alternatives during this preliminary screening based on technical implementability or cost reasons. Alternatives that are potentially viable at this stage in the investigation are discussed below for the general categories of groundwater and surface water and soil and sediment and apply, as appropriate, to each of the OUs.

<u>3.4.1 Groundwater and Surface Water</u> General groundwater and surface water remedial alternatives for OUs 3, 4, 5, and 6 include the following:

- the no action alternative consisting of periodic monitoring of the groundwater and surface water,

- institutional controls to prevent use of contaminated water coupled with provision of an alternate water supply to those impacted by site contamination until natural attenuation of contaminants so they no longer pose an unacceptable risk,

- institutional controls and alternate water supplies combined with containment (e.g., vertical or hydraulic barriers) of the water contamination until natural attenuation of contaminants so they no longer pose an unacceptable risk,

- *in-situ* treatment techniques such as bioremediation and air sparging,

- extraction and onsite treatment of contaminated groundwater and surface water combined with either onsite or offsite disposal of treated water, and

- extraction and offsite disposal of contaminated groundwater and surface water to a hazardous waste treatment facility.

<u>3.4.2 Soil and Sediment</u> General soil and sediment remedial alternatives for OUs 3, 4, 5, and 6 include the following:

- the no action alternative consisting of periodic monitoring of all affected media (e.g., soil and water);

- institutional controls to prevent direct contact with contaminated soil and sediment, consists of fencing and deed restrictions until natural attenuation of contaminants so they no longer pose an unacceptable risk;

- institutional controls combined with containment of the contaminated soil and sediment (e.g., capping or barriers) until natural attenuation of contaminants so they no longer pose an unacceptable risk;

- *in-situ* treatment techniques such as bioremediation, vapor extraction, and air sparging.

- excavation and onsite treatment of contaminated soil and sediment combined with either onsite or offsite disposal of treated material; and

- excavation and offsite disposal of contaminated soil and sediment to a hazardous waste landfill.

3.5 ADDITIONAL DATA REQUIREMENTS. To develop a better conceptual understanding of the contaminant problem at the six sites comprising OUs 3, 4, 5, and 6; better define the ARARs; and narrow the range of remedial alternatives that have been identified, additional site-specific data on the nature and extent of contamination, the pathways for contaminant migration, and potential receptors must be collected. Given the information contained in the existing database, the following list of general data requirements was developed for completion of the RI/FS for each of the six sites comprising OUs 3, 4, 5, and 6:

- the nature and extent of soil contamination resulting from previous activities at each site,

- the nature and extent of groundwater contamination resulting from previous activities at each site,

- the nature and extent of surface water and sediment contamination in the creeks and tributaries at Sites 8 and 10 and water and soil contamination in drainage swales and ditches at Sites 14 and 15 resulting from previous activities at these sites (surface water and sediment are not found at Sites 7 and 11),

- the nature and extent of contamination in tissues of ecological receptors resulting from previous activities at each site, and

- the shallow and intermediate aquifer system characteristics at each site including the groundwater flow directions and hydraulic gradients onsite and offsite, hydraulic properties (i.e., hydraulic conductivities), contaminant transport properties (i.e., distribution coefficients), and the groundwater and surface water interactive flows at streams located near the sites.

4.0 WORKPLAN RATIONALE

4.1 **WORKPLAN APPROACH**. To collect the data required to complete the RI/FS for OUs 3, 4, 5, and 6 in a cost-effective manner, a two-stage comprehensive data collection program was developed. An initial sampling event will first be performed to preliminarily assess the nature and extent of contamination at each site. A confirmatory sampling event will then be performed to verify and supplement the results of the initial sampling event, if necessary. In this RI/FS workplan, potential confirmatory sampling event activities are proposed for planning purposes. The actual confirmatory sampling event activities will be decided after the USEPA and FDEP have reviewed the initial sampling event data with the Navy. The USEPA, FDEP, and the Navy will jointly select the type and location of confirmatory samples with the intention to meet the objectives of the RI (primarily to characterize the nature and extent of contamination at each site). A Technical Memorandum of Rationale will be prepared to summarize the meeting between the USEPA, FDEP, and the Navy. The technical memorandum will include the following:

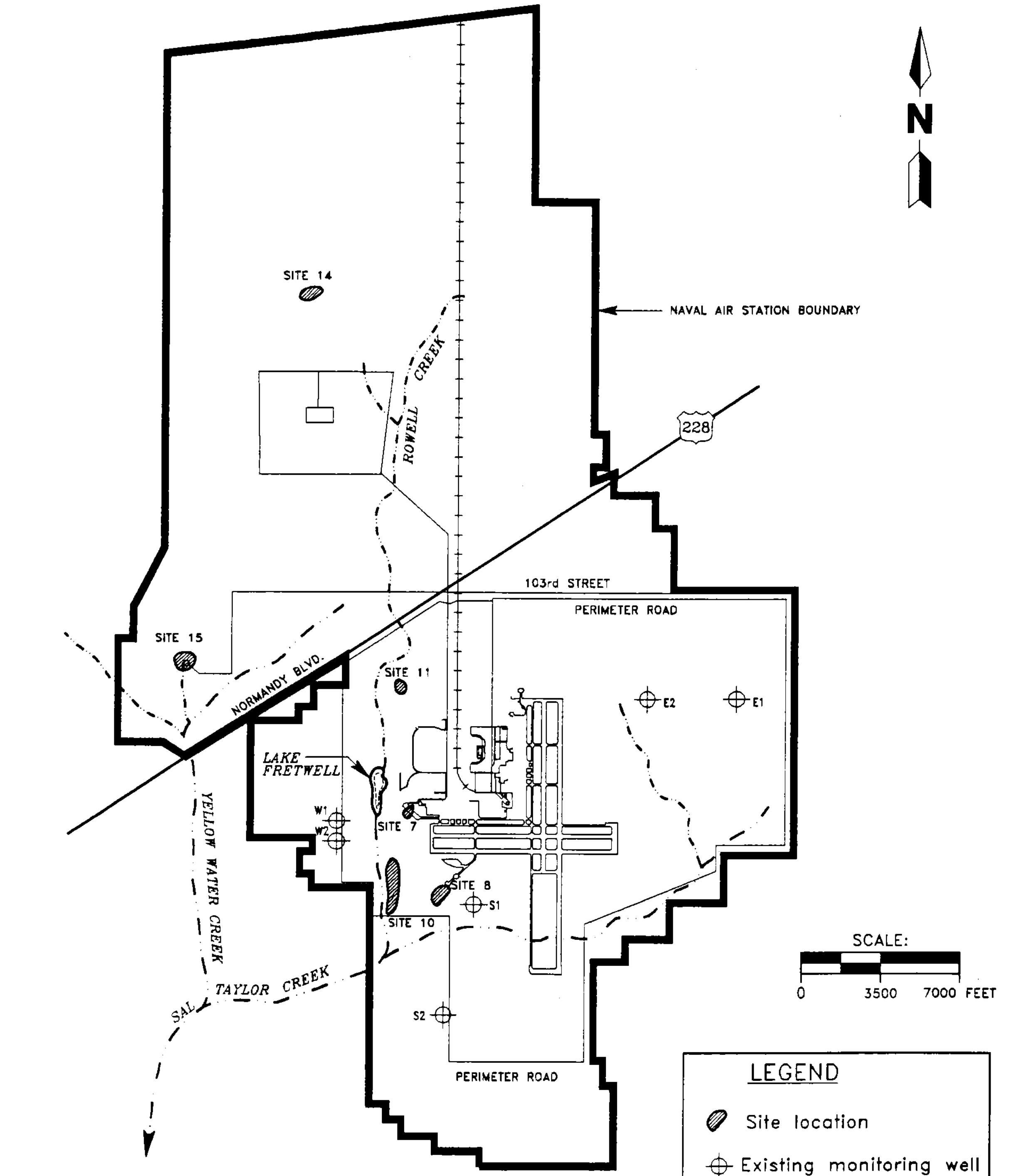
- an evaluation of the data collected during the initial sampling event,
- the rationale for the confirmatory sampling event, and
- a description of the sampling activities including sample locations and procedures to be completed during the confirmatory sampling event.

The general elements of this comprehensive data collection program are described below. Sample codes were not assigned to the sampling locations on the figures because the dynamic nature of the screening program often changes many of the sample locations. However, all screening and confirmatory locations will be assigned codes at the time of collection and these codes will be used throughout the remainder of the remedial investigation. Details regarding each data collection activity are provided in Chapter 5.0 of this workplan (RI/FS Scope of Work) and the Sampling and Analysis Plan (Volume II) accompanying this workplan.

4.1.1 Background Soil and Groundwater Characterization A study of background soil and groundwater conditions for NAS Cecil Field was initiated during the remedial investigation conducted for OUs 1, 2, 7, and 8. During this study, background soil samples were collected from four soil units including the Arents, Albany fine sand, Ridgeland fine sand, and Wesconnett fine sand. In addition, nine background monitoring wells were installed at six locations (see Figure 4-1). Each location has one monitoring well screened in the UZS and, at locations E2, W1, and S2, an LZS well is clustered together with a UZS well (Figure 4-1).

Because other soil units have been identified at the six sites comprising OUs 3, 4, 5, and 6, additional background soil samples will be collected from these soil units during the initial sampling event of this remedial investigation. Six background surface soil samples and three background subsurface soil samples will be collected in each of the following soil units:

- Aquic Quartzipsamments,
- Sapelo fine sand,
- Olustee fine sand, and
- Leon fine sand.



SOURCE: ADAPTED FROM ENVIRODYNE ENGINEERS, 1985

FIGURE 4-1
EXISTING BACKGROUND MONITORING WELL LOCATIONS

CDM\RISWP2\GLC\11-15-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

Three soil borings will be completed in each soil unit for the collection of soil samples at the surface and just above the water table. The locations of these background soil samples will be determined in the field, but generally will be from areas that appear to be unaffected by base operations or other development. All the background soil samples (estimated 36 total) will be sent to an offsite laboratory for full TCL and TAL parameter analyses. These data will be added to the existing background soil database that will be used to establish the background soil conditions for OUs 3, 4, 5, and 6.

Because this remedial investigation will include evaluation of groundwater contamination in the UZH at each of the six sites comprising OUs 3, 4, 5, and 6, additional background groundwater data will also be collected for this aquifer unit during the initial sampling event of this remedial investigation. Three background monitoring wells (each screened in the UZH) will be installed at the facility. One groundwater sample will then be collected from each of the existing and new background monitoring wells (12 total samples) and sent to an offsite laboratory for full TCL and TAL parameter analyses. These data will be added to the existing background groundwater database that will be used to establish the background groundwater conditions for OUs 3, 4, 5, and 6.

A sample analysis summary for the background characterization activities to be conducted for OUs 3, 4, 5, and 6 is provided in Table 4-1.

Table 4-1
Sampling and Analyses Program Summary for
Background Characterization

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	Number of Samples	DQO Level	Chemical Analysis	
			TCL Parameters	TAL Parameters
Surface Soil	24	IV	✓	✓
Subsurface Soil	12	IV	✓	✓
Groundwater	12	IV	✓	✓

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).

4.1.2 Site 7, Old Firefighter Training Area

4.1.2.1 Initial Sampling Event For the purposes of characterizing the soil exposure pathway and for estimating the horizontal and vertical extent of soil contamination, both surface and subsurface soil samples will be collected for analysis at this site as follows.

- One grab surface soil screening sample will be collected from the center of each 50-foot square grid block shown in Figure 4-2 (35 total samples). This grid is designed to cover the burn pit area and potential runoff areas. These samples will be sent to the onsite laboratory for analysis of polynuclear aromatic hydrocarbons (PAHs) and total petroleum hydrocarbon (TPH) (USEPA Methods 8270 and 418.1), and to an offsite laboratory for analysis of lead (USEPA Method 6010). PAHs, TPH, and lead have been selected as the indicator chemicals for surface soil in the FTAs. After the onsite PAH and TPH and offsite lead laboratory analyses are completed, selected sample locations will be resampled, and these samples will be analyzed by an offsite laboratory for full TCL and TAL parameter analyses.

  The number and location of samples will be jointly selected by the USEPA, FDEP, and Navy and resampling will be based on the onsite PAH and TPH and offsite lead laboratory results. The intent of the resampling is to collect these additional samples from the most contaminated areas to evaluate the appropriateness of the screening parameters and techniques for characterizing the limits of contamination. For planning purposes, an estimated 20 percent of the sample locations (seven samples) will be resampled. All surface soil samples will be collected from 0 to 1 foot bls for use in conducting human health and ecological risk assessments.

- Ten soil borings will be completed in and around the former burning pit and burning pad areas (after completion of surface soil sampling) at the approximate locations shown in Figure 4-2. Because the exact locations of the burning pit and burning pad areas are not visually evident at this site, the results of the surface soil sampling will be used to help guide exact placement of the soil borings. Soil screening samples will be collected at 2-foot intervals from the ground surface down to the water table (i.e., 0 to 1, 1 to 3, 3 to 5, and 5 to 7 feet bls). These samples (10 surface and 30 subsurface) will be sent to the onsite laboratory and analyzed for VOCs, PAHs, and TPH (USEPA Methods 8010 [modified], 8020 [modified], 8270, and 418.1), and to an offsite laboratory for analysis of lead (USEPA Method 6010). VOCs, PAHs, TPH, and lead have been selected as the indicator chemicals for subsurface soil in the FTAs. In addition, one sample per boring (10 total samples) will be sent to an offsite laboratory for full TCL and TAL parameter analyses, with the intent being to collect these samples from the most contaminated depths based on visual observation and field screening using a flame ionization detector (FID). Analyses to detect VOCs and naphthalene will be performed for all subsurface samples, but not for the shallow (0 to 1 foot bls) surface soil grab samples because the VOCs are anticipated to be absent due to volatilization from the sandy soil into the atmosphere. However, confirmatory surface soil samples will be collected after the screening program for VOCs to verify the absence of VOC contamination.

For the purposes of characterizing the groundwater exposure pathway and for estimating the horizontal and vertical extent of groundwater contamination, the following activities will be conducted.

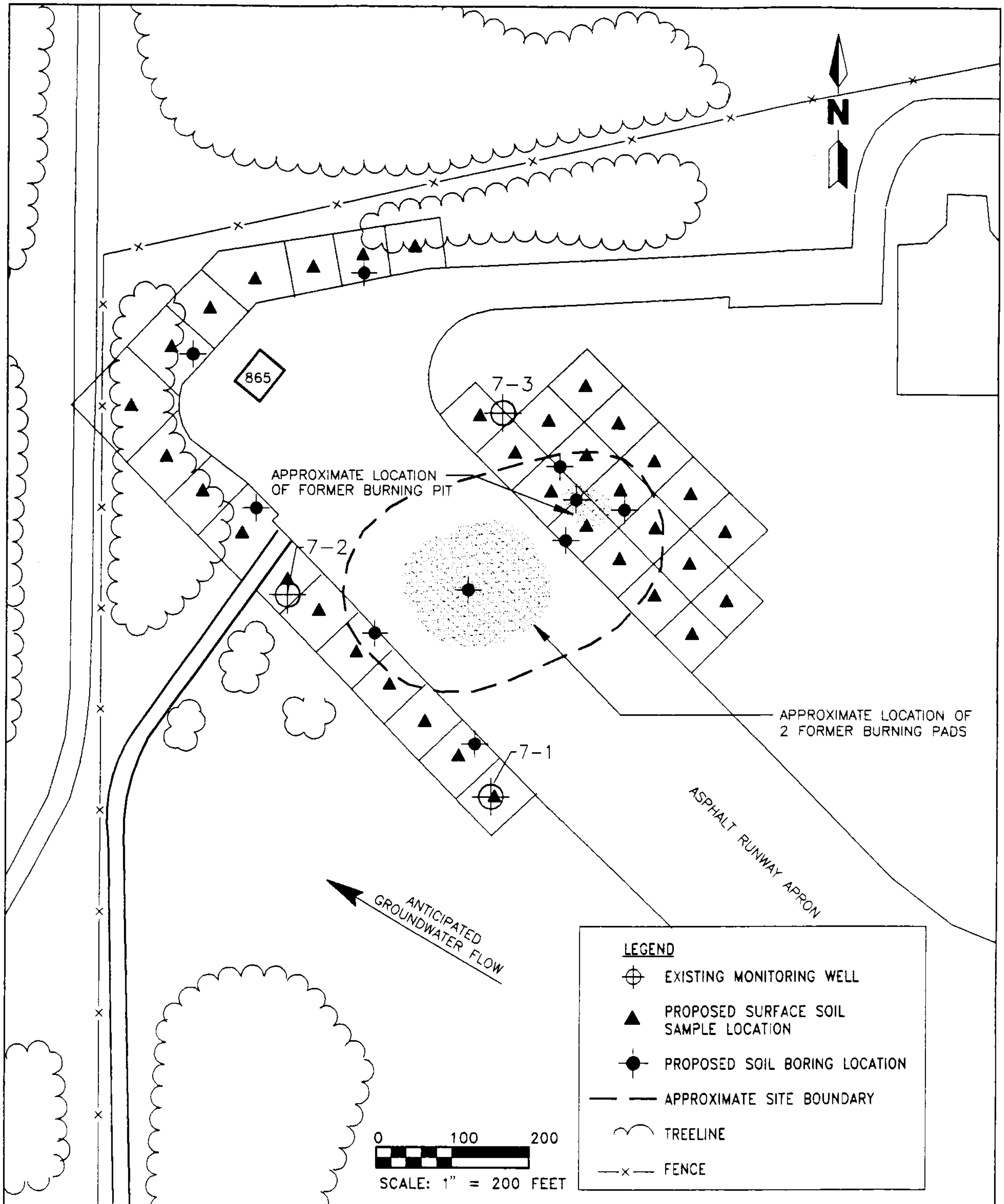


FIGURE 4-2
PROPOSED SITE 7
SOIL SAMPLING LOCATIONS

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REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

- Groundwater screening samples will be collected using the Aquaprobe™ system in conjunction with the hollow-stem auger drilling technique. Details of the Aquaprobe™ system are presented in Subsection 5.1.5 of this workplan and Chapter 2.0 of the Sampling and Analysis Plan (Volume II) accompanying this workplan. Groundwater samples will be collected from various depth intervals in the UZS and the LZS at each Aquaprobe™ location. These samples will be sent to the onsite laboratory and analyzed for VOCs and naphthalene (modified USEPA Methods 8010 and 8020), and TPH (USEPA Method 418.1), which have been selected as the indicator chemicals for groundwater in the FTAs. Five pre-selected Aquaprobe™ sampling locations are shown in Figure 4-3. Other locations will be added in the field based on the onsite laboratory results for the first five and subsequent Aquaprobe™ sample locations, with the intent being to preliminarily define the areal and vertical extent of groundwater contamination.

- Based on the results of the Aquaprobe™ groundwater screening and surface and subsurface soil screening programs, three-well monitoring well clusters will be installed at the site. For planning purposes, preliminary locations of monitoring well clusters are shown in Figure 4-3. The final location and number of monitoring wells will be based on the hydrogeological model and contaminant flow paths resulting from stratigraphic, piezometric, and contaminant type and distribution information collected during the screening process. These locations will be jointly selected by the USEPA, FDEP, and Navy after the screening data have been evaluated. The results of the groundwater and soil screening will be used to help guide areal and vertical placement of the monitoring well clusters with the intent being to locate one cluster in the source area, one cluster upgradient of the source area, and two clusters downgradient of the source area. Unless the stratigraphy dictates otherwise, one well in each cluster will be screened at the water table in the UZS, one well will be screened at the bottom of the LZS, and one well will be screened at the top of the UZH.

  After well installation is completed, one groundwater sample will be collected from each well (for planning purposes assume 12 total samples) and sent to an offsite laboratory for full TCL and TAL analyses. Turbidity readings will be collected throughout purging and wells with values greater than 5 nephelometric turbidity units (NTUs) after purging will have both a filtered and unfiltered sample collected and sent to the offsite laboratory for TAL analyses. If turbidity readings are below 5 NTUs in all wells, only samples from the source area well cluster and one downgradient well cluster will be submitted for filtered and unfiltered TAL analyses.

- During the construction of the UZH well in each of the new monitoring well clusters, the boring will be continuously logged (by visual observation of core samples) to the bottom of the UZH to characterize the lithology at the site.

Each new monitoring well will also be surveyed horizontally and vertically to determine their precise location and elevation. One round of water level measurements will then be collected from the monitoring wells to determine the directions of groundwater flow in each aquifer zone at the site. In addition,

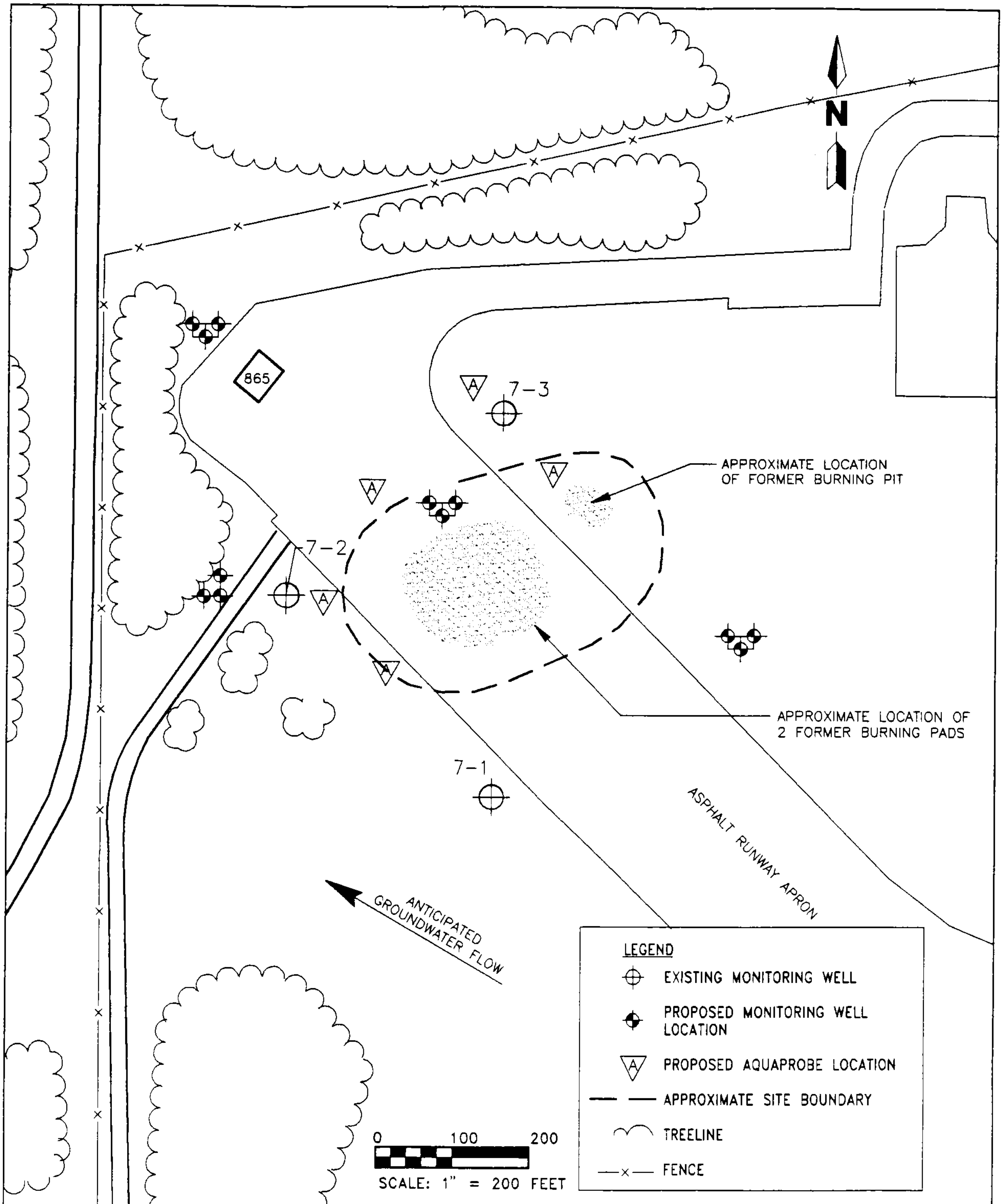

FIGURE 4-3
PROPOSED SITE 7 GROUNDWATER SAMPLING LOCATIONS

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REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

in-situ hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well to provide estimates of the hydraulic properties of each aquifer zone at the site.

Note that because of the age and construction characteristics of the existing monitoring wells at this site (i.e., 30-foot screens), the existing monitoring wells will be abandoned in accordance with procedures specified by the St. Johns River Water Management District once the initial sampling event monitoring wells have been installed and hydrogeologic data are no longer needed from the existing monitoring wells.

Based on the evaluation of the historical use of Site 7 and results of previous investigations there is the potential for remedial action at this site. For the purposes of providing geotechnical, geochemical, and groundwater quality information to be used for potential remedial action at Site 7, soil and groundwater samples will be collected as follows.

- One groundwater sample will be collected from the UZS and analyzed for:

  - pH, conductivity, and temperature (field measurement);
  - alkalinity (USEPA Method 310.1);
  - chloride (USEPA Method 325.1);
  - sulfate (USEPA Method 375.4);
  - total sulfide (USEPA Method 376.1);
  - oil and grease (USEPA Method 413.2);
  - total organic carbon (TOC) (USEPA Method 415.2);
  - total solids (USEPA Method 160.3);
  - total suspended solids (TSS) (USEPA Method 160.2);
  - total dissolved solids (TDS) (USEPA Method 160.1);
  - hardness (USEPA Method 130.2); and
  - color (USEPA Method 110.2).

  One soil sample will be collected from the vadose zone in an area where no contamination appears to be present and analyzed for:

  - pH,

  - moisture content (American Society for Testing and Materials [ASTM] Method D-2216),

  - sieve and hydrometer particle size distribution (ASTM Methods D-421 and 422), and

  - bulk density (ASTM E12-70).

For the evaluation of a potential remedial action involving excavation and disposal, one composite soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for:

- Toxicity Characteristic Leaching Procedure (TCLP) extraction (VOCs, semivolatile organic compounds (SVOCs), metals, and pesticides, as appropriate).

For the evaluation of a potential remedial action involving biological treatment, one soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for the following:

- total Kjeldahl nitrogen (TKN) (USEPA Method 351.3),
- ammonia-nitrogen (USEPA Method 350.2),
- nitrate plus nitrite (USEPA Method 353.2),
- total phosphorous (USEPA Method 365.1),
- total bacteria (USEPA Method 907B modified),
- specific petroleum degraders (USEPA Method 907B modified),
- TOC (USEPA Method 415.2),
- TPH (USEPA Method 418.1 modified), and
- fingerprint (USEPA Method 3550/8100 modified).

For the purposes of identifying site-specific potential ecological receptors of concern at this site, an ecological survey will be completed on and around the site. The ecological inventory will include identification of the vegetative communities, habitat types, physical and chemical characteristics of the environment, and the occurrence of animals. The ecological survey will be based on a field visit by two experienced biologists. The *Guide to the Natural Communities of Florida* (Florida Natural Areas Inventory [FNAI] and Department of Natural Resources, 1990) will be used to identify the upland vegetative communities at this site. The Cowardin (Cowardin and others, 1979) system will be used to describe wetland plant communities found at this site.

A sample analysis summary for the initial sampling event activities to be conducted at Site 7 is provided in Table 4-2.

4.1.2.2 **Confirmatory Sampling Event** The results of the initial sampling event should adequately define the COPCs at this site. However, if the activities conducted during the initial sampling event do not adequately define the extent of contamination or provide adequate information to evaluate the human health and/or ecological exposure pathways, the following activities may be conducted during the confirmatory sampling event.

- Additional surface soil samples (0 to 1-foot depth) may be collected and analyzed to further refine or define the horizontal extent of soil contamination.

- Additional soil borings may be completed with subsurface soil samples collected and analyzed to further refine or define the vertical extent of soil contamination.

- Additional monitoring wells may be installed and groundwater samples collected and analyzed to further refine or define the extent of groundwater contamination.

- If additional monitoring wells are installed, the borings will be continuously logged (by visual observation of core samples) to further characterize the lithology at the site.

Each additional well will also be surveyed and water level measurements will be collected (from all monitoring wells) to further define the direction of groundwater flow in each aquifer zone at the site. In addition, *in-situ*

Table 4-2
Sampling and Analyses Program Summary for Site 7

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	No. of Samples	DQO Level	Chemical Analysis					
			TCL Parameters	TAL Parameters	Onsite Analysis for PAHs (USEPA Method 8270)	Onsite Analysis for VOCs and Naphthalene (USEPA Methods 8010 and 8020 modified)	Onsite Analysis for TPH (USEPA Method 418.1)	Offsite Analysis for Lead (USEPA Method 6010)
Surface Soil	[1]45	III			✓		✓	✓
Surface Soil	7	IV	✓	✓				
Subsurface Soil	[2]30	III			✓	✓	✓	✓
Subsurface Soil	[3]10	IV	✓	✓				
Aquaprobe™	[4]25	III				✓	✓	
Groundwater	12	IV	✓	✓				

[1] Includes one surface soil sample from each of the 10 soil boring locations.
[2] Estimated based on three subsurface soil samples per borehole.
[3] Assumes all soil boring samples sent to the offsite lab will be subsurface soil samples.
[4] Initial estimate only based on five Aquaprobe™ sampling locations and five samples each. Other Aquaprobe™ samples may be collected, as necessary, to preliminarily define the extent of groundwater contamination.

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).
PAH = polynuclear aromatic hydrocarbon.
VOC = volatile organic compound.
USEPA = U.S. Environmental Protection Agency.

hydraulic conductivity tests (slug tests) may be conducted in each additional monitoring well to provide additional estimates of the hydraulic properties of the aquifer zones at the site.

- Toxicity testing of surface soil using the earthworm (*Eisenia foetida*) may be used to evaluate the effects of contaminants in soil on the terrestrial soil invertebrate community. If earthworm toxicity testing is conducted, surface soil samples from a depth of 0 to 1 foot will be collected, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. The toxicity testing (14-day survival test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.5. Earthworms surviving the 14-day test will be further exposed to the soil for an additional 14 days and then analyzed for the same parameters as the analyses of the surface soil samples. Earthworm samples may also be collected in the field from areas representing a range of contaminant concentrations, if there is a sufficient number of worms available.

- A wetlands assessment (functional assessment) and delineation may be completed if during the initial ecological surveys, potential wetlands are found to be on or near the site, and may be potentially disturbed, altered, or destroyed during remedial activities.

4.1.3 Site 8, Firefighter Training Area, Boresite Test Range, and Hazardous Waste Storage Area

4.1.3.1 **Initial Sampling Event** For health and safety purposes, an ordnance survey will first be conducted at this site to identify the presence of and remove any unexploded ordnance. In addition, an ordnance survey will be conducted during all subsequent intrusive activities conducted on the site (i.e., soil borings and groundwater monitoring well installation).

For the purposes of characterizing the soil exposure pathway and for estimating the horizontal and vertical extent of soil contamination, both surface and subsurface soil samples will be collected for analysis at this site as follows.

- One grab surface soil screening sample will be collected from the center of each 50-foot square grid block shown in Figure 4-4 (111 total samples). These samples will be sent to the onsite laboratory for analyses of PAHs and TPH (USEPA Methods 8270 and 418.1), and to an offsite laboratory for analysis of lead (USEPA Method 6010). PAHs, TPH, and lead have been selected as the indicator chemicals for surface soils in the FTAs. After the onsite laboratory analyses are completed, selected sample locations will be resampled, and these samples will be analyzed by an offsite laboratory for full TCL and TAL parameters. The number and location of samples will be jointly selected by the USEPA, FDEP, and Navy and resampling will be based on the onsite laboratory results with the intent being to collect these additional samples from the most contaminated areas due to firefighter training activities and from areas where hazardous wastes may have been spilled. For planning purposes, an estimated 20 percent of the sample locations (22 samples) will be resampled. All surface soil samples will be collected from 0

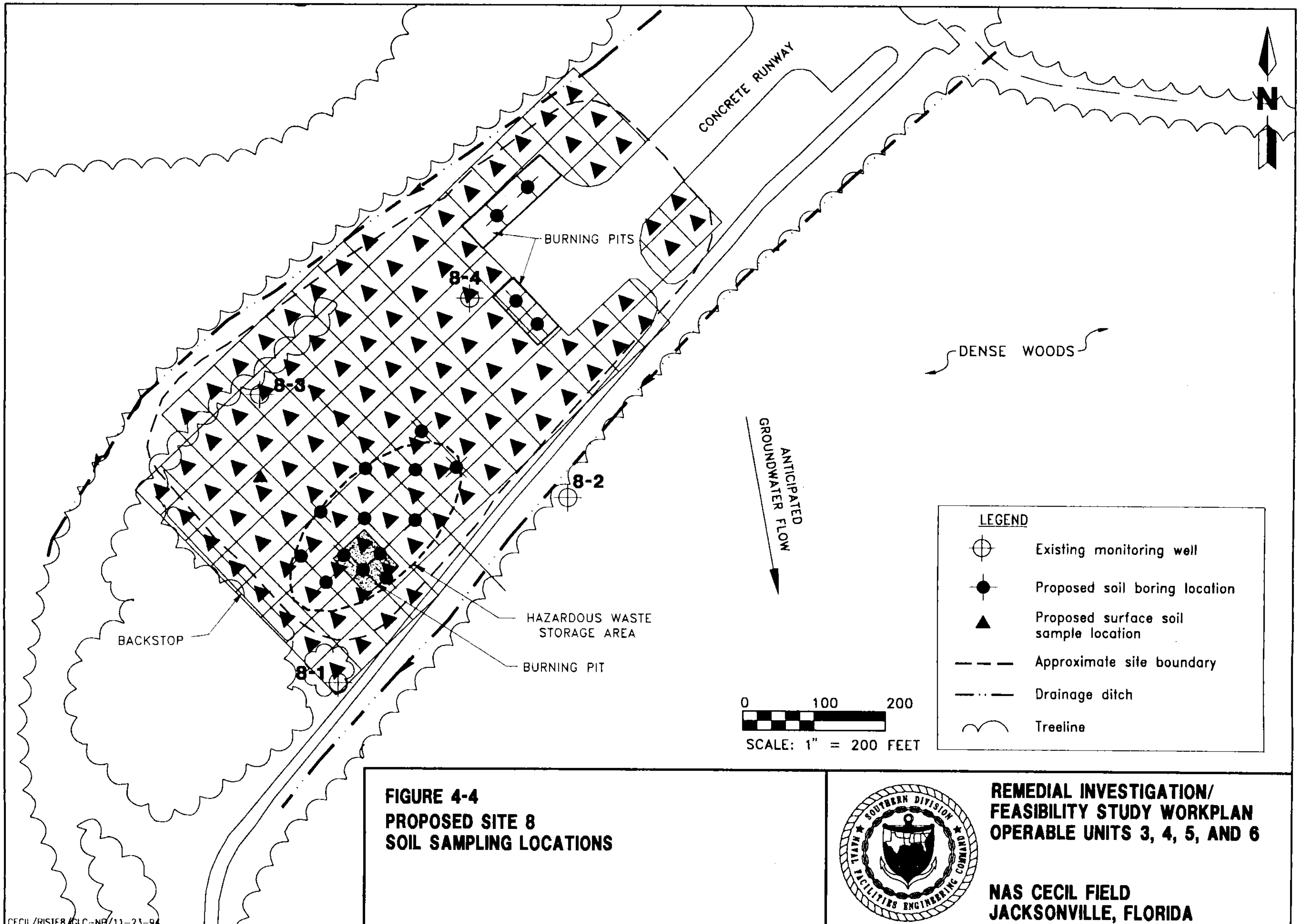

FIGURE 4-4
PROPOSED SITE 8
SOIL SAMPLING LOCATIONS

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

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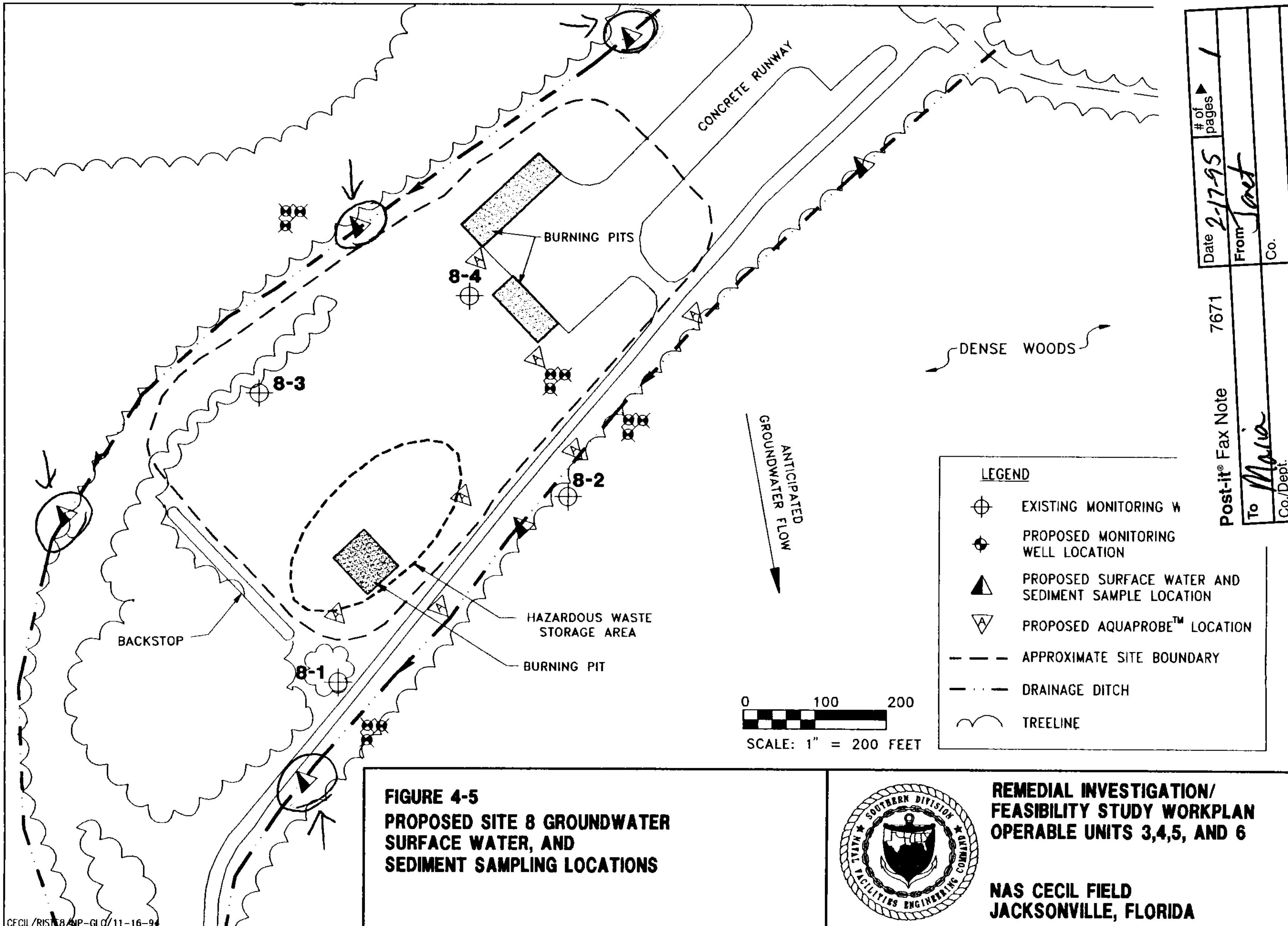

FIGURE 4-5
PROPOSED SITE 8 GROUNDWATER SURFACE WATER, AND SEDIMENT SAMPLING LOCATIONS

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

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to 1 foot bls for use in conducting human health and ecological risk assessments.

- Six soil borings will be completed in the three burning pit areas and 10 soil borings will be completed in the hazardous waste storage area at the approximate locations shown in Figure 4-4. Soil screening samples will be collected at 2-foot intervals from the ground surface down to the water table (i.e., 0 to 1, 1 to 3, 3 to 5, and 5 to 7 feet bls). These soil samples (estimated 64 total, 16 surface and 48 subsurface samples) will be sent to the onsite laboratory and analyzed for VOCs, PAHs, and TPH (USEPA Methods 8010 [modified], 8020 [modified], 8270, and 418.1), and to an offsite laboratory for analysis of lead (USEPA Method 6010). VOCs, PAHs, TPH, and lead have been selected as the indicator chemicals for subsurface soils in the FTAs. In addition, one sample per boring (16 total samples) will be sent to an offsite laboratory for full TCL and TAL parameter analyses, with the intent being to collect these samples from the most contaminated depths based on visual observation and field screening using an FID. Analyses to detect VOCs and naphthalene will be performed for all subsurface soil samples, but not for the shallow (0 to 6 inches) surface soil grab samples.

For the purposes of characterizing the groundwater exposure pathway and for estimating the horizontal and vertical extent of groundwater contamination, the following activities will be conducted.

- Groundwater screening samples will be collected using the Aquaprobe™ system in conjunction with the hollow-stem auger drilling technique. Details of the Aquaprobe™ system are presented in Subsection 5.1.5 of this workplan and Chapter 2.0 of the Sampling and Analysis Plan (Volume II) accompanying this workplan. Groundwater samples will be collected from various depth intervals in the UZS and the LZS at each Aquaprobe™ location. These samples will be sent to the onsite laboratory and analyzed for VOCs and naphthalene (USEPA Methods 8010 [modified] and 8020 [modified]) and TPH (USEPA Method 418.1), which have been selected as the indicator chemicals for groundwater in the FTAs. Seven preselected Aquaprobe™ sampling locations are shown in Figure 4-5. Other locations will be added in the field based on the onsite laboratory results for the first seven and subsequent Aquaprobe™ sample locations, with the intent being to preliminarily define the areal extent of groundwater contamination.

- Based on the results of the Aquaprobe™ groundwater screening and surface and subsurface soil screening programs, three-wall monitoring well clusters will be installed at the site. For planning purposes, preliminary locations of monitoring well clusters are shown in Figure 4-5. The final location and number of monitoring wells will be based on the hydrogeological model and contaminant flow paths resulting from stratigraphic, piezometric, and contaminant type and distribution information collected during the screening process. These locations will be jointly selected by the USEPA, FDEP, and Navy after the screening data has been evaluated. The results of the groundwater and soil screening will be used to help guide areal and vertical placement of the monitoring well clusters with the intent being to locate one cluster in the source area, one cluster upgradient of the source area, and two clusters downgradient of the source area. Unless the stratigraphy dictates otherwise, one well in each cluster will be screened at the water table in the UZS, one well will be screened at the bottom of the LZS, and one well will be screened at the top of the UZH.

After well installation is completed, one groundwater sample will be collected from each well (12 total samples) and sent to an offsite laboratory for full TCL and TAL analyses. Turbidity readings will be collected throughout purging and wells with values greater than 5 NTUs after purging will have both a filtered and unfiltered sample collected and sent to the offsite laboratory for TAL analyses. If turbidity readings are below 5 NTUs in all wells, only samples from the source area well cluster and one downgradient well cluster will be submitted for filtered and unfiltered TAL analyses.

- During the construction of the UZH well in each of the new monitoring well clusters, the boring will be continuously logged (by visual observation of core samples) to the bottom of the UZH to characterize the lithology at the site.

  Each new monitoring well will also be surveyed horizontally and vertically to determine their precise location and elevation. One round of water level measurements will then be collected from the monitoring wells to determine the directions of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well to provide estimates of the hydraulic properties of each aquifer zone at the site.

Note that because of the age and construction characteristics of the existing monitoring wells at this site (i.e., 30-foot screens), the existing monitoring wells will be abandoned in accordance with procedures specified by the St. Johns River Water Management District once the initial sampling event monitoring wells have been installed and hydrogeologic data are no longer needed from the existing monitoring wells.

Based on the preliminary evaluation of the historical use of Site 8 and the results of previous investigations, there is the potential for remedial action at this site. For the purposes of providing geotechnical, geochemical, and groundwater quality information to be used for potential remedial action at Site 8, soil and groundwater samples will be collected as follows.

- One groundwater sample will be collected from the UZS and analyzed for:

  - pH, conductivity, and temperature (field measurement);
  - alkalinity (USEPA Method 310.1);
  - chloride (USEPA Method 325.1);
  - sulfate (USEPA Method 375.4);
  - total sulfide (USEPA Method 376.1);
  - oil and grease (USEPA Method 413.2);
  - TOC (USEPA Method 415.2);
  - total solids (USEPA Method 160.3);
  - TSS (USEPA Method 160.2);

- TDS (USEPA Method 160.1);
- hardness (USEPA Method 130.2); and
- color (USEPA Method 110.2).

One soil sample will be collected from the vadose zone in an area where no contamination appears to be present and analyzed for the following.

- pH,

- moisture content (ASTM Method D-2216),

- sieve and hydrometer particle size distribution (ASTM Methods D-421 and 422), and

- bulk density (ASTM E12-70).

For the evaluation of a potential remedial action involving excavation and disposal, one composite soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for:

- TCLP extraction (VOCs, SVOCs, metals, and pesticides, as appropriate).

For the evaluation of a potential remedial action involving biological treatment, one soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for:

- TKN (USEPA Method 351.3),
- ammonia-nitrogen (USEPA Method 350.2),
- nitrate plus nitrite (USEPA Method 353.2),
- total phosphorous (USEPA Method 365.1),
- total bacteria (USEPA Method 907B modified),
- specific petroleum degraders (USEPA Method 907B modified),
- TOC (USEPA Method 415.2),
- TPH (USEPA Method 418.1 modified), and
- fingerprint (USEPA Method 3550/8100 modified).

For the purposes of characterizing the surface water exposure pathway and for estimating the extent of surface water and sediment contamination, three surface water samples and three sediment samples will be collected from each of the two drainage ditches bordering the site as shown in Figure 4-5. These samples (six total surface water and six total sediment samples) will be sent to an offsite laboratory for full TCL and TAL parameter analyses. Both a filtered and unfiltered surface water sample will be sent to the offsite laboratory for TAL analyses.

For the purposes of identifying site-specific potential ecological receptors of concern at this site, an ecological survey will be completed on and around the site. The ecological inventory will include identification of the vegetative communities, habitat types, physical and chemical characteristics of the environment, and the occurrence of animals. The ecological survey will be based on a field visit by two experienced biologists. The *Guide to the Natural Communities of Florida* (FNAI and Department of Natural Resources, 1990) will be used to identify the upland vegetative communities at this site. The Cowardin

(Cowardin and others, 1979) system will be used to describe wetland plant communities found at this site.

A sample analysis summary for the initial sampling event activities to be conducted at Site 8 is provided in Table 4-3.

4.1.3.2 **Confirmatory Sampling Event** The results of the initial sampling event should adequately define the COPCs at this site. However, if the activities conducted during the initial sampling event do not adequately define the extent of contamination or provide adequate information to evaluate the human health and/or ecological exposure pathways, the following activities may be conducted during the confirmatory sampling event.

- Additional surface soil samples (0 to 1 foot depth) may be collected and analyzed to further refine or define the horizontal extent of soil contamination.

- Additional soil borings may be completed with subsurface soil samples collected and analyzed to further refine or define the vertical extent of soil contamination.

- Additional monitoring wells may also be installed and groundwater samples collected and analyzed to further refine or define the extent of groundwater contamination.

- If additional monitoring wells are installed, the borings will be continuously logged (by visual observation of core samples) to further characterize the lithology at the site.

  Each additional well will also be surveyed and water level measurements will be collected (from all monitoring wells) to further define the direction of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) may be conducted in each additional monitoring well to provide additional estimates of the hydraulic properties of the aquifer zones at the site.

- Additional surface water and sediment samples may be collected and analyzed to further refine or define the extent of surface water and sediment contamination.

- Toxicity testing of surface soil using the earthworm (*Eisenia foetida*) may be used to evaluate the effects of contaminants in soil on the terrestrial soil invertebrate community. If earthworm toxicity testing is conducted, surface soil samples from a depth of 0 to 1 foot will be collected, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. The toxicity testing (14-day survival test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.5. Earthworms surviving the 14-day test will be further exposed to the soil for an additional 14 days and then analyzed for the same parameters as the analyses of the surface soil samples. Earthworm samples may also be collected in the field from areas representing a range of contaminant concentrations, if there is a sufficient number of worms available.

Table 4-3
Sampling and Analysis Program Summary for Site 8

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	No. of Samples	DQO Level	Chemical Analysis					
			TCL Parameters	TAL Parameters	Onsite Analysis for PAHs (USEPA Method 8270)	Onsite Analysis for VOCs and Naphthalene (modified USEPA Methods 8010 and 8020)	Onsite Analysis for TPH (USEPA Method 418.1)	Offsite Analysis for Lead (USEPA Method 6010)
Surface Soil	[1]127	III			✓		✓	✓
Surface Soil	22	IV	✓	✓				
Subsurface Soil	[2]48	III			✓	✓	✓	✓
Subsurface Soil	[3]16	IV	✓	✓				
Surface Water	6	IV	✓	✓				
Sediment	6	IV	✓	✓				
Aquaprobe	[4]35	III				✓	✓	
Groundwater	12	IV	✓	✓				

[1] Includes one surface soil sample from each of the 16 soil boring locations.
[2] Estimated based on three subsurface soil samples per borehole.
[3] Assumes all soil borings sent to the offsite lab will be subsurface soil samples.
[4] Initial estimate only based on seven Aquaprobe™ sampling locations and five samples each. Other Aquaprobe™ samples may be collected, as necessary, to preliminarily define the extent of groundwater contamination.

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).
PAH = polynuclear aromatic hydrocarbon.
TPH = total petroleum hydrocarbon.
VOC = volatile organic compound.
USEPA = U.S. Environmental Protection Agency.

- Toxicity testing of surface soil using the lettuce seed (*Lactuca sativa*) or another suitable species may be used to evaluate the effects of contamination in soil on terrestrial plants. Surface soil samples would be collected from a depth of 0 to 1 foot, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. Toxicity testing (120-hour germination test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989a) in Section A.8.6.

- A wetlands assessment (functional assessment) and delineation may be completed if during the initial ecological surveys, potential wetlands are found to be on or near the site, and may be potentially disturbed, altered, or destroyed during remedial activities.

4.1.4 Site 10, Rubble Disposal Area

4.1.4.1 Initial Sampling Event There is no indication from historical information, field observations, or previous investigations that contamination is present at Site 10. The only indication of contamination was the detection of trichloroethene in monitoring well 10-1 (an upgradient well screened in the dolomite) at a concentration of 1.6 $\mu g/\ell$ during a groundwater monitoring program conducted by Geraghty & Miller in 1985. Monitoring well 10-1 was subsequently sampled two additional times after the detection of trichloroethene and no trichloroethene was detected in either sample. Because no hazardous waste was reportedly disposed or stored at Site 10 and no VOC contaminants were detected in the most recent round of groundwater sampling, the initial sampling event (as discussed with FDEP and USEPA) will consist of minimal sampling to confirm the absence of contamination at Site 10. The field program will consist of monitoring well installation and sampling, mapping of rubble piles, surface soil sampling, and surface water and sediment sampling.

For the purpose of identifying soil sample and monitoring well locations, the rubble piles will be mapped by visual observation and staking the perimeter of each pile, followed by a survey to determine the location and elevation of each pile.

The presence of soil contamination at Site 10 has not yet been assessed. Therefore, for the purpose of determining the nature and presence of soil contamination, and for the purpose of characterizing the soil exposure pathway, six surface soil samples will be collected at Site 10. The surface soil samples will be collected on the downgradient side of the six largest rubble piles. The samples will be collected from 0 to 1 foot bls. Approximate locations of surface soil samples are shown in Figure 4-6.

For the purposes of determining the presence and nature of groundwater contamination, and for the purpose of characterizing the groundwater exposure pathway, the following activities will be conducted.

- One water table monitoring well will be installed (after the rubble piles have been mapped) on the downgradient side of the largest rubble pile at the approximate location shown in Figure 4-7. After well installation is completed, one groundwater sample will be collected from each new and existing well (5 total) and sent to an offsite

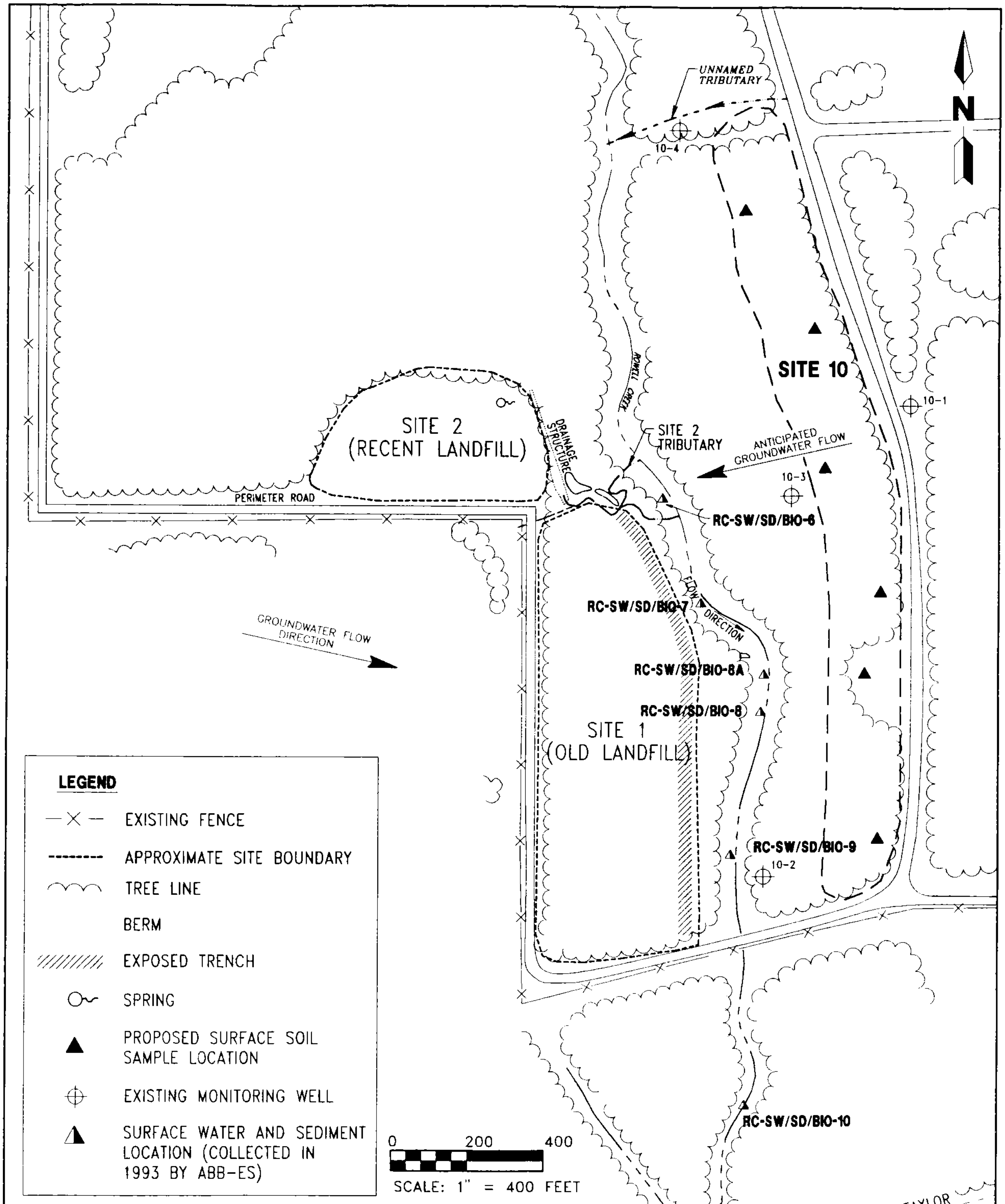

FIGURE 4-6
PROPOSED SITE 10
SOIL SAMPLING LOCATIONS

CECIL/RISTE10/NP/11-23-94

SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

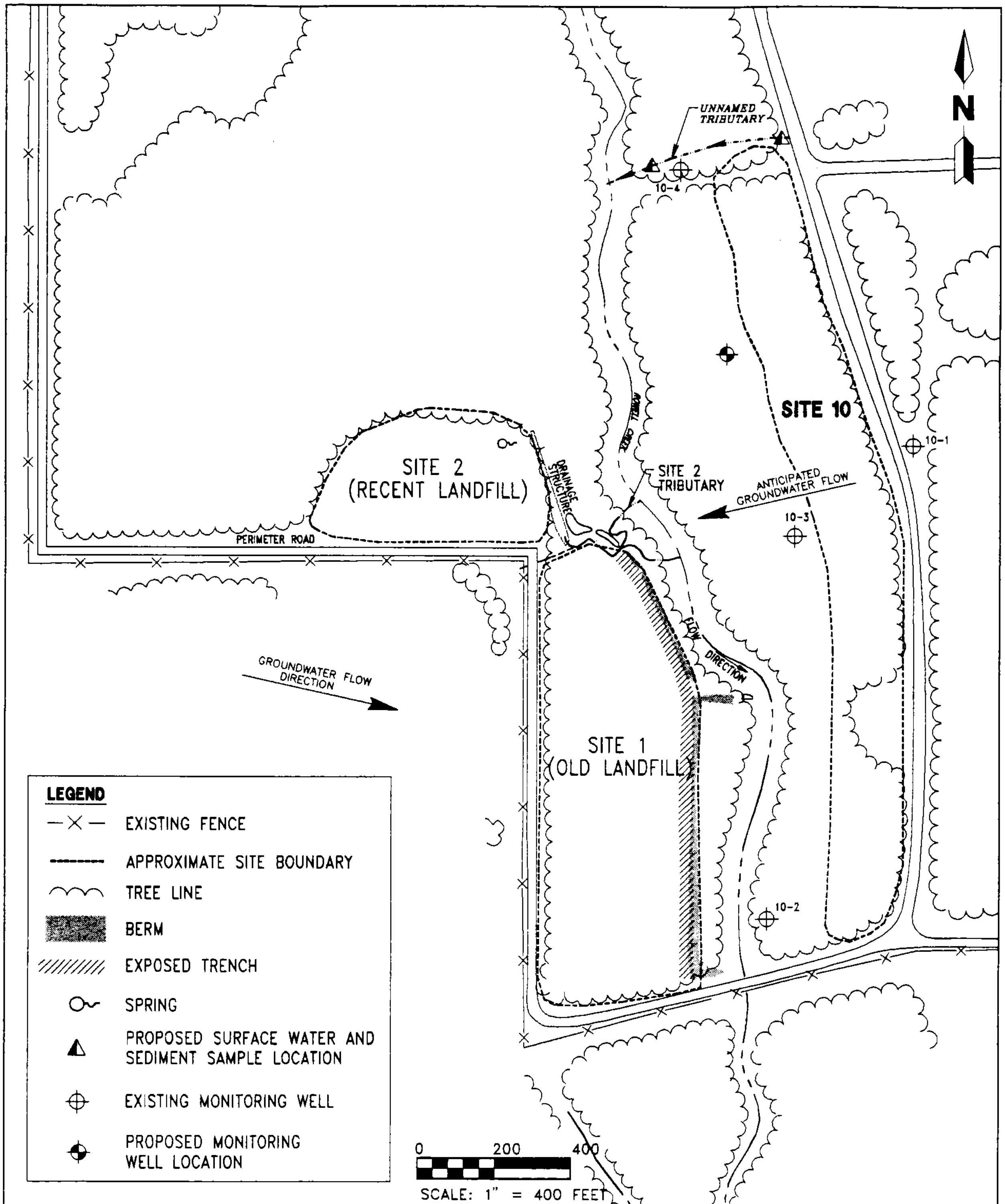

FIGURE 4-7
PROPOSED SITE 10
GROUNDWATER, SURFACE WATER,
AND SEDIMENT SAMPLING LOCATIONS

CECIL/RISTE10/NP/8-12-94

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

laboratory for full TCL and TAL analyses. Because the existing monitoring wells have not been sampled since 1988, they will be redeveloped prior to purging and sampling. Turbidity readings will be collected throughout purging and wells with values greater than 5 NTUs after purging will have both a filtered and unfiltered sample collected and sent to the offsite laboratory for TAL analyses; otherwise, only the upgradient monitoring well sample and two downgradient monitoring well samples will be submitted for filtered and unfiltered TAL analyses.

Each new and existing monitoring well will also be surveyed horizontally and vertically to determine their precise location and elevation. One round of water level measurements will then be collected from the monitoring wells to determine the directions of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well to provide estimates of the hydraulic properties of each aquifer zone at the site.

For the purposes of characterizing the surface water exposure pathway and for estimating the extent of surface water and sediment contamination, two surface water samples and two sediment samples will be collected from the Rowell Creek tributary located north of the site as shown in Figure 4-7. These samples will be sent to an offsite laboratory for full TCL and TAL parameter analyses. Both a filtered and unfiltered surface water sample will be sent to the offsite laboratory for TAL analyses. Note that no surface water or sediment samples are proposed for Rowell Creek. This creek has already been sampled extensively as part of a basewide surface water and sediment sampling program (sample locations are shown in Figure 4-6), and the results from this previous sampling program will be used in conjunction with the above proposed sample results to evaluate the surface water exposure pathway in this remedial investigation. However, reconnaissance of Rowell Creek adjacent to Site 10 will be conducted and if leachate is observed, the visibly contaminated sediment and surface water will be sampled.

For the purposes of identifying site-specific potential ecological receptors of concern at this site, an ecological survey will be completed on and around the site. The ecological inventory will include identification of the vegetative communities, habitat types, physical and chemical characteristics of the environment, and the occurrence of animals. The ecological survey will be based on a field visit by two experienced biologists. The *Guide to the Natural Communities of Florida* (FNAI and Department of Natural Resources, 1990) will be used to identify the upland vegetative communities at this site. The Cowardin (Cowardin and others, 1979) system will be used to describe wetland plant communities found at this site.

A sample analysis summary for the initial sampling event activities to be conducted at Site 10 is provided in Table 4-4.

4.1.4.2 **Confirmatory Sampling Event** The results of the initial sampling event should adequately define any COPCs at this site. However, the activities conducted during the initial sampling event may not adequately define the extent of contamination or provide adequate information to evaluate the human health and/or ecological exposure pathways, if present. Therefore, the following

Table 4-4
Sampling and Analysis Program Summary for Site 10

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	Number of Samples	DQO Level	Chemical Analysis	
			TCL Parameters	TAL Parameters
Surface Soil	6	IV	✓	✓
Surface Water	2	IV	✓	✓
Sediment	2	IV	✓	✓
Groundwater	5	IV	✓	✓

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).

activities may be conducted during the confirmatory sampling event to achieve these goals.

- Surface soil samples (0 to 1 foot depth) may be collected and analyzed to define the horizontal extent of soil contamination.

- Soil borings may be completed with subsurface soil samples collected and analyzed to define the vertical extent of soil contamination.

- Additional monitoring wells may be installed and groundwater samples collected and analyzed to further refine or define the extent of groundwater contamination.

- If additional monitoring wells are installed, the borings will be continuously logged (by visual observation of core samples) to further characterize the lithology at the site.

  Each additional well will also be surveyed and water level measurements will be collected (from all monitoring wells) to further define the direction of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) may be conducted in each additional monitoring well to provide additional estimates of the hydraulic properties of the aquifer zones at the site.

- Additional surface water and sediment samples may be collected and analyzed to further refine or define the extent of surface water and sediment contamination.

- Toxicity testing of surface soil using the earthworm (*Eisenia foetida*) may be used to evaluate the effects of contaminants in soil on the terrestrial soil invertebrate community. If earthworm toxicity testing is conducted, surface soil samples from a depth of 0 to 1 foot will be collected, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. The toxicity testing (14-day survival test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.5. Earthworms surviving the 14-day test will be further exposed to the soil for an additional 14 days and then analyzed for the same parameters as the analyses of the surface soil samples. Earthworm samples may also be collected in the field from areas representing a range of contaminant concentrations, if there is a sufficient number of worms available.

- Toxicity testing of surface soil using the lettuce seed (*Lactuca sativa*) or another suitable species may be used to evaluate the effects of contamination in soil on terrestrial plants. Surface soil samples would be collected from a depth of 0 to 1 foot, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. Toxicity testing (120-hour germination test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.6.

- Benthic macroinvertebrate sampling and enumeration may be conducted in the surface water to evaluate the potential impacts of site contamination on the aquatic ecosystem. This sampling and enumeration would be conducted according to FDEP guidelines.

- Toxicity testing of aquatic organisms found in the surface water may be conducted to evaluate the potential impacts of site contamination on the aquatic ecosystem. If conducted, these toxicity tests will be performed according to ASTM protocols (ASTM E-1383-93).

- Fish tissue samples may be collected from the surface water and analyzed to evaluate the potential for bioaccumulation of contaminants through the aquatic food chain.

- A wetlands assessment (functional assessment) and delineation may be completed, if during the initial ecological surveys, potential wetlands are found to be on or near the site, and may be potentially disturbed, altered, or destroyed during remedial activities.

4.1.5 Site 14, Blue 5 Ordnance Disposal Area

4.1.5.1 **Initial Sampling Event** For health and safety purposes, an ordnance survey will first be conducted at this site to identify the presence of and remove any unexploded ordnance.

The presence of soil contamination at Site 14 has not yet been well documented. Therefore, for the purposes of determining the presence, nature, and potential extent of soil contamination, and for the purpose of characterizing the soil exposure pathway, surface soil samples will be collected from areas along 100-foot and 50-foot grid squares.

One grab surface soil screening sample will be collected from the center of each area defined by the 100-foot square grid block shown in Figure 4-8 (75 total samples). These samples will be screened onsite with 2,4,6-TNT colorimetric field test kits. TNT has been selected as the indicator chemical for surface soil because it is anticipated to have been a major component of the ordnance that was detonated at Site 14.

In addition, because 1,1,1-trichloroethane was detected in the one soil sample previously collected near the bunker at Site 14, surface soil samples will be collected from the center of each area defined by the 50-foot square grid block around the bunker (Figure 4-8) and screened for USEPA modified methods 8010 and 8020 (24 total samples), which detect volatile aromatic and chlorinated aliphatic compounds, respectively. Modifying Methods 8010 and 8020 by extending the chromatographic run allows naphthalene to be quantitatively recovered and measured. By identifying areas of TNT contamination with field test kits, surface soil contaminants associated with ordnance detonation (including nitroaromatics, SVOCs, and metals) can be assessed in a cost-effective manner.

To assess the presence of these contaminants after the field test kit screening, the USEPA, FDEP, and Navy will jointly select the number and location of confirmatory samples. For planning purposes, an estimated 20 percent of these sample locations (15 samples) will be resampled and analyzed by an offsite laboratory for full TCL and TAL parameters and nitroaromatics (USEPA Method

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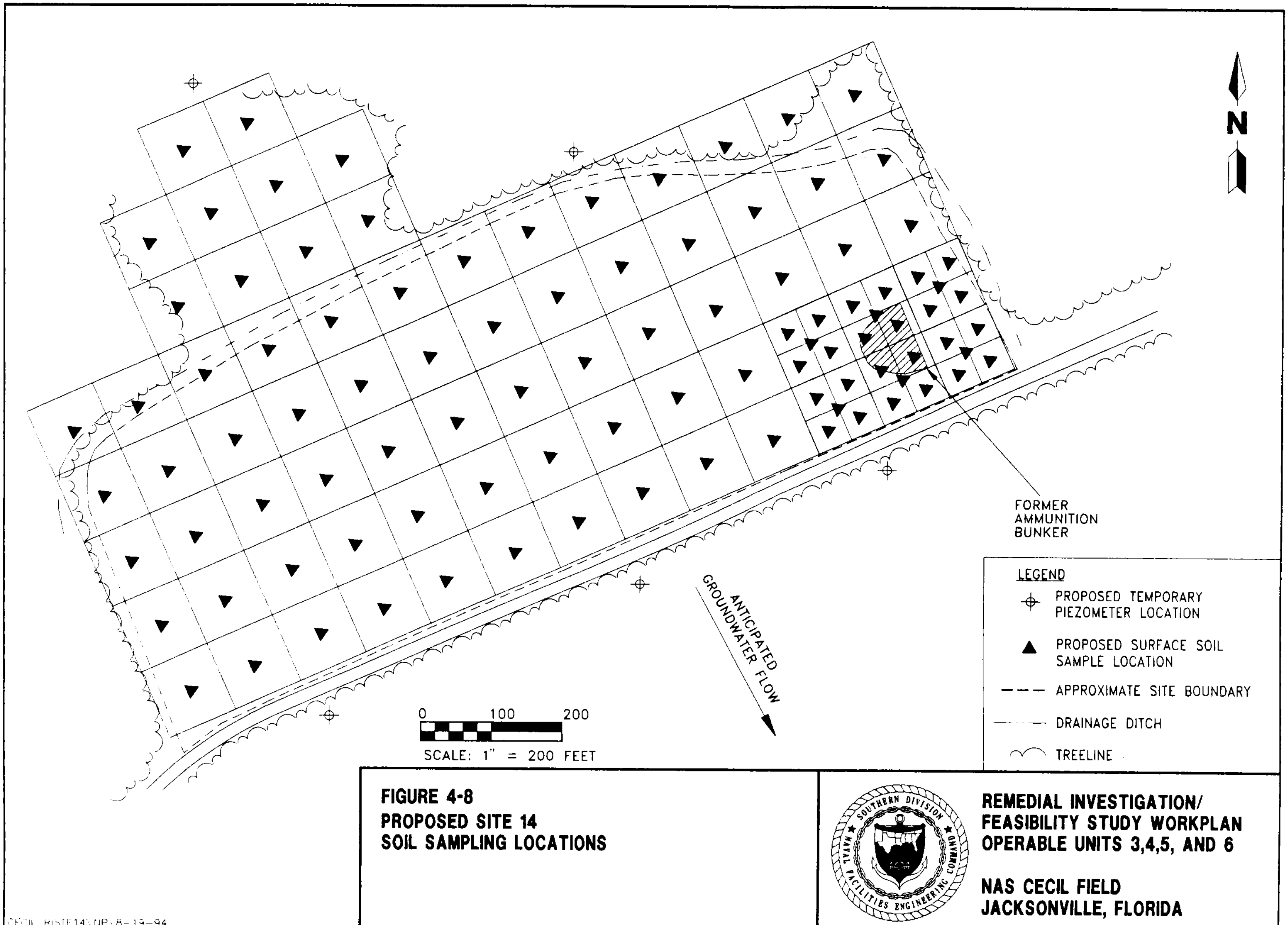

FIGURE 4-8
PROPOSED SITE 14
SOIL SAMPLING LOCATIONS

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

8330). In addition, two samples will be collected as split samples (for offsite nitroaromatic analysis) for correlation of the TNT colorimetric field test kit results. The locations selected for resampling will be from areas with the highest TNT and VOC field screening concentrations. All surface soil samples will be collected from 0 to 1 foot bls for use in conducting human health and ecological risk assessments.

For the purposes of assessing groundwater flow direction; the presence, nature, and potential extent of groundwater contamination; and for the purpose of characterizing the groundwater exposure pathway, the following activities will be conducted.

- Five temporary piezometers will be installed (prior to monitoring well installation) to assess groundwater flow direction and aid in the placement of monitoring wells. The piezometer locations are shown in Figure 4-8.

- Based on the surface soil screening results and the groundwater flow direction identified from the temporary piezometers, three-well monitoring well clusters will be installed at Site 14. For planning purposes, preliminary locations of monitoring well clusters are shown in Figure 4-9. The final location and number of monitoring wells will be based on the hydrogeological model and contaminant flow paths resulting from stratigraphic, piezometric, and contaminated type and distribution information collected during the screening process. These locations will be jointly selected by the USEPA, FDEP, and Navy after the screening data have been evaluated. Unless the stratigraphy dictates otherwise, one well in each cluster will be screened at the water table in the UZS, one well will be screened at the bottom of the LZS, and one well will be screened at the top of the UZH.

  After well installation is completed, one groundwater sample will be collected from each well and sent to an offsite laboratory for full TCL and TAL analyses, and nitroaromatic chemical analyses (USEPA Method 8330). Turbidity readings will be collected throughout purging and wells with values greater than 5 NTUs after purging will have both a filtered and unfiltered sample collected and sent to the offsite laboratory for TAL analyses. If turbidity readings are below 5 NTUs in all wells, only samples from the upgradient well cluster and one downgradient well cluster will be submitted for filtered and unfiltered TAL analyses.

- During the construction of the UZH wells in each of the new monitoring well clusters, the boring will be continuously logged (by visual observation of core samples) to the bottom of the UZH to characterize the lithology at the site.

  Each new monitoring well will also be surveyed horizontally and vertically to determine their precise location and elevation. One round of water level measurements will then be collected from the monitoring wells to determine the directions of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well to provide estimates of the hydraulic properties of each aquifer zone at the site.

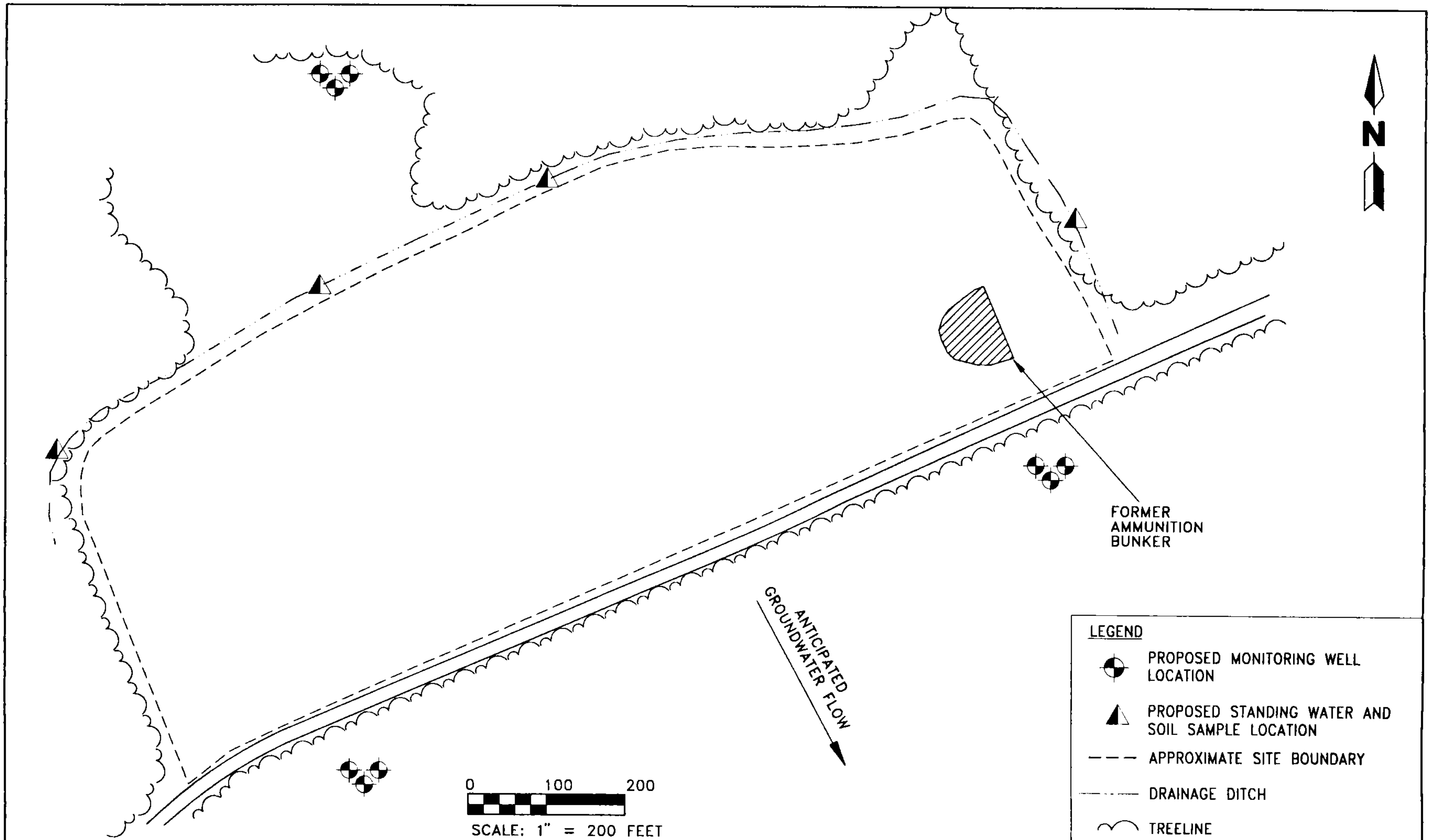

FIGURE 4-9
PROPOSED SITE 14 GROUNDWATER, SURFACE WATER, AND SEDIMENT SAMPLING LOCATIONS

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

CECIL\RISTE14\GLC-NP\11-30-94

For the purposes of characterizing the presence of contamination in the drainage swale water and soil, four water samples and four soil samples will be collected from the drainage swales bordering the site as shown in Figure 4-9. The drainage swales are isolated and are not connected to a stormwater system or surface water body. These samples will be sent to an offsite laboratory for full TCL and TAL parameter analyses and nitroaromatic chemical analyses (USEPA Method 8330). Both filtered and unfiltered surface water samples will be sent to the offsite laboratory for TAL analyses.

For the purposes of identifying site-specific potential ecological receptors of concern at this site, an ecological survey will be completed on and around the site. The ecological inventory will include identification of the vegetative communities, habitat types, physical and chemical characteristics of the environment, and the occurrence of animals. The ecological survey will be based on a field visit by two experienced biologists. The *Guide to the Natural Communities of Florida* (FNAI and Department of Natural Resources, 1990) will be used to identify the upland vegetative communities at this site. The Cowardin (Cowardin and others, 1979) system will be used to describe wetland plant communities found at this site.

A sample analysis summary for the initial sampling event activities to be conducted at Site 14 is provided in Table 4-5.

4.1.5.2 **Confirmatory Sampling Event** The results of the initial sampling event should adequately define any COPCs this site. However, the activities conducted during the initial sampling event may not adequately define the extent of contamination or provide adequate information to evaluate the human health and/or ecological exposure pathways, if present. Therefore, the following activities may be conducted during the confirmatory sampling event to achieve these goals.

- Additional surface soil samples (0- to 1 foot depth) may be collected and analyzed to further refine and define the horizontal extent of soils contamination.

- Soil borings may be completed with subsurface soil samples collected and analyzed to define the vertical extent of soil contamination.

- Additional monitoring wells may be installed and groundwater samples collected and analyzed to further refine or define the extent of groundwater contamination.

- If additional monitoring wells are installed, the borings will be continuously logged (by visual observation of core samples) to further characterize the lithology at the site.

  Each additional well will also be surveyed and water level measurements will be collected (from all monitoring wells) to further define the direction of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) may be conducted in each additional monitoring well to provide additional estimates of the hydraulic properties of the aquifer zones at the site.

Table 4-5
Sampling and Analysis Program Summary for Site 14

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	Number of Samples	DQO Level	Chemical Analysis				
			TCL Parameters	TAL Parameters	Nitroaromatics (USEPA Method 8330)	Onsite VOCs USEPA Modified 8010/8020	Onsite Colorimetric TNT
Surface Soil	75	II					✓
Surface Soil	24	III				✓	
Surface Soil	15	IV	✓	✓	✓		
Surface Soil	[1]2	IV			✓		
Standing Water	4	IV	✓	✓	✓		
Surface Soil[2]	4	IV	✓	✓	✓		
Groundwater	9	IV	✓	✓	✓		

[1] Samples are split samples for correlation to the TNT colorimetric test kits.
[2] Surface soil will be collected from the drainage swales.

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).
USEPA = U.S. Environmental Protection Agency.
VOCs = volatile organic compounds.
TNT = trinitrotoluene.

- Additional surface water and sediment samples may be collected and analyzed to further refine or define the extent of surface water and sediment contamination.

- Toxicity testing of surface soil using the earthworm (*Eisenia foetida*) may be used to evaluate the effects of contaminants in soil on the terrestrial soil invertebrate community. If earthworm toxicity testing is conducted, surface soil samples from a depth of 0 to 1 foot will be collected, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. The toxicity testing (14-day survival test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.5. Earthworms surviving the 14-day test will be further exposed to the soil for an additional 14 days and then analyzed for the same parameters as the analyses of the surface soil samples. Earthworm samples may also be collected in the field from areas representing a range of contaminant concentrations, if there is a sufficient number of worms available.

- Toxicity testing of surface soil using the lettuce seed (*Lactuca sativa*) or another suitable species may be used to evaluate the effects of contamination in soil on terrestrial plants. Surface soil samples would be collected from a depth of 0 to 1 foot, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. Toxicity testing (120-hour germination test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.6.

- A wetlands assessment (functional assessment) and delineation may be completed if during the initial ecological surveys, potential wetlands are found to be on or near the site, and may be potentially disturbed, altered, or destroyed during remedial activities.

4.1.6 Site 15, Blue 10 Ordnance Disposal Area

4.1.6.1 **Initial Sampling Event** For health and safety purposes, an ordnance survey will first be conducted at this site to identify the presence of and remove any unexploded ordnance.

The presence of soil contamination at Site 15 has not yet been well documented. Therefore, for the purposes of determining the presence, nature, and potential extent of soil contamination, and for the purpose of characterizing the soil exposure pathway, both surface and subsurface samples will be collected as follows.

- One grab surface soil screening sample will be collected from the center of each area defined by the 25-foot and 100-foot square grid block shown in Figure 4-10 (64 total samples). These samples will be sent to the onsite laboratory for analyses of PAHs and TPH (USEPA Methods 8270 and 418.1), and to an offsite laboratory for analysis of lead (USEPA Method 6010). The samples will also be screened with colorimetric field test kits for TNT. PAHs, TPH, lead, and TNT have been selected as the indicator parameters for surface soil because they

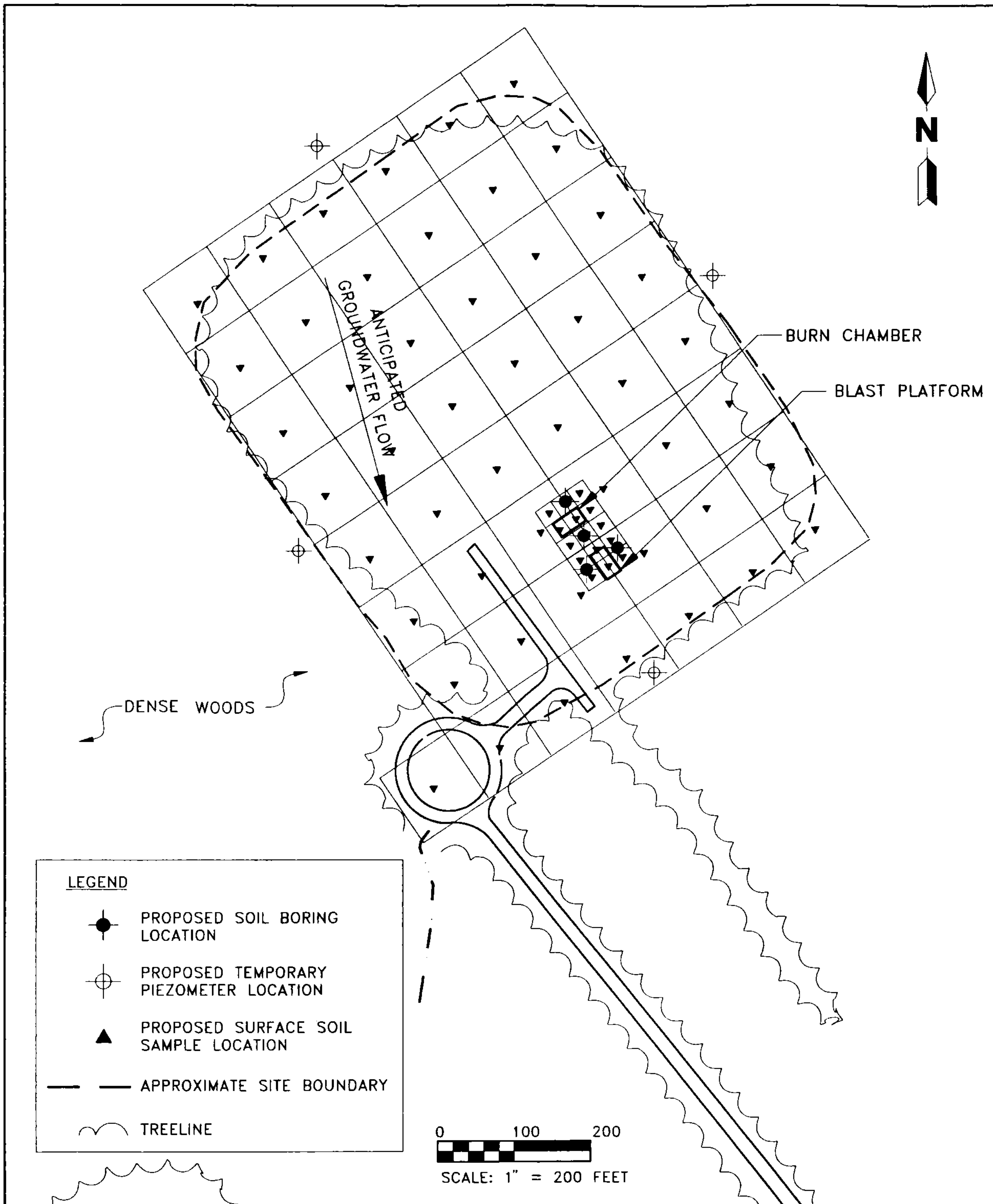

FIGURE 4-10
PROPOSED SITE 15
SOIL SAMPLING LOCATIONS

CECIL\RISTE15\NP\11-23-94

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
SAMPLING AND ANALYSIS PLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

would be associated with the burning of ordnance at Site 15. PAHs and lead have also been detected at elevated concentrations in the one surface soil sample collected at Site 15 during the RFI.

After the soil screening has been completed, the USEPA, FDEP, and Navy will jointly select the number and location of confirmatory soil samples. For planning purposes, an estimated 20 percent of these sample locations (13 samples) will be resampled and analyzed by an offsite laboratory for full TCL and TAL parameters and nitroaromatics (USEPA Method 8330). In addition, two samples will be collected as split samples (for offsite nitroaromatic analysis) for correlation of the TNT colorimetric field test kit results. All surface soil samples will be collected from 0 to 1 foot bls for use in conducting human health and ecological risk assessments.

- Four soil borings will be completed at locations with the highest contaminant concentration detected during the surface soil screening program. Based on results of the RFI soil sample, it is anticipated that the highest concentrations of contaminants will be located adjacent to the burn chamber and the blast platform. Approximate soil boring locations are shown on Figure 4-10. Soil screening samples will be collected at 2-foot intervals from 1 foot bls down to the water table (i.e., 1 to 3, 3 to 5, and 5 to 7 feet bls). No samples will be collected from 0 to 1 foot bls because of the high density of proposed surface soil samples in this area of Site 15.

  These samples (estimated 12 subsurface) will be sent to an onsite laboratory and analyzed for VOCs, PAHs, and TPH (USEPA Methods 8010 [modified], 8020 [modified], 8270, and 418.1), and to an offsite laboratory for analysis of lead (USEPA Method 6010). In addition, one sample per boring (four total samples) will be sent to an offsite laboratory for full TCL and TAL parameter analyses, with the intent being to collect these samples from the most contaminated depths based on visual observation and field screening using an FID. Analyses to detect VOCs and naphthalene will be performed for all subsurface soil samples, but not for the shallow (0 to 6 inches) surface soil grab samples.

For the purposes of assessing groundwater flow direction; the presence, nature, and potential extent of groundwater contamination; and characterization of the groundwater exposure pathway, the following activities will be conducted.

- Four temporary piezometers will be installed (prior to monitoring well installation) to assess groundwater flow direction and subsequently aid in the placement of monitoring wells. The piezometer locations are shown on Figure 4-10.

- Based on the surface soil screening results and the groundwater flow direction identified from the temporary piezometers, three-well monitoring well clusters will be installed at Site 15. For planning purposes, preliminary locations of monitoring well clusters are shown in Figure 4-11. The final location and number of monitoring wells will be based on the hydrogeological model and contaminant flow paths resulting from stratigraphic, piezometric, and contaminant type and

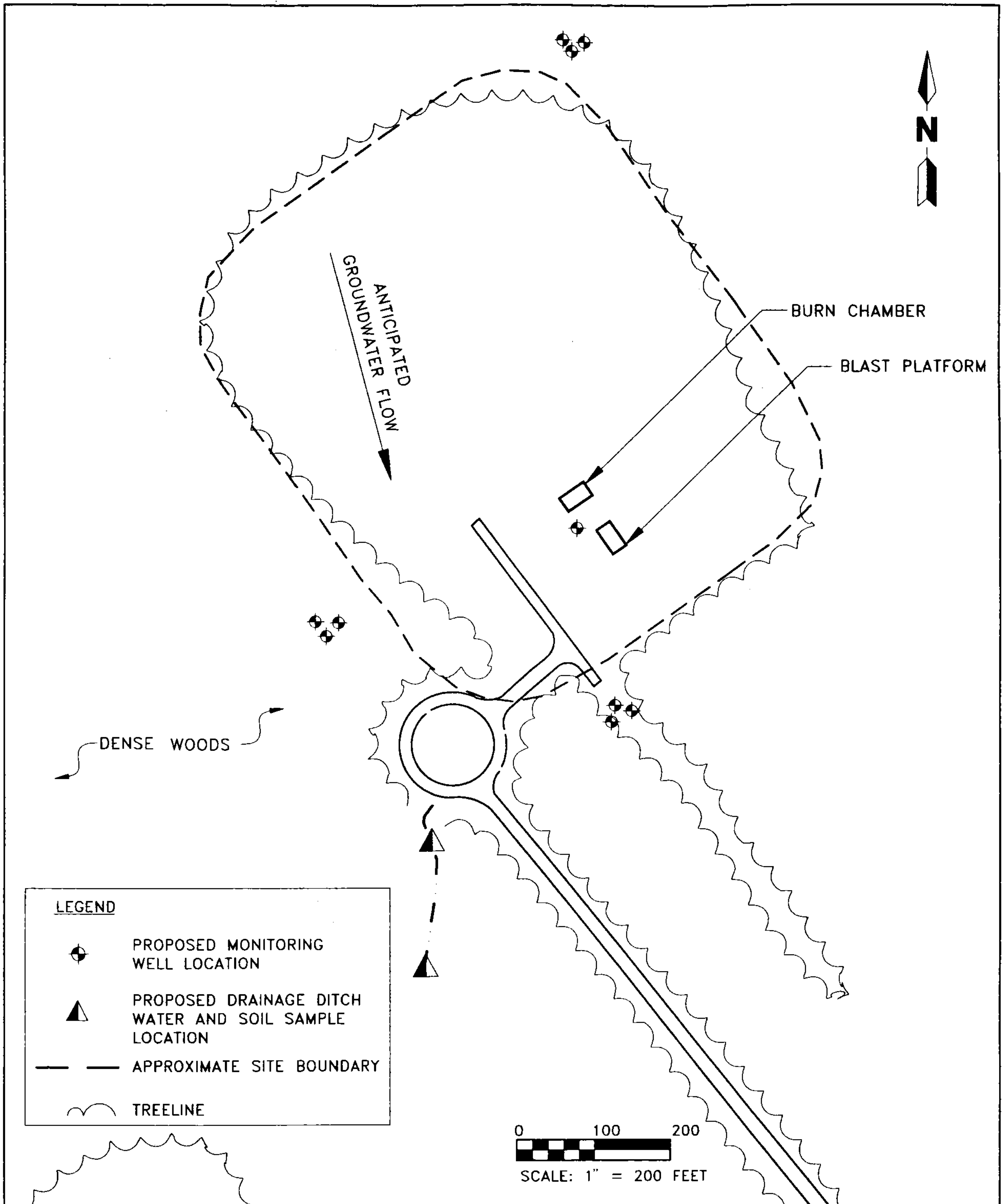

FIGURE 4-11
PROPOSED SITE 15
GROUNDWATER, SURFACE WATER, AND SEDIMENT SAMPLING LOCATIONS

CECIL\RISTE15\GLC-NP\11-30-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

distribution information collected during the screening process. These location will be jointly selected by the USEPA, FDEP, and Navy after the screening data have been evaluated. Unless the stratigraphy dictates otherwise, one well in each cluster will be screened at the water table in the UZS, one well will be screened at the bottom of the LZS, and one well will be screened at the top of the UZH.

After well installation is completed, one groundwater sample will be collected from each well and sent to an offsite laboratory for full TCL and TAL analyses and nitroaromatic chemical analyses (USEPA Method 8330). Turbidity readings will be collected throughout purging and wells with values greater than 5 NTUs after purging will have both a filtered and unfiltered sample collected and sent to the offsite laboratory for TAL analyses. If the turbidity readings are below 5 NTUs in all wells, only samples from the source area well cluster and one downgradient well cluster will be submitted for filtered and unfiltered TAL analyses.

- During the construction of the UZH wells in each of the new monitoring well clusters, the boring will be continuously logged (by visual observation of core samples) to the bottom of the UZH to characterize the lithology at the site.

  Each new monitoring well will also be surveyed horizontally and vertically to determine their precise location and elevation. One round of water level measurements will then be collected from the monitoring wells to determine the directions of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well to provide estimates of the hydraulic properties of each aquifer zone at the site.

Based on the evaluation of the historical use of Site 15 and the results of previous investigations, there is the potential for remedial action at this site. For the purposes of providing geotechnical, geochemical, and groundwater quality information to be used for potential remedial action at Site 15, soil and groundwater samples will be collected as follows.

- One groundwater sample will be collected from the UZS and analyzed for:

  - pH, conductivity, and temperature (field measurement);
  - alkalinity (USEPA Method 310.1);
  - chloride (USEPA Method 325.1);
  - sulfate (USEPA Method 375.4);
  - total sulfide (USEPA Method 376.1);
  - oil and grease (USEPA Method 413.2);
  - TOC (USEPA Method 415.2);
  - total solids (USEPA Method 160.3);
  - TSS (USEPA Method 160.2);
  - TDS (USEPA Method 160.1);
  - hardness (USEPA Method 130.2); and
  - color (USEPA Method 110.2).

One soil sample will be collected from the vadose zone in an area where no contamination appears to be present and analyzed for:

- pH,
- moisture content (ASTM Method D-2216),
- sieve and hydrometer particle size distribution (ASTM Methods D-421 and 422), and
- bulk density (ASTM E12-70).

For the evaluation of a potential remedial action involving excavation and disposal, one composite soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for:

- TCLP extraction (VOCs, SVOCs, metals, and pesticides, as appropriate).

For the evaluation of a potential remedial action involving biological treatment, one soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for the following:

- TKN (USEPA Method 351.3),
- ammonia-nitrogen (USEPA Method 350.2),
- nitrate plus nitrite (USEPA Method 353.2),
- total phosphorous (USEPA Method 365.1),
- total bacteria (USEPA Method 907B modified),
- specific petroleum degraders (USEPA Method 907B modified),
- TOC (USEPA Method 415.2),
- TPH (USEPA Method 418.1 modified), and
- fingerprint (USEPA Method 3550/8100 modified).

For the purposes of characterizing the presence of contamination in the drainage ditch leaving the site (Figure 4-11), two water samples (if present), and two soil samples will be collected. These samples will be sent to an offsite laboratory for full TCL and TAL parameter analyses and nitroaromatic chemical analyses (USEPA Method 8330). Both filtered and unfiltered water samples will be sent to the offsite laboratory for TAL analyses.

For the purposes of identifying site-specific potential ecological receptors of concern at this site, an ecological survey will be completed on and around the site. The ecological inventory will include identification of the vegetative communities, habitat types, physical and chemical characteristics of the environment, and the occurrence of animals. The ecological survey will be based on a field visit by two experienced biologists. The *Guide to the Natural Communities of Florida* (FNAI and Department of Natural Resources, 1990) will be used to identify the upland vegetative communities at this site. The Cowardin (Cowardin and others, 1979) system will be used to describe wetland plant communities found at this site.

A sample analysis summary for the initial sampling event activities to be conducted at Site 15 is provided in Table 4-6.

Table 4-6
Sampling and Analysis Program Summary for Site 15

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	Number of Samples	DQO Level	Chemical Analysis						
			TCL Parameters	TAL Parameters	Nitroaromatics (USEPA Method 8330)	Onsite Colorimetric TNT	Onsite		Offsite
							TPH	PAH	Pb
Surface Soil	64	II/III				✓	✓	✓	✓
Surface Soil	13	IV	✓	✓	✓				
Surface Soil	[1]2	IV			✓				
Subsurface Soil	12	III				✓	✓	✓	✓
Subsurface Soil	4	IV	✓	✓	✓				
Drainage Ditch Water	2	IV	✓	✓	✓				
Surface Soil[2]	2	IV	✓	✓	✓				
Groundwater	10	IV	✓	✓	✓				

[1] Samples are split samples for correlation to the trinitrotoluene colorimetric test kits.
[2] Surface soil will be collected from the drainage ditch.

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).
USEPA = U.S. Environmental Protection Agency.
TNT = trinitrotoluene.
TPH = total petroleum hydrocarbon.
PAH = polynuclear aromatic hydrocarbon.
Pb = lead.

4.1.6.2 Confirmatory Sampling Event The results of the initial sampling event should adequately define any COPCs at this site. However, the activities conducted during the initial sampling event may not adequately define the extent of contamination or provide adequate information to evaluate the human health and/or ecological exposure pathways, if present. Therefore, the following activities may be conducted during the confirmatory sampling event to achieve these goals.

- Additional surface soil samples (0 to 1 foot depth) may be collected and analyzed to further refine and define the horizontal extent of soil contamination.

- Soil borings may be completed with subsurface soil samples collected and analyzed to define the vertical extent of soil contamination.

- Additional monitoring wells may be installed and groundwater samples collected and analyzed to further refine or define the extent of groundwater contamination.

- If additional monitoring wells are installed, the borings will be continuously logged (by visual observation of core samples) to further characterize the lithology at the site.

  Each additional well will also be surveyed and water level measurements will be collected (from all monitoring wells) to further define the direction of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) may be conducted in each additional monitoring well to provide additional estimates of the hydraulic properties of the aquifer zones at the site.

- Additional surface water and sediment samples may be collected and analyzed to further refine or define the extent of surface water and sediment contamination.

- Toxicity testing of surface soil using the earthworm (*Eisenia foetida*) may be used to evaluate the effects of contaminants in soil on the terrestrial soil invertebrate community. If earthworm toxicity testing is conducted, surface soil samples from a depth of 0 to 1 foot will be collected, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. The toxicity testing (14-day survival test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.5. Earthworms surviving the 14-day test will be further exposed to the soil for an additional 14 days and then analyzed for the same parameters as the analyses of the surface soil samples. Earthworm samples may also be collected in the field from areas representing a range of contaminant concentrations, if there is a sufficient number of worms available.

- Toxicity testing of surface soil using the lettuce seed (*Lactuca sativa*) or another suitable species may be used to evaluate the effects of contamination in soil on terrestrial plants. Surface soil samples would be collected from a depth of 0 to 1 foot, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. Toxicity testing (120-hour germination test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.6.

- A wetlands assessment (functional assessment) and delineation may be completed if during the initial ecological surveys, potential wetlands are found to be on or near the site, and may be potentially disturbed, altered, or destroyed during remedial activities.

4.1.7 Site 11, Pesticide Disposal Area

4.1.7.1 Initial Sampling Event For the purposes of characterizing the soil exposure pathway and for estimating the horizontal and vertical extent of soil contamination (after the removal action is completed), both surface and subsurface soil samples will be collected for analysis at this site as follows.

- Nineteen soil borings will be completed at the approximate locations shown on Figure 4-12. One soil boring will be completed in each of the 19 anomalous areas identified in the 1993 geophysical survey of the site. One soil sample will be collected at the surface (0 to 1 foot bls) and one soil sample will be collected just above the water table in each of these boreholes. These samples (38 total samples) will be sent to an offsite laboratory for full TCL and TAL parameter analyses and for analyses of other pesticides and herbicides potentially associated with this site (USEPA Methods 8150, 8140, and 1,2-dibromo-3-chloropropane).

- Grab surface soil samples (0 to 1 foot bls) will be collected from the areas between the soil borings as shown in Figure 4-12. These samples (19 total samples) will be sent to an offsite laboratory for TCL and TAL parameter analyses and for analyses of other pesticides and herbicides potentially associated with this site (USEPA Methods 8150, 8140, and 1,2-dibromo-3-chloropropane).

For the purposes of characterizing the groundwater exposure pathway and for estimating the horizontal and vertical extent of groundwater contamination, the following activities will be conducted.

- Three temporary piezometers will be installed (prior to monitoring well installation) to assess groundwater flow direction and subsequently aid in the placement of monitoring wells. The piezometer locations are shown on Figure 4-12.

- Based on the groundwater flow direction identified from the temporary piezometers, monitoring well clusters will be installed at Site 11. For planning purposes, preliminary locations of three-well monitoring well clusters are shown on Figure 4-13. The final location and number of monitoring wells will be based on the hydrogeological model and contaminant flow paths resulting from stratigraphic, piezometric, and contaminant type and distribution information collected during the initial sampling event and previous investigations. These locations will be jointly selected by the USEPA, FDEP and Navy after the field data have been evaluated. Unless the stratigraphy dictates otherwise,

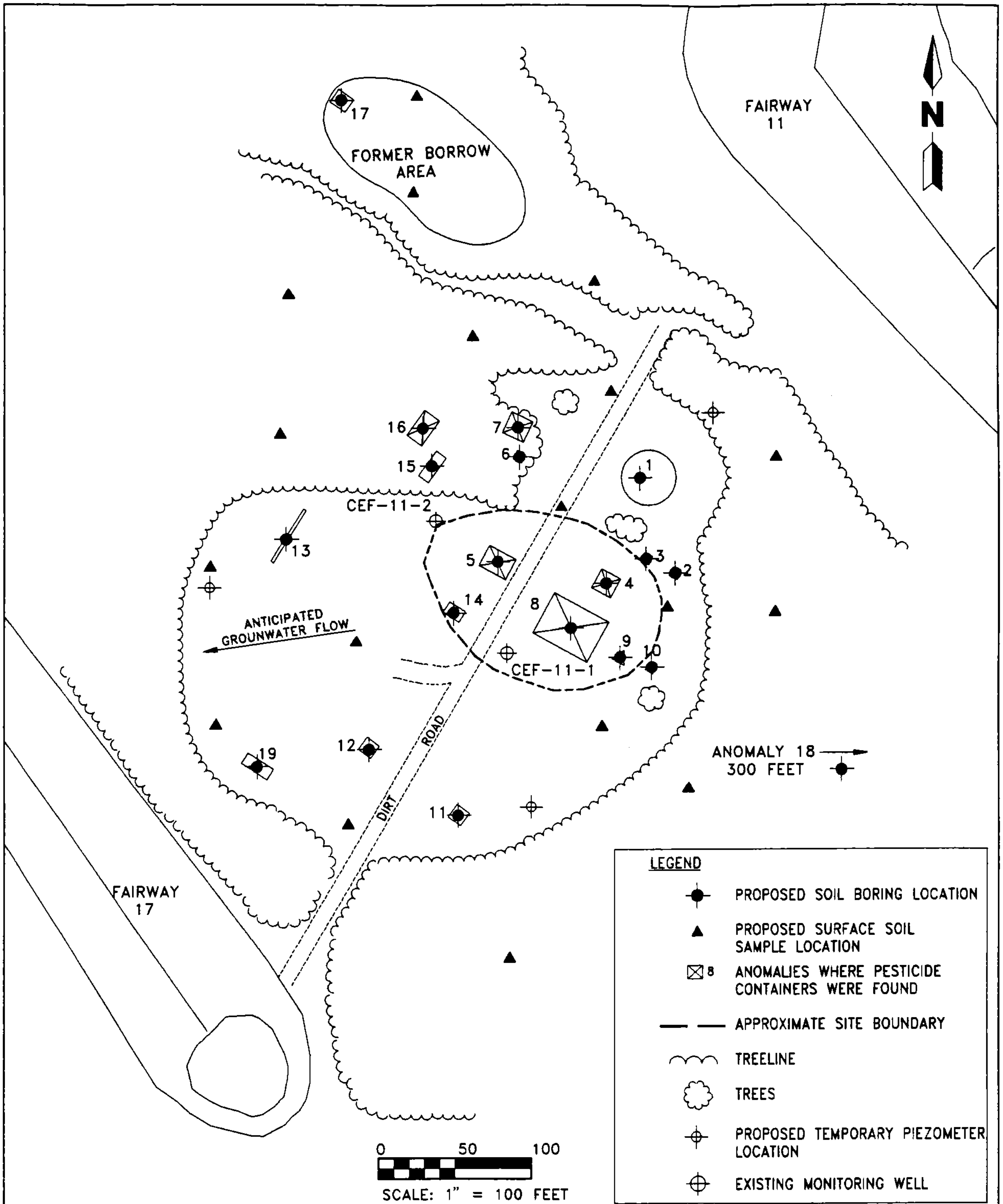

FIGURE 4-12
PROPOSED SITE 11
SOIL SAMPLING LOCATIONS

CECIL/RISTE11/NP-GLC/11-15-94

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

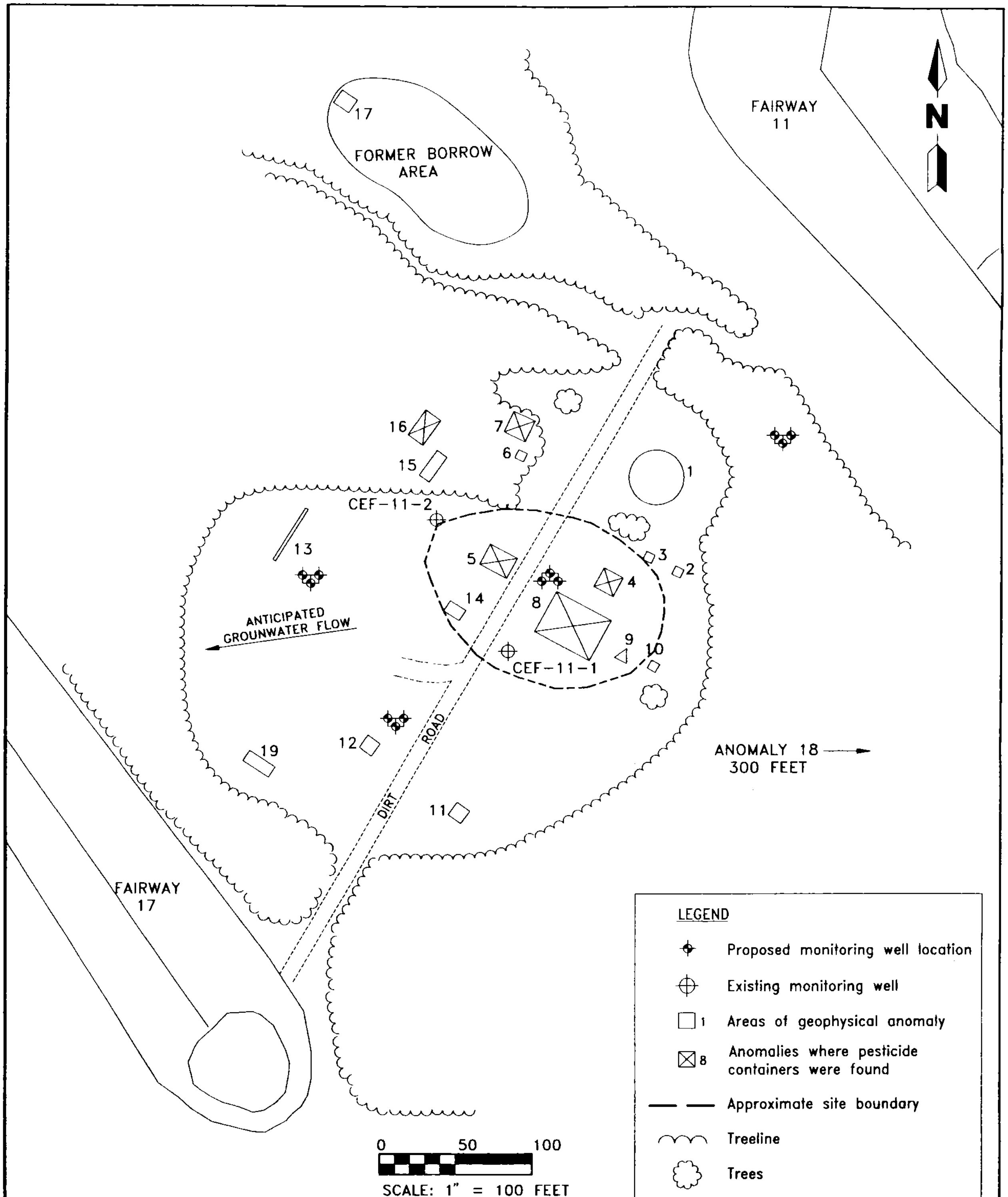

FIGURE 4-13
PROPOSED SITE 11
GROUNDWATER SAMPLING LOCATIONS

CECIL/RISTE11/NP/8-10-94

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3,4,5, AND 6

NAS CECIL FIELD
JACKSONVILLE, FLORIDA

one well in each cluster will be screened at the water table in the UZS, one well will be screened at the bottom of the LZS, and one well will be screened at the top of the UZH. After well installation is completed, one groundwater sample will be collected from each well and sent to an offsite laboratory for full TCL and TAL analyses and for analyses of other pesticides and herbicides potentially associated with this site (USEPA Methods 8150, 8140, and 1,2-dibromo-3-chloropropane). Turbidity readings will be collected throughout purging and wells with values greater than 5 NTUs after purging will have both a filtered and unfiltered sample collected and sent to the offsite laboratory for TAL analyses. If turbidity readings are below 5 NTUs in all wells, only samples from the source area well cluster and one downgradient well cluster will be submitted for filtered and unfiltered TAL analyses.

- During the construction of the UZH well in each of the new monitoring well clusters, the boring will be continuously logged (by visual observation of core samples) to the bottom of the UZH to characterize the lithology at the site.

  Each new monitoring well will also be surveyed horizontally and vertically to determine their precise location and elevation. One round of water level measurements will then be collected from the monitoring wells to determine the directions of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well to provide estimates of the hydraulic properties of each aquifer zone at the site.

Note that because of the age and construction characteristics of the existing monitoring wells at this site (i.e., 30-foot screens), the existing monitoring wells will be abandoned in accordance with procedures specified by the St. Johns River Water Management District during this investigation.

Based on the preliminary evaluation of the historical use of Site 11 and results of previous investigations there is the potential for remedial action at this site. For the purposes of providing geotechnical, geochemical, and groundwater quality information to be used for potential remedial action at Site 11, soil and groundwater samples will be collected as follows.

- One groundwater sample will be collected from the UZS and analyzed for:

  - pH, conductivity, and temperature (field measurement);
  - alkalinity (USEPA Method 310.1);
  - chloride (USEPA Method 325.1);
  - sulfate (USEPA Method 375.4);
  - total sulfide (USEPA Method 376.1);
  - oil and grease (USEPA Method 413.2);
  - TOC (USEPA Method 415.2);
  - total solids (USEPA Method 160.3);
  - TSS (USEPA Method 160.2);
  - TDS (USEPA Method 160.1);
  - hardness (USEPA Method 130.2); and
  - color (USEPA Method 110.2).

One soil sample will be collected from the vadose zone in an area where no contamination appears to be present and analyzed for:

- pH,

- moisture content (ASTM Method D-2216),

- sieve and hydrometer particle size distribution (ASTM Methods D-421 and 422), and

- bulk density (ASTM E12-70).

For the evaluation of a potential remedial action involving excavation and disposal, one composite soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for:

- TCLP extraction (VOCs, SVOCs, metals, and pesticides, as appropriate).

For the evaluation of a potential remedial action involving biological treatment, one soil sample will be collected from the area in the vadose zone with the highest observed contamination and analyzed for the following:

- TKN (USEPA Method 351.3),
- ammonia-nitrogen (USEPA Method 350.2),
- nitrate plus nitrite (USEPA Method 353.2),
- total phosphorous (USEPA Method 365.1),
- total bacteria (USEPA Method 907B modified),
- specific petroleum degraders (USEPA Method 907B modified),
- TOC (USEPA Method 415.2),
- TPH (USEPA Method 418.1 modified), and
- fingerprint (USEPA Method 3550/8100 modified).

For the purposes of identifying site-specific potential ecological receptors of concern at this site, an ecological survey will be completed on and around the site. The ecological inventory will include identification of the vegetative communities, habitat types, physical and chemical characteristics of the environment, and the occurrence of animals. The ecological survey will be based on a field visit by two experienced biologists. The *Guide to the Natural Communities of Florida* (FNAI and Department of Natural Resources, 1990) will be used to identify the upland vegetative communities at this site. The Cowardin (Cowardin and others, 1979) system will be used to describe wetland plant communities found at this site.

A sample analysis summary for the initial sampling event activities to be conducted at Site 11 is provided in Table 4-7.

4.1.7.2 **Confirmatory Sampling Event** The results of the initial sampling event should adequately define the COPCs at this site. However, if the activities conducted during the initial sampling event do not adequately define the extent of contamination or provide adequate information to evaluate the human health and/or ecological exposure pathways, the following activities may be conducted during the confirmatory sampling event.

Table 4-7
Sampling and Analysis Program Summary for Site 11

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

INITIAL SAMPLING EVENT

Sample Descriptor	Number of Samples	DQO Level	Chemical Analysis		
			TCL Parameters	TAL Parameters	Other Pesticides and Herbicides (USEPA Methods 8140, 8150, and 1,2-dibromo-3-chloropropane)
Surface Soil	38	IV	✓	✓	✓
Subsurface Soil	19	IV	✓	✓	✓
Groundwater	12	IV	✓	✓	✓

Notes: DQO = data quality objective.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).
USEPA = U.S. Environmental Protection Agency.

- Additional surface soil samples (0 to 1 foot depth) may be collected and analyzed to further refine or define the horizontal extent of soil contamination.

- Additional soil borings may be completed with subsurface soil samples collected and analyzed to further refine or define the vertical extent of soil contamination.

- Additional monitoring wells may be installed and groundwater samples collected and analyzed to further refine or define the extent of groundwater contamination.

- If additional monitoring wells are installed, the borings will be continuously logged (by visual observation of core samples) to further characterize the lithology at the site.

  Each additional well will also be surveyed and water level measurements will be collected (from all monitoring wells) to further define the direction of groundwater flow in each aquifer zone at the site. In addition, *in-situ* hydraulic conductivity tests (slug tests) may be conducted in each additional monitoring well to provide additional estimates of the hydraulic properties of the aquifer zones at the site.

- Toxicity testing of surface soil using the earthworm (*Eisenia foetida*) may be used to evaluate the effects of contaminants in soil on the terrestrial soil invertebrate community. If earthworm toxicity testing is conducted, surface soil samples from a depth of 0 to 1 foot will be collected, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. The toxicity testing (14-day survival test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.5. Earthworms surviving the 14-day test will be further exposed to the soil for an additional 14 days and then analyzed for the same parameters as the analyses of the surface soil samples. Earthworm samples may also be collected in the field from areas representing a range of contaminant concentrations, if there is a sufficient number of worms available.

- Toxicity testing of surface soil using the lettuce seed (*Lactuca sativa*) or another suitable species may be used to evaluate the effects of contamination in soil on terrestrial plants. Surface soil samples would be collected from a depth of 0 to 1 foot, homogenized, and split with one portion submitted for chemical analyses and one portion submitted for the toxicity test. Toxicity testing (120-hour germination test) will be performed according to the protocols provided in *Protocols for Short Term Toxicity Screening of Hazardous Waste Sites* (USEPA, 1989d) in Section A.8.6.

- A wetlands assessment (functional assessment) and delineation may be completed if during the initial ecological surveys, potential wetlands are found to be on or near the site, and may be potentially disturbed, altered, or destroyed during remedial activities.

4.2 DATA QUALITY OBJECTIVES (DQOs). DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions during remedial response activities. DQOs are based on the concept that different data uses may require different data quality. DQOs are, therefore, determined based on the end uses of the data to be collected. DQOs need to be established prior to data collection and integrated with the project planning process so that sufficient data of known quality are collected to support sound decisions concerning the remedial action selection.

For assistance in defining DQOs, USEPA has established the following five levels of data quality (USEPA, 1987a).

- Level I, field screening or analysis using portable instruments. Results are often not compound specific and not quantitative but results are available in real time.

- Level II, field analyses using more sophisticated portable analytical instruments. In some cases, the instruments may be set up in a mobile laboratory onsite. Results are available in real time or several hours.

- Level III, all analyses are performed in an onsite or offsite analytical laboratory. Level III analyses may or may not use USEPA Contract Laboratory Program (CLP) procedures, but do not usually use the validation or documentation procedures required of CLP Level IV analysis.

- Level IV, CLP routine analytical services. All analyses are performed in an offsite CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous quality assurance and quality control (QA/QC) protocols and documentation.

- Level V, analysis by non-standard methods. All analyses are performed in an offsite analytical laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits.

Based on the types and intended uses of the data to be collected during this RI/FS, categories of data to be collected were developed and DQO levels were established for each category. These categories and DQO levels are presented in the previous sample summary tables (Tables 4-1 through 4-4 and Tables 4-6 through 4-7). It is anticipated that all DQO Level III and IV data collected in this remedial investigation (with the exception of the Aquaprobe™ sample data) will be used in both the risk assessment and feasibility study analyses.

5.0 RI/FS SCOPE OF WORK

The primary objective of this RI/FS is to collect the additional data needed to support a risk assessment and provide a basis on which to recommend a remedial action plan for the six sites comprising OUs 3, 4, 5, and 6 at NAS Cecil Field. The specific goals of this RI/FS include the following:

- identifying the nature of, and the areal and vertical extent of contamination (contaminant types, concentrations, and distributions) in the soil, sediment, surface water, and groundwater at each of the six sites;
- estimating the hydraulic characteristics and contaminant transport mechanisms of the surficial and intermediate aquifers at the sites;
- evaluating the potential migration rates and pathways of site contaminants;
- assessing public health risks and environmental impacts associated with the site contamination (i.e., performing a baseline human health and ecological risk assessment);
- identifying current Federal and State ARARs for site remediation;
- developing the remedial levels for contaminants found at the sites;
- identifying technological options for cleaning up the site contamination and/or preventing further migration of contaminants offsite;
- performing bench or pilot scale treatability studies, as necessary, to evaluate the applicability of potential treatment technologies;
- assembling the technologies into remedial action alternatives and screening the alternatives to identify those that appear to be most promising with respect to effectiveness, implementability, and cost; and
- evaluating the screened remedial action alternatives in a manner that is consistent with the NCP and other regulatory requirements.

The following sections describe in detail each of the tasks and subtasks (except for the confirmatory sampling event field investigation subtasks) to be completed to fulfill these goals.

5.1 TASK 1, FIELD INVESTIGATION. As discussed in Chapter 4.0, to collect the additional data required to complete the RI/FS for OUs 3, 4, 5, and 6 in a cost-effective manner, a two-stage comprehensive data collection program was developed. An initial sampling event will first be performed to preliminarily assess the nature and extent of contamination at each site. A confirmatory sampling event will then be performed to verify and supplement the results of the initial sampling event, if necessary. Details of the initial sampling event field investigative activities are discussed below and in the Sampling and

Analysis Plan (Volume II) accompanying this workplan. Details of the confirmatory sampling event field investigative activities will be presented in Technical Memoranda of Rationale to be prepared and submitted to the Navy, USEPA, and FDEP for review and approval after the initial sampling events are completed.

The initial sampling event field investigative activities are divided into the following subtasks:

- Subtask 1, Subcontractor Procurement;
- Subtask 2, Mobilization;
- Subtask 3, Soil Sampling;
- Subtask 4, Aquaprobe™ Screening;
- Subtask 5, Monitoring Well Installation and Sampling;
- Subtask 6, Surface Water and Sediment Sampling;
- Subtask 7, Aquifer Testing and Measurement;
- Subtask 8, Ecological Survey;
- Subtask 9, Remedial Investigation Waste Disposal; and
- Subtask 10, Surveying and Permitting.

Each of these subtasks is described in more detail below.

<u>5.1.1 Subcontractor Procurement</u> Immediately following Navy, USEPA, and FDEP approval of this workplan and associated plans, technical performance specification will be prepared to assist in procurement of the following subcontractors:

- drilling,
- land surveying,
- onsite laboratory services, and
- offsite laboratory services.

A drilling subcontractor will be selected and a subcontract agreement executed to provide monitoring well installation and soil boring services. A surveyor, licensed in the State of Florida, will also be selected and a subcontract agreement executed to measure the horizontal location and vertical elevation of each monitoring well installed, and the horizontal locations of all soil, surface water, and sediment samples collected, as well as other pertinent features identified during the field investigation (e.g., geophysical survey markers). Subcontract agreements for both onsite and offsite laboratory services will also be executed to provide DQO Level III and IV sample analyses, respectively. Only Navy-approved analytical laboratories will be procured. All subcontractor specifications will be written to follow both Navy and USEPA Region IV standard operating procedures.

<u>5.1.2 Mobilization</u> Prior to initiation of any field activities, various mobilization tasks must be completed to ensure an efficient field sampling program. Limited site clearing will be required at most of the sites. Ordnance surveys will also be needed at Sites 8, 10, 14, and 15. The Environmental Coordinator (NAS Cecil Field) will be contacted for coordination of clearing and ordnance survey activities.

Temporary decontamination pads will be constructed for each of the areas under investigation. The temporary decontamination pads will be sloped to drain to one side so that contaminated wash water can be easily pumped to drums.

As part of mobilization, sampling locations will also be marked in the field. Soil sample grids will be laid out and stakes will be driven at all sampling locations.

Mobilization will also include travel to and from the site, and the procurement of all sampling supplies and equipment needed to perform the field investigation. Field equipment categories include necessary sampling and testing devices, air monitoring equipment, and decontamination equipment.

All mobilization activities will be coordinated with the NAS Cecil Field Environmental Coordinator.

<u>5.1.3 Soil Sampling</u> As indicated in Section 4.1, soil sampling will be conducted at each of the six sites comprising OUs 3, 4, 5, and 6, and also at background locations, to help characterize and estimate the extent of soil contamination. The proposed locations and depths of the soil samples and the laboratory analyses to be conducted on these samples are presented in Section 4.1. Note that the sample locations are only approximate. Actual locations will be determined in the field based on the actual physical characteristics of the sites, observed evidence of contamination, and accessibility to the sampling locations.

The proposed soil borings will be drilled using hollow stem augering (HSA) and only after the surface soil sample has been collected from the soil boring location. Continuous split-spoon samples will be collected down to the water table interface. All borings will be terminated just above the water table interface, where the last sample will be collected. After the last sample in the soil boring has been collected, the borehole will be grouted back up to land surface.

<u>5.1.4 Aquaprobe™ Screening</u> As indicated in Subsections 4.1.2 and 4.1.3, Aquaprobe™ screening will be conducted at Sites 7 and 8 to preliminarily define the areal and vertical extent of groundwater contamination and help guide placement of monitoring wells. The Aquaprobe™ consists of: (1) a stainless steel drive point, (2) a 4-foot screened section made of 10 slot wound stainless-steel, (3) a retractable outer casing that seats against the drive point and encloses the screen until the time of sample collection, and (4) screw-joint riser pipe fitted with o-rings, which is attached to the outer casing.

In-situ groundwater sample collection using the Aquaprobe™ is accomplished by augering (using HSA) down to 4 to 5 feet above the desired sampling interval. The Aquaprobe™ is then placed inside the augers, with the outer casing firmly seated against the drive point, and lowered to the bottom of the boring. The probe is then advanced to the desired sampling interval by hammering (as with a split spoon) or pushing with the drill rig. After the probe has been advanced to the desired sampling interval, the outer casing is retracted exposing the screened section to the otherwise undisturbed aquifer. Groundwater enters the probe through the screen and the sample is collected using a Teflon™ bailer. Following sample collection, the Aquaprobe™ is removed from the boring and decontaminated. Augering is then continued to the next sample interval where the procedure is completed again.

The proposed initial locations and depths of the Aquaprobe™ samples and the laboratory analyses to be conducted on these samples are presented in Subsections

4.1.2 and 4.1.3. Note that the sample locations are only approximate. Actual locations will be determined in the field based on the actual physical characteristics of the sites, observed evidence of contamination, and accessibility to the sampling locations. Additional Aquaprobe™ sampling locations may also be selected based on the results of the initial Aquaprobe™ samples to preliminarily define the areal extent of groundwater contamination at Sites 7 and 8.

5.1.5 Monitoring Well Installation and Sampling As indicated in Section 4.1, monitoring wells will be installed at each of the six sites comprising OUs 3, 4, 5, and 6, and also at background locations, to help characterize the groundwater flow pathway, as well as to help characterize and estimate the extent of groundwater contamination. The proposed locations and depths of the monitoring wells are presented in Section 4.1. Note that the monitoring well locations are only approximate. Actual locations will be determined in the field based on the actual physical characteristics of the sites, observed evidence of contamination, accessibility to the sampling locations, and, at Sites 7 and 8, the results of Aquaprobe™ screening.

All monitoring wells will be installed according to USEPA standards specified in the *Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, USEPA Region IV, Environmental Services Division (USEPA, 1991c, as well as *Guidelines for Groundwater Monitoring Well Installation* (SOUTHNAVFACENGCOM, 1989). Procedures for drilling, constructing, and developing the wells and decontaminating the equipment are described in detail in the Sampling and Analysis Plan accompanying this workplan (Volume II).

Typical well construction details for the shallow aquifer (UZS and LZS) and intermediate aquifer (UZH) monitoring wells are shown in Figures 5-1 and 5-2, respectively. All monitoring wells will be composed of 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) well casing and screen that complies with National Sanitation Foundation (NSF) Standard 14. The UZH wells will have a surface casing installed through the soil and at least 3 feet into the upper Hawthorn semi-confining unit. Screen lengths will generally be 10 feet, and slot sizes in the screens will be 0.010-inch. Every effort will be made to prevent collapse of the formation materials during construction of the wells. If collapse of the formation materials does not occur during construction of the well, clean quartz sand, graded to a larger particle size than the screen slots, will be used to pack the annular space adjacent to the screen. However, if collapse of the formation materials cannot be prevented, the filter pack will be constructed with a mixture of the formation materials and the clean quartz sands described above. The filter pack will extend at least 2 feet above the top of the screen. A 2-foot thick bentonite seal will be placed above the sand pack. The annular space above the bentonite will be grouted to the surface. All stick-up casing monitoring wells will be finished with concrete pads at the ground surface, locking protective casings, and bumper posts surrounding the well. Flush mounted protective covers will be installed on wells located in the runway apron at Site 7. These wells will be installed in a manner that avoids accumulation of rainwater or runoff by draining to the aggregate below the runway apron pavement. These wells will also be finished with concrete pads constructed level with the ground surface and locking, flush-mounted protective covers.

HSA and either dual-wall reverse circulation or ODEX drilling methods are anticipated for use on this project. All the UZS and LZS monitoring wells will

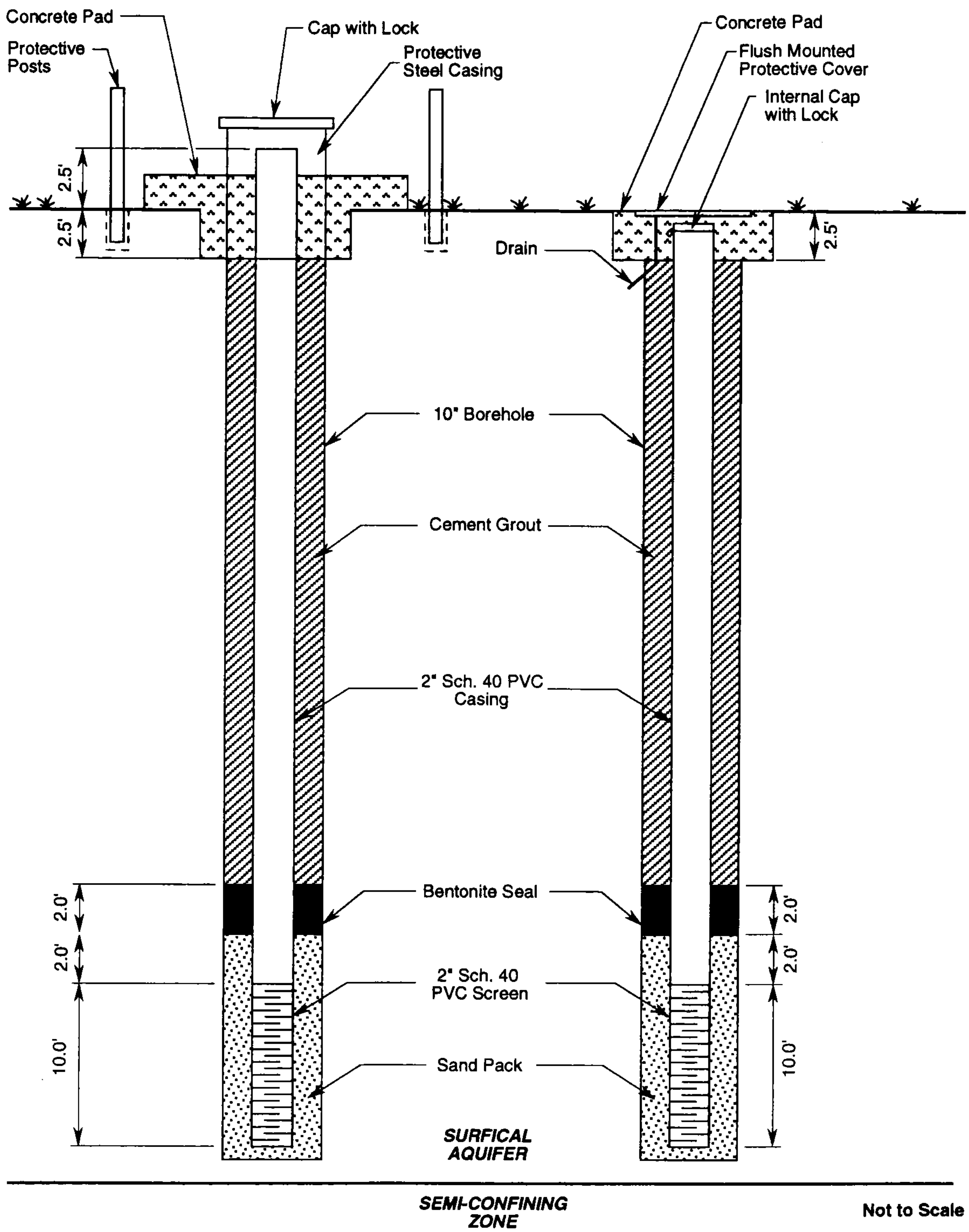

FIGURE 5-1

SURFICIAL AQUIFER MONITORING WELL CONSTRUCTION DIAGRAM

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

8520-48 941116WEM
CEFOU3-6.Wkp
MVL.11.94

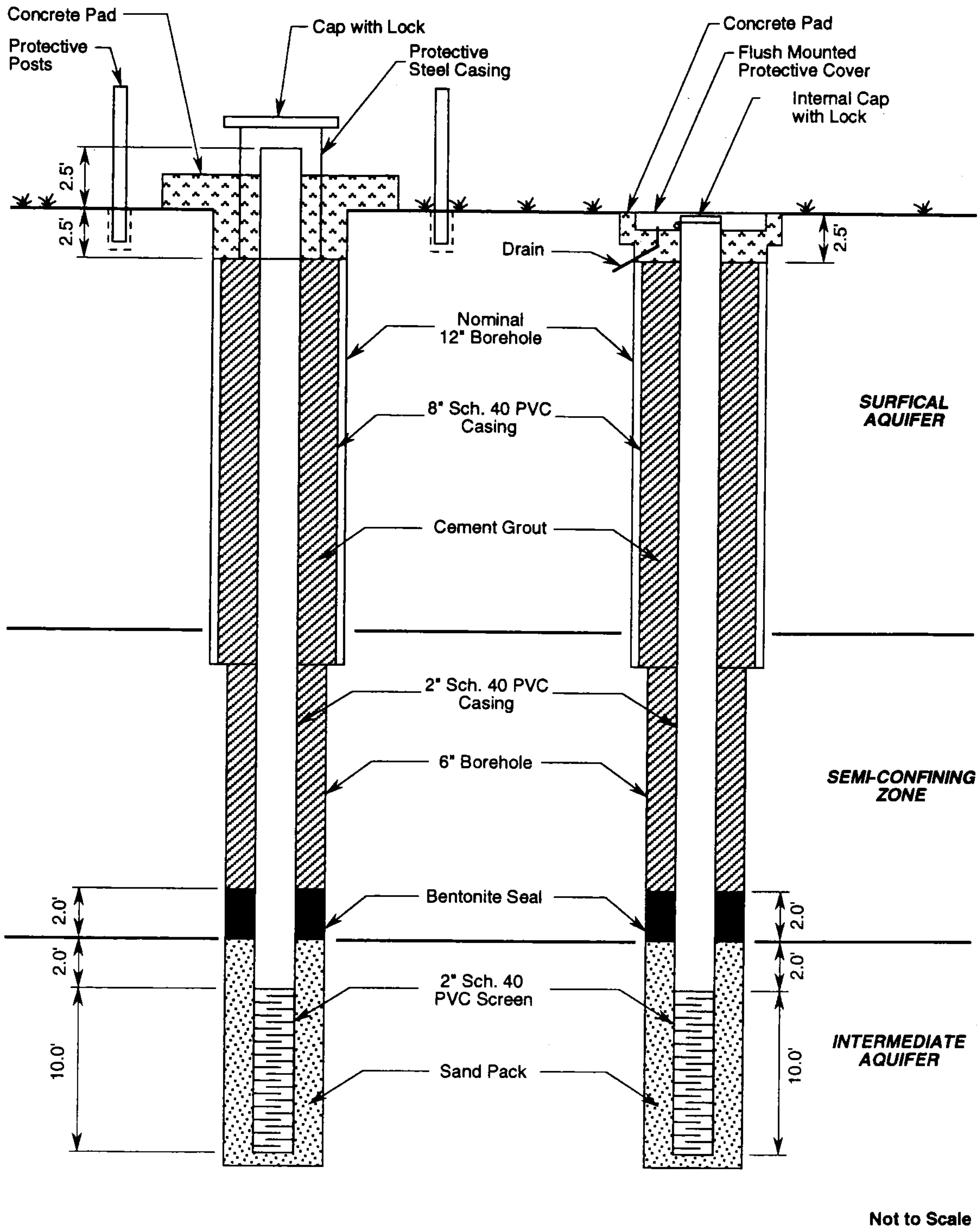

FIGURE 5-2 **INTERMEDIATE AQUIFER MONITORING WELL CONSTRUCTION DIAGRAM**	**REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6** **NAS CECIL FIELD JACKSONVILLE, FLORIDA**

8520-21 941116WEM

CEFOU3-6.Wkp
MVL.11.94

be drilled using HSA. UZH monitoring wells will be drilled using dual-wall reverse circulation or reverse circulation (ODEX) drilling methods. All wells will be installed in a manner that will minimize the chances of cross contamination. In addition, the drilling, construction, and development of all wells will be performed under the continuous supervision of an experienced hydrogeologist. An ABB-ES hydrogeologist will observe and document monitoring well installation and will continuously log the deep boreholes to characterize the lithology at the site.

After completion of monitoring well installation, groundwater samples will be collected from each newly installed monitoring well and sent to an offsite laboratory for analysis. The proposed laboratory analyses to be conducted on these samples are presented in Section 4.1.

5.1.6 Aquifer Testing and Measurement As indicated in Section 4.1, aquifer testing and measurement will be performed at each of the six sites comprising OUs 3, 4, 5, and 6 to provide additional data on the contaminant transport properties of the aquifer system. First, after the permanent monitoring wells have been constructed and sampled, *in-situ* hydraulic conductivity tests (slug tests) will be conducted in each new monitoring well constructed in the surficial aquifer to estimate the horizontal hydraulic conductivity of the aquifer media. The slug tests will be performed by causing an instantaneous change in the water level in the well, and continuously logging the change in water level as it recovers until the well water has stabilized again. One round of groundwater level measurements will also be collected from each new monitoring well. These water level measurements will be used to construct groundwater contour maps that indicate the principal directions of groundwater flow at each site.

5.1.7 Surface Water and Sediment Sampling As indicated in Subsections 4.1.3 through 4.1.6, surface water and sediment sampling will be conducted at Sites 8, 10, 14, and 15 to help characterize and estimate the extent of surface water and sediment contamination. The proposed locations of the surface water and sediment samples, and the laboratory analyses to be conducted on these samples, are presented in Subsections 4.1.3 through 4.1.6. Note that the sample locations are only approximate. Actual locations will be determined in the field based on the actual physical characteristics of the sites, observed evidence of contamination, and accessibility to the sampling locations.

Surface water samples will be collected from the middle of the standing water column and will be collected directly into the sample container, where possible. The sediment samples will be collected at the same locations as the surface water samples. The sediment samples will be collected from the upper foot of sediment in depositional areas, when possible, using decontaminated, stainless-steel sampling devices (e.g., corer and spoons).

5.1.8 Ecological Survey As indicated in Section 4.1, an ecological survey will be conducted at each of the six sites comprising OUs 3, 4, 5, and 6. The ecological surveys will be conducted by an experienced field biologist or ecologist. The inventory of the biological community in the area of each site will include a description of the vegetative communities, identification of habitat types, physical and chemical characteristics of the environment, occurrence of terrestrial and aquatic animals, and any obvious zones of chemical contamination that could result in ecological exposure. The *Guide to the Natural Communities of Florida* (FNAI and Department of Natural Resources, 1990) will be used to identify the vegetative communities at the sites. The Cowardin (Cowardin and others, 1979) system will be used to describe wetland plant communities found at the sites.

5.1.9 Remedial Investigation Waste Disposal Wastes will be generated as a by-product of the RI field investigations. Types of wastes to be generated include:

- drill and auger cuttings,
- wastewater from decontamination,
- well development and purge water, and
- disposable health and safety clothing and sampling supplies.

All remedial investigation-derived wastes will be handled according to the procedures described in *Investigation-Derived Waste Management Plan* (ABB-ES, 1994c).

5.1.10 Surveying and Permitting All new monitoring wells will be surveyed by a Florida-registered surveyor to determine their horizontal locations and vertical elevations. The horizontal locations of all soil, surface water, and sediment samples collected, as well as other pertinent features identified during the field investigation (e.g., geophysical survey markers), will also be surveyed. Standard engineering leveling techniques, as described in basic surveying textbooks, will be used to provide vertical control. The datum for elevation control is the National Geodetic Vertical Datum (NGVD) of 1929, formerly known as 1929 Sea Level Datum, established by the U.S. Coastal and Geodetic Survey. Benchmarks of known elevation will be used. The location of all benchmarks used will be shown on the site base map. Elevation surveys will be conducted to close back to the starting benchmark. The survey accuracy should be within 0.01 foot.

Permits are not required by the State (FDEP) or St. Johns River Water Management District (SJRWMD) for well construction. County (Bio-Environmental Services Division, Jacksonville [BESD JAX]) and NAS Cecil Field permitting requirements will be reviewed prior to initiation of field activities. Currently, BESD JAX requires monitoring well applications to be completed 3 weeks prior to installation at a cost of $20 per well. Completion reports must also be submitted to BESD JAX.

5.2 TASK 2, SAMPLE MANAGEMENT AND VALIDATION. This task includes efforts related to the management and validation of sample data. Table 5-1 presents an estimated numerical summary of all proposed samples to be collected for laboratory analysis in this RI/FS, including the QA/QC samples. Descriptions of the QA/QC samples are provided in the Sampling and Analysis Plan accompanying this workplan (Volume II). A data management system that includes maintaining field logs, sample management and tracking procedures, and document control and inventory procedures for both laboratory data and field measurements will be implemented to ensure that the data collected during the investigation are of adequate quality and quantity to support the risk assessment and the feasibility study. Sample management procedures used in this investigation will be in accordance with the standards specified in the *Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, USEPA Region IV, Environmental Services Division (USEPA, 1991c). In addition, analytical data will be validated at the appropriate laboratory QC level (see Chapter 4.0) to determine if it is appropriate for its intended use. Details of the data

Table 5-1
Summary of Proposed Sample Collection for Initial Sampling Event

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Sample Type	PARAMETER								
	DQO Level IV				DQO Level III				
	TCL Parameters	TAL Parameters	Nitroaromatics[1]	Other Pesticides and Herbicides[2]	PAHs[3] and Lead[4]	TPH[5]	VOCs[6] and Naphthalene	TNT[7]	Geotechnical and Geochemical[8]
Investigation Samples (Estimated Minimum)									
Soil									
Surface	101	101	32	38	236	236	24	139	0
Subsurface	49	49	4	19	90	90	90	0	66
Groundwater	60	60	19	12	0	60	60	0	0
Surface Water	14	14	6	0	0	0	0	0	0
Sediment	14	14	6	0	0	0	0	0	0
Subtotal	**238**	**238**	**67**	**69**	**326**	**386**	**174**	**139**	**66**
QA/QC Samples (Estimated Minimum)									
Duplicates									
Soil	16	16	4	6	33	39	18	14	0
Groundwater	6	6	2	2	0	6	6	0	0
Surface water	2	2	1	0	0	0	0	0	0
Sediment	2	2	1	0	0	0	0	0	0
Equipment Rinsate Blanks	24	24	6	7	0	0	0	0	0
Field Blanks	6	6	6	6	0	0	0	0	0
Trip Blanks (VOCs only)	10	0	0	0	0	0	0	0	0
Subtotal	**66**	**56**	**20**	**21**	**33**	**45**	**24**	**14**	**0**
Total Samples	**304**	**294**	**87**	**90**	**359**	**431**	**198**	**153**	**66**

See notes on next page.

Table 5-1 (Continued)
Summary of Proposed Sample Collection for Initial Sampling Event

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

[1] USEPA Method 8330, and four samples have been included as split samples for correlation of the TNT colorimetric test kit results.
[2] USEPA Methods 8140 and 8150, and 1,2-dibromo-3-chloropropane.
[3] USEPA Method 8270.
[4] USEPA Method 6010.
[5] USEPA Method 418.1.
[6] Via modified USEPA Methods 8010 and 8020 to include the detection of naphthalene per the onsite laboratory Standard Operating Procedures.
[7] USEPA Draft Field Method 8515, Level II DQO.
[8] Geotechnical and geochemical parameters include grain size distribution, specific gravity, moisture content, bulk density, porosity, pH, total organic carbon content, and cation exchange capacity.

Notes: DQO = data quality objectives.
TCL = target compound list (includes volatile organics, extractable organics, pesticides, and polychlorinated biphenyls [PCBs]).
TAL = target analyte list (includes metals).
PAHs = polynuclear aromatic hydrocarbons.
TPH = total petroleum hydrocarbon.
VOCs = volatile organic compounds.

management and validation procedures are discussed below and in the Sampling and Analysis Plan accompanying this workplan (Volume II).

<u>5.2.1 Data Management</u> Work elements included in the data management subtasks are: coordination with the laboratories, data acquisition and filing, completion of a sample identification matrix, and compilation of laboratory data for data entry. Due to the large volume of sample analyses for this project, data will be stored in an automated computer data management system with hard copy backup in laboratory notebooks. Laboratory data, correspondence, and data validation reports will be organized and filed by sample matrix and sample date. Copies of the original data sheets will be organized into notebooks for data entry. Copies will be used so that data entry personnel can highlight, make notes, or verify data entry with a signature and date. The notebooks will be organized by matrix and by station number.

<u>5.2.2 Data Validation</u> The purpose of data validation is to evaluate the quality of the data with respect to its intended use. Both DQO Level III and DQO Level IV analyses are planned for this RI/FS. The DQO Level IV data generated will be validated in accordance with USEPA CLP criteria, as outlined in the following documents:

- *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses* (USEPA, 1988c), and

- *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (USEPA, 1988b).

<u>5.3 TASK 3, DATA EVALUATION</u>. The data evaluation task includes efforts related to the analyses of data once it has been verified that the data are of acceptable accuracy and precision (i.e., validated). This task involves reviewing the data in terms of comparability, representativeness, and completeness in accordance with the requirements specified in the Sampling and Analysis Plan accompanying this workplan (Volume II). The task begins when the first set of validated data is received and ends during preparation of the RI report when it is decided that no additional data are required. The data evaluation task will consist of three basic components: (1) data compilation, (2) data analysis, and (3) Technical Memoranda of Rationale preparation. Brief descriptions of these components are presented in the following sections.

<u>5.3.1 Data Compilation</u> All site investigative data will be organized in a logical manner so that the relationships between site investigative results are apparent. The data compiled will include well construction details, water level measurements, water quality measurements, aquifer test data, etc. The data compilation process may include tabulation, computer analysis, graphic representation, or other methods that will aid in the evaluation of the data and conceptualization of the results.

<u>5.3.2 Data Analysis</u> The data collected in this RI/FS will be evaluated to identify the vertical and horizontal extent of contamination, relative contaminant concentrations, contaminant transport mechanisms, and the potential for future transport of contaminants. In addition, field QA/QC samples will be reviewed to determine the field sampling precision and accuracy.

The RI data evaluation methods will include plotting of analytical results, by matrix, on appropriate base maps. Generally, source (i.e., soil) maps will be prepared showing the areal distribution of contaminants by sample interval. Groundwater contaminant concentration maps will be prepared to show the contaminant distribution by aquifer zone. Surface water and sediment analytical results will be plotted with source and/or groundwater data as a graphical representation of pathway interaction.

Physical groundwater and surface water data will be graphically presented as water level contour maps and/or hydrographs. Groundwater flow velocities will also be estimated using the hydraulic conductivity test results and groundwater gradient data derived from the water level contour maps.

Contaminant fate and transport evaluations may also be performed using partitioning calculations and contaminant transport predictive modeling, as necessary, to assess contaminant migration potentials and to check on the validity and consistency of a conceptual understanding of site conditions. The models may be simple analytical equations or more complex numeric simulations depending on the need and complexity of site conditions. The modeling efforts may include groundwater transport simulations, surface water dispersion simulations, sediment transport simulations, and air dispersion modeling, as appropriate.

It is probable that for each site where groundwater contamination is found, a groundwater model will be developed and calibrated to the extent possible using the data collected during this remedial investigation, as well as data collected in previous studies. These data may include hydrostratigraphic data, hydraulic and contaminant transport properties, stresses (pumping and rainfall recharge), water levels, water quality data, etc. Once the model is calibrated, it could be used to estimate the ultimate fate of the contaminants under various potential remedial action alternatives. These potential remedial action alternatives may include:

- natural degradation and attenuation;
- plume containment by hydraulic measures, such as pumping;
- plume containment by physical measures, such as slurry walls;
- plume containment by *in-situ* treatment measures; and
- plume extraction by pumping.

The effectiveness of each remedial alternative could then be evaluated based on the model results.

<u>5.3.3 Technical Memoranda of Rationale Preparation</u> As indicated above in Section 5.1, Technical Memoranda of Rationale will be prepared for each OU and submitted to the Navy, USEPA, and FDEP for review and approval after the initial sampling event for each OU is completed. The purpose of these technical memoranda is to present an evaluation of the initial sampling event results, and then provide rationale and descriptions for additional sampling activities to be conducted to confirm the understanding and characterization of site conditions.

<u>5.4 TASK 4, BASELINE RISK ASSESSMENT (BRA)</u>. BRAs, including both a human health and ecological risk assessments, will be completed for each of the six sites comprising OUs 3, 4, 5, and 6. The BRA assesses both qualitatively and

quantitatively the risks posed by contamination at the sites to human health and/or the environment. The BRAs will be completed according to the following USEPA guidance for risk assessments at Superfund sites:

- *Ecological Risk Assessment* (USEPA, 1986);
- *Quality Criteria for Water* (USEPA, 1987b);
- *Superfund Exposure Assessment Manual* (USEPA, 1988d);
- *Exposure Factors Handbook* (USEPA, 1989b);
- *Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites* (USEPA, 1989c);
- *Risk Assessment Guidance for Superfund, Vol. I: Human Health Evaluation Manual* (USEPA, 1989e);
- *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference* (USEPA, 1989a);
- *Risk Assessment Guidance for Superfund, Vol. II: Environmental Evaluation Manual* (USEPA, 1989f);
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors* (USEPA, 1991);
- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (USEPA, 1991d);
- *Ecological Assessment of Superfund Sites: An Overview* (USEPA, 1991b); ECO Update Volume 1, Number 2;
- "Letter from Elmer W. Aiken, Health Assessment Officer, to Hazardous Waste Contractors, re. Region IV Risk Assessment Guidance" (USEPA, 1991e);
- *Dermal Exposure Assessment: Principles and Applications* (USEPA, 1992b);
- *Guidance for Data Useability in Risk Assessment* (Part A and B) (USEPA, 1992c);
- *Guidelines for Exposure Assessment* (USEPA, 1992d);
- *ECO Update*, Volume 1, Number 4, *Developing a Work Scope for Ecological Assessments* (USEPA, 1992);
- *ECO Update*, Volume 1, Number 5, *Briefing the BTAG: Initial Description of Setting History and Ecology of a Site*;
- *Integrated Risk Information System (IRIS)* (USEPA, 1994a);

- *Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening* (USEPA, 1993c);
- *Health Effects Summary Tables (HEAST)* (USEPA, 1993b);
- *Drinking Water Regulations and Health Advisories* (USEPA, 1993a);
- *Waste Management Division Screening Values for Hazardous Waste Sites* (USEPA, 1994b); and
- *Framework for Ecological Risk Assessment* (USEPA, 1992f).

The BRAs will be completed for each of the six sites after completion of the confirmatory sampling event activities. The human health assessment, ecological risk assessment, and BRA reports are described separately in the following subsections.

5.4.1 Human Health Risk Assessment (HHRA) The HHRA to be completed for each of the six sites will include six basic components: (1) data evaluation, (2) selection of COPCs, (3) exposure assessment, (4) toxicity assessment, (5) risk characterization, and (6) uncertainty analysis. Each of these components is described in the following subsections.

5.4.1.1 Data Evaluation Data from the confirmatory sampling event activities and prior sampling for each of the sites will be evaluated independently to determine (1) which data are of sufficient quality for use in quantitative risk assessment, and (2) which detected chemicals are believed to be site related. Data are first compiled and sorted by environmental medium (i.e., surface soil, groundwater, surface water, and sediment). Then, based on results of the data validation, overall quality of the data are reviewed to determine which data were of sufficient quality for use in quantitative risk assessment. The analytical precision, accuracy, representativeness, comparability, and completeness of the data are evaluated to determine data usability.

Precision. Precision is a measure of the agreement of a set of replicate results obtained from duplicate laboratory analyses of samples collected from the same location. Precision is calculated from laboratory analytical data and cannot be measured directly.

Accuracy. Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is used to identify the bias in a given measurement system (i.e., laboratory conditions, sample matrix, and sampling conditions).

Representativeness. Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is evaluated using the field and laboratory QC sample results (i.e., rinsate blanks, field blanks, trip blanks, and laboratory method blanks). Positive detections of target analytes in the QC blank samples identify contaminants that possibly are introduced to the associated environmental sample during sample collection, transport, or laboratory analysis.

__Comparability__. Comparability is a qualitative measure designed to express the confidence with which one data set may be compared with another. Factors affecting comparability include sample collection and handling techniques, sample matrix types, and analytical method.

__Completeness__. Completeness is defined as the percentage or measurements that are judged to be valid to the total number of measurements made in the laboratory. Valid usable data are values that were not qualified as rejected ("R" qualifier) during data validation. Valid useable data either have no qualifier or are qualified with a "J", "U", or "UJ" qualifier.

Sample concentrations are further compared with background concentrations (e.g., soil) and upgradient background concentrations (e.g., surface water, sediment, and groundwater) to evaluate which contaminants may reasonably be attributed to a site.

The product of the data evaluation is a summary of usable data for each medium that is used in the HHRA. This summary includes the frequency of detection, the arithmetic mean (using only samples with detected contamination), the range of detected concentrations, the arithmetic mean of background concentrations, and the range of the quantitation limits. The summary information is used to select human health chemicals of potential concern (HHCPCs) as described in Section 5.4.1.2.

5.4.1.2 Identification of Human Health Chemicals of Potential Concern (HHCPC)
Chemicals for which data of sufficient quality are available for use in the risk assessment and that are potentially site related are defined as HHCPCs. HHCPCs are a subset of all compounds detected in the various media at the site, and are selected based on concentration and frequency of detection; physical, chemical, and toxicological characteristics; and comparison of detected values to background (and associated blanks) and appropriate regulatory standards and guidelines.

For each medium at each site, the following criteria are used to exclude detected analytes from the list of HHCPCs. Each criterion by itself is justification for excluding the analyte.

- The analyte will be excluded if the maximum reported site concentration is less than 2 times the reported average background concentration (inorganics only).

- The analyte will be excluded if the maximum reported soil or groundwater concentration is less than the corresponding Risk Based Concentration (RBC) described in the most recent USEPA Region III screening guidance for residential land use. Screening against the Region III RBC table will be conducted in accordance with the USEPA Region IV guidance (1991e). This guidance suggests that chemicals detected at sites that do not contribute significantly to human health risks be removed or "screened" from further consideration as HHCPCs. This screening process is accomplished by comparing concentrations of chemicals detected in each medium to several different criteria, including local and regional background levels as well as USEPA media-specific regulatory guidelines. The media-specific Screening Criteria Values (SCVs) used to screen detected chemicals will be the most recent

USEPA Region III RBC corresponding to lifetime excess cancer risks of $1x10^{-6}$ (a in a million) or a hazard index (HI) of 0.1. For soil SCVs, a residential exposure scenario was assumed. For groundwater and surface water, the SCVs are "tap water" risk based concentrations.

- If the analyte concentrations are within 5 times or 10 times the concentrations in associated blanks they will be excluded. Following the Functional Guidelines for Organics (USEPA, 1988c), detections of the common laboratory contaminants (acetone, 2-butanone, methylene chloride, toluene, or the phthalate esters) will not be considered site related if detected at concentrations less than 10 times the highest concentration detected in the associated trip blank, field blank, or method blank. Those compounds not considered common laboratory contaminants will not be considered site related if detected at concentrations less than 5 times the concentration detected in the associated trip blank, field blank, or method blank. This evaluation is conducted as part of the data validation process.

- The essential nutrients sodium, potassium, magnesium, iron, calcium, and chloride are eliminated as HHCPCs for the HHRA unless they are detected at concentrations that could be hazardous if exposure were to occur.

- If an analyte is detected in less than 5 percent of the samples of a specific medium at a site, it was not detected in any other medium, it is not a degradation product of another HHCPC, and it does not have any significant toxicity (such as bioaccumulation), then the analyte may be detected from consideration as an HHCPC.

Tentatively identified compounds (TICs) will be screened based on suspected presence at the sites under consideration, contaminant concentration, migration potential via each of the identified exposure pathways, and the chemical's toxicity. The TICs of concern are evaluated qualitatively in the BRA.

5.4.1.3 **Exposure Assessment** The exposure assessment identifies the pathways by which humans are potentially exposed, the magnitude of actual and/or potential human exposure, and the frequency and duration of exposure. This process involves three steps: (1) characterization of the exposure setting in terms of physical characteristics and the populations that may potentially be exposed to site-related chemicals, (2) identification of potential exposure pathways, and (3) quantification of exposure for each population in terms of the amount of chemical either ingested, inhaled, or absorbed through the skin from exposure pathways. The exposure assessment process will be completed for both current and future land use conditions.

The exposure assessment includes calculation of an exposure point concentration (EPC), which represents the concentration of an HHCPC at the point of exposure. The EPCs will be calculated in a manner consistent with USEPA guidance. The EPCs are, with the exceptions noted below, the 95 percent upper confidence limit (UCL) on the arithmetic mean of the concentrations in the data set used to evaluate exposure. In calculating the 95 percent UCLs, non-detections are assigned a value of one-half the associated sample quantitation limit (SQL) in the calculation of the arithmetic mean. In cases where there are fewer than 10 samples or where the 95 percent UCL is greater than the maximum detected concentration, the maximum detected concentration is identified as the EPC. The following equation is used for calculating the UCL on the arithmetic mean for a lognormal distribution:

$$UCL = e^{\left(\bar{x} + 0.5\, s^2 + \frac{s\,H}{\sqrt{n-1}} \right)} \qquad (1)$$

where

UCL	=	upper confidence limit,
e	=	constant (base of the natural log, equal to 2.718),
xbar	=	mean of transformed data,
s	=	standard deviation of the transformed data,
H	=	H-statistic (from table published in Gilbert, 1987), and
n	=	number of samples.

5.4.1.4 **Toxicity Assessment** The purpose of the toxicity assessment is to identify the adverse effects associated with exposures to each HHCPC and to identify the relationship between level of exposure and severity or likelihood of adverse effects. The toxicity assessment is developed in two steps: hazard identification and dose-response assessment.

Hazard identification is the process of determining if exposure to the HHCPC can cause an adverse health effect and if that effect is likely to occur in humans. The objectives of the hazard identification are to (1) identify which of the HHCPCs are potential hazards, and (2) to summarize their potential toxicity in brief narrative profiles.

The objective of the dose-response assessment is to define the relationship between the exposure or dose of an HHCPC and the likelihood that a toxic effect, either carcinogenic or noncarcinogenic, may result from exposure to that substance. As a result of this assessment, identified dose-response values are used to estimate the incidence of adverse effects as a function of human exposure to an agent. A dose-response assessment will be completed to identify the relevant oral, dermal, and inhalation toxicity values for carcinogenic (cancer slope factors) and noncarcinogenic effects (reference doses [RfDs]) of the HHCPCs. These values will be identified from either the USEPA's Integrated Risk Information System database or the USEPA's Health Effects Assessment Summary Tables.

Risks associated with soil and water dermal contact will be evaluated using RfDs and cancer slope factors (CSFs) that are specific to absorbed doses. It will, therefore, be necessary to adjust toxicity values (commonly oral toxicity values) based on administered dose so that they can be used for evaluation of absorbed doses.

5.4.1.5 **Risk Characterization** Risk characterization is the final step in the risk assessment process in which the exposure and toxicity information generated in previous sections will be integrated to qualitatively or quantitatively evaluate the potential health risks associated with exposure to the HHCPCs at each of the six sites. Quantitative estimates of both carcinogenic and noncarcinogenic risks will be calculated for each HHCPC and each complete exposure scenario selected for evaluation in the exposure assessment.

Carcinogenic risks associated with exposure to individual chemicals will be estimated by multiplying the estimated chemical intake for each carcinogen (in units of milligrams per kilogram a day [mg/kg-day]) by its USEPA CSF (in units of $(mg/kg\text{-}day)^{-1}$). The result is a chemical-specific excess lifetime cancer risk (ELCR). This value represents the probability of developing cancer over the course of a 70-year lifetime as a result of exposure to a chemical. Within each exposure pathway, cancer risks associated with multiple carcinogenic compounds are determined by summing the chemical-specific risks to yield a pathway-specific lifetime incremental cancer risk. USEPA's guidelines state that the total incremental carcinogenic risk for an individual resulting from exposure at a hazardous waste site should not exceed a range of 10^{-6} to 10^{-4}.

Noncarcinogenic risk estimates will be determined by dividing estimated chemical intakes (in units of mg/kg-day) by the appropriate RfD (in units of mg/kg-day). The resulting ratio is called the hazard quotient (HQ). The HQs for individual HHCPCs within an exposure pathway are summed resulting in an HI for that pathway. An HI less than or equal to 1 represents concentrations and levels of exposure that are generally considered to be without deleterious effects for a lifetime exposure, even for sensitive individuals. As the HI increases above 1, so does the risk of adverse effects. An HI above 1 will result in additional analyses to determine the likelihood of an adverse effect actually occurring if exposure were to occur.

5.4.1.6 **Uncertainty Analysis** Risk estimates are generally conservative values that result from multiple layers of conservative assumptions inherent in the risk assessment process. Quantitative estimates of risk are based on numerous assumptions, most intended to be protective of human health (i.e., conservative). As such, risk estimates are not truly probabilistic estimates of risk, but rather conditional estimates given a series of conservative assumptions about exposure and toxicity.

A thorough discussion of all potential sources of uncertainty in risk assessment is not feasible. In general, the sources of uncertainty will be categorized into site-specific factors (e.g., variability in analytical data and exposure assessment) and toxicity and risk characterization assessment factors. Site-specific uncertainties will be discussed to provide perspective for the interpretation of the risk estimates.

5.4.1.7 **Remedial Goal Options (RGO)** RGOs will be calculated according to the USEPA Region IV guidance. RGOs will be calculated for all media for which exposure to the HHCPCs results in an excess lifetime cancer risk of 1×10^{-4} or an HI of 1. The RGOs for each HHCPC will be media concentrations associated with cancer risks of 10^{-4}, 10^{-5}, and 10^{-6} or an HI of 10, 1, and 0.1. According to USEPA guidance, the risk-specific concentrations and ARARs are intended to provide options for the development of various remedial options in the FS and Proposed Plan that follow the RI.

The risk-specific concentrations are not proposed clean-up goals. The calculations of RGOs for an analyte do not necessarily indicate that remedial action is required to control that analyte. These numbers will be presented for informational purposes only.

5.4.2 Ecological Risk Assessment (ERA) The ERA is the process that evaluates actual or potential adverse effects to the ecosystem or ecosystem components associated with exposure(s) to contamination from a hazardous waste site. The following sections describe the approach for the ERA at OUs 3, 4, 5, and 6. The assessment approach integrates both predictive and field measurement methodologies to assess risks. The decisions regarding overall risk to ecological receptors are based on the weight of evidence from the results of both methodologies. There are six primary components of the ERA process including: (1) problem formulation, (2) selection of ecological contaminants of potential concern, (3) exposure assessment, (4) ecological effects assessment, (5) risk characterization, and (6) uncertainty analyses. Each component is described separately in the following subsections.

5.4.2.1 Problem Formulation Problem formulation is the initial step of the ecological risk assessment process where the purpose and scope are defined. Figures 3-1 through 3-6 present the site conceptual models for each of the six sites comprising OUs 3, 4, 5, and 6. The site conceptual model illustrates the contaminant pathway from source to ecological receptors for each of the waste sites. Three tasks are achieved during problem formulation including identification of ecological receptors, identification of exposure pathways for those receptors, and identification of the endpoints used for the assessments. Each of the tasks is described separately in the following paragraphs.

<u>Identification of Ecological Receptors</u>. Potential ecological receptors of contamination will be identified based on information obtained during an ecological field survey and literature information search on the range and distribution of wildlife species. Information will be collected during the ecological survey to describe the plant communities on each waste site and the surrounding area. The plant community information will be used to characterize the habitat provided for terrestrial wildlife species. Information will also be collected to describe the aquatic communities present at Site 10.

Potential ecological receptors of contamination include terrestrial wildlife, aquatic life, terrestrial plants, and terrestrial invertebrates. Terrestrial wildlife species include reptiles, amphibians, birds, and mammals. Potential aquatic receptors include invertebrates, plants, algae, amphibians, and fish. Potential aquatic receptors are present in the tributary to Rowell Creek that drains Site 10 and Rowell Creek adjacent and downstream of Site 10. Aquatic receptors may also be present in a drainage ditch at Site 8, although this stream is ephemeral (dries up periodically) and may not support aquatic life.

<u>Identification of Exposure Pathways</u>. Exposure pathways will be identified at each site based on information generated in the ecological survey. Exposure pathways describe how ecological receptors may come into contact with contaminated media and include: (1) the contaminant source, (2) the means of transport from source to environmental medium (soil, water, or air), (3) the point of receptor contact (soil, water, or food), and (4) the exposure route (e.g., ingestion, dermal contact, or inhalation). Exposure pathways will be evaluated for aquatic receptors, terrestrial wildlife, terrestrial plants, and terrestrial invertebrates as follows.

- Aquatic Receptors. Potential exposure pathways for aquatic receptors (including invertebrates, plants, amphibians, algae, and fish) include direct contact with surface water, sediment, and groundwater (as it discharges to surface water). Aquatic receptors may also be exposed to contamination in sediment as the result of ingestion of the sediment.

This pathway can, however, only be evaluated if information is available on the amount of sediment ingested by aquatic organisms and the toxicity of contaminants to aquatic life via the ingestion exposure route.

- Terrestrial Wildlife. The primary potential exposure routes for terrestrial wildlife are ingestion of surface soil and food items that are contaminated as a result of accumulation of contamination from the soil. Exposures related to dermal contact are possible but not usually evaluated as an assumption is made that fur, feathers, or chitinous exoskeletons limit the transfer of contamination across the dermis. Exposures related to inhalation of dust or vapors are also possible but not often evaluated as this pathway is generally considered an insignificant route of exposure except in unusual circumstances, such as following a spill or release.

- Terrestrial Plants and Invertebrates. Terrestrial plants and soil invertebrates may be exposed to contamination in surface soil by direct contact with soil. Terrestrial invertebrates may also be exposed to contamination as a result of incidental ingestion of the soil. Terrestrial plants may be exposed to contamination in groundwater where roots reach a zone of saturation.

Identification of Endpoints. Endpoints for the ecological risk assessment will be identified including both measurement and assessment endpoints. Assessment endpoints represent the ecological component to be protected whereas the measurement endpoints approximate or provide a measure of the achievement of the assessment endpoint. Preliminary assessment endpoints will be identified for aquatic receptors, terrestrial wildlife, terrestrial plants, and terrestrial invertebrates, as follows.

- Aquatic Receptors. The assessment endpoint for aquatic receptors is the survival and maintenance of a well-balanced benthic macroinvertebrate community structure and function. Survival and maintenance of fish and aquatic plant populations is a second assessment endpoint.

- Terrestrial Wildlife. The assessment endpoint selected for terrestrial wildlife is the maintenance of well-balanced terrestrial wildlife populations and communities within the habitats present at OUs 3, 4, 5, and 6. There is no direct measure of this assessment endpoint; therefore, it is necessary to use the results of laboratory toxicity studies in the literature that relate the dose of a contaminant in an oral exposure with an adverse response to growth, reproduction, or survival of a test population (avian or mammalian species).

- Terrestrial Plants and Invertebrates. The assessment endpoint selected for terrestrial plants and invertebrates is the survival, growth, and reproduction of terrestrial invertebrate and plant communities. This endpoint is measured by the survival of the earthworm *Eisenia foetida* in testing with surface soil samples and the response of the lettuce seed in germination tests with surface soil samples from the individual sites. This testing provides a direct measure of the toxicity of a mixture of contaminants in soil to a terrestrial invertebrate and plant, respectively. It is assumed that the responses of these test species will be an adequate indicator for other terrestrial invertebrates and plants.

5.4.2.2 **Selection of Ecological Contaminants of Potential Concern (ECPCs)** ECPCs represent the analytes detected in media (surface soil, surface water, sediment, and groundwater) that are considered in the risk assessment process. The ECPCs are assumed to be associated with hazardous waste practices at OUs 3, 4, 5, and 6 and could present a potential risk for ecological receptors.

ECPCs will be selected using the summary information of the analytical data provided after the data evaluation process, as described in Subsection 5.4.1.1. For each of the six sites, ECPCs will be selected for each media of concern (surface soil, sediment, surface water, and groundwater). Analytes will be excluded as ECPCs if:

- they are detected in 5 percent or less of the samples analyzed, or
- the maximum detected concentration is less than 2 times the average concentrations detected in respective background samples.

ECPCs for aquatic life for groundwater, surface water, and sediment will be screened based on an additional step. Analytes in sediment will be excluded as an ECPC if the maximum concentration detected is lower than the USEPA screening values for sediment. Analytes in surface water and groundwater will be excluded as an ECPC if the maximum concentration detected is lower than the USEPA screening values for surface water.

Aluminum and iron are natural, major components of soil and will not considered as ECPCs for surface soil or sediment. Iron and aluminum are, however, potentially toxic in the aquatic environment and will be included in the ECPC selection process for aquatic receptors for surface water. Calcium, magnesium, potassium, and sodium will be excluded as ECPCs for surface water, surface soil, sediment, and groundwater as they are considered to be essential nutrients.

5.4.2.3 **Exposure Assessment** Exposure assessment is the process of estimating or measuring the amount of an ECPC in environmental media (surface soil, surface water, sediment, or groundwater) to which an ecological receptor may be exposed via respective exposure routes (ingestion or direct contact). The following subsections discuss how contaminant exposures will be estimated or measured for aquatic life, terrestrial wildlife, terrestrial plants, and terrestrial invertebrates.

Aquatic Receptors. Exposure concentrations for aquatic receptors are the amounts of the ECPCs measured in surface water and sediment at respective sampling locations.

Terrestrial Wildlife. Concentrations of the ECPCs measured in surface soil samples from the respective waste sites will be used to estimate exposures for terrestrial wildlife. The actual amount of an ECPC taken in by a wildlife species as the result of indirect or direct ingestion is dependant upon the habits of the species. As it is not possible to evaluate ECPC exposure concentrations for each and every terrestrial wildlife species potentially residing at OUs 3, 4, 5, and 6, representative wildlife species will be selected for each waste site. The species will be selected to represent a simple food chain that would be expected within the communities present at the site. A simple model will then be used to predict contaminant exposures in the diet for each of the species.

__Terrestrial Plants and Invertebrates__. Concentrations of the ECPCs measured in surface soil samples from the respective waste sites will be used to estimate exposures for terrestrial plants and invertebrates. Where toxicity testing of soil samples is completed with the earthworm and lettuce seed, these tests represent actual exposures for the test species and plants and soil invertebrates to contamination in site soil.

5.4.2.4 **Ecological Effects Assessment** The ecological effects assessment describes the potential adverse effects associated with the identified ECPCs to ecological receptors and reflects the type of assessment endpoints selected. The methods that will be used to identify and characterize ecological effects for aquatic life, terrestrial wildlife, terrestrial plants, and terrestrial invertebrates are described in the following subsections.

__Aquatic Receptors__. Available toxicity benchmarks for each of the ECPCs in surface water will be identified. State of Florida Surface Water Quality Standards and Federal Ambient Water Quality Criteria (AWQC) will be considered. Additional aquatic toxicity information for the ECPCs will be obtained from searches of the USEPA Aquatic Information Retrieval (AQUIRE) database.

__Terrestrial Wildlife__. Reference Toxicity Values (RTVs) will be determined for each ECPC for both avian and mammalian receptors. The RTV relates the dose of a respective ECPC in an oral exposure with an adverse effect. For each ECPC identified and each representative wildlife species selected, two RTVs will be identified. A lethal RTV will be selected that represents the threshold for lethal effects and is based on an oral LD_{50} (oral dose lethal to 50 percent of a test population). The lethal RTV is one-fifth of the lowest reported LD_{50} for the most closely related test species. One fifth of an oral LD_{50} value is considered to be protective of lethal effects for 99.9 percent of individuals in a test population. An assumption will be made that the value represented by one fifth of an oral LD_{50} would be protective of 99.9 percent of individuals within the terrestrial wildlife populations present at OUs 3, 4, 5, and 6 and represents a level of acceptable risk.

A sublethal RTV will also be identified that represents a threshold for sublethal effects. Sublethal effects are defined as those that impair or prevent reproduction, growth, or survival. The sublethal RTV reflects the assessment endpoint chosen as the basis for establishing risk. The RTVs are assumed to be a measure of the goal for protection of the survival, growth, and reproduction of terrestrial wildlife populations. RTVs will be derived separately for avian and mammalian species. If toxicity information is not available for an ECPC, it will not be possible to identify RTVs and risks associated with the predicted exposure for the respective ECPC cannot be evaluated. The absence of toxicity information for an ECPC will be discussed as part of the uncertainty analyses.

__Terrestrial Plants and Invertebrates__. The toxicity of ECPCs in surface soil (that includes the entire mixture of ECPCs) will be measured by the use of the two soil toxicity tests proposed as part of the confirmatory sampling event.

5.4.2.5 **Risk Characterization** The following paragraphs describe how risks will be characterized for ecological receptors including aquatic life, terrestrial wildlife, terrestrial plants, and terrestrial invertebrates.

Aquatic Receptors. Risks for aquatic receptors will be characterized for each sampling location based on a weight-of-evidence evaluation of the following factors:

- presence or absence of analytes in surface water and sediment samples,
- concentrations of analytes measured in surface water and sediment samples,
- measurements of the aquatic macroinvertebrate community structure and function (data are available for Rowell Creek adjacent to Site 10),
- concentrations of ECPCs in surface water relative to reported toxicity of the ECPC in laboratory tests (AQUIRE information) and State of Florida Surface Water Quality Standards, and
- physical and chemical factors in the aquatic environment (other than chemical contamination).

Terrestrial Wildlife. Risks for the representative wildlife species associated with ingestion of surface soil and food will be quantitatively evaluated using HQs, which are calculated for each ECPC by dividing the estimated exposure concentration by the toxicological benchmark (RTV). HIs will be determined for each representative wildlife species by summing the HQs for all ECPCs. When the estimated exposure concentration is less than the RTV (i.e., the HQ is less than 1), the contaminant exposure is assumed to fall below the range considered to be associated with adverse effects for growth, reproduction, and survival (of the individual organism) and no risks to the wildlife populations will be assumed. When the HQ or HI is greater than one, a discussion of the ecological significance will be included and risk will be assumed. When HIs are greater than 1, an evaluation of the HQs comprising the HI will be completed.

Although this quantitative approach evaluates potential ecological effects based on studies of impacts to individual organisms, the number of affected individuals in a population presumably increases with increasing HQ or HI values; therefore, the likelihood of population level effects occurring is generally expected to increase as HQ or HI values increase.

Terrestrial Plants and Invertebrates. Risks for terrestrial plants and soil invertebrates will be characterized based on the responses of the test population observed in any toxicity testing completed as part of the confirmatory sampling event activities.

5.4.2.6 **Uncertainty Analyses** Uncertainties in the ERA process will be identified and discussed. The emphasis of the uncertainty analyses will be to discuss the assumptions and data gaps of the ERA process that may influence the risk characterization results and assessment conclusions.

5.4.3 Baseline Risk Assessment Reports Following completion of the various risk assessment tasks, BRA reports will be prepared for each of the four OUs. The BRA reports will document in detail the results of both the baseline human health and ecological risk assessments and the conclusions drawn from these results. All supporting data, information, and calculations will be included in the BRA reports and all documents and publications used in their preparation will be properly referenced.

The BRA report format will comply with *Risk Assessment Guidance for Superfund, Volumes I and II* (USEPA, 1989f), and *Southern Division Report Format Guidance Manual* (SOUTHNAVFACENGCOM, 1989c). Draft reports will first be submitted to the USEPA and FDEP for review. All subsequent Navy and agency review comments will then be addressed in final reports that will be submitted to the USEPA and FDEP for approval.

<u>5.5 TASK 5, TREATABILITY STUDIES PLANNING</u>. Bench and/or pilot studies may be conducted, as necessary, to determine the suitability of remedial technologies to site conditions and problems. Technologies that may be suitable to the site will be identified and a literature survey to identify applicable treatability data will be conducted as early as possible to determine if there is a need to conduct treatability studies to better estimate costs and performance capabilities.

Should treatability studies be required, a treatability study workplan, sampling and analysis plan, and health and safety plan will be prepared. The workplan will identify the types of studies and goals of the studies, the schedule for completion, and the data management guidelines. The sampling and analysis plan will consist of a detailed site-specific field sampling plan and a quality assurance project plan for collecting and analyzing the samples needed to perform the treatability studies. The health and safety plan will provide the health and safety requirements for all personnel working at the site for each task identified in the treatability studies workplan. These submittals will be made within the time frame required to maintain steady progress of the overall feasibility study. However, if a treatability study is identified as critical to completing the FS, then the FS schedule may be affected by delaying completion of the FS report.

Upon completion of the testing, the results will be evaluated to assess the technologies with respect to the goals identified in the treatability study workplan. A report summarizing the testing program and its results will then be prepared and submitted to the Navy, USEPA, and FDEP for review and approval as identified in the treatability study workplan.

<u>5.6 TASK 6, RI REPORTS</u>. Following completion of the data evaluation task, an RI report presenting the RI results will be prepared for each of the four OUs. The reports will document in detail the activities conducted during the remedial investigation, present the results of each remedial investigative activity, and discuss the conclusions drawn from the remedial investigative results. All the field and analytical laboratory data will be presented in an organized and logical manner so that the relationships between site investigation results for each medium are apparent. All supporting data, information, and calculations will be included in appendices to the reports, and all documents and publications used in preparing the reports will be properly referenced.

The RI report format will comply with *USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988a), and *Southern Division Report Format Guidance Manual* (SOUTHNAVFACENGCOM, 1989c). Draft reports will first be submitted to the USEPA and FDEP for review. All subsequent review comments will then be addressed in final reports that will be submitted to the USEPA and FDEP for approval.

5.7 TASK 7, REMEDIAL ALTERNATIVES DEVELOPMENT AND SCREENING. A range of distinct waste management alternatives that will remediate or control contamination at the site, as deemed necessary based on the remedial investigation results, will be developed to provide adequate protection of human health and the environment. The potential alternatives will encompass, as appropriate, the following:

- a range of alternatives in which *in-situ* and *ex-situ* treatment is used to reduce the toxicity, mobility, or volume of wastes (the range will vary in the types of treatment, the amount treated, and the manner in which long-term residuals or untreated wastes are managed);
- alternatives involving both containment and treatment components;
- alternatives involving containment with little or no treatment; and
- a natural degradation alternative.

The subtasks described below will be performed in sequential order to develop the appropriate range of alternatives for each of the four OUs.

5.7.1 Remedial Action Objectives Establishment Based on the information collected during the RI, the remedial action objectives that were established in the project planning phase (see Section 3.4) will be reviewed and, if necessary, refined. These objectives will specify the contaminants found and media of concern, exposure pathways and receptors, and an acceptable contaminant level or range of levels for each exposure route (i.e., RGOs). A review of both State and Federal ARARs will be performed. All cleanup levels established for the six sites will either meet or exceed the ARAR requirements unless the BRA justifies why a variance should be considered.

The general response actions, defining contaminant containment, treatment, excavation, pumping, or other actions, singly or in combination, will also be developed to satisfy the remedial action objectives. Areas and volumes of media to which general response actions may apply will be identified, taking into account the requirements for protectiveness as identified in the remedial action objectives. The chemical and physical characteristics of the site and the baseline risk assessment and remedial goals will also be considered.

5.7.2 Technology Identification And Screening Those technologies applicable to each general response action will be identified and evaluated to eliminate those that cannot be implemented. Based on the developed general response actions, treatment technologies will be identified and screened to consider only those technologies applicable to the contaminants present, their physical matrix, and other site characteristics. This screening will be based primarily on the ability of a technology to effectively address the contaminants at the sites, but will also take into account the implementability and cost of the technology. Technologies that are innovative; or reduce the mobility, toxicity, or volume; or lead to a permanent remedy will be emphasized in the alternatives. Representative process options will be selected, as appropriate, and carried forward into alternatives development. In addition, the need for treatability testing will be identified (as described in Task 5) for those technologies that are probable candidates for consideration during the detailed analysis (Task 8).

5.7.3 Alternatives Configuration And Screening Selected technologies and process options retained in the FS will be combined into media-specific or site-wide alternatives for each site. The developed alternatives will be defined with respect to size and configuration of the representative process options, relative time for remediation, rates of flow or treatment, spatial requirements, distances for disposal, required permits, imposed limitations, and other factors necessary to evaluate the alternatives. If many distinct, viable options are available and developed, a screening of alternatives will be conducted to limit the number of alternatives that undergo the detailed analysis and to provide consideration of the most promising process options. The alternatives will be screened on a general basis with respect to their effectiveness, implementability, and cost. As appropriate, the screening will preserve the range of treatment and containment alternatives that was initially developed. The action-specific ARARS will also be updated as the remedial action alternatives are refined.

5.8 TASK 8, DETAILED ANALYSIS OF ALTERNATIVES. A detailed analysis of the alternatives that passed through the development and screening process of Task 7 will be performed. Each alternative will be analyzed with respect to the eight evaluation criteria described below.

- Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARS addresses whether or not a remedy will meet all of the ARARS of Federal and State environmental statutes and/or provide grounds for provoking a waiver.

- Long-Term Effectiveness and Permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- Reduction of Toxicity, Mobility, or Volume refers to the anticipated performance of the treatment technologies used in a remedy.

- Short-Term Effectiveness addresses the effects on human health and the environment during the implementation of a remedy and until cleanup goals are achieved.

- Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs and net present worth costs.

- State Acceptance addresses the technical or administrative issues and concerns FDEP and USEPA may have regarding a remedy.

The ninth criterion specified in the NCP, community acceptance, addresses the issues and concerns the public may have regarding a remedy. Note that formal public comments are provided during the 30-day public comment period (with a possible 30-day extension) on the RI/FS report and Proposed Plan. Specific public concerns or comments will, thus, be addressed in the Record of Decision (ROD) and the Responsiveness Summary.

The individual analyses will include: (1) a technical description of each alternative that outlines the waste management strategy and identifies the key ARARS associated with the alternative, and (2) a discussion that profiles the performance of the alternative with respect to each of the evaluation criteria. A table summarizing the results of the analyses will be prepared and included in the FS report (see Task 9). Once the individual analyses are completed, the alternatives will be compared and contrasted to one another with respect to each of the evaluation criteria.

5.9 TASK 9, FS REPORTS. Following completion of the detailed analysis of alternatives, FS reports will be prepared for each of the four OUs. The reports will document the results of the remedial alternatives development and screening task (Task 7), and the detailed analysis of alternatives task (Task 8). All supporting data, information, and calculations will be included in appendices to the reports, and all documents and publications used in preparing the reports will be properly referenced.

The FS report format will comply with *USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988a), and *Southern Division Report Format Guidance Manual* (SOUTHNAVFACENGCOM, 1989c). Draft reports will first be submitted to the USEPA and FDEP for review. All subsequent comments will then be addressed in final reports that will be submitted to the USEPA and FDEP for approval.

6.0 SCHEDULE OF ACTIVITIES AND DELIVERABLES

The tentative schedule of activities for this RI/FS is presented in Figure 6-1. The duration of each activity in this schedule corresponds to the level of effort described in Chapter 5.0.

The proposed schedule of deliverables for this RI/FS is presented in Table 6-1. The anticipated deliverables include the Technical Memoranda of Rationale, the RI reports, the BRA reports, and the FS reports.

Note that the proposed schedule for this RI/FS is an integrated schedule where two or more OUs are being investigated or evaluated at the same time. For example, the field investigation schedule was developed based on the assumption that two field crews could be in operation at the same time. This integrated schedule provides a more efficient use of resources; thus, allowing quicker completion of the total work at lower cost.

Note also, however, that the schedule of activities and the schedule of deliverables proposed herein are estimates only, and are certainly subject to change as the RI/FS progresses, particularly once the initial sampling event is completed. The Technical Memoranda of Rationale will provide more definitive and accurate schedules for completing the work.

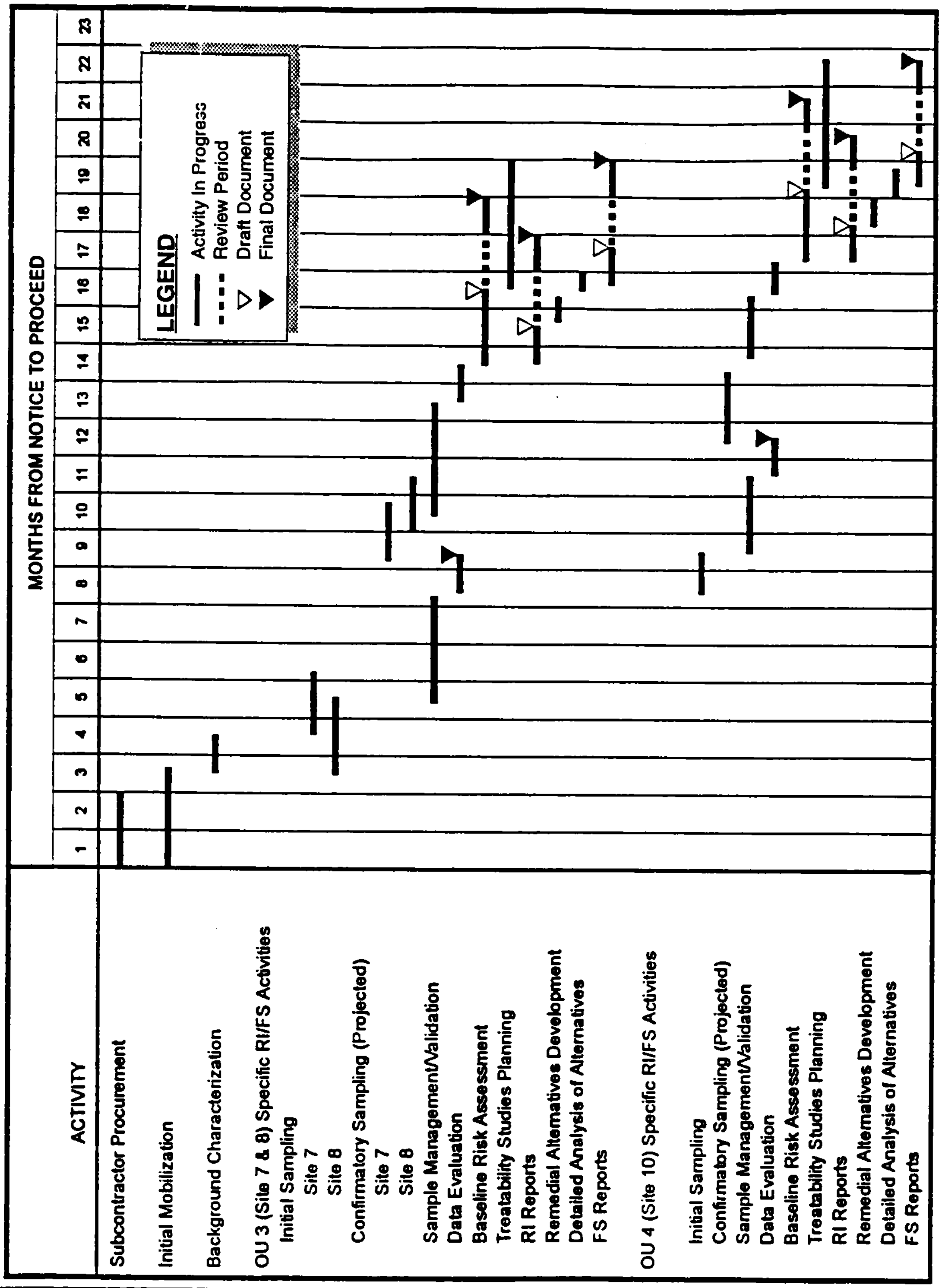

FIGURE 6-1

TENTATIVE SCHEDULE OF ACTIVITIES

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORKPLAN OPERABLE UNITS 3, 4, 5, AND 6

NAS CECIL FIELD JACKSONVILLE, FLORIDA

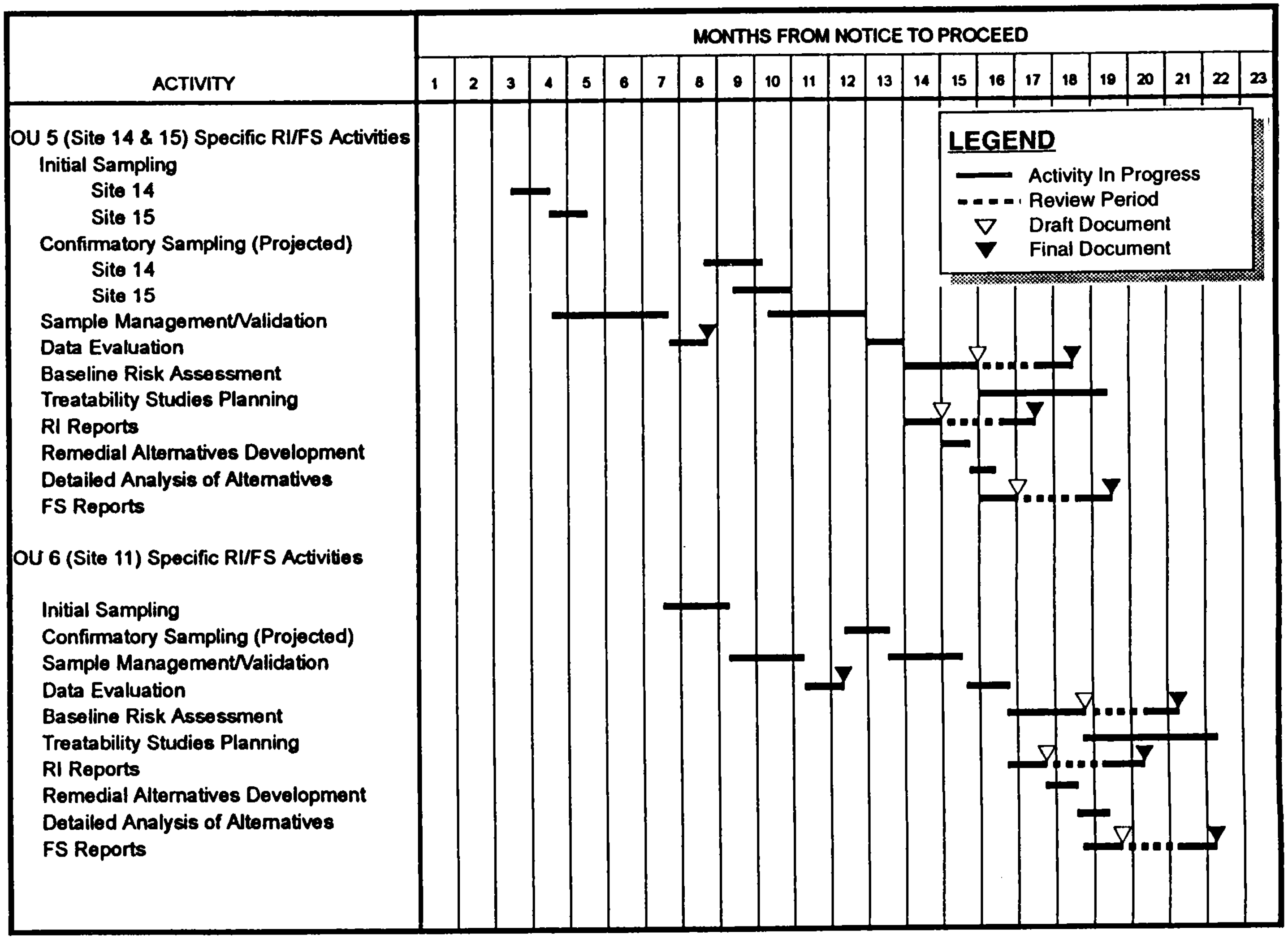

FIGURE 6-1 (Continued)
TENTATIVE SCHEDULE OF ACTIVITIES

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY WORKPLAN
OPERABLE UNITS 3, 4, 5, AND 6
NAS CECIL FIELD
JACKSONVILLE, FLORIDA

Table 6-1
Proposed Schedule of Deliverables

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Deliverable	Approximate Due Date (Months from Notice to Proceed)
Operable Unit 3	
Technical Memorandum of Rationale	8.25
Remedial Investigation Report	
Draft	14.5
Final	17
Baseline Risk Assessment Report	
Draft	15.5
Final	18
Feasibility Study Report	
Draft	16.5
Final	19
Operable Unit 4	
Technical Memorandum of Rationale	11.5
Remedial Investigation Report	
Draft	17.25
Final	19.75
Baseline Risk Assessment Report	
Draft	18.25
Final	20.75
Feasibility Study Report	
Draft	19.25
Final	21.75
Operable Unit 5	
Technical Memorandum of Rationale	7.75
Remedial Investigation Report	
Draft	14
Final	16.5
Baseline Risk Assessment Report	
Draft	15
Final	17.5
Feasibility Study Report	
Draft	16
Final	18.5

Table 6-1 (Continued)
Proposed Schedule of Deliverables

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Deliverable	Approximate Due Date (Months from Notice to Proceed)
Operable Unit 6	
Technical Memorandum of Rationale	11.25
Remedial Investigation Report	
Draft	16.75
Final	19.25
Baseline Risk Assessment Report	
Draft	17.75
Final	20.25
Feasibility Study Report	
Draft	18.75
Final	21.25

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APPENDIX A

EXISTING MONITORING WELL CONSTRUCTION DETAILS

Existing Monitoring Well Construction Detail Summary

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Well Number	Reference	Date Installed	East X (1)	North Y (1)	Top of Casing Elevation (feet, msl)	Casing Above Land Surface (2) (feet, msl)	Land Surface Elevation (3) (feet, msl)	Length of Screen (feet)	Total Depth of Well (feet) (4)	Depth to Bottom of Screen (feet)	Bottom of Hole Elevation (feet,msl)	Screen Slot Size (inch)	Construction/ Remarks
CEF 7-1	(a)	06/13/87	2,141,140.64	373,637.68	78.99	2.50	76.49	30	50.00	42.50	26.49	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 7-2	(a)	06/12/87	2,141,357.72	373,417.94	78.22	2.50	75.72	30	50.00	42.50	25.72	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 7-3	(a)	06/11/87	2,141,484.50	373,629.80	78.74	2.50	76.24	30	50.00	42.50	26.24	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 8-1	(a)	06/16/87	2,137,404.75	375,055.87	69.10	2.50	66.60	30	50.00	42.50	16.60	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 8-2	(a)	06/19/87	2,137,654.53	375,306.84	71.01	2.50	68.51	30	50.00	42.50	18.51	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 8-3	(a)	06/20/87	2,137,756.15	374,897.26	72.64	2.50	70.14	30	50.00	42.50	20.14	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 8-4	(a)	06/20/87	2,137,902.86	375,171.87	73.42	2.50	70.92	30	50.00	42.50	20.92	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 10-1	(b)	03/19/84	2,138,075.69	373,243.55	69.87	NA	69.87	NA	115.00	NA	-45.13	NA	4"PVC (d)
CEF 10-2	(a)	06/08/87	2,136,963.63	372,876.92	50.81	2.70	48.11	20	38.00	32.50	10.11	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 10-3	(a)	06/11/87	2,137,933.45	372,921.46	58.62	2.50	56.12	10	24.00	22.50	32.12	0.020	2"PVC (c) No. 1 6-20 Standard Silica

See notes at end of table.

Existing Monitoring Well Construction Detail Summary (Continued)

Remedial Investigation and Feasibility Study Workplan
Operable Units 3, 4, 5, and 6
NAS Cecil Field, Jacksonville, Florida

Well Number	Reference	Date Installed	East X (1)	North Y (1)	Top of Casing Elevation (feet, msl)	Casing Above Land Surface (2) (feet, msl)	Land Surface Elevation (3) (feet, msl)	Length of Screen (feet)	Total Depth of Well (feet) (4)	Depth to Bottom of Screen (feet)	Bottom of Hole Elevation (feet,msl)	Screen Slot Size (inch)	Construction/ Remarks
CEF 10-4	(a)	06/11/87	2,138,869.03	372,611.55	58.49	2.58	55.91	20	30.00	32.50	25.91	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 11-1	(a)	06/18/87	2,146,983.54	372,494.21	78.06	2.50	75.56	30	50.00	42.50	25.56	0.020	2"PVC (c) No. 1 6-20 Standard Silica
CEF 11-2	(a)	06/17/87	2,147,074.48	372,451.27	78.23	2.50	75.73	30	50.00	42.50	25.73	0.020	2"PVC (c) No. 1 6-20 Standard Silica

(1) Unless otherwise noted State Plane Coordinates and elevations reflect values obtained in the 1993 survey by Jones, Wood, & Gentry.
(2) Measured from land surface elevation.
(3) Elevation of northeast corner of concrete pad.
(4) Measured from land surface elevation. Includes any sump.

Notes: msl = mean sea level.
(a) = Harding Lawson Associates, 1988.
PVC = polyvinyl chloride.
(c) = Installed using hollow stem auger technique.
(b) = As-Built Ground-Water Monitoring Network, NAS-Cecil Field, Jacksonville, Florida, Geraghty & Miller, 1984.
NA = not applicable.
(d) = Installed using mud-rotary technique.
NA = information not available.

APPENDIX B

COMPILED ANALYTICAL DATA FOR OPERABLE UNITs 3, 4, 5, AND 6

Footnotes for Analytical Data Tables

NOTES: Units in Micrograms per liter (ug/l) for water samples and ug/kg for soil and sediment samples, except for soil and sediment metals analyses. where the units are mg/kg. Not all parameters tested for are listed in the following tables. Only parameters with a positive hit are listed.

* = Estimated value. Found below detection limit.

(a) = "Year-end Report of Ground-water Monitoring at NAS-Cecil Field, Jacksonville, Florida" Geraghty & Miller, Inc., July 1985.

(b) = Draft Final RCRA Facilities Investigation Report Naval Air Station Cecil Field, Jacksonville, Florida; Harding Lawson Assoc., Inc., March 1988.

(c) = Found Below Method Detection Limit.

(d) = "Results of Sampling of Potable Water Wells Cecil Field Naval Air Station, Jacksonville, Florida," Geraghty and Miller, March 5, 1986.

(e) = Finished Water.

(f) = Analyzed for Ethylene Dibromide only Below Detection Limit of 0.01 ug/l.

(g) = Diatomacious Earth.

(h) = Methylene Chloride appeared in the QA/QC sample at 25 ug/l. 1,1,1-trichloroethane (1,1,1-TCA) appeared in the QA/QC sample at 11 ug/l. Therefore, the quantification of methylene chloride and 1,1,1-TCA in these samples is questionable.

(i) = Lead at 40 ug/l and cadmium at 6 ug/l were identified in the field blank. Therefore, the quantification of cadmium and lead in these samples is questionable.

GROUNDWATER DATA

Site 15 Compilation of Analytical Results

Sample Type	SOIL
Reference	(b)
Date Sampled	07/14/87
Volatile Organic Compounds	
EPA Method Number	624
Benzene	<10
2-Chloroethylvinyl ether	<20
Chloroethane	<20
Chloroform	<10
Methylene Chloride	<10
1,1-Dichloroethane	<10
1,2- Dichloroethane	<10
1,1-Dichloroethene	<10
Trans-1,3-dichloropropane	<10
Ethylbenzene	<10
Toluene	<10
1,1,1-Trichloroethane	<10
Trichloroethylene	<10
Extractable Organic Compounds	
Acid Fraction(625)	BDL
Base/Neutral Fractions(625)	
Acenaphthene	6,600 *
Anthracene	25,800 *
Fluorene	3,000 *
Bis(2-ethylhexyl) phthalate	<51,900
2-Methylnaphthalene	<51,900
4-Methylphenol	<51,900
Naphthalene	5,700 *

Site 15 Compilation of Analytical Results

Sample Type	SOIL
Reference	(b)
Date Sampled	07/14/87
PAHs	
Benzo(a)Anthracene	176,400
Benzo(b)Fluoranthene	352,800
Benzo(k)Fluoranthene	176,400
Benzo(a)Pyrene	192,000
Benzo(ghi)Perylene	103,800
Chrysene	202,500
Fluoranthene	238,800
Indeno(1,2,3-CD)Pyrene	108,900
Phenanthrene	108,900
Pyrene	275,100
Pesticides/PCBs	
Arochlor 1260	NA
Endrin	NA
Lindane	NA
Methoxychlor	NA
Toxaphene	NA
2,4-D	NA
2,4,5-TP (Silvex)	NA
Gross Alpha, pCi/l	NA
Gross Beta, pCi/l	NA
TOX	NA
Field Parameters	
Water-Level (Ft msl)	NA
Temperature (Celcius)	NA
pH (s.u.)	NA
Specific Conductance (umhos/cm)	NA

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-4
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 08-26-94	COMPLTD: 08-27-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 72.0 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 91FT.	DPTH TO ∇ 7 FT.
LOGGED BY: A. Workman / WELL DEVELOPMENT DATE: 08-27-94		SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
0				0-2 0	0-86.0 *Sand (SP)*, 100%, quartz, pale brown to brown to dark brown to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, loose, saturated, occasionally silty.		SP	0-4'bls: post hole 4-8'bls: split-spoon	
				2-4 0					
	4-6 soil		2-4 3-5	4-6 0					
5	6-8 soil		5-4 6-7	6-8 0				groundwater encountered	∇
10	11-15 water							wl sampling string: 0 wl augers: 8'bls	
15									
	18-22 water							wl sampling string: 0 wl augers: 8'bls	
20									
25									
	28-32 water							wl sampling string: 0 wl augers: 9'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:	BORING NO. GS-8-4
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 08-26-94	COMPLTD: 08-27-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 72.0 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 91FT.	DPTH TO ▽ 7 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-27-94		SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 1				
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 0 wl augers: 9'bls	
55									
60									
65									
70									
	72-74 water							wl sampling string: 0 wl augers: 11'bls	
75									
80									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:	BORING NO. GS-8-4
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 08-26-94	COMPLTD: 08-27-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 72.0 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 91FT.	DPTH TO ▽ 7 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-27-94		SITE: 8

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85									
					86.0-91.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 50%, medium to dark gray, wet, plastic, soft, dense, sandy; dolomite cobbles, 50%, medium to dark gray, microcrystalline, poorly to moderately well cemented, moderately soft, shell replacement features visible.		CL DOLOMITE		
90	90-91 water							bottom hole augers wl sampling string: 88'bls wl augers: 11'bls bottom hole probe	
					91.0 *Dolomite*, 100%, medium gray to moderate yellowish-brown, microcrystalline, very poorly cemented, cavernous, some shell replacement features visible.		DOLOMITE		
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.				
95					End of boring: 91'bls.				
100									
105									
110									
115									
120									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-6
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

CONTRACTOR: Layne Environmental Services		DATE STARTED: 08-25-94	COMPLTD: 08-25-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 71.7 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 56FT.	DPTH TO ∇ 7 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-25-94		SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-56.0 *Sand (SP)*, 100%, quartz, pale brown to brown to dark brown to gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, loose, saturated, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: split-spoon	
				2-4 0					
	4-6 soil		3-4	4-6 0					
5			6-6						
	6-8 soil		3-6	6-8 0					
			9-12					groundwater encountered	∇
			9-9	8-10 n/a					
			17-17						
10									
	11-15 water							wl sampling string: 0 wl augers: 7'bls	
15									
	18-22 water							wl sampling string: 0 wl augers: 7'bls	
20									
25									
	28-32 water							wl sampling string: 0 wl augers: 7'bls	
30									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:		BORING NO. GS-8-6
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 08-25-94	COMPLTD: 08-25-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 71.7 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 56FT.	DPTH TO ▽ 7 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-25-94		SITE: 8

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
35									
40									
45									
50									
	52-56 water							bottom hole augers wl sampling string: 52'bls wl augers: 7'bls	
55					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole probe	
					End of boring: 56'bls.				
60									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-8
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

CONTRACTOR: Layne Environmental Services		DATE STARTED: 09-07-94	COMPLTD: 09-07-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 70.1 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 90FT.	DPTH TO ☿ 6.5 FT.
LOGGED BY: D. Jones	WELL DEVELOPMENT DATE: 09-07-94		SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-88.0 *Sand (SP)*, 100%, quartz, dark gray to black, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, loose, saturated, silty.		SP	0-4'bls: post hole 4-6'bls: split-spoon	
	2-4 soil			2-4 0					
5	4-6 soil		1-3 6-6	4-6 0					
								groundwater encountered	☿
10	8-12 water							wl sampling string: 0 wl augers: dry	
15									
20	18-22 water							wl sampling string: 0 wl augers: 6'bls	
25									
30	28-32 water							wl sampling string: 0 wl augers: 5.5'bls	
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-8
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-07-94	COMPLTD: 09-07-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 70.1 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 90FT.	DPTH TO ∇ 6.5 FT.
LOGGED BY: D. Jones / WELL DEVELOPMENT DATE: 09-07-94		SITE: 8

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 51'bls wl augers: 6'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 0 wl augers: 7'bls	
75									
80									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-8
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-07-94	COMPLTD: 09-07-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 70.1 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 90FT.	DPTH TO ▽ 6.5 FT.
LOGGED BY: D. Jones / WELL DEVELOPMENT DATE: 09-07-94		SITE: 8

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85									
	88-90 water				88.0-90.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 50%, medium to dark gray, saturated, plastic, soft, dense, sandy; dolomite cobbles, 50%, medium to dark gray, microcrystalline, poorly to moderately well cemented, moderately soft, shell replacement features visible.		CL DOLOMITE	bottom hole augers wl sampling string: 0	
90					90.0 *Dolomite*, 100%, medium gray to moderate yellowish-brown, microcrystalline, very poorly cemented, cavernous, some shell replacement features visible.		DOLOMITE	wl augers: 13'bls bottom hole probe	
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.				
95					End of boring: 90'bls.				
100									
105									
110									
115									
120									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-10
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-13-94	COMPLTD: 09-14-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 70.1 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 84FT.	DPTH TO ∇ 6 FT.
LOGGED BY: D. Jones / WELL DEVELOPMENT DATE: 09-14-94		SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-84.0 *Sand (SP)*, 100%, quartz, brown to dark brown to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, loose, saturated, occasionally silty.		SP	0-4'bls: post hole 4-8'bls: split-spoon	
				2-4 0.2					
5	4-6 soil		2-3 5-5	4-6 0.5					
	6-8 soil		3-5 7-8	6-8 0.4				groundwater encountered	∇
	8-12 water							wl sampling string: 0 wl augers: 9'bls	
10									
15									
	18-22 water							wl sampling string: 0 wl augers: 9'bls	
20									
25									
	28-32 water							wl sampling string: 13'bls wl augers: 9'bls	
30									
35									
40									
45									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:		BORING NO. GS-8-10
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 09-13-94	COMPLTD: 09-14-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 70.1 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 84FT.	DPTH TO ∇ 6 FT.
LOGGED BY: D. Jones	WELL DEVELOPMENT DATE: 09-14-94		SITE: 8

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
50									
	52-56 water							wl sampling string: 0 wl augers: 9'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 0 wl augers: 10'bls	
75									
80	80-84 water							bottom hole augers wl sampling string: 0 wl augers: 9'bls	
					84.0 *Dolomite*, 100%, medium gray to moderate yellowish-brown, microcrystalline, very poorly cemented, cavernous, some shell replacement features visible.		DOLOMITE	bottom hole probe	
85					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.				
					End of boring: 84'bls.				
90									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:		BORING NO. GS-8-11
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 09-19-94	COMPLTD: 09-20-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 68.7 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 75FT.	DPTH TO ▽ 3.5 FT.
LOGGED BY: D. Jones	WELL DEVELOPMENT DATE: 09-20-94		SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
0	0-2 soil			0-2 0	0-75.0 *Sand (SP)*, 100%, quartz, pale brown to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, loose, saturated, silty.		SP	0-4'bls: post hole	
	2-4 soil			2-4 0					
								groundwater encountered	▽
5	5-9 water							wl sampling string: 0 wl augers: 4'bls	
10									
	11-15 water							wl sampling string: 0 wl augers: 4'bls	
15									
	18-22 water							wl sampling string: 0 wl augers: 4'bls	
20									
25									
	28-32 water							wl sampling string: 20'bls wl augers: 4'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-11
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-19-94	COMPLTD: 09-20-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 68.7 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 75FT.	DPTH TO ▽ 3.5 FT.
LOGGED BY: D. Jones / WELL DEVELOPMENT DATE: 09-20-94		SITE: 8

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 0 wl augers: 5'bls	
55									
60									
65									
70									
	72-75 water							bottom hole augers wl sampling string: 0 wl augers: 5'bls	
75					Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 75'bls.			bottom hole probe	
80									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-21-94	COMPLTD: 09-22-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA / SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 66.4 FT.	MONITOR INST.: Microtip-PID / TOT DPTH: 92FT.	DPTH TO ▽ 3.5 FT.
LOGGED BY: D. Jones	WELL DEVELOPMENT DATE: 09-22-94	SITE: 8

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
	0-2 soil			0-2 0	0-75.0 *Sand (SP)*, 100%, quartz, pale brown to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, loose, saturated, silty, shell fragments @ 66'bls.		SP	0-4'bls: post hole	
	2-4 soil			2-4 35					
								groundwater encountered	▽
5	5-9 water							wl sampling string: 0 wl augers: 5'bls	
10	11-15 water							wl sampling string: 0 wl augers: 5'bls	
15									
	18-22 water							wl sampling string: 20'bls wl augers: 6'bls	
20									
25									
	28-32 water							wl sampling string: 30'bls wl augers: 4'bls	
30									
35									
40									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-21-94	COMPLTD: 09-22-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 66.4 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 92FT.	DPTH TO ∇ 3.5 FT.
LOGGED BY: D. Jones / WELL DEVELOPMENT DATE: 09-22-94		SITE: 8

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 0 wl augers: 5'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 0 wl augers: 5'bls	
75					75.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 85%, quartz, gray, medium-to coarse-grained, saturated, plastic, soft, dense, sandy; dolomite cobbles, 15%, medium to dark gray, microcrystalline, poorly to moderately well cemented, shell replacement features visible.		CL DOLOMITE		
80									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-8-12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 09-21-94	COMPLTD: 09-22-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 66.4 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 92FT.	DPTH TO ▽ 3.5 FT.
LOGGED BY: D. Jones	WELL DEVELOPMENT DATE: 09-22-94	SITE: 8

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sandy Clay continued.		CL DOLOMITE		
85									
90	90-92 water				89.0-92.0 *Dolomite*, 100%, medium gray to moderate yellowish-brown, microcrystalline, very poorly cemented, cavernous, some shell replacement features visible, weathered. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 92'bls.		DOLOMITE	bottom hole augers wl sampling string: 0 wl augers: 6'bls bottom hole probe	
95									
100									
105									
110									
115									
120									

 ABB ENVIRONMENTAL SERVICES, INC.

[1] From: Al Stodghill 5/30/96 4:02PM (537 bytes: 18 ln)
To: Cy Kidd
Subject: Cross section for Site 7, OU 3, NAS Cecil

------------------------------- Message Contents -------------------------------

Cy,

For the lithologic cross section use these boring identifiers:

CEF-7-GS-21
CEF-7-GS-18
CEF-7-GS-1
CEF-7-GS-2
CEF-7-GS-5
CEF07-GS-12

This will give us a cross section pretty much down the long axis of the site.

Thanks

'bert

(373743.83, 2141

(373766.68, 2141107.98)

AUGER PROBES

NAME	NORTH	EAST	ELEVATION
CEF-7-AB-1	2,141,368.53	373,617.42	76.9
CEF-7-AB-2	2,141,295.83	373,686.95	76.7
CEF-7-AB-3	2,141,279.14	373,706.68	76.9
CEF-7-AB-4	2,141,274.77	373,672.91	76.9
CEF-7-AB-5	2,141,231.17	373,587.80	76.4
CEF-7-AB-6	2,141,294.37	373,579.16	76.7
CEF-7-AB-7	2,141,198.68	373,681.06	77.0
CEF-7-AB-8	2,141,244.67	373,636.01	76.8
CEF-7-AB-9	2,141,240.57	373,550.25	76.3
CEF-7-AB-10	2,141,249.74	373,508.56	75.8
CEF-7-AB-11	2,141,279.97	373,481.21	76.2
CEF-7-AB-12	2,141,267.00	373,528.47	76.2
CEF-7-AB-13	2,141,285.55	373,500.40	76.1
CEF-7-AB-14	2,141,334.54	373,561.16	76.9
CEF-7-AB-15	2,141,307.90	373,483.25	76.2
CEF-7-AB-16	2,141,274.27	373,442.55	76.4
CEF-7-AB-17	2,141,208.77	373,482.95	75.6
CEF-7-AB-18	2,141,228.82	373,514.62	75.8
CEF-7-AB-19	2,141,171.95	373,491.14	75.5
CEF-7-AB-20	2,141,126.64	373,450.72	74.4
CEF-7-AB-21	2,141,097.46	373,392.51	74.7
CEF-7-AB-22	2,141,060.18	373,336.25	75.0
CEF-7-AB-22A	2,141,038.62	373,407.36	74.2
CEF-7-AB-23	2,141,159.30	373,382.39	74.9
CEF-7-AB-24	2,141,186.50	373,414.58	75.1
CEF-7-AB-25	2,141,227.89	373,568.97	76.3
CEF-7-AB-26	2,141,187.21	373,541.68	76.4
CEF-7-AB-27	2,141,197.86	373,588.37	76.3
CEF-7-AB-28	2,141,309.28	373,551.22	76.5
CEF-7-AB-29	2,141,284.60	373,554.09	76.7
CEF-7-AB-31	2,141,400.61	373,511.47	77.0
CEF-7-AB-32	2,141,383.56	373,388.50	75.3
CEF-7-AB-33	2,141,320.84	373,775.37	76.5
CEF-7-AB-34	2,141,277.89	373,817.72	76.4
CEF-7-AB-35	2,141,235.24	373,862.29	76.2
CEF-7-AB-36	2,141,194.71	373,904.00	76.3
CEF-7-AB-37	2,141,286.33	373,906.53	76.8
CEF-7-AB-38	2,141,318.46	373,867.03	77.6
CEF-7-AB-39	2,141,361.39	373,827.50	77.9
CEF-7-AB-40	2,141,387.12	373,723.41	75.8
CEF-7-AB-41	2,141,425.65	373,677.57	76.3
CEF-7-AB-42	2,141,488.00	373,612.77	76.4
CEF-7-AB-43	2,141,424.34	373,764.03	76.7
CEF-7-AB-45	2,141,185.19	373,767.45	77.1
CEF-7-AB-46	2,141,299.23	373,629.38	77.1
CEF-7-AB-47	2,141,365.63	373,580.48	77.0
CEF-7-AB-48	2,141,148.36	373,534.10	75.2

AQUA PROBES

NAME	NORTH	EAST	ELEVATION
CEF-7-GS-1	2,141,410.08	373,554.69	77.1
CEF-7-GS-2	2,141,337.70	373,627.41	77.0
CEF-7-GS-3	2,141,418.38	373,641.32	76.6

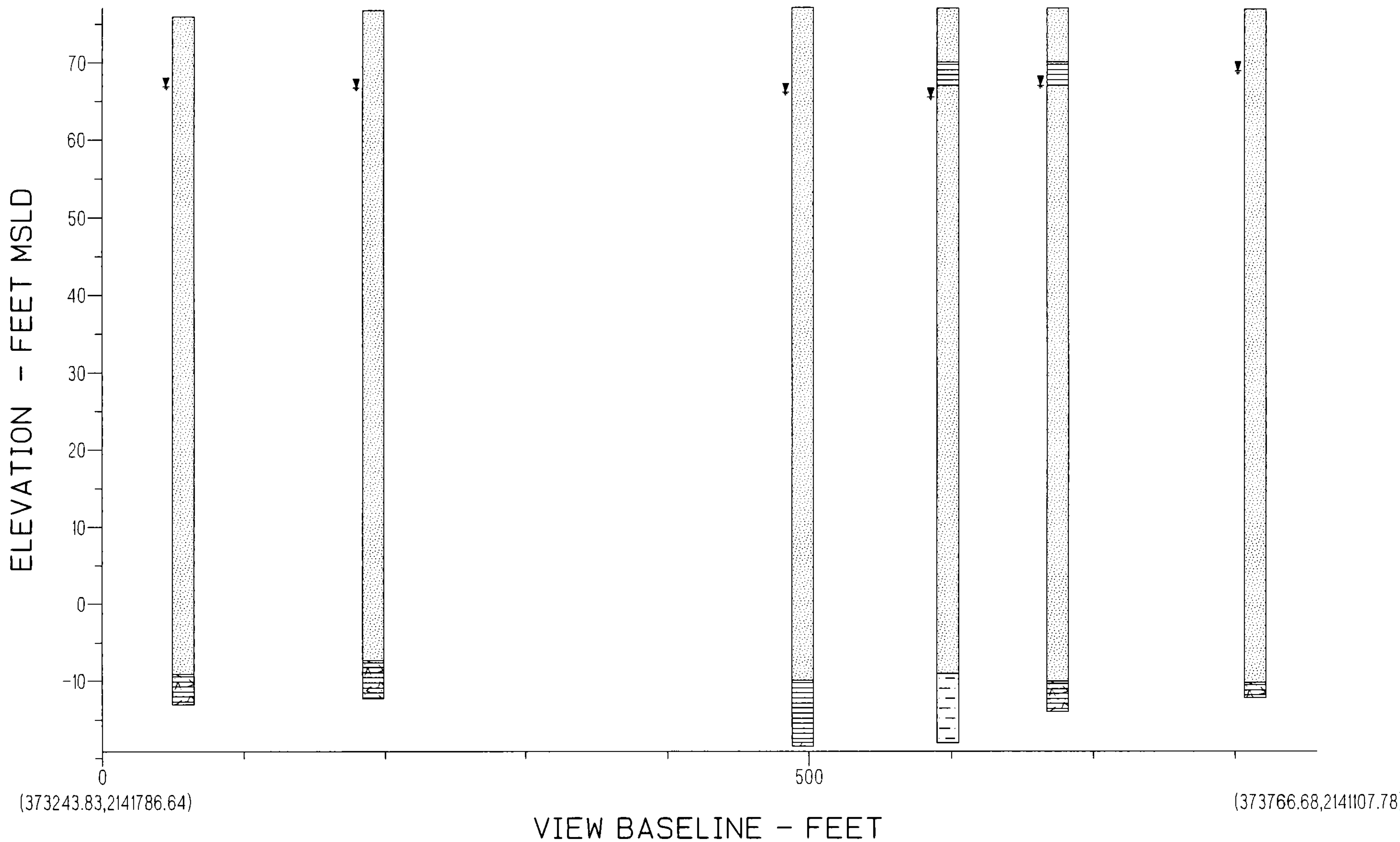
CEF-7-GS-4	2,141,254.80	373,537.63	76.2
CEF-7-GS-5	2,141,275.34	373,672.94	77.0
CEF-7-GS-6	2,141,248.25	373,607.90	76.8
CEF-7-GS-7	2,141,299.47	373,452.03	76.6
CEF-7-GS-8	2,141,264.91	373,794.73	76.5
CEF-7-GS-9	2,141,176.71	373,507.20	75.6
CEF-7-GS-10	2,141,229.98	373,412.97	75.4
CEF-7-GS-11	2,141,108.59	373,594.41	75.8
CEF-7-GS-12	2,141,162.65	373,755.98	76.8
CEF-7-GS-13	2,141,255.33	373,868.55	76.4
CEF-7-GS-14	2,141,386.03	373,819.47	77.8
CEF-7-GS-15	2,141,254.42	373,964.23	77.0
CEF-7-GS-16	2,141,459.58	373,901.26	77.4
CEF-7-GS-17	2,141,631.53	373,700.11	76.0
CEF-7-GS-18	2,141,652.98	373,371.26	76.7
CEF-7-GS-19	2,141,410.72	373,351.33	76.3
CEF-7-GS-20	2,141,516.72	373,250.97	76.8
CEF-7-GS-21	2,141,762.28	373,294.15	75.9

SURFACE SOIL SAMPLE LOCATIONS

NAME	NORTH	EAST	ELEVATION
CEF-7-SS-1	2,141,141.16	373,634.01	76.6
CEF-7-SS-2	2,141,175.97	373,598.90	76.3
CEF-7-SS-3	2,141,210.28	373,563.41	76.2
CEF-7-SS-4	2,141,246.17	373,528.08	76.0
CEF-7-SS-5	2,141,281.81	373,493.48	76.0
CEF-7-SS-6	2,141,317.94	373,459.07	76.5
CEF-7-SS-7	2,141,353.79	373,423.93	75.7
CEF-7-SS-8	2,141,395.89	373,381.52	76.2
CEF-7-SS-9	2,141,430.66	373,345.24	76.2
CEF-7-SS-10	2,141,467.02	373,305.83	76.2
CEF-7-SS-11	2,141,534.59	373,260.83	76.8
CEF-7-SS-12	2,141,616.93	373,337.00	76.6
CEF-7-SS-13	2,141,652.41	373,372.19	76.7
CEF-7-SS-14	2,141,687.75	373,407.90	76.6
CEF-7-SS-15	2,141,693.63	373,461.24	76.5
CEF-7-SS-16	2,141,691.15	373,501.85	75.9
CEF-7-SS-17	2,141,704.61	373,560.53	75.7
CEF-7-SS-18	2,141,533.22	373,593.65	75.7
CEF-7-SS-19	2,141,496.37	373,627.21	76.3
CEF-7-SS-20	2,141,460.31	373,662.42	76.1
CEF-7-SS-21	2,141,425.74	373,698.71	76.2
CEF-7-SS-22	2,141,391.34	373,736.20	76.7
CEF-7-SS-23	2,141,354.41	373,769.54	76.4
CEF-7-SS-24	2,141,319.24	373,805.59	76.9
CEF-7-SS-25	2,141,350.28	373,840.42	77.9
CEF-7-SS-26	2,141,386.85	373,806.49	77.6
CEF-7-SS-27	2,141,422.87	373,771.49	76.9
CEF-7-SS-28	2,141,459.86	373,737.30	76.4
CEF-7-SS-29	2,141,497.06	373,703.15	76.3
CEF-7-SS-30	2,141,534.39	373,667.44	75.6
CEF-7-SS-31	2,141,566.47	373,700.58	75.8
CEF-7-SS-32	2,141,528.84	373,738.19	75.8
CEF-7-SS-33	2,141,492.23	373,773.89	76.6
CEF-7-SS-34	2,141,456.75	373,809.92	77.5
CEF-7-SS-35	2,141,420.97	373,844.11	77.8
CEF-7-SS-36	2,141,384.12	373,877.77	77.9
CEF-7-SS-37	2,141,417.58	373,914.96	77.9

CEF-7-SS-38	2,141,453.83	373,881.85	77.6
CEF-7-SS-39	2,141,490.51	373,846.74	76.4
CEF-7-SS-40	2,141,526.19	373,813.53	76.3
CEF-7-SS-41	2,141,564.85	373,777.19	76.2
CEF-7-SS-42	2,141,604.02	373,740.59	75.9
CEF-7-SS-43	2,141,631.18	373,700.90	75.9
CEF-7-SS-44	2,141,601.59	373,665.09	75.6
CEF-7-SS-45	2,141,571.07	373,634.39	75.7
CEF-7-SS-46	2,141,608.36	373,598.69	75.9
CEF-7-SS-47	2,141,624.48	373,639.44	76.0
CEF-7-SS-48	2,141,742.53	373,551.51	75.7
CEF-7-SS-49	2,141,734.05	373,504.89	76.0
CEF-7-SS-50	2,141,724.36	373,455.98	76.6
CEF-7-SS-51	2,141,711.49	373,391.43	76.4
CEF-7-SS-52	2,141,687.07	373,336.99	76.2
CEF-7-SS-53	2,141,649.58	373,301.29	76.4
CEF-7-SS-54	2,141,564.41	373,236.79	76.0
CEF-7-SS-55	2,141,460.71	373,241.26	76.2
CEF-7-SS-56	2,141,428.40	373,277.00	76.2
CEF-7-SS-57	2,141,392.48	373,312.52	76.1
CEF-7-SS-58	2,141,357.92	373,346.70	75.7
CEF-7-SS-59	2,141,319.45	373,387.02	75.1
CEF-7-SS-60	2,141,284.26	373,421.79	76.3
CEF-7-SS-61	2,141,247.76	373,456.49	76.2
CEF-7-SS-62	2,141,212.61	373,491.69	75.6
CEF-7-SS-63	2,141,175.93	373,524.53	75.6
CEF-7-SS-64	2,141,139.92	373,562.68	76.0
CEF-7-SS-67	2,141,702.09	373,610.24	76.0
CEF-7-SS-68	2,141,363.73	373,616.10	76.7
CEF-7-SS-69	2,141,349.72	373,601.15	77.0
CEF-7-SS-70	2,141,382.12	373,580.45	77.0
CEF-7-SS-71	2,141,363.58	373,561.65	77.0
CEF-7-SS-72	2,141,747.68	373,600.10	75.7
CEF-7-SS-73	2,141,749.69	373,650.25	75.9
CEF-7-SS-74	2,141,757.63	373,703.60	76.0
CEF-7-SS-75	2,141,705.48	373,660.50	75.7
CEF-7-SS-76	2,141,708.53	373,710.08	75.9
CEF-7-SS-77	2,141,630.50	373,770.08	75.7
CEF-7-SS-78	2,141,598.02	373,814.99	76.1
CEF-7-SS-79	2,141,556.98	373,851.36	75.9
CEF-7-SS-80	2,141,524.00	373,883.00	75.9
CEF-7-SS-81	2,141,790.73	373,445.45	76.5
CEF-7-SS-82	2,141,774.85	373,351.30	76.6
CEF-7-SS-83	2,141,723.76	373,300.43	76.1
CEF-7-SS-84	2,141,626.94	373,192.81	75.1
CEF-7-SS-85	2,141,535.19	373,192.67	74.9
CEF-7-SS-86	2,141,463.33	373,191.03	75.1
CEF-7-SS-87	2,141,391.42	373,242.75	75.7
CEF-7-SS-88	2,141,286.44	373,351.25	74.8
CEF-7-SS-89	2,141,214.74	373,419.51	75.4
CEF-7-SS-90	2,141,176.90	373,453.91	75.5
CEF-7-SS-93	2,140,998.57	373,706.45	76.2
CEF-7-SS-94	2,140,964.48	373,741.19	76.4
CEF-7-SS-95	2,140,998.19	373,774.98	76.4
CEF-7-SS-96	2,141,034.80	373,739.97	76.7
CEF-7-SS-97	2,141,069.68	373,705.13	76.3
CEF-7-SS-98	2,141,796.57	373,494.76	76.6
CEF-7-SS-99	2,141,801.27	373,542.12	77.0
CEF-7-SS-100	2,141,805.02	373,594.45	75.6
CEF-7-SS-101	2,141,631.15	373,811.37	75.7

CEF-7-SS-102	2,141,632.30	373,850.88	75.5
CEF-7-SS-103	2,141,589.91	373,889.77	75.7
CEF-7-SS-104	2,141,558.23	373,919.62	75.7
CEF-7-SS-105	2,141,623.06	373,927.05	75.6
CEF-7-SS-106	2,141,318.36	373,314.00	74.8
CEF-7-SS-107	2,141,251.32	373,386.08	76.5
CEF-7-SS-108	2,141,142.87	373,490.51	75.9
CEF-7-SS-109	2,141,106.88	373,450.52	74.3
CEF-7-SS-110	2,141,142.57	373,413.97	74.8
CEF-7-SS-111	2,141,180.01	373,380.15	75.1
CEF-7-SS-112	2,141,215.00	373,348.63	75.1
CEF-7-SS-113	2,141,215.57	373,275.29	74.5
CEF-7-SS-114	2,141,038.40	373,596.04	76.1
CEF-7-SS-115	2,140,926.85	373,774.33	76.4
CEF-7-SS-116	2,140,890.95	373,812.03	76.1
CEF-7-SS-117	2,140,925.61	373,846.41	76.1
CEF-7-SS-118	2,140,961.80	373,809.78	76.1



TITLE BLOCK ANNOTATIONS

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-1
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 04-19-94	COMPLTD: 04-21-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.1 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 95FT.	DPTH TO ▽ 11 FT.
LOGGED BY: M. Pijnenburg / WELL DEVELOPMENT DATE: 04-21-94		SITE: 7

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-87.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular, well sorted, clean.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons	
				2-4 0					
			5-6	4-6 0					
5			6-6						
	6-8 soil		4-3	6-8 0					
			6-9						
	8-10 soil		7-10	8-10 0					
			10-10						
10									
	11-15 water							groundwater encountered wl sampling string: 0 wl augers: dry	▽
15									
	18-22 water							wl sampling string: 0 wl augers: 12'bls	
20									
25									
	28-32 water							wl sampling string: 28'bls wl augers: 12'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**BORING NO.** GS-7-1
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
CONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-19-94	**COMPLTD:** 04-21-94
METHOD: Gus Pech BR22 / **CASE SIZE:** 4.25" ID HSA	**SCREEN INT.:** Aqua Probe	**PROTECTION LEVEL:** D
TOC ELEV.: 77.1 FT. / **MONITOR INST.:** Microtip-PID	**TOT DPTH:** 95FT.	**DPTH TO ∇** 11 FT.
LOGGED BY: M. Pijnenburg / **WELL DEVELOPMENT DATE:** 04-21-94		**SITE:** 7

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 53'bls wl augers: 11'bls	
55									
60									
65									
70									
	72-74 water							wl sampling string: 64'bls wl augers: 12'bls	
75									
80									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:		BORING NO. GS-7-1
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 04-19-94	COMPLTD: 04-21-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.1 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 95FT.	DPTH TO ▽ 11 FT.
LOGGED BY: M. Pijnenburg	WELL DEVELOPMENT DATE: 04-21-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85									
					87.0-95.0 *Sandy Clay (CL)*, 100%, medium to dark gray, moist, plastic, soft, dense, trace dolomite pebbles.		CL		
90									
	94-95 water							bottom hole augers wl sampling string: 88'bls wl augers: 12'bls bottom hole probe	
95					95.0-95.5 *Dolomite*, 100%, moderate yellowish-orange to light brown, dense, microcrystalline, well cemented to very well cemented, shell replacement features visible. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 95.5'bls.		DOLOMITE		
100									
105									
110									
115									
120									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 07-16-94	COMPLTD: 07-17-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 76.8 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 89FT.	DPTH TO ⊽ 8 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 07-17-94	SITE: 7

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
0				0-2 0	0-87.0 *Sand (SP)*, 100%, quartz, colorless to brown to dark brown to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons	
				2-4 0					
			5-6 6-4	4-6 0					
5	6-8 soil		3-7 9-13	6-8 0					
	8-10 soil		10-11 12-14	8-10 0				groundwater encountered	⊽
10	11-15 water							wl sampling string: 0 wl augers: 8'bls	
15									
	18-22 water							wl sampling string: 0 wl augers: 11'bls	
20									
25									
	28-32 water							wl sampling string: 26'bls wl augers: 11'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 07-16-94	COMPLTD: 07-17-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 76.8 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 89FT.	DPTH TO ▽ 8 FT.
LOGGED BY: A. Workman / WELL DEVELOPMENT DATE: 07-17-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 48'bls wl augers: 9'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 66'bls wl augers: 12'bls	
75									
80									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 07-16-94	COMPLTD: 07-17-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA / SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 76.8 FT.	MONITOR INST.: Microtip-PID / TOT DPTH: 89FT.	DPTH TO ▽ 8 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 07-17-94	SITE: 7

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85									
	87-89 water				87.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers wl sampling string: 84'bls wl augers: 10'bls bottom hole probe	
90					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.				
					End of boring: 89'bls.				
95									
100									
105									
110									
115									
120									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-18
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

CONTRACTOR: Layne Environmental Services		DATE STARTED: 08-01-94	COMPLTD: 08-01-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 76.7 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 89FT.	DPTH TO ▽ 10 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-01-94		SITE: 7

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-84.0 *Sand (SP)*, 100%, quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons	
				2-4 0					
5			2-5 10-11	4-6 0					
	6-8 soil		4-9 7-6	6-8 0					
	8-10 soil		5-7 7-7	8-10 0					
10								groundwater encountered	▽
	11-15 water							wl sampling string: 0 wl augers: dry	
15									
	18-22 water							wl sampling string: 0 wl augers: 11'bls	
20									
25									
	28-32 water							wl sampling string: 32'bls wl augers: 11'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-18
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 08-01-94	COMPLTD: 08-01-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 76.7 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 89FT.	DPTH TO ▽ 10 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-01-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 0 wl augers: 11'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 69'bls wl augers: 11'bls	
75									
80									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-18
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 08-01-94	COMPLTD: 08-01-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA / SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 76.7 FT.	MONITOR INST.: Microtip-PID / TOT DPTH: 89FT.	DPTH TO ▽ 10 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-01-94	SITE: 7

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85	85-89 water				84.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers wl sampling string: 60'bls wl augers: 11'bls	
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.				
					End of boring: 89'bls.			bottom hole probe	
90									
95									
100									
105									
110									
115									
120									

TITLE: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:		BORING NO. GS-7-2
CLIENT: SOUTHDIVNAVFACENGCOM				PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services			DATE STARTED: 04-21-94	COMPLTD: 04-22-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA		SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.0 FT.	MONITOR INST.: Microtip-PID		TOT DPTH: 95FT.	DPTH TO ∇ 11.5 FT.
LOGGED BY: M. Pijnenburg	WELL DEVELOPMENT DATE: 04-22-94			SITE: 7

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-7.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular, moderately well to well sorted, soft, clean.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons	
				2-4 0					
			5-6	4-6 0					
5			10-10						
	6-8 soil		6-4	6-8 0					
			10-20		7.0-10.0 *Sandy Clay (CL)*, 100%, quartz, light to medium gray to yellowish-brown, dense, dry to moist, compacted, homogeneous, sandy.		CL		
	8-10 soil		13-12	8-10 0					
			13-13						
10					10-86.0 *Sand (SP)*, 100%, quartz, colorless to light brown, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted.		SP		
	11-15 water							wl sampling string: 0 wl augers: dry groundwater encountered	∇
15									
	18-22 water							wl sampling string: 0 wl augers: 15'bls	
20									
25									
	28-32 water							wl sampling string: 0 wl augers: 15'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-2
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 04-21-94	COMPLTD: 04-22-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.0 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 95FT.	DPTH TO ▽ 11.5 FT.
LOGGED BY: M. Pijnenburg	WELL DEVELOPMENT DATE: 04-22-94	SITE: 7

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 45'bls wl augers: 11'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 68'bls wl augers: 17'bls	
75									
80									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-2
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 04-21-94	COMPLTD: 04-22-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.0 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 95FT.	DPTH TO ▽ 11.5 FT.
LOGGED BY: M. Pijnenburg / WELL DEVELOPMENT DATE: 04-22-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85									
					86.0–95.0 *Clayey Sand (SC)*, 100%, quartz, medium to dark gray, fine-to medium-grained, sub-angular, poorly to moderately well sorted, clayey, trace dolomite stringers.		SC		
90									
	92-95 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers wl sampling string: 78'bls wl augers: 15'bls	
95					End of boring: 95'bls.			bottom hole probe	
100									
105									
110									
115									
120									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-21
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 08-11-94	COMPLTD: 08-12-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA / SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 75.9 FT.	MONITOR INST.: Microtip-PID / TOT DPTH: 89FT.	DPTH TO ▽ 9 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-12-94	SITE: 7

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0-2 0	0-85.0 *Sand (SP)*, 100%, quartz, brown to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty, saturated, loose.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons	
				2-4 0					
5	4-6 soil		3-3 2-1	4-6 0					
			3-3 8-9	6-8 0					
10	8-10 soil		3-11 12-13	8-10 0				groundwater encountered	▽
	11-15 water							wl sampling string: 0 wl augers: dry	
15									
	18-22 water							wl sampling string: 0 wl augers: 10'bls	
20									
25									
	28-32 water							wl sampling string: 32'bls wl augers: 10'bls	
30									
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-21
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 08-11-94	COMPLTD: 08-12-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 75.9 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 89FT.	DPTH TO ☿ 9 FT.
LOGGED BY: A. Workman / WELL DEVELOPMENT DATE: 08-12-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 0 wl augers: 11'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 73'bls wl augers: 10'bls	
75									
80									

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:		BORING NO. GS-7-21
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services		DATE STARTED: 08-11-94	COMPLTD: 08-12-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 75.9 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 89FT.	DPTH TO ▽ 9 FT.
LOGGED BY: A. Workman	WELL DEVELOPMENT DATE: 08-12-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85	85-89 water				85.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers wl sampling string: 83'bls wl augers: 11'bls	
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole probe	
					End of boring: 89'bls.				
90									
95									
100									
105									
110									
115									
120									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-5
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 04-26-94	COMPLTD: 05-02-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.0 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 91FT.	DPTH TO ▽ 10 FT.
LOGGED BY: M. Pijnenburg	WELL DEVELOPMENT DATE: 05-02-94	SITE: 7

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
0				0-2: 0	0-7.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons	
				2-4: 0					
5			7-10 10-6	4-6: 0					
	6-8 soil		3-6 13-12	6-8: 0	7.0-10.0 *Sandy Clay (CL)*, 100%, quartz, moderate yellowish-brown to light gray, dense, dry, compacted, homogeneous, sandy.		CL		
	8-10 soil		16-13 10-12	8-10: 0					
10	11-15 water				10-87.0 *Sand (SP)*, 100%, quartz, colorless to moderate yellowish-brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted.		SP	groundwater encountered wl sampling string: 0 wl augers: dry	▽
15									
20	18-22 water							wl sampling string: 0 wl augers: 12'bls	
25									
30	28-32 water							wl sampling string: 28'bls wl augers: 9'bls	
35									
40									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-5
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 04-26-94	COMPLTD: 05-02-94
METHOD: Gus Pech BR22	CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.0 FT.	MONITOR INST.: Microtip-PID	TOT DPTH: 91FT.	DPTH TO ▽ 10 FT.
LOGGED BY: M. Pijnenburg	WELL DEVELOPMENT DATE: 05-02-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
45									
50									
	52-56 water							wl sampling string: 42'bls wl augers: 12'bls	
55									
60									
65									
70									
	72-76 water							wl sampling string: 69'bls wl augers: 12'bls	
75									
80									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	BORING NO. GS-7-5
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
CONTRACTOR: Layne Environmental Services	DATE STARTED: 04-26-94	COMPLTD: 05-02-94
METHOD: Gus Pech BR22 / CASE SIZE: 4.25" ID HSA	SCREEN INT.: Aqua Probe	PROTECTION LEVEL: D
TOC ELEV.: 77.0 FT. / MONITOR INST.: Microtip-PID	TOT DPTH: 91FT.	DPTH TO ▽ 10 FT.
LOGGED BY: M. Pijnenburg	WELL DEVELOPMENT DATE: 05-02-94	SITE: 7

Continued from PAGE 2

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Sand continued.		SP		
85									
					87.0-91.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, many shell replacement features visible, friable.		CL DOLOMITE		
90	90-91 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers wl sampling string: 56'bls wl augers: 13'bls	
					End of boring: 91'bls.				
95								bottom hole probe	
100									
105									
110									
115									
120									

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSBIS
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-20-94	**COMPLETED:** 09-20-94

DRILL RIG: CME 75	**DRILL MTHD.:** 2 3/8" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.3 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-20-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		4-6	3-5 0				
			6-8					
5	5-7 soil		5-4	5-7 72	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			4-4					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB2S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-20-94	**COMPLETED:** 09-20-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA; **SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.4 FT. NGVD	**MONITOR INST.:** Microtip-PID; **TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ▽** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-20-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		2-3	3-5 55				
			4-4					
5	5-7 soil		3-3	5-7 731	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			4-4					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: CF7SSB3S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 08-20-94	COMPLETED: 08-20-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 78.0 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS
DEPTH TO ▽ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 08-20-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		3-5	3-5 0				
			9-9					
5	5-7 soil		9-7	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			4-4					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB4S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-20-94	**COMPLETED:** 09-20-94
DRILL RIG: CME 75 w/2.375"HSA	**DRILL MTHD.:** n/a	**SAMP. MTHD.:** n/a
PROTECTION LEVEL: n/a		
GROUND ELEV.: n/a FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS
DEPTH TO ∇ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** n/a	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 8.2	0-7.0 *Sand (SP)* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 6				split-spoons
	3-5 soil		6-7	3-5 286				
			9-11					
5	5-7 soil		9-7	5-7 520	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			7-7					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB5S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-20-94	**COMPLETED:** 09-20-94
DRILL RIG: CME 75 / **DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.7 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO** ∇ 7 FT. BLS
LOGGED BY: M. Pijnenburg / **HOLE ABANDONMENT DATE:** 09-20-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		4-5	3-5 0				
			8-10					
5	5-7 soil		10-7	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			7-8					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB6S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Groundwater Protection Inc.		**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 77.0 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ⊻** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-21-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		10-12	3-5 0				
			16-12					
5	5-7 soil		11-10	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			5-8					
					End of boring: 7'bls.			groundwater encountered bottom hole ⊻
10								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB7S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-21-94	COMPLETED: 09-21-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 76.4 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS
DEPTH TO ▽ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-21-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		8-8 10-10	3-5 0				
5	5-7 soil		6-5 6-7	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB8S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 78.3 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 09-21-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		10-9	3-5 0				
			8-9					
5	5-7 soil		9-9	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			8-12					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB8S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 78.4 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS
DEPTH TO ∇ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-21-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		7-12	3-5 152				
			10-12					
5	5-7 soil		9-5	5-7 230	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			5-7					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB10S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 78.4 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 7 FT. BLS	**DEPTH TO ▽** 7 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 09-21-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		6-4	3-5 120				
			3-6					
5	5-7 soil		6-7	5-7 100	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			7-8					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB11S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94

DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.5 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-21-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		5-5	3-5 0.9				
			5-5					
5	5-7 soil		6-5	5-7 141	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			5-7					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB12S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75 / **DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.8 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-21-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		4-4	3-5 0				
			4-5					
5	5-7 soil		2-2	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			2-2					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB13S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA / **SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.9 FT. NGVD	**MONITOR INST.:** Microtip-PID / **TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO** ∇ 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-21-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		7-7	3-5 0				
			8-9					
5	5-7 soil		7-3	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			3-3					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB14S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-21-94	**COMPLETED:** 09-21-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 78.3 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 09-21-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		4-8	3-5 0				
			10-11					
5	5-7 soil		9-9	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			6-6					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB15S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-22-94	**COMPLETED:** 09-22-94
DRILL RIG: CME 75 / **DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.6 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO** ▽ 6.5 FT. BLS
LOGGED BY: M. Pijnenburg / **HOLE ABANDONMENT DATE:** 09-22-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		5-5	3-5 0				
			5-4					
5	5-7 soil		4-2	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			4-5					groundwater encountered ▽
					End of boring: 7'bls.			bottom hole
10								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB16S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-22-94	**COMPLETED:** 09-22-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 78.0 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 7 FT. BLS	**DEPTH TO ▽** 7 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 09-22-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		7-9	3-5 0				
			12-11					
5	5-7 soil		4-3	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			9-11					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB17S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-22-94	**COMPLETED:** 09-22-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.7 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 7 FT. BLS	**DEPTH TO ⊽** 7 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 09-22-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		3-3	3-5 0				
			5-5					
5	5-7 soil		5-8	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			9-8					
					End of boring: 7'bls.			groundwater encountered bottom hole ⊽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: CF7SSB18S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-24-94	COMPLETED: 09-24-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 78.3 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS
DEPTH TO ∇ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-24-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 801	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 712				split-spoons
	3-5 soil		3-5	3-5 975				
			6-11					
5	5-7 soil		4-5	5-7 1025	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			5-5					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB19S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-24-94	**COMPLETED:** 09-24-94

DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.2 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ▽** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-24-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 10	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 312				
	3-5 soil		3-4	3-5 401				
			9-7					
5	5-7 soil		3-2	5-7 575	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			2-2					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB20S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-24-94	**COMPLETED:** 09-24-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.4 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 7 FT. BLS	**DEPTH TO ⊽** 7 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 09-24-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		3-5	3-5 0				
			10-10					
5	5-7 soil		6-5	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			4-3					
					End of boring: 7'bls.			groundwater encountered bottom hole ⊽
10								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB21S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-24-94	**COMPLETED:** 09-24-94
DRILL RIG: CME 75 / **DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.2 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ∇** 6.5 FT. BLS
LOGGED BY: M. Pijnenburg / **HOLE ABANDONMENT DATE:** 09-24-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		1-1	3-5 0				
			1-2					
5	5-7 soil		3-7	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			10-10					groundwater encountered ∇
					End of boring: 7'bls.			bottom hole
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB22S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-25-94	**COMPLETED:** 09-25-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 78.0 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS
DEPTH TO ▽ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-25-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		3-8	3-5 0				
			10-10					
5	5-7 soil		5-10	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			11-11					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: CF7SSB23S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-25-94	COMPLETED: 09-25-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 78.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ▽ 7 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-25-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		4-6	3-5 0				
			10-10					
5	5-7 soil		8-8	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			8-8					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB24S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-25-94	COMPLETED: 09-25-94
DRILL RIG: CME 75 / DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.7 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ▽ 7 FT. BLS
LOGGED BY: M. Pijnenburg / HOLE ABANDONMENT DATE: 09-25-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		6-9	3-5 0				
			10-7					
5	5-7 soil		5-6	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			5-3					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB25S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-25-94	**COMPLETED:** 09-25-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 76.4 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS
DEPTH TO ∇ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-25-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 618				
	3-5 soil		3-6	3-5 1340				
			8-14					
5	5-7 soil		4-9	5-7 867	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			12-11					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB26S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Groundwater Protection Inc.		**DATE STARTED:** 09-26-94	**COMPLETED:** 09-26-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.7 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-26-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		4-3	3-5 0				
			2-2					
5	5-7 soil		5-4	5-7 38.1	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			8-4					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB27S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-25-94	COMPLETED: 09-25-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 78.5 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS
DEPTH TO ∇ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-25-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		6-2	3-5 0				
			2-2					
5	5-7 soil		5-4	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			6-9					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6		**LOG of WELL:**	**LOG OF BORING:** CF7SSB28S
CLIENT: SOUTHDIVNAVFACENGCOM			**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.		**DATE STARTED:** 09-26-94	**COMPLETED:** 09-26-94
DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.8 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ∇** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-26-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 9.9	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 12.8				split-spoons
	3-5 soil		5-6	3-5 630				
			6-7					
5	5-7 soil		5-5	5-7 145	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			5-7					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB29S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-26-94	COMPLETED: 09-26-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.4 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ▽ 7 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-26-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP),* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		5-3	3-5 0				
			3-4					
5	5-7 soil		5-8	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			8-10					
					End of boring. 7'bls.			groundwater encountered bottom hole ▽
10								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB30S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-26-94	COMPLETED: 09-26-94

DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.1 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ∇ 7 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-26-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		4-5	3-5 0				
			6-6					
5	5-7 soil		2-2	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			2-3					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB31S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-28-94	**COMPLETED:** 09-28-94

DRILL RIG: CME 75	**DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.1 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO ▽** 7 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 09-28-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		5-6	3-5 0				
			6-3					
5	5-7 soil		2-2	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			6-5					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB32S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-26-94	COMPLETED: 09-26-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: 76.5 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS
DEPTH TO ▽ 7 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-26-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		2-2	3-5 0				
			2-3					
5	5-7 soil		2-2	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			3-3					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB33S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-28-94	COMPLETED: 09-28-94
DRILL RIG: CME 75 / DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 78.1 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ∇ 7 FT. BLS
LOGGED BY: M. Pijnenburg / HOLE ABANDONMENT DATE: 09-28-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		8-8	3-5 0				
			10-10					
5	5-7 soil		10-9	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			10-7					
					End of boring: 7'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:		LOG OF BORING: CF7SSB34S
CLIENT: SOUTHDIVNAVFACENGCOM				PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 09-26-94		COMPLETED: 09-26-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon		PROTECTION LEVEL: D
GROUND ELEV.: 75.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS		DEPTH TO ▽ 7 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 09-26-94			SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		2-2	3-5 0				
			2-3					
5	5-7 soil		5-5	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			4-6					
					End of boring: 7'bls.			groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SSB35S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 10-06-94	**COMPLETED:** 10-06-94
DRILL RIG: CME 75 / **DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.5 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS	**DEPTH TO** ⊻ 6 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 10-06-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous split-spoons
	1-3 soil			1-3 0				
	3-5 soil		8-10	3-5 0				
			7-9					
5	5-7 soil		10-5	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			3-4					groundwater encountered ⊻
					End of boring: 7'bls.			bottom hole
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB36S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

DRILLING SUBCONTRACTOR: Groundwater Protection Inc.		DATE STARTED: 10-06-94	COMPLETED: 10-06-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.2 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ▽ 6 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 10-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		9-12	3-5 0				
			12-10					
5	5-7 soil		3-4	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			2-2					groundwater encountered ▽
					End of boring: 7'bls.			bottom hole
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB37S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 10-06-94	COMPLETED: 10-06-94
DRILL RIG: CME 75 / DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 75.9 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ▽ 6 FT. BLS
LOGGED BY: M. Pijnenburg / HOLE ABANDONMENT DATE: 10-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-3'bls: Hand Auger 3-7'bls: continuous
	1-3 soil			1-3 0				split-spoons
	3-5 soil		8-13	3-5 0				
			12-16					
5	5-7 soil		7-8	5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
			7-5					groundwater encountered ▽
					End of boring: 7'bls.			bottom hole
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB38S
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: n/a	**DATE STARTED:** 10-10-94	**COMPLETED:** 10-10-94
DRILL RIG: n/a	**DRILL MTHD.:** n/a	**SAMP. MTHD.:** Hand Auger
PROTECTION LEVEL: D		
GROUND ELEV.: 78.8 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 7 FT. BLS
DEPTH TO ▽ 8 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 10-10-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)*, 100% quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-7'bls Hand Auger
	1-3 soil			1-3 0				
	3-5 soil			3-5 0				
5	5-7 soil			5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
								groundwater encountered ▽
					End of boring: 7'bls.			bottom hole
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB39S
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: n/a	DATE STARTED: 10-11-94	COMPLETED: 10-11-94
DRILL RIG: n/a / DRILL MTHD.: n/a	SAMP. MTHD.: Hand Auger	PROTECTION LEVEL: D
GROUND ELEV.: 78.8 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 7 FT. BLS	DEPTH TO ▽ 6 FT. BLS
LOGGED BY: M. Pijnenburg / HOLE ABANDONMENT DATE: 10-11-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-1 soil			0-1 0	0-7.0 *Sand (SP)* 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-7'bls Hand Auger
	1-3 soil			1-3 0				
	3-5 soil			3-5 0				
5	5-7			5-7 0	Samples collected were analyzed for USEPA Level III analysis of VOCs, PAHs, TPH, and Lead.			
								groundwater encountered ▽
					End of boring: 7'bls.			bottom hole
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB40
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 11-01-94	COMPLETED: 11-05-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: n/a FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 92 FT. BLS
DEPTH TO ⊽ 10 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 11-05-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0					0-7.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, well sorted, clean, loose.		SP	0-4' bls post hole
5								
6	6-8 soil		9-10	6-8 0				
7			11-9		7.0-10.0 *Clayey Sand (SC)*, 100%, light red to yellowish-brown, fine-grained, sub-angular to sub-rounded, moderately well sorted, soft, saturated.		SC	
8			3-4	8-10 13.6				
9			4-3					
10				10-12 0	10.0-80.0 *Sand (SP)*, 100%, quartz, colorless to light brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, saturated.		SP	groundwater encountered ⊽
15								
20	20-22 soil		5-7	20-22 6.5				
21			7-8					
25								
30								
33					33.0-55.0 color change; light brown to dark gray.			
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SSB40
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 11-01-94	COMPLETED: 11-05-94
DRILL RIG: CME 75	DRILL MTHD.: 2.375" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D		
GROUND ELEV.: n/a FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 82 FT. BLS
DEPTH TO ∇ 10 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 11-05-94	SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
49–51	49–51 soil		1-2 2-2	49–51 3				
50								
55					55.0–80.0 color change: medium gray.			
60								
65								
70	70–72 soil		5-7 7-8	70–72 218				
75								
80	80–82 soil			80–82 0			CL	

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SSB40
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 11-01-94	**COMPLETED:** 11-05-94
DRILL RIG: CME 75 / **DRILL MTHD.:** 2.375" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: n/a FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 92 FT. BLS	**DEPTH TO ▽** 10 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 11-05-94	**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
80			60-50 ref		80.0-92.0 *Clayey Sand (SC)*, 100% quartz, medium to dark gray, fine-to medium-grained, sub-angular, poorly sorted, some dolomite cobbles, shell replacement features visible.		CL	
85								
90	90-92 soil		60-100 ref	90-92 0	Samples collected were analyzed for geotechnical analysis.			
92					End of boring: 92'bls.			bottom hole
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB1
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-05-94	**COMPLETED:** 12-05-94

DRILL RIG: Speedstar 300	**DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.5 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 6 FT. BLS	**DEPTH TO ∇** 6.5 FT. BLS
LOGGED BY: B. McGuffee	**HOLE ABANDONMENT DATE:** 12-05-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 62.1	0-6.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 32.2				
	4-6 soil		3-5	4-6 1100	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals and cyanide.			
5			7-5					
					End of boring: 6'bls.			groundwater encountered bottom hole ∇
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB2
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-08-94	**COMPLETED:** 12-08-94
DRILL RIG: Speedstar 300 / **DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.5 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 6 FT. BLS	**DEPTH TO ▽** 6.5 FT. BLS
LOGGED BY: B. McGuffee	**HOLE ABANDONMENT DATE:** 12-08-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 1.3	0-6.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, some clay.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 3.5				
	4-6 soil		1-1	4-6 1.8	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			1-2					
					End of boring. 6'bls.			
								groundwater encountered bottom hole ▽
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SB3
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 12-06-94	COMPLETED: 12-06-94
DRILL RIG: Speedstar 300	DRILL MTHD.: 2.25" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 77.0 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 6 FT. BLS	DEPTH TO ∇ 6.5 FT. BLS
LOGGED BY: B. McGuffee	HOLE ABANDONMENT DATE: 12-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 3.7	0-6.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, trace clay.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 6.8				
	4-6 soil		8-10	4-6 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			9-5					
					End of boring: 6'bls.			
								groundwater encountered bottom hole ∇
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB4
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-06-94	**COMPLETED:** 12-06-94
DRILL RIG: Speedstar 300	**DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.1 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 6 FT. BLS	**DEPTH TO ∇** 6 FT. BLS	**LOGGED BY:** B. McGuffee
HOLE ABANDONMENT DATE: 12-06-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-6.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		8-6	4-6 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			4-3					
					End of boring: 6'bls.			groundwater encountered bottom hole ∇
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SB5
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 12-06-94	COMPLETED: 12-06-94
DRILL RIG: Speedstar 300	DRILL MTHD.: 2.25" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.2 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 6 FT. BLS	DEPTH TO ▽ 6.5 FT. BLS
LOGGED BY: B. McGuffee	HOLE ABANDONMENT DATE: 12-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-6.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		3-4	4-6 612	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			8-10					
					End of boring: 6'bls.			groundwater encountered bottom hole
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SB6
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 12-06-94	COMPLETED: 12-06-94
DRILL RIG: Speedstar 300	DRILL MTHD.: 2.25" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.5 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 8 FT. BLS	DEPTH TO ▽ 7.5 FT. BLS
LOGGED BY: B. McGuffee	HOLE ABANDONMENT DATE: 12-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-8.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls: Post Hole 4-8'bls: split-spoon
				2-4 2.1				
				4-6 0				
			6-8					
5								
			10-15					
	6-8 soil			6-8 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
			13-13					
			7-8					groundwater encountered ▽
					End of boring: 8'bls.			bottom hole
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SB7
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-08-94	**COMPLETED:** 12-08-94
DRILL RIG: Speedstar 300 / **DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.3 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 8 FT. BLS	**DEPTH TO ▽** 8 FT. BLS
LOGGED BY: B. McGuffee / **HOLE ABANDONMENT DATE:** 12-08-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-8.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, clean.		SP	0-4'bls: Post Hole 4-8'bls: split-spoon
				2-4 0				
	4-8 soil		9-10	4-8 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			13-15					
					End of boring: 8'bls.			groundwater encountered bottom hole ▽
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PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB8
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-08-94	**COMPLETED:** 12-08-94
DRILL RIG: Speedstar 300	**DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.8 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 6 FT. BLS	**DEPTH TO ▽** 6 FT. BLS	**LOGGED BY:** B. McGuffee
HOLE ABANDONMENT DATE: 12-08-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-6.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, clean.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		9-9	4-6 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			10-15					
					End of boring: 6'bls.			groundwater encountered bottom hole ▽
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SB9
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 12-06-94	COMPLETED: 12-06-94
DRILL RIG: Speedstar 300 / DRILL MTHD.: 2.25" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 77.0 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 6 FT. BLS	DEPTH TO ▽ 6 FT. BLS
LOGGED BY: B. McGuffee / HOLE ABANDONMENT DATE: 12-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-6.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, clean.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		7-8	4-6 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			13-15					
					End of boring: 6'bls.			groundwater encountered bottom hole ▽
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB10
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-06-94	**COMPLETED:** 12-06-94
DRILL RIG: Speedstar 300	**DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.5 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 6 FT. BLS	**DEPTH TO ∇** 5.5 FT. BLS	**LOGGED BY:** B. McGuffee
HOLE ABANDONMENT DATE: 12-06-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-6.0 *Sand (SP) and Sandy Clay (CL)* sand, 90%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately sorted; sandy clay, 10%, quartz, light to medium gray to yellowish-brown, dense, wet, homogeneous, sandy.		SP CL	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		6-8	4-6 319	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			9-11					groundwater encountered ∇
					End of boring: 6'bls.			bottom hole
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PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SB11
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-08-94	**COMPLETED:** 12-08-94
DRILL RIG: Speedstar 300 / **DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.3 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 6 FT. BLS	**DEPTH TO ∇** 6 FT. BLS
LOGGED BY: B. McGuffee / **HOLE ABANDONMENT DATE:** 12-08-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-6.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, clean.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		4-4	4-6 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			4-8					
					End of boring: 6'bls.			groundwater encountered bottom hole ∇
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SB12
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 12-06-94	COMPLETED: 12-06-94
DRILL RIG: Speedstar 300	DRILL MTHD.: 2.25" ID HSA	SAMP. MTHD.: 2"x2' spoon	PROTECTION LEVEL: D
GROUND ELEV.: 76.5 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 6 FT. BLS	DEPTH TO ▽ 6 FT. BLS
LOGGED BY: B. McGuffee	HOLE ABANDONMENT DATE: 12-06-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-5.0 *Sand (SP)* 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, clean.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 0				
	4-6 soil		4-5	4-6 0				
5			6-12		5.0-6.0 *Sandy Clay (CL)* 100%, quartz, light to medium gray to yellowish-brown, dense, moist to wet, homogeneous, sandy.		CL	
					Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			groundwater encountered bottom hole ▽
					End of boring: 6'bls.			
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** CF7SB13
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-07-94	**COMPLETED:** 12-07-94
DRILL RIG: Speedstar 300 / **DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.4 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 8 FT. BLS	**DEPTH TO ▽** 5.5 FT. BLS
LOGGED BY: B. McGuffee / **HOLE ABANDONMENT DATE:** 12-07-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6In.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-8.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls: Post Hole 4-8'bls: split-spoon
				2-4 0				
	4-8 soil		3-5	4-8 18	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			6-8					groundwater encountered ▽
					End of boring: 8'bls.			bottom hole
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: CF7SB14
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 12-07-94	COMPLETED: 12-07-94
DRILL RIG: Speedstar 300	DRILL MTHD.: 2.25" ID HSA	SAMP. MTHD.: 2"x2' spoon
PROTECTION LEVEL: D	GROUND ELEV.: 76.7 FT. NGVD	MONITOR INST.: Microtip-PID
TOTAL DEPTH: 8 FT. BLS	DEPTH TO ∇ 7.5 FT. BLS	LOGGED BY: B. McGuffee
HOLE ABANDONMENT DATE: 12-08-94	SITE: 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-8.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, trace sandy clay		SP	0-4'bls: Post Hole 4-8'bls: split-spoon
				2-4 14.3				
			8-8	4-6 0				
5			9-8					
	6-8 soil		4-5	6-8 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
			6-9					groundwater encountered ∇
					End of boring: 8'bls.			bottom hole
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB15
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-07-94	**COMPLETED:** 12-07-94
DRILL RIG: Speedstar 300	**DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 75.9 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 6 FT. BLS	**DEPTH TO ∇** 6 FT. BLS	**LOGGED BY:** B. McGuffee
HOLE ABANDONMENT DATE: 12-07-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 25.7	0-6.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls: Post Hole 4-6'bls: split-spoon
				2-4 127				
	4-6 soil		1-1	4-6 447	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			1-3					
					End of boring: 6'bls.			groundwater encountered bottom hole ∇
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 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB16
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-07-94	**COMPLETED:** 12-07-94
DRILL RIG: Speedstar 300	**DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.2 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 8 FT. BLS	**DEPTH TO ▽** 5.5 FT. BLS	**LOGGED BY:** B. McGuffee
HOLE ABANDONMENT DATE: 12-07-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-8.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft.		SP	0-4'bls Post Hole 4-8'bls: split-spoon
				2-4 0				
	4-8 soil		6-6	4-8 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			7-5					groundwater encountered ▽
					End of boring: 8'bls.			bottom hole
10								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** CF7SB17
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 12-07-94	**COMPLETED:** 12-07-94
DRILL RIG: Speedstar 300 / **DRILL MTHD.:** 2.25" ID HSA	**SAMP. MTHD.:** 2"x2' spoon	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.1 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 8 FT. BLS	**DEPTH TO ∇** 5.5 FT. BLS
LOGGED BY: B. McGuffee / **HOLE ABANDONMENT DATE:** 12-07-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-8.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, soft, clean.		SP	0-4'bls: Post Hole 4-8'bls: split-spoon
				2-4 0				
	4-8 soil		8-9	4-8 0	Samples collected were analyzed for USEPA Level IV analysis of VOCs, BNAs, pesticides/PCBs, TPH/TOC, metals, and cyanide.			
5			9-7					groundwater encountered ∇
					End of boring: 8'bls.			bottom hole
10								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-1
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-19-94	**COMPLETED:** 04-21-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 77.1 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 95 FT. BLS	**DEPTH TO ▽** 11 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 04-21-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 0	0-87.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular, well sorted, clean.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5			5-6 6-6	4-6 0				
	6-8 soil		4-3 6-9	6-8 0				
	8-10 soil		7-10 10-10	8-10 0				
10	11-15 water							groundwater encountered ▽ w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 0 w/ augers: 12'bls
20								
25								
	28-32 water							w/ sampling string: 28'bls w/ augers: 12'bls
30								
35								
40								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-1
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 04-19-94	**COMPLETED:** 04-21-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 77.1 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 95 FT. BLS	**DEPTH TO ∇** 11 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-21-94		**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 53'bls wl augers: 11'bls
55								
60								
65								
70								
	72-74 water							wl sampling string: 64'bls wl augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:		LOG OF BORING: GS-7-1
CLIENT: SOUTHDIVNAVFACENGCOM				PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		DATE STARTED: 04-19-94		COMPLETED: 04-21-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe		PROTECTION LEVEL: D
GROUND ELEV.: 77.1 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 85 FT. BLS		DEPTH TO ▽ 11 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 04-21-94			SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6In.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0–95.0 *Sandy Clay (CL)*, 100%, medium to dark gray, moist, plastic, soft, dense, trace dolomite pebbles.		CL	
90								
	94–95 water							bottom hole augers w/ sampling string: 88'bls w/ augers: 12'bls bottom hole probe
95					95.0–95.5 *Dolomite*, 100%, moderate yellowish-orange to light brown, dense, microcrystaline, well cemented to very well cemented, shell replacement features visible. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 95.5'bls.		DOLOMITE	
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-2
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-21-94	**COMPLETED:** 04-22-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D		
GROUND ELEV.: 77.0 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 85 FT. BLS
DEPTH TO ⊻ 11.5 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-22-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 0	0-7.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular, moderately well to well sorted, soft, clean.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5			5-6 10-10	4-6 0				
	6-8 soil		6-4 10-20	6-8 0				
	8-10 soil		13-12 13-13	8-10 0	7.0-10.0 *Sandy Clay (CL)*, 100%, quartz, light to medium gray to yellowish-brown, dense, dry to moist, compacted, homogeneous, sandy.		CL	
10	11-15 water				10-86.0 *Sand (SP)*, 100%, quartz, colorless to light brown, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted.		SP	w/ sampling string: 0 w/ augers: dry groundwater encountered ⊻
15								
20	18-22 water							w/ sampling string: 0 w/ augers: 15'bls
25								
30	28-32 water							w/ sampling string: 0 w/ augers: 15'bls
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-2
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-21-94	**COMPLETED:** 04-22-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 77.0 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 85 FT. BLS	**DEPTH TO ▽** 11.5 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-22-94	**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 45'bls wl augers: 17'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 68'bls wl augers: 17'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-2
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 04-21-94	COMPLETED: 04-22-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.0 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 95 FT. BLS	DEPTH TO ▽ 11.5 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 04-22-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					86.0–95.0 *Clayey Sand (SC)*, 100%, quartz, medium to dark gray, fine-to medium-grained, sub-angular, poorly to moderately well sorted, clayey, trace dolomite stringers.		SC	
90								
	92-95 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers w/ sampling string 78'bls w/ augers: 15'bls
95					End of boring: 95'bls.			bottom hole probe
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-3
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-23-94	**COMPLETED:** 04-24-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.6 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 85 FT. BLS	**DEPTH TO ▽** 10 FT. BLS
LOGGED BY: M. Pijnenburg / **HOLE ABANDONMENT DATE:** 04-24-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 2.4	0-7.0 *Sand (SP)*, 100%, quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well to well sorted.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 1.4				
			4-8	4-6 1.3				
5			8-6					
	6-8 soil		3-2	6-8 1.2				
			4-10		7.0-10.0 *Sandy Clay (CL)*, 100%, quartz, medium gray to yellowish-brown, dense, dry, well compacted, homogeneous, sandy.		CL	
	8-10 soil		8-6	8-10 1.1				
			8-10					
10					10-87.0 *Sand (SP)*, 100%, quartz, colorless to pale olive green to medium gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty.		SP	groundwater encountered ▽
	11-15 water							wl sampling string: 0 wl augers: dry
15								
	18-22 water							wl sampling string: 0 wl augers: 13'bls
20								
25								
	28-32 water							wl sampling string: 23'bls wl augers: 17'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**		**LOG OF BORING:** GS-7-3
CLIENT: SOUTHDIVNAVFACENGCOM			**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 04-23-94	**COMPLETED:** 04-24-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.8 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 85 FT. BLS	**DEPTH TO ▽** 10 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-24-94		**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-58 water							wl sampling string 55'bls wl augers: 8'bls
55								
60								
65								
70								
	72-78 water							wl sampling string 58'bls wl augers: 14'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-4
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-25-94	**COMPLETED:** 04-28-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D		
GROUND ELEV.: 78.2 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 85 FT. BLS
DEPTH TO ▽ 10 FT. BLS		
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-28-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-87.0 *Sand (SP)*, 100% quartz, dark brown to colorless, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5			1-2 2-2	4-6 0				
	6-8 soil		2-2 2-4	6-8 0				
	8-10 soil		7-10 20-20	8-10 202				
10								▽
	11-15 water							groundwater encountered w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 22'bls w/ augers: 12'bls
20								
25								
	28-32 water							w/ sampling string: 31'bls w/ augers: 12'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-3
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-23-94	**COMPLETED:** 04-24-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.6 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 95 FT. BLS	**DEPTH TO ▽** 10 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-24-94	**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0-95.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 80%, quartz, medium to dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown, poorly cemented, sucrosic, microcrystalline, many shell replacement features visible, friable.		CL DOLOMITE	
90								
	92-95 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers wl sampling string: 66'bls wl augers: 12'bls
95					End of boring: 95'bls.			bottom hole probe
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-4
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-25-94	**COMPLETED:** 04-26-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.2 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 95 FT. BLS	**DEPTH TO ∇** 10 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 04-26-94	**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 45'bls wl augers: 11'bls
55								
60								
65								
70								
	72-74 water							wl sampling string: 69'bls wl augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:		LOG OF BORING: GS-7-4
CLIENT: SOUTHDIVNAVFACENGCOM				PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		DATE STARTED: 04-25-94		COMPLETED: 04-28-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe		PROTECTION LEVEL: D
GROUND ELEV.: 78.2 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 95 FT. BLS		DEPTH TO ▽ 10 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 04-28-94			SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0–95.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 80%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown, poorly cemented, microcrystalline, many shell replacement features visible, sucrosic, friable.		CL DOLOMITE	
90								
	92–95 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers w/ sampling string: 8'bls w/ augers: 9'bls
95					End of boring: 95'bls.			bottom hole probe
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-5
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-28-94	**COMPLETED:** 05-02-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 77.0 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 91 FT. BLS	**DEPTH TO ▽** 10 FT. BLS	**SITE:** 7
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 05-02-94	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 0	0-7.0 *Sand (SP)*, 100% quartz, colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
			7-10 10-8	4-6 0				
5	6-8 soil		3-6 13-12	6-8 0	7.0-10.0 *Sandy Clay (CL)*, 100% quartz, moderate yellowish-brown to light gray, dense, dry, compacted, homogeneous, sandy.		CL	
	8-10 soil		16-13 10-12	8-10 0				
10	11-15 water				10-87.0 *Sand (SP)*, 100% quartz, colorless to moderate yellowish-brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted.		SP	groundwater encountered ▽ wl sampling string: 0 wl augers: dry
15								
	18-22 water							wl sampling string: 0 wl augers: 12'bls
20								
25								
	28-32 water							wl sampling string: 28'bls wl augers: 9'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-5
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 04-26-94	**COMPLETED:** 05-02-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 77.0 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 91 FT. BLS	**DEPTH TO ▽** 10 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 05-02-94	**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 42'bls wl augers: 12'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 69'bls wl augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-5
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 04-28-94	COMPLETED: 05-02-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.0 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 91 FT. BLS	DEPTH TO ▽ 10 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-02-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0-91.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, many shell replacement features visible, friable.		CL DOLOMITE	
90	90-91 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers
					End of boring: 91'bls.			w/ sampling string: 56'bls w/ augers: 13'bls
95								bottom hole probe
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-6
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		DATE STARTED: 05-03-94	COMPLETED: 05-05-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 76.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 92 FT. BLS	DEPTH TO ▽ 11 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-05-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0 2-4 0	0-87.0 *Sand (SP)*, 100%, quartz, light brown to colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
5			3-3 3-4	4-6 0				
	6-8 soil		3-3 5-6	6-8 26				
	8-10 soil		6-3 6-7	8-10 344				
10	11-15 water							groundwater encountered ▽ w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 0 w/ augers: 12'bls
20								
25								
	28-32 water							w/ sampling string: 24'bls w/ augers: 6'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-6
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-03-94	COMPLETED: 05-05-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe
PROTECTION LEVEL: D	GROUND ELEV.: 76.8 FT. NGVD	MONITOR INST.: Microtip-PID
TOTAL DEPTH: 92 FT. BLS	DEPTH TO ▽ 11 FT. BLS	
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-05-94	SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 5'bls wl augers: 9'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 68'bls wl augers: 15'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-6
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-03-94	COMPLETED: 05-05-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 76.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 92 FT. BLS	DEPTH TO ▽ 11 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-05-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0-92.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown, poorly cemented, microcrystalline, shell replacement features visible, sucrosic, friable.		CL DOLOMITE	
90								bottom hole augers
	91-92 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			wl sampling string: 9'bls
					End of boring: 92'bls.			wl augers: 12'bls bottom hole probe
95								
100								
105								
110								
115								
120								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-7
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 05-05-94	**COMPLETED:** 05-08-94

DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.6 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 92 FT. BLS	**DEPTH TO ∇** 11 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 05-08-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
			woh6"-	0-2 0	0-87.0 *Sand (SP)*, 100% quartz, light brown to colorless to medium gray, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-10'bls: continuous split-spoons
			woh6"-					
			3-1	2-4 0				
			3-5					
			5-3	4-6 0				
5			3-5					
	6-8 soil		7-8	6-8 0				
			8-13					
	8-10 soil		8-8	8-10 0				
			16-3					
10								
	11-15 water							groundwater encountered ∇ wl sampling string: 0 wl augers: dry
15								
	18-22 water							wl sampling string: 0 wl augers: 1'fbls
20								
25								
	28-32 water							wl sampling string: 3'fbls wl augers: 10'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-7
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-05-94	COMPLETED: 05-06-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA / SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 78.8 FT. NGVD	MONITOR INST.: Microtip-PID / TOTAL DEPTH: 92 FT. BLS	DEPTH TO ▽ 11 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-06-94	SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 5ftbls wl augers: 1ftbls
55								
60								
65								
70								
	72-76 water							wl sampling string: 66'bls wl augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-7
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-05-94	COMPLETED: 05-08-94
DRILL RIG: Gus Pech BR22 / DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 76.6 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 92 FT. BLS	DEPTH TO ∇ 11 FT. BLS
LOGGED BY: M. Pijnenburg / HOLE ABANDONMENT DATE: 05-08-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0–92.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown, poorly cemented, microcrystalline, shell replacement features visible, sucrosic, friable.		CL DOLOMITE	
90	91-92 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers wl sampling string: 89'bls wl augers: 11'bls bottom hole probe
					End of boring: 92'bls.			
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-8
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 05-07-94	**COMPLETED:** 05-08-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.5 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 81 FT. BLS	**DEPTH TO ▽** 11 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 05-08-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0			10-8 6-6	0-2 0	0-87.0 *Sand (SP)*, 100%, quartz, light brown to colorless to medium gray, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-10'bls: continuous split-spoons
			6-15 15-10	2-4 0				
			8-18 18-18	4-6 0				
5	6-8 soil		10-10 10-10	6-8 546				
	8-10 soil		8-8 10-14	8-10 412				
10	11-15 water							groundwater encountered ▽ w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 0 w/ augers: 1'bls
20								
25								
	28-32 water							w/ sampling string: 3'bls w/ augers: 8'bls
30								
35								
40								

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-8
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 05-07-94	**COMPLETED:** 05-08-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.5 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 91 FT. BLS	**DEPTH TO ▽** 11 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 05-08-94		**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 0 wl augers: 11'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 68'bls wl augers: 16'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-8
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-07-94	COMPLETED: 05-08-94
DRILL RIG: Gus Pech BR22 / DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 76.5 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 91 FT. BLS	DEPTH TO ▽ 11 FT. BLS
LOGGED BY: M. Pijnenburg / HOLE ABANDONMENT DATE: 05-08-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
	88-91 water				87.0-91.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers w/ sampling string: 81'bls
90					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			w/ augers: 11'bls
					End of boring: 91'bls.			bottom hole probe
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-9
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 05-08-94	**COMPLETED:** 05-10-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.6 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 81 FT. BLS	**DEPTH TO ∇** 11.5 FT. BLS
LOGGED BY: M. Pijnenburg / **HOLE ABANDONMENT DATE:** 05-10-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
			2-2	0-2 0	0-87.0 *Sand (SP)*, 100% quartz, light gray to colorless, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-10'bls: continuous split-spoons
			2-2					
			1-2	2-4 0				
			5-5					
5			5-6	4-6 0				
	6-8 soil		6-5					
			4-5	6-8 0				
	8-10 soil		10-10					
			10-16	8-10 0				
			20-20					
10								
	11-15 water							w/ sampling string 0 w/ augers: 6'bls groundwater encountered ∇
15								
	18-22 water							w/ sampling string 20'bls w/ augers: 7'bls
20								
25								
	28-32 water							w/ sampling string n/a w/ augers: n/a
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-9
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 05-08-94	**COMPLETED:** 05-10-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 75.8 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 91 FT. BLS	**DEPTH TO ∇** 11.5 FT. BLS	**LOGGED BY:** M. Pijnenburg
HOLE ABANDONMENT DATE: 05-10-94	**SITE:** 7	

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 48'bls wl augers: 7'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 74'bls wl augers: 10'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-9
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 05-08-94	**COMPLETED:** 05-10-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA / **SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.6 FT. NGVD	**MONITOR INST.:** Microtip-PID / **TOTAL DEPTH:** 91 FT. BLS	**DEPTH TO** ▽ 11.5 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 05-10-94	**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0-91.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	
90	90-91 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers w/ sampling string: 84'bls w/ augers: 1'bls bottom hole probe
					End of boring: 91'bls.			
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-10
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-10-94	COMPLETED: 05-18-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe
PROTECTION LEVEL: D		
GROUND ELEV.: 75.4 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 92 FT. BLS
DEPTH TO ▽ 10 FT. BLS		
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-18-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 3.2	0-87.0 *Sand (SP)*, 100% quartz, colorless to medium brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 5.1				
	4-6 soil		2-4	4-6 5.4				
5			4-2					
			woh12"	6-8 5.1				
			5-10					
	8-10 soil		8-7	8-10 5.9				
			12-12					
10								groundwater encountered ▽
	11-15 water							w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 0 w/ augers: 1fbls
20								
25								
	28-32 water							w/ sampling string: 25'bls w/ augers: 7'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-10
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 05-10-94	COMPLETED: 05-18-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 75.4 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 82 FT. BLS	DEPTH TO ▽ 10 FT. BLS
LOGGED BY: M. Pijnenburg	HOLE ABANDONMENT DATE: 05-18-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-58 water							wl sampling string: 53'bls wl augers: 10'bls
55								
60								
65								
70								
	72-78 water							wl sampling string: 73'bls wl augers: 11'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-10
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 05-10-94	**COMPLETED:** 05-18-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.4 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 92 FT. BLS	**DEPTH TO ▽** 10 FT. BLS
LOGGED BY: M. Pijnenburg	**HOLE ABANDONMENT DATE:** 05-18-94		**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
					87.0-92.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystaline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	
90	90-92 water				Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole augers w/ sampling string: 0
					End of boring: 92'bls.			w/ augers: 17bls bottom hole probe
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-11
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-14-94	**COMPLETED:** 07-15-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 75.8 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 81 FT. BLS	**DEPTH TO ▽** 10 FT. BLS	**LOGGED BY:** A. Workman
HOLE ABANDONMENT DATE: 07-15-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 0 2-5 0	0-89.0 *Sand (SP)*, 100% quartz, colorless to light gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-5'bls: post hole 5-9'bls: continuous split-spoons
5	5-7 soil 7-9 soil		1-1 1-3 3-4 7-8	5-7 0 7-9 0				
10	11-15 water							groundwater encountered ▽ w/ sampling string: 10'bls w/ augers: dry
15	18-22 water							w/ sampling string: 0 w/ augers: 10'bls
20								
25	28-32 water							w/ sampling string: 0 w/ augers: 12'bls
30								
35								
40								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-11
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-14-94	COMPLETED: 07-15-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 75.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 81 FT. BLS	DEPTH TO ▽ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-15-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 48'bls wl augers: 5'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 66'bls wl augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-11
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-14-94	COMPLETED: 07-15-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe
PROTECTION LEVEL: D		
GROUND ELEV.: 75.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 81 FT. BLS
DEPTH TO ∇ 10 FT. BLS		
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-15-94	SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
90	89-91 water				89.0-91.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 80%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers w/ sampling string: 78'bls w/ augers: 8'bls bottom hole probe
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			
					End of boring: 91'bls.			
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-12
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 07-16-94	**COMPLETED:** 07-17-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.8 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ▽** 8 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 07-17-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-87.0 *Sand (SP)*, 100% quartz, colorless to brown to dark brown to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5			5-6 6-4	4-6 0				
	6-8 soil		3-7 9-13	6-8 0				
	8-10 soil		10-11 12-14	8-10 0				groundwater encountered ▽
10	11-15 water							w/ sampling string: 0 w/ augers: 8'bls
15								
	18-22 water							w/ sampling string: 0 w/ augers: 17'bls
20								
25								
	28-32 water							w/ sampling string: 28'bls w/ augers: 17'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8		LOG of WELL:		LOG OF BORING: GS-7-12
CLIENT: SOUTHDIVNAVFACENGCOM				PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		DATE STARTED: 07-16-94		COMPLETED: 07-17-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe		PROTECTION LEVEL: D
GROUND ELEV.: 76.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS		DEPTH TO ∇ 8 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-17-94			SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string 48'bls wl augers: 9'bls
55								
60								
65								
70								
	72-76 water							wl sampling string 66'bls wl augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6		**LOG of WELL:**		**LOG OF BORING:** GS-7-12
CLIENT: SOUTHDIVNAVFACENGCOM				**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 07-16-94		**COMPLETED:** 07-17-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe		**PROTECTION LEVEL:** D
GROUND ELEV.: 76.8 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS		**DEPTH TO ∇** 8 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 07-17-94			**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
	87-89 water				87.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers wl sampling string 84'bls wl augers: 10'bls bottom hole probe
90					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			
					End of boring: 89'bls.			
95								
100								
105								
110								
115								
120								

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-13
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-17-94	COMPLETED: 07-18-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA / SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 78.4 FT. NGVD	MONITOR INST.: Microtip-PID / TOTAL DEPTH: 90 FT. BLS	DEPTH TO ∇ 8 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-18-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 0	0-89.0 *Sand (SP)*, 100%, quartz, colorless to brown to dark brown to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5			2-2 3-4	4-6 0				
	6-8 soil		4-7 7-11	6-8 0				
	8-10 soil		13-13 13-14	8-10 0				groundwater encountered ∇
10	11-15 water							w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 0 w/ augers: 12'bls
20								
25								
	28-32 water							w/ sampling string: 0 w/ augers: 13'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-13
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-17-94	**COMPLETED:** 07-18-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.4 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 90 FT. BLS	**DEPTH TO ▽** 8 FT. BLS
LOGGED BY: A. Workman / **HOLE ABANDONMENT DATE:** 07-18-94		**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string 0 wl augers: 8'bls
55								
60								
65								
70								
	72-76 water							wl sampling string 0 wl augers: 10'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-13
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-17-94	**COMPLETED:** 07-18-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.4 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 90 FT. BLS	**DEPTH TO** ▽ 8 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 07-18-94	**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	88-90 water							bottom hole augers w/ sampling string: 88'bls w/ augers: 8'bls bottom hole probe
					89.0-90.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	
90					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			
					End of boring: 90'bls.			
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-14
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-19-94	**COMPLETED:** 07-25-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 77.8 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 88 FT. BLS	**DEPTH TO ▽** 9 FT. BLS
LOGGED BY: A. Workman / **HOLE ABANDONMENT DATE:** 07-25-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-84.0 *Sand (SP)*, 100%, quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty, loose, saturated.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5	4-6 soil		5-5 3-2	4-6 0				
	6-8 soil		3-9 8-8	6-8 0				
			5-7 7-7	8-10 0				groundwater encountered ▽
10	11-15 water							wl sampling string: 0 wl augers: dry
15								
20	18-22 water							wl sampling string: 0 wl augers: 11'bls
25								
30	28-32 water							wl sampling string: 0 wl augers: 9'bls
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-14
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-19-94	COMPLETED: 07-25-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 88 FT. BLS	DEPTH TO ▽ 9 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-25-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 48'bls wl augers: 9'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 75'bls wl augers: 8'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-14
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-19-94	COMPLETED: 07-25-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe
PROTECTION LEVEL: D	GROUND ELEV.: 77.8 FT. NGVD	MONITOR INST.: Microtip-PID
TOTAL DEPTH: 88 FT. BLS	DEPTH TO ▽ 9 FT. BLS	LOGGED BY: A. Workman
HOLE ABANDONMENT DATE: 07-25-94	SITE: 7	

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	86-88 water				84.0-88.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 88'bls.		CL DOLOMITE	bottom hole augers w/ sampling string 87'bls w/ augers: 8'bls bottom hole probe
90								
95								
100								
105								
110								
115								
120								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-15
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-25-94	COMPLETED: 07-28-94
DRILL RIG: Gus Pech BR22 / DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.0 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 88 FT. BLS	DEPTH TO ▽ 8 FT. BLS
LOGGED BY: A. Workman / HOLE ABANDONMENT DATE: 07-28-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-84.0 *Sand (SP)*, 100% quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
			6-10	4-6 0				
5			8-8					
	6-8 soil		8-15 15-27	6-8 0				
	8-10 soil		23-24 31-18	8-10 0				groundwater encountered ▽
10	11-15 water							w/ sampling string: 0 w/ augers: 9'bls
15								
	18-22 water							w/ sampling string: 8'bls w/ augers: 8'bls
20								
25								
	28-32 water							w/ sampling string: 28'bls w/ augers: 8'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-15
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-25-94	**COMPLETED:** 07-28-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 77.0 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 88 FT. BLS	**DEPTH TO ▽** 8 FT. BLS	**LOGGED BY:** A. Workman
HOLE ABANDONMENT DATE: 07-28-94	**SITE:** 7	

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 54'bls wl augers: 10'bls
55								
60								
65								
70								
	74-77 water							wl sampling string: 0 wl augers: 13'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-15
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-25-94	COMPLETED: 07-28-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.0 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 88 FT. BLS	DEPTH TO ▽ 8 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-28-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	86-88 water				84.0-88.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 88'bls.		CL DOLOMITE	bottom hole augers wl sampling string 83'bls wl augers: 13'bls bottom hole probe
90								
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-16
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 07-29-94	COMPLETED: 07-30-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.4 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ∇ 9 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-30-94		SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-85.0 *Sand (SP)*, 100% quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
5			7-3 4-6	4-6 0				
	6-8 soil		8-7 8-11	6-8 0				
	8-10 soil		8-8 17-13	8-10 0				groundwater encountered ∇
10	11-15 water							w/ sampling string: 0 w/ augers: 9'bls
15								
	18-22 water							w/ sampling string: 20'bls w/ augers: 9'bls
20								
25								
	28-32 water							w/ sampling string: 29'bls w/ augers: 9'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6		LOG of WELL:	LOG OF BORING: GS-7-16
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		DATE STARTED: 07-29-94	COMPLETED: 07-30-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 77.4 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ▽ 9 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 07-30-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string 55'bls wl augers: 10'bls
55								
60								
65								
70								
	74-77 water							wl sampling string 74'bls wl augers: 15'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**		**LOG OF BORING:** GS-7-16
CLIENT: SOUTHDIVNAVFACENGCOM			**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 07-29-94	**COMPLETED:** 07-30-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 77.4 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ∇** 9 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 07-30-94		**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	86-89 water				85.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*; sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 89'bls.		CL DOLOMITE	bottom hole augers w/ sampling string: 88'bls w/ augers: 10'bls bottom hole probe
90								
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-16
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 07-31-94	**COMPLETED:** 07-31-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.0 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 88 FT. BLS	**DEPTH TO ▽** 8 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 07-31-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
	0-2 soil			0-2 0	0-85.0 *Sand (SP)*, 100% quartz, light brown to dark brown to reddish-yellow, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
			2-2	4-6 0				
5			2-1					
			5-13	6-8 0				
			28-26					
	8-10 soil		19-21	8-10 0				groundwater encountered ▽
			48-47					
10								
	11-15 water							w/ sampling string: 0 w/ augers: 8'bls
15								
	18-22 water							w/ sampling string: 0 w/ augers: 11'bls
20								
25								
	28-32 water							w/ sampling string: 0 w/ augers: 10'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-16
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-31-94	**COMPLETED:** 07-31-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.0 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 89 FT. BLS	**DEPTH TO ⊽** 9 FT. BLS	**LOGGED BY:** A. Workman
HOLE ABANDONMENT DATE: 07-31-94	**SITE:** 7	

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 47'bls wl augers: 9'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 74'bls wl augers: 9'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-16
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 07-31-94	**COMPLETED:** 07-31-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 76.0 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ∇** 9 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 07-31-94	**SITE:** 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	85-89 water				85.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 89'bls.		CL DOLOMITE	bottom hole augers w/ sampling string: 86'bls w/ augers: 9'bls bottom hole probe
90								
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-18
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 08-01-94	**COMPLETED:** 08-01-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.7 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ∇** 10 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 08-01-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0	0-84.0 *Sand (SP)*, 100%, quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
			2-5 10-11	4-6 0				
5	6-8 soil		4-9 7-6	6-8 0				
	8-10 soil		5-7 7-7	8-10 0				
10								groundwater encountered ∇
	11-15 water							wl sampling string: 0 wl augers: dry
15								
	18-22 water							wl sampling string: 0 wl augers: 11'bls
20								
25								
	28-32 water							wl sampling string: 32'bls wl augers: 11'bls
30								
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-18
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services		**DATE STARTED:** 08-01-94	**COMPLETED:** 08-01-94
DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.7 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ∇** 10 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 08-01-94		**SITE:** 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-58 water							wl sampling string: 0 wl augers: 1f'bls
55								
60								
65								
70								
	72-78 water							wl sampling string: 69'bls wl augers: 1f'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-18
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 08-01-94	COMPLETED: 08-01-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 76.7 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ▽ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-01-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	85-89 water				84.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	bottom hole augers w/ sampling string: 80'bls wl augers: 1fbls
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			
					End of boring: 89'bls.			bottom hole probe
90								
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-19
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 08-02-94	COMPLETED: 08-03-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA; SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 78.3 FT. NGVD	MONITOR INST.: Microtip-PID; TOTAL DEPTH: 89 FT. BLS	DEPTH TO ▽ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-03-94	SITE: 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	SOIL CLASS	REMARKS
0			0-2 0	0-85.0 *Sand (SP)*, 100%, quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty, saturated, loose.	SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
			2-4 0			
5		2-7 5-3	4-6 0			
	6-8 soil	3-4 6-11	6-8 0			
	8-10 soil	4-7 10-15	8-10 0			
10						groundwater encountered ▽
	11-15 water					w/ sampling string: 0 w/ augers: 10'bls
15						
	18-22 water					w/ sampling string: 0 w/ augers: 10'bls
20						
25						
	28-32 water					w/ sampling string: 0 w/ augers: 10'bls
30						
35						
40						

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-19
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 08-02-94	COMPLETED: 08-03-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 78.3 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ∇ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-03-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string: 52'bls wl augers: 10'bls
55								
60								
65								
70								
	72-76 water							wl sampling string: 73'bls wl augers: 10'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-19
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 08-02-94	COMPLETED: 08-03-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 76.3 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ∇ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-03-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	85-89 water				85.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 80%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 89'bls.		CL DOLOMITE	bottom hole augers w/ sampling string 0 w/ augers: 10'bls bottom hole probe
90								
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-20
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22

DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 08-08-94	**COMPLETED:** 08-08-94

DRILL RIG: Gus Pech BR22	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 78.8 FT. NGVD	**MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ∇** 10 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 08-08-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
				0-2 0 2-4 0	0-88.0 *Sand (SP)*, 100%, quartz, light to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty, saturated, loose.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
5	4-6 soil 6-8 soil		2-4 7-7 2-5 7-12 6-10 10-12	4-6 0 6-8 0 8-10 0				
10	11-15 water							groundwater encountered ∇ wl sampling string: 0 wl augers: dry
15								
20	18-22 water							wl sampling string: 0 wl augers: 12'bls
25								
30	28-32 water							wl sampling string: 0 wl augers: 10'bls
35								
40								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8		LOG of WELL:	LOG OF BORING: GS-7-20
CLIENT: SOUTHDIVNAVFACENGCOM			PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services		DATE STARTED: 08-08-94	COMPLETED: 08-08-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 78.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ▽ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-08-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-58 water							w/ sampling string: 0 w/ augers: 10'bls
55								
60								
65								
70								
	72-78 water							w/ sampling string: 73'bls w/ augers: 12'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-20
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 08-08-94	COMPLETED: 08-08-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe / PROTECTION LEVEL: D
GROUND ELEV.: 78.8 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS / DEPTH TO ▽ 10 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-08-94	SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	85-89 water							bottom hole augers w/ sampling string: 88'bls w/ augers: 10'bls
					86.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*: sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles.		CL DOLOMITE	
					Samples collected were analyzed for USEPA Method 8010/8020 and TPH.			bottom hole probe
90					End of boring: 89'bls.			
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-21
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 08-11-94	**COMPLETED:** 08-12-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.9 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO ▽** 9 FT. BLS
LOGGED BY: A. Workman	**HOLE ABANDONMENT DATE:** 08-12-94	**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0				0-2 0	0-85.0 *Sand (SP)*, 100% quartz, brown to dark brown to tan to gray to dark gray, fine-to medium-grained, sub-angular to sub-rounded, poorly to moderately well sorted, occasionally silty, saturated, loose.		SP	0-4'bls: post hole 4-10'bls: continuous split-spoons
				2-4 0				
	4-6 soil		3-3 2-1	4-6 0				
5			3-3 8-9	6-8 0				
	8-10 soil		3-11 12-13	8-10 0				groundwater encountered ▽
10	11-15 water							w/ sampling string: 0 w/ augers: dry
15								
	18-22 water							w/ sampling string: 0 w/ augers: 10'bls
20								
25								
	28-32 water							w/ sampling string: 32'bls w/ augers: 10'bls
30								
35								
40								

ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	LOG of WELL:	LOG OF BORING: GS-7-21
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	DATE STARTED: 08-11-94	COMPLETED: 08-12-94
DRILL RIG: Gus Pech BR22	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Aqua Probe	PROTECTION LEVEL: D
GROUND ELEV.: 75.9 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 89 FT. BLS	DEPTH TO ▽ 9 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 08-12-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
	52-56 water							wl sampling string 0 wl augers: 11'bls
55								
60								
65								
70								
	72-76 water							wl sampling string 73'bls wl augers: 10'bls
75								
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,8	**LOG of WELL:**	**LOG OF BORING:** GS-7-21
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Layne Environmental Services	**DATE STARTED:** 08-11-94	**COMPLETED:** 08-12-94
DRILL RIG: Gus Pech BR22 / **DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Aqua Probe	**PROTECTION LEVEL:** D
GROUND ELEV.: 75.9 FT. NGVD / **MONITOR INST.:** Microtip-PID	**TOTAL DEPTH:** 89 FT. BLS	**DEPTH TO** ▽ 9 FT. BLS
LOGGED BY: A. Workman / **HOLE ABANDONMENT DATE:** 08-12-94		**SITE:** 7

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85	85-89 water				85.0-89.0 *Sandy Clay (CL) with Dolomite Cobbles*, sandy clay, 60%, quartz, dark gray, dense, moist, soft, sandy; dolomite cobbles, 40%, moderate yellowish-brown to light gray, poorly cemented, sucrosic, microcrystalline, shell replacement features visible, friable, occasional dolomite pebbles. Samples collected were analyzed for USEPA Method 8010/8020 and TPH. End of boring: 89'bls.		CL DOLOMITE	bottom hole augers w/ sampling string: 83'bls w/ augers: 1'bls bottom hole probe
90								
95								
100								
105								
110								
115								
120								

Continued from PAGE 2

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	**LOG of WELL:**	**LOG OF BORING:** GS-7-22
CLIENT: SOUTHDIVNAVFACENGCOM		**PROJECT NO:** 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	**DATE STARTED:** 09-22-94	**COMPLETED:** 09-24-94
DRILL RIG: CME 75	**DRILL MTHD.:** 4.25" ID HSA	**SAMP. MTHD.:** Hydropunch
PROTECTION LEVEL: D	**GROUND ELEV.:** 76.2 FT. NGVD	**MONITOR INST.:** Microtip-PID
TOTAL DEPTH: 94 FT. BLS	**DEPTH TO ▽** 7 FT. BLS	**LOGGED BY:** A. Workman
HOLE ABANDONMENT DATE: 09-24-94	**SITE:** 7	

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
0					0-94.0 *Sand (SP)*, 100%, quartz, light to dark brown, fine-to medium-grained, sub-angular to sub-rounded, moderately well sorted, occasionally silty.		SP	
5								
7								groundwater encountered ▽
8	8-10 water							
10								
15								
20	20-22 water							
25								
30	30-32 water							
35								
40								

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-22
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-22-94	COMPLETED: 09-24-94
DRILL RIG: CME 75 / DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Hydropunch	PROTECTION LEVEL: D
GROUND ELEV.: 78.2 FT. NGVD / MONITOR INST.: Microtip-PID	TOTAL DEPTH: 94 FT. BLS	DEPTH TO ▽ 7 FT. BLS
LOGGED BY: A. Workman / HOLE ABANDONMENT DATE: 09-24-94		SITE: 7

Continued from PAGE 1

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
45								
50								
55	54-56 water							
60								
65								
70								
75	74-76 water							
80								

 ABB ENVIRONMENTAL SERVICES, INC.

PROJECT: NAS Cecil Field RI OUs 3,4,5,6	LOG of WELL:	LOG OF BORING: GS-7-22
CLIENT: SOUTHDIVNAVFACENGCOM		PROJECT NO: 8520.22
DRILLING SUBCONTRACTOR: Groundwater Protection Inc.	DATE STARTED: 09-22-94	COMPLETED: 09-24-94
DRILL RIG: CME 75	DRILL MTHD.: 4.25" ID HSA	SAMP. MTHD.: Hydropunch	PROTECTION LEVEL: D
GROUND ELEV.: 78.2 FT. NGVD	MONITOR INST.: Microtip-PID	TOTAL DEPTH: 94 FT. BLS	DEPTH TO ▽ 7 FT. BLS
LOGGED BY: A. Workman	HOLE ABANDONMENT DATE: 09-24-94		SITE: 7

Continued from PAGE 2

DEPTH FT.	SAMP. DEPTH /MATRIX.	SAMPLE INTERVAL	BLOWS/6in.	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	REMARKS
					Sand continued.		SP	
85								
90								
					Samples collected were analyzed for USEPA Method 8010/8020.			
	93-94 water							
					End of boring: 94'bls.			
95								
100								
105								
110								
115								
120								

 ABB ENVIRONMENTAL SERVICES, INC.