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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY PHASE IIC WORK PLAN FOR SITES 3, 4, 30, 32 AND 33 NAS WHITING FIELD FL

8/1/1997

BROWN & ROOT ENVIRONMENTAL

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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY PHASE II-C WORK PLAN FOR SITES 3, 4, 30, 32, AND 33

Naval Air Station
Whiting Field
Milton, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order CTO-0028

AUGUST 1997

Rev. 1
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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY PHASE II-C WORK PLAN FOR SITES 3, 4, 30, 32, AND 33

NAVAL AIR STATION WHITING FIELD MILTON, FLORIDA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

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Naval Facilities Engineering Command
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PROFESSIONAL GEOLOGIST CERTIFICATION

This document, *Remedial Investigation and Feasibility Study Phase IIC Work Plan for Sites 3, 4, 30, 32, and 33*, Naval Air Station Whiting Field, Milton, Florida, has been prepared under the direction of a Florida Registered Professional Geologist. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document was prepared for U.S. Naval Air Station Whiting Field, Milton, Florida, and should not be construed to apply to any other site.

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FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment. With growing knowledge of the long-term effects of hazardous materials on the environment, the U. S. Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at its facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act, and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and federal facilities. The CERCLA and SARA acts form the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Naval Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program consists of Preliminary Assessment (PA) and Site Inspections (SIs), Remedial Investigation (RI) and Feasibility Study (FS), and Remedial Design (RD) and Remedial Action (RA) at sites where chemicals were allegedly spilled or disposed of. The PA and SI identify the presence of pollutants. The nature and extent of contamination as well as the selected remedial solutions are determined during the RI/FS. The RD and RA are performed to complete implementation of the solution.

The investigative procedures, site assessment activities, and remedial alternative evaluations to be performed during RI/FS Phase II-C Work Plan activities at Sites 3, 4, 30, 32, and 33 are discussed in this report.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection (formerly the Florida Department of Environmental Regulation) oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. All aspects of the program are conducted in compliance with state and federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1878, at (803) 820-5574.

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ABB-ES	ABB Environmental Services, Inc.
AIMD	Aircraft Intermediate Maintenance Department
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
AVGAS	aviation gasoline
B&R Environmental	Brown & Root Environmental
bls	below land surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAR	Contamination Assessment Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	chemical of concern
COMPQAP	Comprehensive Quality Assurance Plan
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DMS	database management system
DNAPL	dense, nonaqueous-phase liquid
DO	dissolved oxygen
DPT	direct-push technology
DQO	data quality objective
EDB	ethylene dibromide
ELCR	excess lifetime cancer risk
EP Tox	Extraction Procedure Toxicity
EPC	exposure point concentration
ERA	ecological risk assessment
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FFS	Focused Feasibility Study

ACRONYMS AND ABBREVIATIONS (continued)

FID	flame ionization detector
FOL	Field Operations Leader
FR	Federal Register
FS	Feasibility Study
GAC	granular activated carbon
GC	gas chromatograph
GPS	Global Positioning System
HHCOPC	human health chemicals of potential concern
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HRS	Hazard Ranking System
HSA	hollow-stem auger
IAS	Initial Assessment Study
IDW	investigation-derived waste
IR	Installation Restoration
IRIS	Integrated Risk Information System
LOAEL	lowest observed adverse effect level
MCL	Maximum Contaminant Level
MSL	mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants
NAPL	nonaqueous-phase liquid
NAS	Naval Air Station
Navy	U.S. Navy
NCP	National Oil and Hazardous Substances Contingency Plan
NFA	No Further Action
NGVD	National Geodetic Vertical Datum
NOAEL	no observed adverse effect level
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
NWFWMD	Northwest Florida Water Management District

ACRONYMS AND ABBREVIATIONS (continued)

OLF	Outlying Landing Field
ORNL	Oak Ridge National Laboratory
OVA	organic vapor analyzer
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethene
POC	Point of Contact
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RAO	remedial action objective
RBC	risk-based concentration
RD	Remedial Design
Redox	oxidation-reduction
RfD	reference dose
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RTV	reference toxicity value
SACM	Superfund Accelerated Cleanup Model
SARA	Superfund Amendments Reauthorization Act of 1986
SI	Site Inspection
SOP	Standard Operating Procedure
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SOW	Scope of Work
SQL	sample quantitation limit
SSL	soil screening level
SVE	soil vapor extraction
SVOC	semivolatile organic compound

ACRONYMS AND ABBREVIATIONS (continued)

TAL	target analyte list
TCA	trichloroethane
TCE	trichloroethene
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
TRAWING FIVE	Training Air Wing Five
UCL	upper confidence limit
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UV	ultraviolet
VOC	volatile organic compound

EXECUTIVE SUMMARY

The work to be performed for the Remedial Investigation and Feasibility Study at Sites 3, 4, 30, 32, and 33 at Naval Air Station Whiting Field, Milton, Florida, are presented in this Work Plan. At Sites 30 and 33 only soils will be investigated because groundwater is being investigated by another environmental consultant under Phase II-B of the Remedial Investigation and Feasibility Study. Remedial Investigation and Feasibility Study activities will be performed in accordance with this Work Plan as well as with Brown and Root Environmental's *Comprehensive Quality Assurance Plan* (Florida Department of Environmental Protection Comprehensive Quality Assurance Plan No. 870055G) and with its 1997 *Site-Specific Health and Safety Plan*. This Remedial Investigation and Feasibility Study is being conducted by Southern Division, Naval Facilities Engineering Command as part of the U.S. Department of Defense Installation Restoration program.

The purpose of this Work Plan is to propose an investigation to further define the nature and extent of contamination at Sites 3, 4, 30, 32, and 33. The information generated from this investigation will be used as a basis for recommending remedial alternatives that address identifiable risks to public health and the environment. To achieve this objective, the Remedial Investigation will collect data sufficient to assess the nature and extent of contaminants and to evaluate remedial alternatives associated with each site. The Feasibility Study will use the data collected during the Remedial Investigation as well as data from previous investigations to evaluate and recommend remedial alternatives.

This Work Plan is intended to be a dynamic document that permits flexibility during implementation of the investigation at Sites 3, 4, 30, 32, and 33. Central to this work is an understanding that complete site characterization is not possible, or even necessary. Furthermore, investigators must recognize that uncertainties will remain that will have to be managed during the Remedial Investigation and Feasibility Study. By managing these uncertainties and moving forward to developing and implementing remedies, the overall Remedial Investigation and Feasibility Study process will be streamlined and shortened. Such streamlining was the U. S. Environmental Protection Agency's major objective in the development of the Superfund Accelerated Cleanup Model, which permits earlier initiation of remedies, thereby reducing existing risks to humans and the environment.

As part of the Superfund Accelerated Cleanup Model process, presumptive remedies are encouraged that will enable the continued focusing of the program. The presumptive remedy approaches identified by the U.S. Environmental Protection Agency for Superfund sites with contaminated groundwater and volatile organic compounds in soil have been used to plan for the collection of appropriate data during the field investigation. The overall objective of this Work Plan is to collect only those data required to further define the nature and extent of contamination and that are required to evaluate the remedial technologies applied to reach the remedial objectives. Additionally, only data that will permit the evaluation of risks and exposures as related to the application of the presumptive remedy will be acquired.

The field program proposed in this document was developed to achieve these goals. The field program will include the collection of soil, biota, and groundwater samples for data evaluation and analysis. The resulting data should enable sufficient site characterization and risk evaluation for determination of the appropriate technologies to support the presumptive remedy for this site.

1.0 INTRODUCTION

1.1 REGULATORY BACKGROUND

To meet its mission objectives, the U.S. Navy (Navy) performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks as well as through conventional past methods of disposal, hazardous materials may have entered the environment. With growing knowledge of the long-term effects of hazardous materials on the environment, the U.S. Department of Defense initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at its facilities. One of these programs is the Installation Restoration (IR) program.

Originally, the Navy's program was called the Navy Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adopted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages as follows:

1. Preliminary Assessment (PA),

2. Site Inspection (SI) [under the NACIP program, the PA and SI steps were called the Initial Assessment Study (IAS)],

3. Remedial Investigation (RI) and Feasibility Study (FS), and

4. Remedial Design and Remedial Action.

The Navy IR program was designed to identify and abate or control contaminant migration resulting from past operations at naval installations, with a goal of expediting and improving environmental response actions while protecting human health and the environment. The IR program is conducted in accordance with Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and Executive Order 12580. CERCLA requires that federal facilities comply with the act, both procedurally and substantively. Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) is the agency responsible for the Navy IR program in the southeastern

United States; therefore, SOUTHNAVFACENGCOM has the responsibility of processing Naval Air Station (NAS) Whiting Field through the PA, SI, RI/FS, and remedial response selection in compliance with the guidelines of the National Oil and Hazardous Substances Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300].

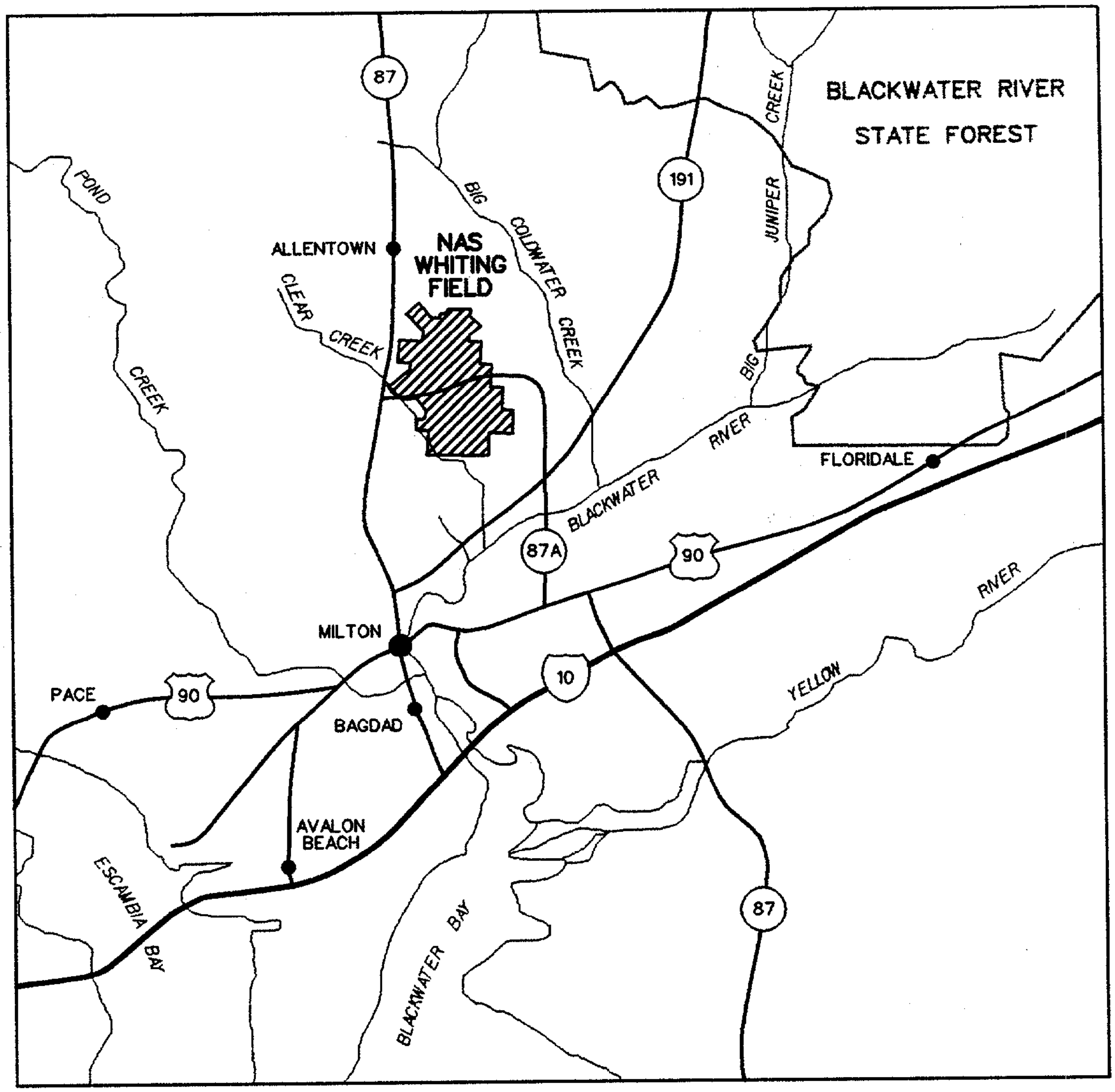
Section 105(a)(8)(A) of SARA required the U.S. Environmental Protection Agency (USEPA) to develop criteria to set priorities for remedial action based on relative risk to public health and the environment. To meet this requirement, USEPA has established the Hazard Ranking System (HRS) as Appendix A to the NCP. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 [55 *Federal Register* (FR) No. 241:51532-51667], to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk.

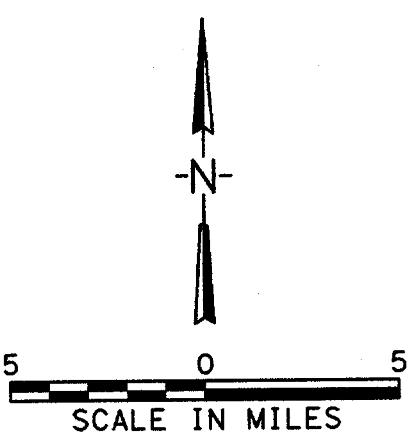
The HRS score for NAS Whiting Field was generated in 1993. The score was sufficient to place NAS Whiting Field on the National Priorities List (NPL); therefore, in January 1994, USEPA placed NAS Whiting Field on a list of sites proposed for inclusion on the NPL (40 CFR 300; FR 18 January 1994), and on May 31, 1994, NAS Whiting Field was placed on the NPL effective June 30, 1994 (40 CFR 300; FR 31 May 1994). As a result, the RI/FS for NAS Whiting Field must follow the requirements of the NCP, as amended by SARA, and guidance for conducting an RI/FS under CERCLA (USEPA 1988a).

1.2 FACILITY BACKGROUND

NAS Whiting Field is located in Santa Rosa County, which is in Florida's northwest coastal area, approximately 7 miles north of Milton and 20 miles northeast of Pensacola (Figure 1-1). NAS Whiting Field presently consists of two airfields separated by an industrial area. The installation is approximately 2,560 acres in size. Figure 1-2 presents the installation layout and the locations of the sites at NAS Whiting Field.

NAS Whiting Field, home of Training Air Wing Five (TRAWING FIVE), was constructed in the early 1940s. It was commissioned as the Naval Auxiliary Air Station Whiting Field in July 1943 and has served as a naval aviation training facility ever since its commissioning. The field's mission has been to train student naval aviators in the use of basic instruments; formation and tactic phases of fixed-wing, propeller-driven aircraft; and basic; and advanced helicopter operation.





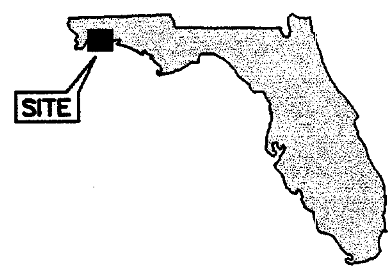


FIGURE 1-1

FACILITY LOCATION MAP

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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1.3 PURPOSE OF THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

The purpose of the RI is to collect data and characterize the site to assess the threat(s) to human health and the environment, while the FS serves to identify a range of remedial alternatives to address any identified risk. To achieve this objective, an RI will be conducted to assess the nature and distribution of chemicals associated with a number of sites at the installation. The data collected during the RI field program will be used in the FS to evaluate and select remedial alternatives to provide permanent, feasible solutions to environmental contamination problems at NAS Whiting Field.

This RI/FS Phase II-C Work Plan was prepared by Brown & Root Environmental (B&R Environmental) under a Comprehensive Long-Term Environmental Action Navy (CLEAN) contract with the SOUTHNAVFACENGCOM for conducting an RI/FS at Sites 3, 4, 30, 32, and 33. At Sites 30 and 33 investigation of only soil is included in this Work Plan because the investigation of groundwater at these sites is being performed by another environmental contractor.

The RI/FS will be conducted in accordance with the methods described in the following USEPA documents: *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988a), *The Superfund Accelerated Cleanup Model (SACM)* (1992a), *Final Guidance: Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (1996a), *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils* (1993a), and *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites* (1988b).

The objectives of the investigations are to

- determine the nature and distribution of contaminants at the site;
- identify potential threats to public health or the environment posed by the potential release of contaminants from the site; and
- evaluate potential remedial alternatives based on engineering factors, implementability, environmental and public health concerns, and costs.

This Work Plan presents the technical scope of actions necessary to achieve these objectives and the schedule for conducting field activities, preparing reports, and developing and evaluating remedial alternatives. The program has been designed to be as efficient and streamlined as possible to support a rapid data acquisition and evaluation process during the RI/FS. To this end, investigators begin with the understanding that it will not be possible to completely characterize this site or any other similar site, even with a very large number of explorations and chemical analyses. Rather, the approach will be to sufficiently characterize the site with a limited number of explorations and analyses that will permit development and refinement of a conceptual model based on reasonable conclusions drawn from those data. USEPA's presumptive response strategy will be used to identify remedial alternatives that will be evaluated during the FS process, and the RI will be planned to provide technology-specific data required to support selection of the presumptive response. Contingencies are included in this Work Plan that may be invoked at any time during the investigation when it becomes apparent that probable conditions have given way to deviations. In this situation, a working hypothesis will be formulated that will evolve and grow as knowledge of the site increases, providing a balance between managed uncertainties and site investigation activities, resulting in improved efficiencies.

This Work Plan consists of nine sections and five appendices. Section 1.0 provides an introduction to the process and a description of the components of the Work Plan. Section 2.0 summarizes the site background and setting and includes a description of the site, its history, the geologic and hydrogeologic settings, and a summary of the results of previous investigations. Also in Section 2.0 is an approach overview that presents and discusses the concepts of streamlining and presumptive remedies (USEPA 1993a and 1996a) as well as an evaluation of data needs. Section 3.0 provides the rationale and task-by-task approach for the field investigation activities. Section 4.0 describes the laboratory analytical program. The risk assessment and waste management [investigation-derived waste (IDW)] tasks are described in Sections 5.0 and 6.0, respectively. Sections 7.0 and 8.0 describe the RI and FS reports. The project schedule is presented in Section 9.0. Appendix A contains a summary of potential federal and state applicable or relevant and appropriate requirements (ARARs) that may apply to Sites 3, 4, 30, 32, and 33. Field investigation procedures and forms are contained in Appendix B, while human health risk assessment parameters are included in Appendix C. The NAS Whiting Field IDW Management Plan is included in Appendix D. B&R Environmental's responses to the review comments on the draft Work Plan are included in Appendix E.

2.0 INSTALLATION BACKGROUND AND SETTING

2.1 INSTALLATION LOCATION AND DESCRIPTION

NAS Whiting Field is located in Santa Rosa County, which is in Florida's northwest coastal area, approximately 7 miles north of Milton and 20 miles northeast of Pensacola (Figure 1-1). Mobile, Alabama, is approximately 79 miles west of the air station, and Tallahassee, the capital of Florida, is 174 miles to the east. NAS Whiting Field presently consists of two airfields (North and South Fields) separated by an industrial area. North Field is used for fixed-wing aircraft training, while South Field is used for helicopter training. The installation is approximately 2,560 acres in size. NAS Whiting Field provides the support facilities for flight and academic training. Most of these services and support activities are provided by private contractors. Figure 1-2 presents the installation layout and the locations of the sites at NAS Whiting Field.

Land surrounding NAS Whiting Field consists primarily of agricultural land to the northwest, residential and forested areas to the south and southwest, and forests along the remaining boundaries.

Located on an upland area, elevations at Whiting Field range from 50 to 190 feet above sea level. The facility is bounded by low-lying receiving waters: Clear Creek to the west and south and Big Coldwater Creek to the east. These two streams are tributaries of the Blackwater River, which discharges to the estuarine waters of the East Bay of the Escambia Bay coastal system. Both Clear Creek and Big Coldwater Creek are classified by the Florida Department of Environmental Protection (FDEP) as Class II Waters–Recreation–Propagation and Management of Fish and Wildlife. Blackwater River is classified as an Outstanding Florida Water. Outstanding Waters are considered to be of exceptional recreational and ecological significance.

2.2 INSTALLATION HISTORY

NAS Whiting Field was constructed in the early 1940s and commissioned as a Naval Auxiliary Air Station in July 1943. NAS Whiting Field has served as a naval aviation training facility ever since its commissioning. The field's mission has been to train student naval aviators in the use of basic instruments, formation and tactical phases of fixed-wing, propeller-driven aircraft, and basic and advanced helicopter operation.

NAS Whiting Field is the home of TRAWING FIVE. Subordinate commands currently stationed at NAS Whiting Field include fixed-wing training squadrons VT-2, VT-3, and VT-6 and helicopter training squadrons HT-8 and HT-18. VT-2 and VT-3 are stationed at North Field. VT-6 was originally stationed at South Field; however, in 1972, with the transfer of HT-8 and HT-18 to South Field, VT-6 was transferred to North Field. This division still exists, with North Field being used for fixed-wing training and South Field for helicopter training.

2.3 GEOLOGIC SETTING

The following discussion of the geologic setting at NAS Whiting Field is based on *Technical Memorandum No. 2 (Final), Geologic Assessment, Remedial Investigation and Feasibility Study, Phase IIA* [ABB Environmental Services, Inc. (ABB-ES) 1995a].

The majority of Santa Rosa County, including NAS Whiting Field, is located in the Western Highlands subdivision of the Coastal Plain Physiographic province. The Coastal Plain Physiographic province is a major division of the United States that extends eastward from Texas and as far north as New York. The Coastal Plain is primarily underlain by beds of sand, silt, clay, and limestone that dip gently toward the coast. Most of these sediments were deposited during periods of elevated sea levels.

The Western Highlands subdivision consists of a well-drained, southward-sloping plateau that has been eroded by numerous streams (Scott 1992). Three marine shorelines can be recognized from existing topographic profiles across Escambia and Santa Rosa Counties. The shoreline at 30 feet above National Geodetic Vertical Datum (NGVD) is visible as the Pimlico terrace, the Penholoway terrace represents the relic shoreline at 70 feet above NGVD, and the third shoreline is a seaward-sloping upland surface ranging from 70 to 270 feet above NGVD (Marsh 1966).

The southwestward dip of all the formations (down to the Cretaceous-period deposits) in Santa Rosa County is explained by the fact that the area is located on the eastern flank of the Mississippi embayment (westward dip) and the northern flank of the Gulf Coast Geosyncline (southward dip) (Marsh 1966). The Gulf Coast Geosyncline, located slightly south of the present coastline, was created by subsidence during deposition of 50,000 feet of Tertiary deposits. The local structure created by these regional features is a simple homocline with few faults and folds found in northern Santa Rosa County.

2.3.1 Regional Geology

The subsurface geology of Santa Rosa County has more in common with the central Gulf Coast of Alabama, Mississippi, and Louisiana than it does with that of peninsular Florida. Only two peninsular Florida units (the Tampa Formation and the Ocala Group) are present within the area (Marsh 1966).

NAS Whiting Field is underlain by a thick sequence of Tertiary sedimentary formations. A generalized geologic column of these formations is presented in Figure 2-1. The regional geologic characterization presented in this section was compiled using numerous documents prepared by the Florida Geologic Survey (Marsh 1966; Musgrove, Barraclough, and Grantham 1965; Scott 1992).

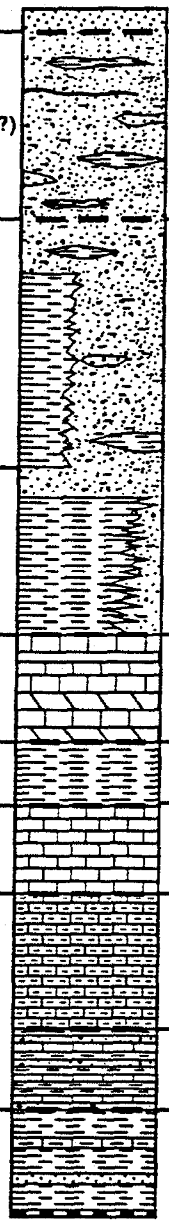
The oldest formation studied in the panhandle area (Escambia and Santa Rosa Counties) is the Hatchetigbee Formation of the early Eocene series. This formation is composed of silty clay with beds of glauconitic shale and shaly limestone. The average thickness of the Hatchetigbee Formation is 315 feet (Marsh 1966).

Overlying the Hatchetigbee is the Tallahatta Formation of middle Eocene, which consists of shale and siltstone deposits interbedded with gray limestone and well-sorted sand. Above the Tallahatta is the Lisbon equivalent that has been correlated with the Lisbon Formation of Alabama. The Lisbon is approximately 500 feet thick and consists of a shaly limestone (Marsh 1966; Scott 1992).

The upper Eocene series is represented by the Ocala Group. The Ocala is a light-gray limestone and averages 165 feet in thickness. Fifty-seven species of Foraminifera were identified in this group. Unconformably overlying the Ocala is the Bucatunna Clay member of the Byram Formation. The Bucatunna is a dark gray, soft clay averaging 125 feet in thickness throughout the western Florida Panhandle (Marsh 1966; Scott 1992).

The Chickasawhay Limestone and Tampa Formation are so similar in the western Panhandle that they are presented as undifferentiated on the geologic column. The Chickasawhay is a gray, dolomitic limestone, while the Tampa is a light gray to white, hard limestone (generally not dolomitic). These undifferentiated sediments range in thickness from 30 to 270 feet in western Florida; however, they are believed to be between 100 and 150 feet thick in northern Santa Rosa County (Marsh 1966; Scott 1992).

GENERALIZED GEOLOGIC COLUMN
OF FORMATIONS IN THE WESTERN FLORIDA PANHANDLE

THICKNESS	SERIES	GRAPHIC SECTION	FORMATION
APPROXIMATE THICKNESS	PLEISTOCENE		**MARINE TERRACE DEPOSITS :** Sand, light tan, fine to coarse
250' - 400'	PLEISTOCENE (?)		**CITRONELLE FORMATION :** Sand with lenses of clay and gravel. Sand, light-yellowish-brown to reddish-brown, very fine to very coarse and poorly sorted. Hardpan layers in upper part. Logs and carbonaceous zones present in places. Fossils extremely scarce except near the coast where shell beds may be the marine equivalent of the fluvial facies of the Citronelle.
100' - 300'	UPPER MIOCENE		**MIOCENE COARSE CLASTICS :** Fossiliferous sand with lenses of clay and gravel. Sand is light-gray to light-brown, very fine to very coarse and poorly sorted. Fossils abundant, mostly minute mollusks. Contains a few zones of carbonaceous material. Lower part of coarse clastics present only in northern part of area, interfingering with Pensacola Clay in the central part.
100' - 250'	UPPER MIDDLE TO LOWER UPPER MIOCENE		**PENSACOLA CLAY :** Formation consists of an Upper Member and Lower Member of dark-to-light-gray, tough, sandy clay; separated by the Escambia Sand Member of gray, fine to coarse, quartz sand. Contains carbonized plant fragments, and abundant mollusks and foraminifers. Pensacola Clay is present only in southern half of area; interfingering with the Miocene coarse clastics in the central part.
100' - 150'	LOWER MIOCENE AND UPPER OLIGOCENE		**CHICKASAWHAY LIMESTONE AND TAMPA FORMATION UNDIFFERENTIATED : Tampa:** Limestone, light-gray to grayish-white, hard, with several beds of clay; **Chickasawhay:** Dolomitic limestone, gray, vesicular.
100' - 150'	MIDDLE OLIGOCENE		**BUCATUNNA CLAY MEMBER OF BYRAM FORMATION :** Clay, dark-gray soft, silty to sandy, foraminiferal, carbonaceous.
165'	UPPER EOCENE		**OCALA GROUP :** Limestone, light-gray to chalky-white foraminifers extremely abundant, esp. *Lepidocyclina*; corals, echinoids, mollusks, bryozoans.
500'	MIDDLE EOCENE		**LISBON EQUIVALENT :** Shaly limestone, dark-gray to grayish-cream; hard, compact; glauconitic; with thick intervals of dense, light-gray shale.
300' - 400'			**TALLAHATTA FORMATION :** Shale and siltstone, light-gray, hard, with numerous interbeds of gray limestone and very fine to coarse, pebbly sand. Foraminifers locally abundant.
315'	LOWER EOCENE		**HATCHETIGBEE FORMATION :** Clay, gray to dark-gray, micaceous, silty, with beds of glauconitic shale, siltstone, and shaly limestone. Mollusks, foraminifers, corals, echinoids. Bashi Marl Member (about 10 feet thick) at base.

SOURCE:

MODIFIED FROM MARSH 1966.

FIGURE 2-1

GENERALIZED GEOLOGIC COLUMN
OF WESTERN FLORIDA PANHANDLE

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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Above the Chickasawhay-Tampa Formation lies the Pensacola clay, which consists of an upper and lower member of dark to light gray, sandy clay. These two members are separated by the Escambia sand member of gray, fine- to coarse-grained sand (Marsh 1966; Scott 1992). The upper member of the Pensacola clay is not present in the immediate vicinity of NAS Whiting Field, and the lower member is believed to pinch out north of the installation (Marsh 1966).

Miocene coarse clastics, however, are present throughout the western Florida Panhandle. These coarse clastics are described as brown to gray, poorly sorted sand and gravel with thick lenses of clay. These sediments overlie the Chickasawhay limestone in the vicinity of NAS Whiting Field (Marsh 1966).

The Citronelle Formation of Pleistocene age overlies the Miocene coarse clastics and is very similar in composition. The two units are differentiated by the abundance of shells in the Miocene coarse clastics. The thickness of the Citronelle Formation ranges from 40 to 800 feet in westernmost Florida, and between 250 and 400 feet in northern Santa Rosa County. The Citronelle Formation also contains layers of fossil wood, limonite-cemented zones, shells, and kaolinitic burrows of aquatic animals (Marsh 1966; Scott 1992).

The overlying marine terrace deposits are thin in comparison to the Citronelle Formation and are indistinguishable from Citronelle sediments. They are typically included in the average thickness of the formation (Marsh 1966).

In Escambia and Santa Rosa Counties, the Citronelle Formation consists principally of quartz sand that contains numerous lenses, beds, and stringers of clay and gravel. The lithology changes abruptly over short distances. The sand is typically light yellowish-brown to reddish-brown, although some is white or light gray. The grains are typically angular to subangular and very poorly sorted, ranging from very finely to very coarsely grained. Clay occurs in lenses as thick as 60 feet and is primarily white or gray in color, although lavender and yellow brown are not uncommon. The rapid facies changes, absence of fossils, and presence of sand and gravel suggest that the shallow sediments of the sand and gravel aquifer were deposited in an environment similar to that of the current Mississippi River delta. The sediments were probably deposited in stream channels, that continually shifted back and forth across the face of the delta. The clay lenses were deposited in quiet pools or abandoned channels, whereas the gravel was deposited in swiftly moving streams nearby (Musgrove, Barraclough, and Grantham 1965).

2.3.2 Industrial Area Geology

The Industrial Area that separates North and South Fields is the largest and most-studied portion of the installation (Figure 2-2). The area encompasses Sites 3, 4, 5, 6, 7, 8, 29, 30, 32, and 33. Data from 39 soil borings completed at Sites 3, 6, 29, 30, 32, and 33; lithologic descriptions from 37 monitoring wells; and 7 Piezocone Penetrometer soundings completed during the RI/FS Phase II-A were used to generate cross sections (Figures 2-3 and 2-4) and to characterize the subsurface geology of the area. Additionally, lithologic descriptions from 61 monitoring well borings completed under the underground storage tank (UST) program were reviewed and used to augment the Phase II-A data and to complete the cross sections for the area. The UST monitoring wells were originally installed to investigate UST Sites 1467 and 1466 (Sites 4 and 7, respectively).

The most abundant soil type encountered in the area consists of light-colored, poorly graded (fine- to medium-grained) sands containing frequent layers of clay and silty sand. The soil from shallow depths (0 to 30 feet) tends to be darker (various shades of reddish-brown) in color and contain significant amounts of clay and silt. The shallow unit is referred to as interbedded sand, silt, and clay on the cross sections. Well-graded sand layers containing coarse-grained sands are common throughout the Industrial Area (Figures 2-3 and 2-4).

Clay layers of significant thickness (greater than 4 feet) were encountered at Sites 3, 5, 6, and 30. Although a clay layer may be significant at individual sites, none of the layers were determined to be continuous throughout the entire Industrial Area (Figures 2-3 and 2-4).

At Site 3, a single clay layer ranging in thickness from 12 to 15 feet (located between 55 to 75 feet above NGVD) was identified. The clay layer was identified in lithologic descriptions for monitoring wells WHF-3-7D and WHF-3-3D in the north–south direction and in such descriptions for WHF-3-4 and WHF-3-1D in the east–west direction. The lithologic descriptions for monitoring well WHF-3-2D indicate that clayey sand is present within the same depth range as is the clay layer in the other wells, possibly indicating that the layer is discontinuous to the east of the site. The clay at Site 3 is believed to be part of a larger layer consisting of interbedded sand, silt, and clay that appears to extend farther east from the site. Based on data from UST wells located west of Sites 3 and 32 (North Field Maintenance Hangar Area), the layer is believed to be absent in this area.

All reported clay layers in the immediate vicinity of Sites 7 and 30 (South Field Maintenance Hangar Area) appear to be discontinuous. Because of the lack of soil borings and monitoring wells southwest

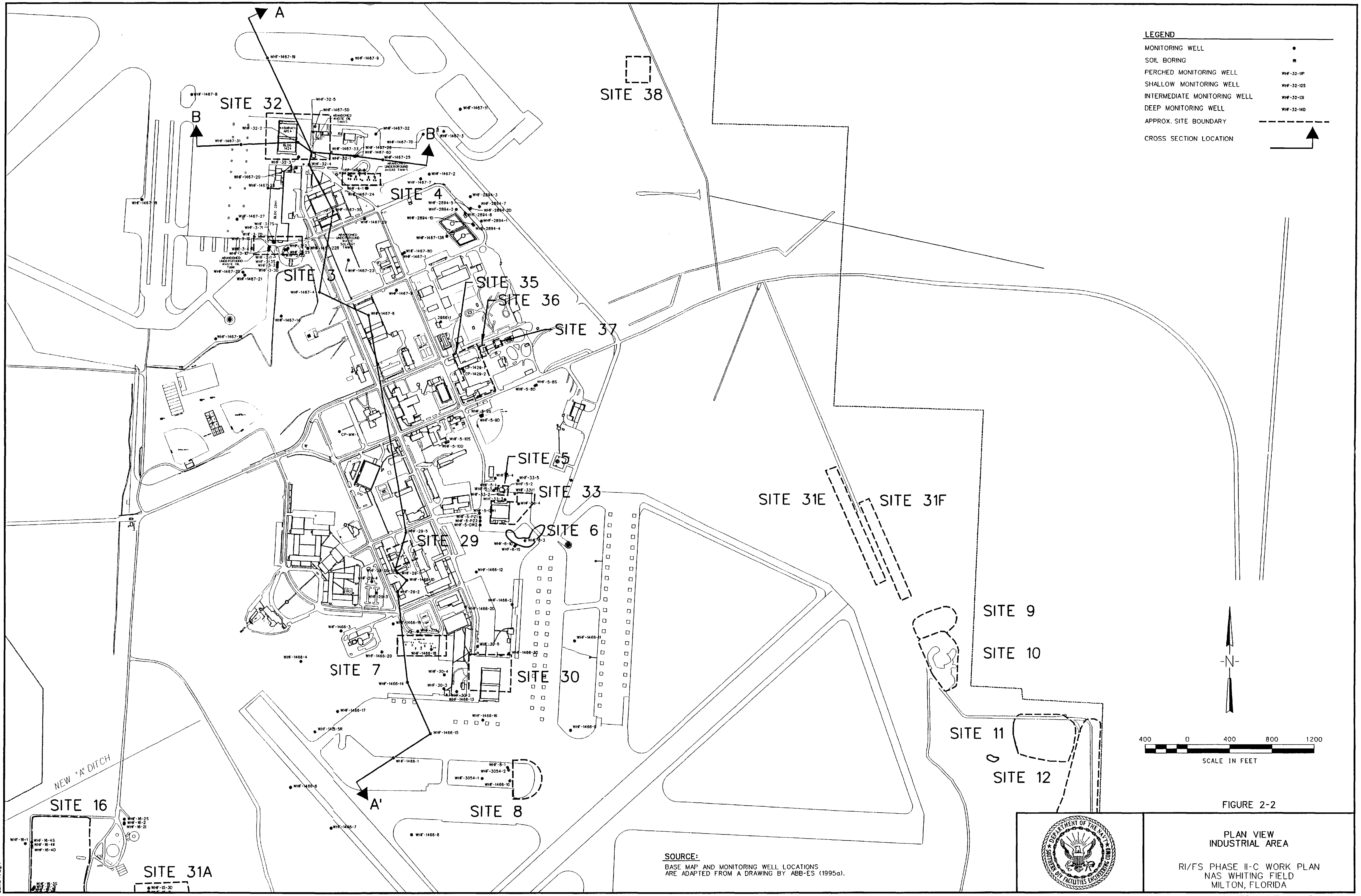

FIGURE 2-2

PLAN VIEW
INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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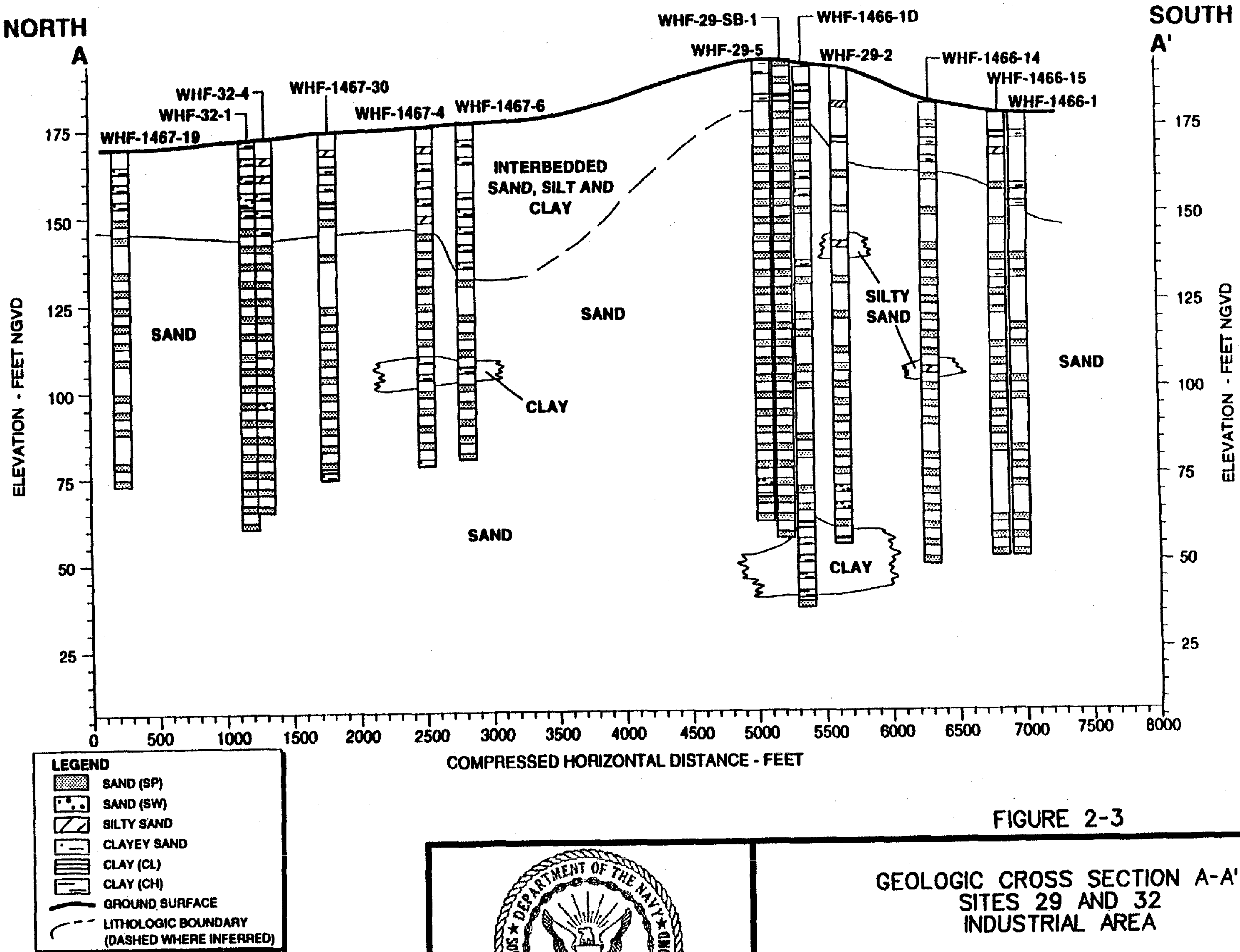

SOURCE:
ABB-ES 1995a

FIGURE 2-3

GEOLOGIC CROSS SECTION A-A'
SITES 29 AND 32
INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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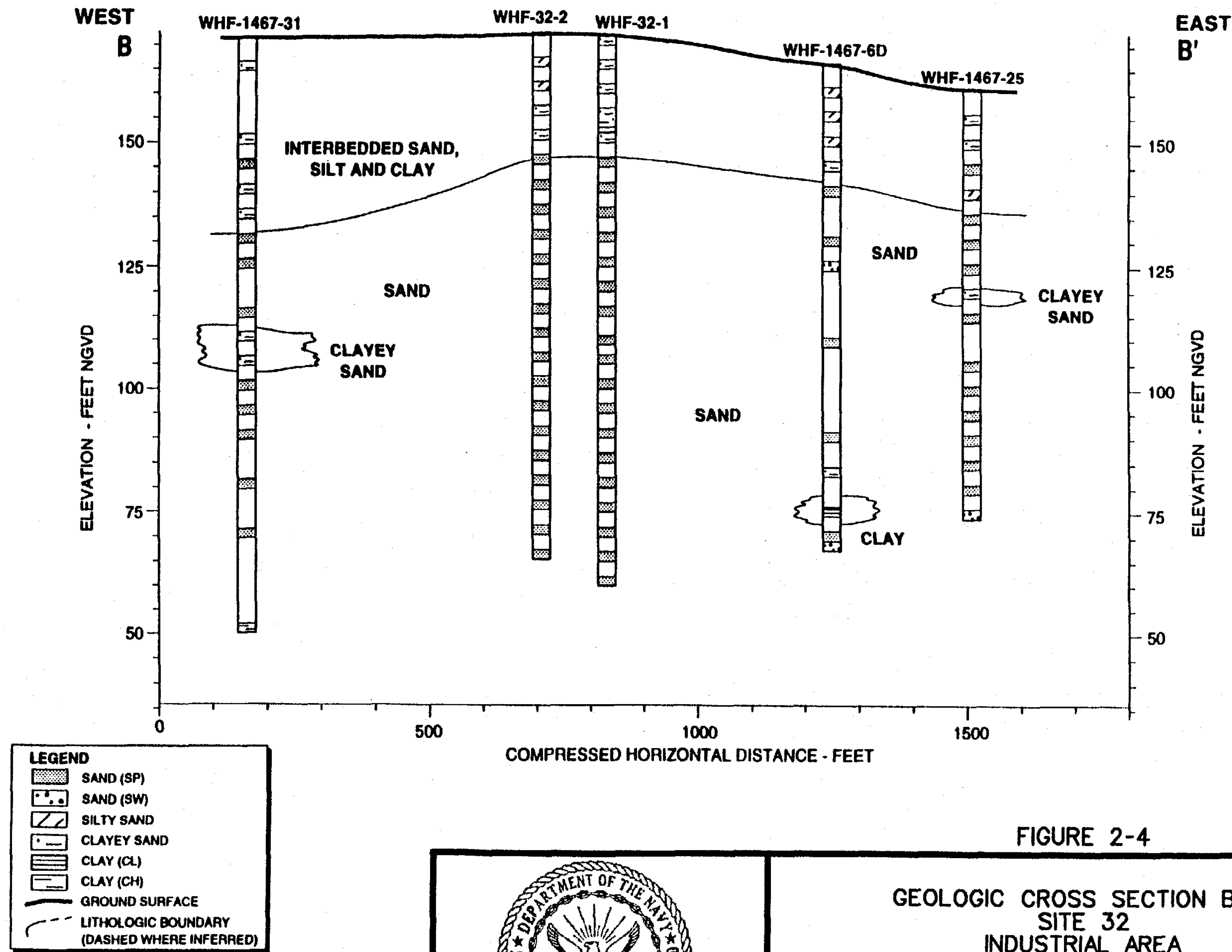

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FIGURE 2-4

GEOLOGIC CROSS SECTION B-B'
SITE 32
INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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of Site 30, however, lithologic data are limited and the continuity of the layer cannot be confirmed. It is uncertain whether the clay is present or absent below terminal depths of the wells south of Sites 7 and 30.

The clay layer present in the vicinity of Sites 5, 6, and 33 (Midfield Maintenance Hangar Area) appears to contain discontinuities similar to those at Sites 3 and 30. A thick layer of clay, between 55 and 70 feet above NGVD, underlies Site 6; however, the same depth range in Site 33 monitoring wells contains sand, silt, and clay mixtures, while the upgradient well for Site 5 (WHF-5-8D) contains sandy clay at the same depth range. Although the upgradient wells are more than 700 feet north and west of Site 5, clay in the three Site 5 wells and at Site 6 indicates that a continuous clay-dominated layer may underlie the Midfield Maintenance Hangar Building and the western part of Site 5. The lithologic descriptions of the Site 33 wells indicate that the clay is thin and/or discontinuous in the areas north and east of the hangar. The clay at Site 6 may extend westward toward Site 29; however, it grades into silty clay between the site and monitoring well WHF-1466-12. There are no borings east of the area; therefore, the presence of clay in that area is uncertain. Although clay lithologies were identified at similar depths in descriptions of many wells in the Midfield Maintenance Hangar Area, the wide variations in layer thickness and percentage of clay indicate that the layer may be discontinuous.

2.4 HYDROGEOLOGIC SETTING

NAS Whiting Field is located within the boundaries of the Northwest Florida Water Management District (NWFWMD), which encompasses the entire Florida panhandle. The topography of northwest Florida is the result of 25 million years of stream erosion and deposition in addition to wave action during periods when the shoreline exceeded its present level. The resulting surficial sediments consist of sand and silt mixtures containing interbedded clay lenses.

2.4.1 Regional Hydrogeology

Groundwater in northwest Florida occurs within three major aquifer systems. These aquifer systems include: the surficial aquifer system (referred to as the sand-and-gravel aquifer in the western panhandle), the intermediate aquifer system and confining unit, and the Floridan aquifer system (NWFWMD 1988; Scott 1992).

The three aquifer systems in Escambia and Santa Rosa Counties differ significantly from their counterparts throughout the remainder of the district. For example, the sand-and-gravel aquifer is considerably thicker in the western part of the panhandle than is its counterpart (the surficial aquifer) in the eastern part of the panhandle (NWFWMD 1988). The intermediate system in the eastern part of the panhandle consists of a confining layer that contains thin water-bearing zones. That confining layer is called the Pensacola Clay in Escambia and Santa Rosa Counties. It consists of upper and lower members separated by the Escambia sand member. The upper member pinches out west of Milton, and the lower member is absent in the northern half of Escambia and Santa Rosa Counties. The installation is situated at the approximate location where the lower member begins interconnecting with the Miocene coarse clastics. Although the intermediate system contains water-bearing units, it functions primarily as a confining unit between the surficial (sand-and-gravel) aquifer and the Floridan aquifer throughout the entire district. The Floridan aquifer in Escambia and Santa Rosa Counties contains a confining unit (the Bucatunna Clay Member of the Byram Formation, middle Oligocene in age) that divides the Floridan aquifer into upper and lower units. The Bucatunna Clay is present in only the western part of the panhandle (NWFWMD 1988; Scott 1992).

The sand-and-gravel aquifer is the major water-bearing unit in Santa Rosa County and the only aquifer that has been studied in the IR program at NAS Whiting Field. The aquifer consists of a complex sequence of sand, gravel, silt, and clay that is estimated to be approximately 350 feet thick in the vicinity of the airfield (Scott 1992). The sand-and-gravel aquifer includes the upper Miocene coarse clastics, the Citronelle Formation, and marine terrace deposits. These units have similar hydraulic properties and sometimes are indistinguishable. The aquifer consists of poorly sorted, fine- to coarse-grained sands with gravel and lenses of clay that may be as thick as 60 feet. The presence of interbedded clay layers often creates localized artesian conditions in which the less permeable clay deflects the surface of the water table below its true (unconfined) elevation. In some areas the aquifer may be subdivided into upper and lower zones, which are separated by layers of clay or clayey sand. These semiconfining layers are typically leaky, and the upper part serves as the primary source of recharge to the more productive lower zone of the aquifer (NWFWMD 1991). Groundwater can also potentially move laterally along the semiconfining layers until it discharges into local streams or other surface water features (NWFWMD 1991; Scott 1992).

Throughout most of the Florida panhandle, the bottom of the sand-and-gravel aquifer is typically marked by the intermediate aquifer system. In Escambia County, the Pensacola Clay Formation serves as that confining layer. Throughout most of Santa Rosa County, only the lower member of the formation is thought to overlay the top of the Upper Floridan. NAS Whiting Field is located approximately 4 miles south of where the lower member pinches out completely (Musgrove, Barraclough, and Grantham 1965).

Virtually all of the groundwater used in Santa Rosa County is pumped from the sand-and-gravel aquifer. The aquifer is recharged entirely by rainfall. The western panhandle receives between 55 and 67 inches of rainfall per year (NWFWMD 1988). Evapotranspiration returns approximately 60 percent of the total volume of rainfall to the hydrologic cycle before entering the aquifer systems. Rainfall is generally highest in the summer months and lowest in fall and winter.

The water quality of the sand-and-gravel aquifer is satisfactory for most uses. The concentrations of naturally occurring dissolved minerals are low due to the insolubility of the sand through which the water migrates. The pH of water in the aquifer falls as low as 5.0 in some areas, largely as a result of high concentrations of dissolved iron (Florida Geological Survey 1992).

The hydraulic properties of the sand-and-gravel aquifer have been studied throughout Escambia County (NWFWMD 1991). The results of this work have indicated that the transmissivity of the main producing zone is variable throughout the county (5,000 to 20,000 square feet/day) and that the values from the western part of the county fall within the lower end of the range. The average storativity for the main producing zone is on the order of 1×10^{-4} (dimensionless). Transmissivity calculated from multi-well aquifer tests conducted by NWFWMD ranged from 5,800 to 7,800 square feet/day, with storage coefficients of 2.9×10^{-4} to 5.7×10^{-4} (dimensionless) (NWFWMD 1991).

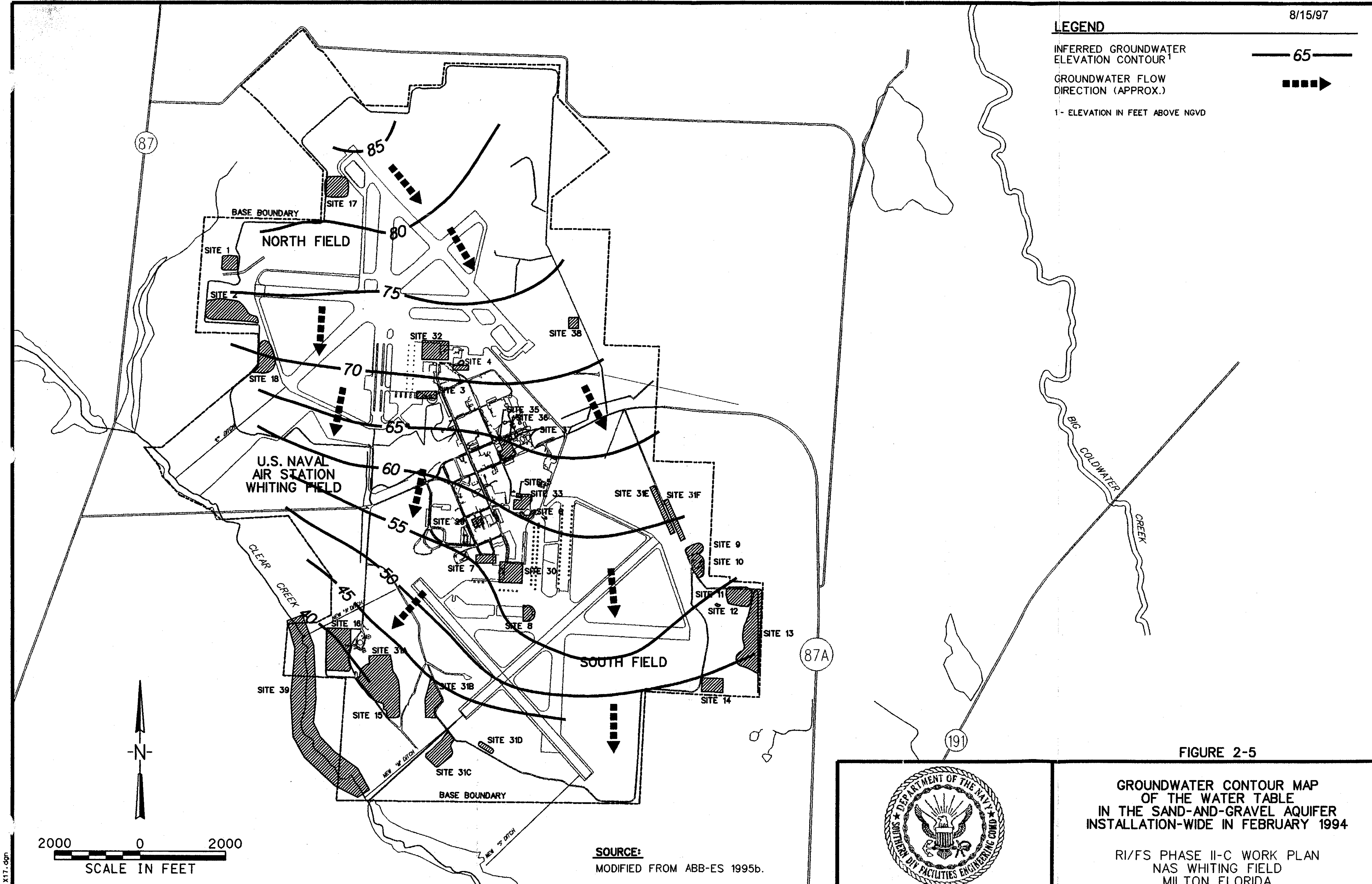
2.4.2 Industrial Area

The following information characterizing the hydrogeology at the NAS Whiting Field Industrial Area was obtained primarily from the *Technical Memorandum No. 4 (Final) Hydrogeologic Assessment, Remedial Investigation and Feasibility Study, Phase IIA* (ABB-ES 1995b).

The Industrial Area encompasses Sites 3, 4, 5, 6, 7, 8, 29, 30, 32, and 33. The hydrogeologic assessment of the area included: collecting water level data from 37 RI/FS Phase II-A monitoring wells, 49 wells installed under the UST program, 5 RI Phase I wells, 6 wells constructed during the Verification Study (Geraghty & Miller 1986), and slug tests conducted on 16 monitoring wells.

2.4.2.1 Groundwater Flow Direction

Shallow, intermediate, and deep groundwater flow patterns in the sand and gravel aquifer were determined based on water level data from monitoring wells. Figures 2-5 and 2-6 provide a graphic representation for the shallow and deep flow zones, respectively, collected during the February 8 and 9, 1994, water level measurement event. Groundwater flow contour maps were also completed for the September 30 and October 1, 1993, measurement event. Both shallow and deep zone groundwater maps showed flow patterns similar to those on the February 1994 flow maps. Because of the limited number of intermediate zone monitoring wells, the flow direction was not determined for this interval.



SOURCE:
MODIFIED FROM ABB-ES 1995b.

FIGURE 2-5

GROUNDWATER CONTOUR MAP OF THE WATER TABLE IN THE SAND-AND-GRAVEL AQUIFER INSTALLATION-WIDE IN FEBRUARY 1994

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

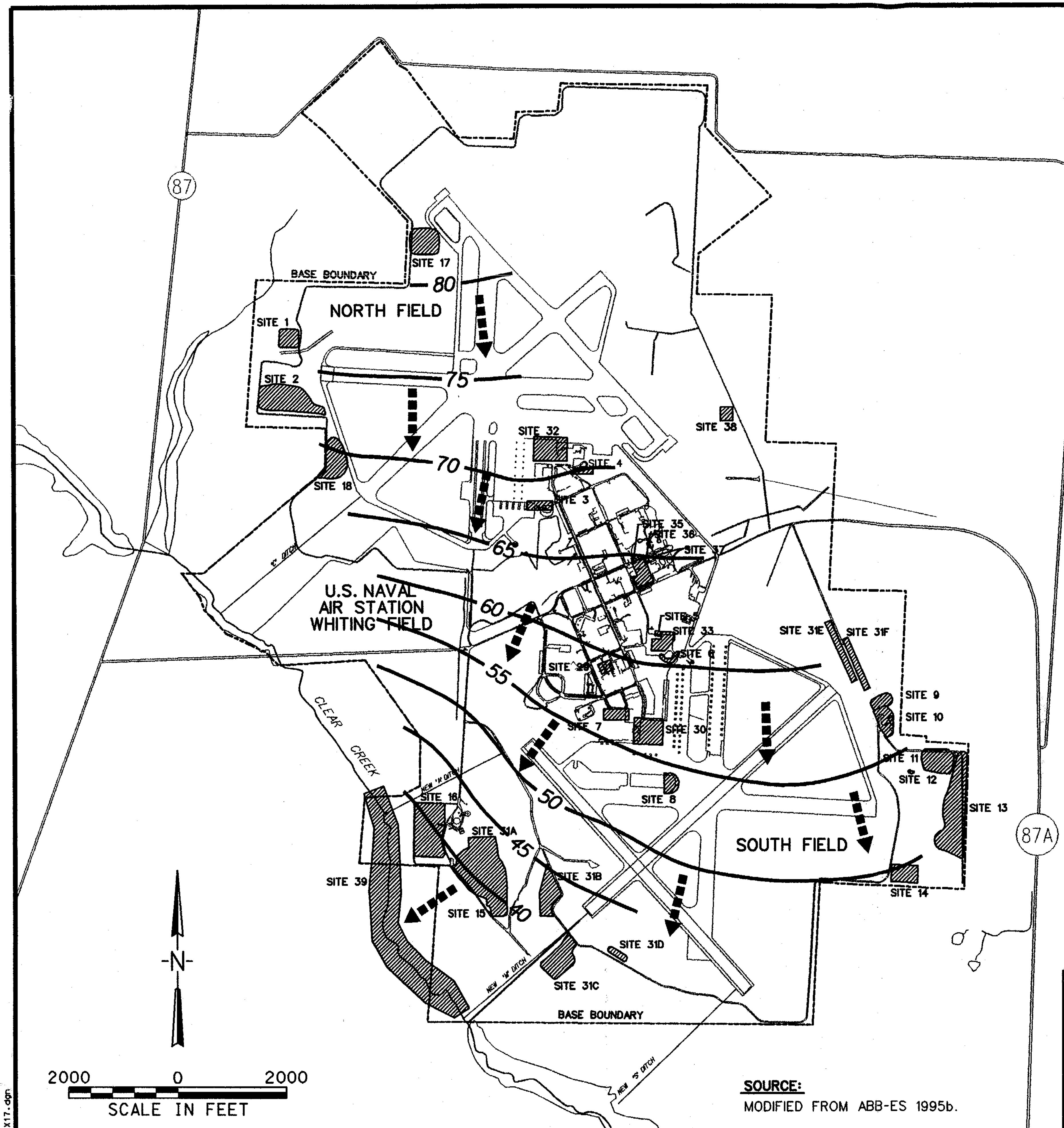


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FIGURE 2-6

GROUNDWATER CONTOUR MAP OF THE DEEP ZONE IN THE SAND-AND-GRAVEL AQUIFER INSTALLATION-WIDE IN FEBRUARY 1994

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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Comparison of the intermediate and deep groundwater data, however, suggests that the flow direction for the intermediate zone is similar to that of the deep zone. As indicated on Figures 2-5 and 2-6, both shallow and deep groundwater flow throughout most of the Industrial Area is to the south and southwest.

A review of the monitoring well data indicated that a perched groundwater flow zone corresponding with previously identified clay layers lies within the Industrial Area. A comparison of groundwater elevations with lithologic logs for individual monitoring wells indicated potential perched groundwater conditions at Sites 3 and 4 (UST Site 1467), Site 7 (UST Site 1466), and Site 29 (Auto Hobby Shop). Figure 2-7 shows the inferred groundwater contours for the perched zone within the Industrial Area.

The variation in water levels between identified perched monitoring wells and monitoring wells screened across the water table ranged from 2.31 feet at Site 3 (monitoring well WHF-3-2) to 8.98 feet at Site 29. The largest difference in water level elevations occurred north of Site 4 (UST Site 1467) in UST wells WHF-1467-6D and WHF-1467-26, where the water levels varied by 17.61 feet. Interpretation of the perched groundwater potentiometric surface suggests a more irregular flow pattern than that of the shallow (Figure 2-5) or deep (Figure 2-6) flow zones. The irregular flow pattern is probably a result of influence by the surface of the clay layer upon which it is perched.

2.4.2.2 Horizontal and Vertical Gradients

Horizontal hydraulic gradients in the Industrial Area varied over one order of magnitude. Values ranged from 0.016 feet/feet (monitoring wells WHF-29-5 and WHF-29-4) to 0.0002 feet/feet (monitoring wells WHF-30-5 and WHF-30-3). The average horizontal hydraulic gradient for the Industrial Area was the same (0.0046 feet/feet) for measurement events conducted in October 1993 and February 1994.

Vertical hydraulic gradients varied by up to two orders of magnitude from 0.0486 feet/feet at Site 3 well cluster WHF-3-3 to 0.0006 at Site 5 well cluster WHF-5-9. The direction of the vertical hydraulic gradient was predominantly downward. An upward hydraulic gradient occurred at one well cluster (WHF-6-1) at Site 6, and two well clusters (WHF-3-7 and WHF-5-9) indicated a reversal of flow direction from downward to upward between the groundwater elevation measurement events.

2.4.2.3 Hydraulic Conductivity and Seepage Velocity

Slug tests were conducted at 12 shallow and 5 deep monitoring wells. From a total of 59 slug tests performed on the wells, 45 were deemed usable. Hydraulic conductivities for the shallow and intermediate

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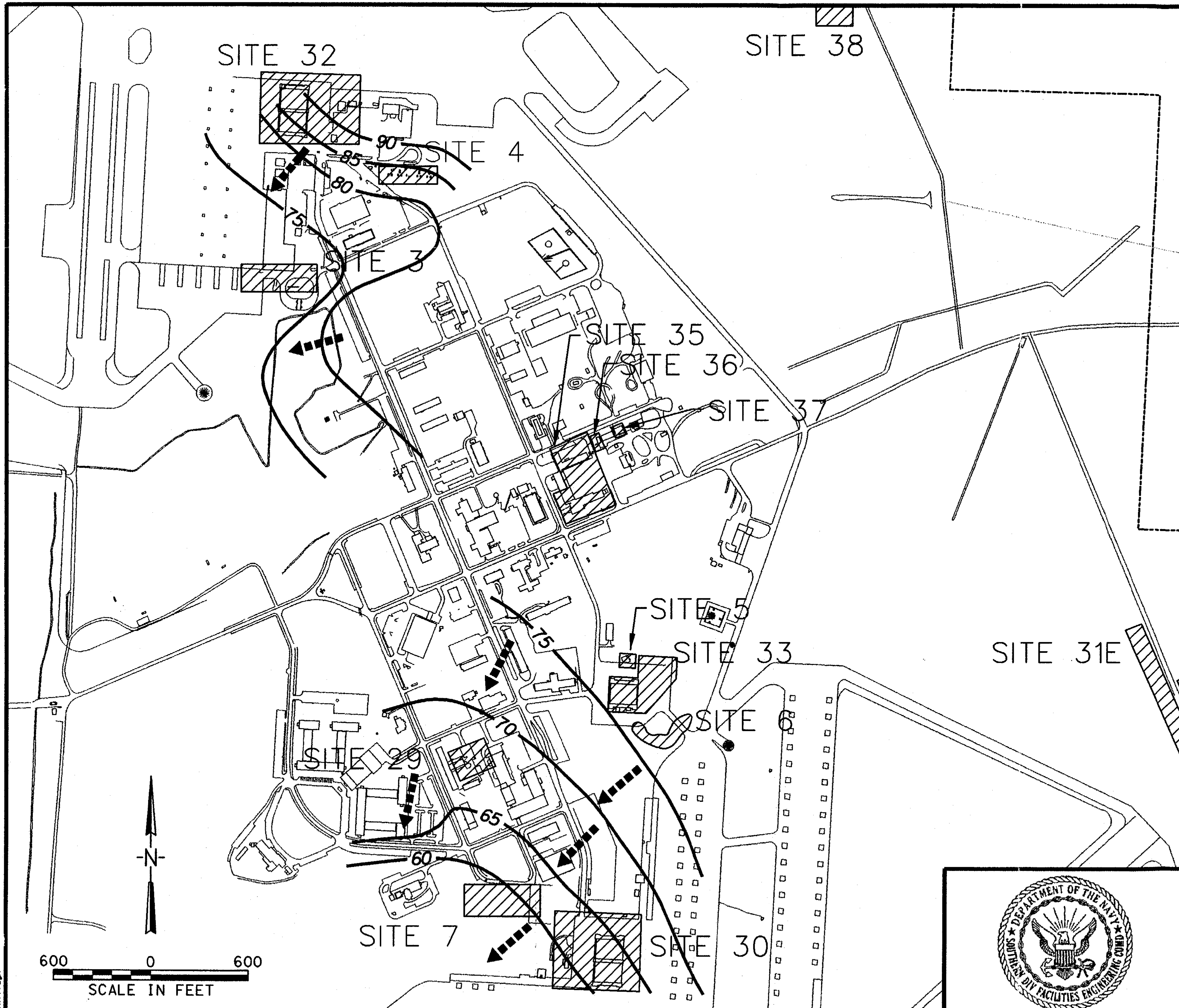

LEGEND

INFERRED GROUNDWATER ELEVATION CONTOUR[1] —— 65 ——

GROUNDWATER FLOW DIRECTION (APPROX.)

1 - ELEVATION IN FEET ABOVE NGVD

SOURCE:

MODIFIED FROM ABB-ES 1995b.

FIGURE 2-7

GROUNDWATER CONTOUR MAP OF THE PERCHED ZONE ABOVE THE SAND-AND-GRAVEL AQUIFER INDUSTRIAL AREA IN FEBRUARY 1994

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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monitoring wells varied from 31.16 feet/day (1.10×10^{-2} cm/sec) at Site 5 to 0.35 feet/day (1.24×10^{-4} cm/sec) at Site 6 (South Transformer Oil Disposal Area). The geometric mean across the Industrial Area was 4.48 feet/day (1.57×10^{-3} cm/sec) for the shallow and intermediate-depth monitoring wells. For the deep monitoring wells, hydraulic conductivities ranged from 41.46 feet/day (1.46×10^{-2} cm/sec) (WHF-3-7D) to 0.32 feet/day (1.12×10^{-4} cm/sec) (WHF-5-8D). The geometric mean for the deep wells was 6.67 feet/day (2.35×10^{-3} cm/sec).

The shallow and intermediate monitoring well screen elevations ranged from 77 feet above to 2 feet below mean sea level (MSL). The sediments in this depth range varied from poorly graded sands to clayey/silty sands. The deep monitoring well screen elevations ranged from 11 feet above to 12 feet below MSL. The lithologies in this depth range varied from well-graded to poorly graded, dense sands.

The calculated seepage velocity value for the Industrial Area ranged from 0.48 feet/day at Site 29 to 0.004 feet/day at Site 6. The average of the seepage velocity values for the Industrial Area was 0.11 feet/day.

2.5 PREVIOUS INVESTIGATIONS

Numerous investigations have been conducted at NAS Whiting Field including an IAS; a Verification Study; and RI/FS Phases I, II-A, and II-B completed in response to CERCLA requirements. Two other investigations have also been completed at NAS Whiting Field. One investigation focused on the Battery Acid Seepage Pit (Site 5) and was initiated under a Consent Order with the Florida Department of Environmental Regulation (FDER), which has since been renamed FDEP. Another investigation was completed under the Navy's UST program on three petroleum sites. These previous investigations are summarized in Table 2-1 and are briefly discussed in the following sections.

2.5.1 Initial Assessment Study, 1985

Historical records were reviewed during the IAS (Envirodyne Engineers, Inc. 1985). The records search indicated that throughout its years of operation, NAS Whiting Field has generated a variety of wastes related to pilot training, the operation and maintenance of aircraft and ground support equipment, and the facility maintenance programs. Figure 1-2 shows the location of all sites that have been identified for investigation at NAS Whiting Field.

Interviews with facility personnel and reviews of the records indicated that before the establishment during the 1970s of hazardous waste management programs and the practice of recycling waste oil, most of the

TABLE 2-1

SUMMARY OF SITE INVESTIGATIONS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MIILTON, FLORIDA

Site Number	Site Name	Previous Studies			RI/FS Phase I	Navy's UST Program	RI/FS Phase II-A	RI/FS Phase II-B
		IAS	Verification Study	Consent Order				
1	Northwest Disposal Area	*	*		*		*	
2	Northwest Open Disposal Area	*			*		*	
3	Underground Waste Solvent Storage Area	*	*		*		*	
4	North AVGAS Tank Sludge Disposal Area	*	*			*		
5	Battery Acid Seepage Pit	*		*			*	
6	South Transformer Oil Disposal Area	*	*		*		*	
7	South AVGAS Tank Sludge Disposal Area	*	*			*		
8	AVGAS Fuel Spill Area	*	*			*		
9	Waste Fuel Disposal Pit	*	*		*		*	
10	Southeast Open Disposal Area (A)	*	*		*		*	
11	Southeast Open Disposal Area (B)	*	*		*		*	
12	Tetraethyl Lead Disposal Area	*	*		*		*	
13	Sanitary Landfill	*	*		*		*	
14	Short-Term Sanitary Landfill	*	*		*		*	
15	Southwest Landfill	*	*		*		*	
16	Open Disposal and Burning Area	*	*		*		*	
17	Crash Crew Training Area		*		*		*	
18	Crash Crew Training Area		*		*		*	
29	Auto Hobby Shop						*	
30	South Field Maintenance Hangar Area						*	*
31	Sludge Drying Beds and Disposal Areas						*	
32	North Field Maintenance Hangar Area						*	
33	Midfield Maintenance Hangar Area						*	*
35	Public Works Maintenance Facility, Building 1429							*
36	Auto Repair Booth, Building 1440A							*
37	Paint Spray Booth, Building 1486							*
38	Golf Course Maintenance Building, Building 2877							*
39	Clear Creek Floodplain							*

Notes: Sites 19 through 28 are located at Outlying Landing Field (OLF) Barin and are being addressed under a separate investigation.

AVGAS – aviation gasoline
IAS – Initial Assessment Study
RI/FS – Remedial Investigation and Feasibility Study
UST – underground storage tank

hazardous wastes were disposed of on site. Waste materials were disposed of either in dumpsters that were emptied into on-site disposal areas or in waste oil bowsers that probably were used for crash crew training. Envirodyne Engineers, Inc. (1985) estimated that thousands of gallons of wastes including waste paints, paint thinners, solvents, waste oils, waste gasoline, hydraulic fluids, aviation gasoline (AVGAS), tank-bottom sludges, polychlorinated biphenyl (PCB) transformer fluids, and paint stripping wastewater were potentially dumped into on-site disposal areas. These disposal areas consisted of natural or man-made depressions located within the confines of the air station. Additional materials were reportedly released on site as the result of accidents or equipment failure.

Based on a review of historical data, aerial photographs, field inspections, and interviews with facility personnel, 16 potentially contaminated disposal or spill sites, and/or sources for contaminant migration, were initially identified at NAS Whiting Field by the IAS team (Envirodyne Engineers, Inc. 1985).

The IAS report (Envirodyne Engineers, Inc. 1985) concluded that 15 of the 16 sites warranted further investigation under the Navy's IR program to assess potential long-term impacts. Only Site 2, the Northwest Open Disposal Area, was determined not to warrant further consideration.

To evaluate the 15 sites requiring further investigation, the IAS recommended a Confirmation Study including sampling and monitoring of the sites to confirm the presence or absence of suspected contamination and to further quantify the extent of any problems that might exist.

2.5.2 Confirmation Study, 1985–1986

The Confirmation Study consisted of two parts: verification and characterization. In November 1985, Geraghty & Miller, Inc., prepared a plan of action for verification entitled *Naval Assessment and Control of Installation Pollutants, Verification Study, NAS Whiting Field* (Geraghty & Miller 1985a), which was subsequently submitted to FDER. This plan outlined the details of the proposed scope of work for the Verification Study. In December 1985 during discussions with FDER, two additional sites (Sites 17 and 18) were added to the Verification Study. Both sites were in use in 1985 and were locations at which waste fuels and solvents were burned during crash crew training exercises.

The results of the Verification Study (*Verification Study, Assessment of Potential Ground-Water Pollution at Naval Air Station Whiting Field, Florida*, Geraghty & Miller 1986) provided an assessment of the physical and chemical conditions at NAS Whiting Field. Groundwater contamination was confirmed at some sites and not at others. The conclusions of the study indicated that a Characterization Study was needed to further characterize the nature and extent of contamination at some sites.

The nomenclature in the three-phase (IAS, Confirmation Study, and Remedial Measures) IR program was modified in 1987–88 to be consistent with CERCLA and SARA regulatory requirements. The updated IR nomenclature included:

- PA and SI,
- RI,
- FS, and
- planning and implementation of Remedial Design.

Under the updated rules, the IAS became equivalent to a PA and the first part of the Confirmation Study (the Verification Study) functioned as the SI. Consequently the Characterization Study was not performed, and the existing investigations were used to support the updated program.

2.5.3 Battery Shop Site Investigation, 1985

During 1985 one of the IAS sites (Site 5, Battery Acid Seepage Pit) was investigated separately under a Consent Order with FDER. The results indicated that no significant contamination had resulted from past activities at the Battery Acid Shop, and rescindment of the Consent Order was recommended on April 15, 1987. Data from this investigation were compiled in a report entitled *Detection and Monitoring Program, Battery Shop Site, Final Report, NAS Whiting Field, Florida* (Geraghty & Miller 1985b) and submitted to FDER.

2.5.4 Phase I Remedial Investigation, 1990–1992

In December 1990, ABB-ES, under contract to the Department of the Navy, SOUTHNAVFACENGCOM, initiated a Phase I RI at NAS Whiting Field. The objective of the Phase I RI was to characterize the nature and extent of contamination at sites identified during the IAS. The Phase I RI program addressed 14 of the 18 previously identified sites at the installation (Table 2-1). Only limited investigations were conducted at Sites 2 and 12 during the Phase I RI because no contaminants had been detected during the Verification Study.

No contamination attributable to Sites 2 or 12 was detected during the Phase I RI, so No Further Action (NFA) was proposed for both sites. Site 2, the Northwest Open Disposal Area, received only construction and demolition debris and was initially judged in the IAS to warrant no further consideration. At a Project Managers' meeting in Atlanta, Georgia, on November 13, 1992, however, USEPA and FDER requested

The results of the UST program investigation were reported in the *Jurisdiction Assessment Report* (ABB-ES 1994a). The report concluded that the benzene, toluene, ethylbenzene, and xylenes (BTEX) and trichloroethene (TCE) plumes at Sites 4 and 7 are commingled and that petroleum contaminants could not be remediated without design considerations for TCE contamination. Based on these findings, the report recommended that the sites be returned to the IR program.

Site 8 (UST Site 3054) was investigated under a separate contamination assessment conducted on July 17, 1993. The results of the investigation were reported in the *Contamination Assessment Report Addendum for Site 3054 (IR Site 8), NAS Whiting Field, Milton, Florida* (ABB-ES 1993a). Based on the data presented in the Contamination Assessment Report (CAR) Addendum, NFA was recommended for the site. In correspondence dated January 20, 1994, FDEP formally accepted the NFA recommendation presented in the CAR Addendum for Site 8 (UST Site 3054). The NFA recommendation was incorporated into a Site Rehabilitation Completion order that has been signed by the Director of FDEP's Division of Waste Management.

2.5.6 Phase II Remedial Investigation, 1992–Present

Phase II of the RI/FS, as outlined in the NAS Whiting Field Work Plan (E.C. Jordan 1990), was to consist of the following elements:

- potential receptors survey,
- plume delineation,
- production well investigation, and
- source area characterization.

Phase II of the RI/FS was comprised of two parts: A and B. The Phase II-A RI/FS was an extension of the investigation begun in Phase I. The objective of Phase II-A was to perform the additional investigation and site characterization required to determine the nature and extent of contamination at NAS Whiting Field and to support a baseline risk assessment and FS. Twenty sites were investigated in Phase II-A (Table 2-1). Phase II-A was designed to confirm that no release had occurred or is likely to occur at Sites 1, 9, 10, 11, 13, and 14; previous investigations has already indicated that environmental contamination had occurred at the remaining sites. At the end of Phase II-A, another set of technical memoranda was prepared to present the results of the field investigation. Identified data gaps were to be addressed during Phase II-B of the RI/FS.

2.6 PHASE II-C APPROACH OVERVIEW

The current system for Superfund cleanups allows for two cleanup pathways: remedial actions and removal actions. The remedial action pathway is traditionally structured toward long-term remedies that address risk as predicted under future scenarios. This traditional process has led to long study-based investigations to enable detailed alternative selection and evaluation of proposed remedies.

Recognizing that the process is both slow and expensive, USEPA sought to encourage flexibility in the program through the Superfund Accelerated Cleanup Model (SACM) program (USEPA 1992a). SACM encourages early action or development of ways to focus the RI/FS parts of an investigation, especially for certain types of sites with similar characteristics such as contaminated groundwater or volatile organics in soil. The goal of SACM is to accelerate the entire remedial process.

Based on information acquired from evaluating and remediating previous Superfund sites, the presumptive remedy approach, which is one acceleration tool within SACM, has been developed by USEPA (USEPA 1993b). Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection within the Superfund program. The use of presumptive remedies can streamline or focus the site investigation and remedy selection, reducing the cost and time required to clean up the site.

For the Phase II-C RI of Sites 3, 4, 30, 32, and 33 at NAS Whiting Field, USEPA's presumptive remedy strategy presented in *Final Guidance: Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (USEPA 1996a) and *Presumptive Remedies; Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils* (USEPA 1993a) will be used. The presumptive remedies for removal of volatile organic compounds (VOCs) from soil are soil vapor extraction (SVE), thermal desporption, and incineration. The key strategy elements for remediating contaminated groundwater sites include those listed below.

- Site characterization should be coordinated with response actions, and both should be implemented in a phased approach.
- Early or interim actions should be used to reduce site risks and to provide additional site data.
- Site characterization and interim action data should be used to assess the likelihood of restoring groundwater to ARARs or risk-based cleanup levels.

- Restoration potential should be assessed before establishing objectives for the long-term remedy.

- Provisions for monitoring and evaluating the performance of all groundwater actions should be included.

- Groundwater response actions should generally be implemented in more that one phase.

- Postconstruction refinements will generally be needed for long-term remedies.

During the RI, information will be collected to evaluate both the presumptive remedies for removal of VOCs from soil and for restoration/treatment of contaminated groundwater. Both active (e.g., pump and treat) and passive (e.g., natural attenuation) groundwater remedial alternatives will be evaluated because it may be necessary to apply active remedial technologies to the plume source areas and passive remedial technologies to restore the aqueous plume.

The steps presented below lead to identification of the most probable conditions and account for reasonable deviations for the site that are to be used during design and implementation. Monitoring and contingent actions to take if deviations are detected are also identified.

1. Planning sessions are conducted to sort through issues, review existing data, and screen possible remedial actions and technologies. A Work Plan is developed to give direction to the subsequent investigation and analyses.

2. Information is gathered to determine general site conditions and to refine the nature and extent of contamination. Investigations are complete when it is possible to determine probable conditions (including associated risk), differentiate among alternatives, set monitoring requirements, and identify reasonable deviations. Probable site conditions are those most likely to occur. Reasonable deviations are other potentially valid interpretations of site conditions.

3. The most probable site conditions and reasonable deviations are established. Based on identification of these conditions, conceptual designs incorporating both a base action and a contingent action can be developed and a Record of Decision (ROD) can be signed. The

selected alternatives will identify probable technology performance and reasonable deviations from that performance.

4. Following remedy selection, remedial designs based on the most probable site conditions plus designs covering contingencies for the agreed-upon reasonable deviations are produced.

5. Parameters to detect deviations during construction and operation of remedial actions will be selected. Key indicators (chemical, physical, and others) are selected for observation during remediation for both expected and reasonable-deviation conditions. The selected parameters are measured, and necessary modifications (contingent action) are made if deviations occur. Decisions on changes to the remedial action are made on the basis of the detected deviations, then contingent actions are developed.

This proposed approach recognizes that complete site characterization is not possible or necessary and, therefore, the remaining uncertainties must be managed. This approach emphasizes the collection of data only to support decisions. At Sites 3, 4, 30, 32, and 33, because of the presumptive remedies proposed, the primary decisions will be to determine (1) if free-phase dense, nonaqueous-phase liquids (DNAPLs) are present in the subsurface (Site 32 only) and, if they are present, whether they can practicably be removed; (2) the measures necessary to contain the groundwater plume (i.e., whether natural attenuation is sufficient to contain and restore the aqueous plume in a reasonable time frame); and (3) whether soil in the vadose zone poses an unacceptable risk to human health and the environment or a risk to groundwater (i.e., through leaching of contaminants) and, if so, the actions needed to remediate the soil. To make these decisions, data must be available to support a human health risk assessment, a qualitative ecological risk evaluation, and an FS.

The following investigation strategies will be applied to the media surrounding Sites 3, 4, 30, 32, and 33 to provide confidence that potential contamination has been identified and to verify the conceptual site model (CSM) for groundwater and surface soil.

- Soil and groundwater data will be collected near hot spots, potential migration pathways, and suspected source areas to fill data gaps identified during pervious investigations. This data collection will be performed to identify and quantify soil and groundwater contaminants in potential source areas.

- Near the boundaries of the groundwater plume, where contamination is considered to be present at low concentrations, additional groundwater data will be collected to define the extent of contamination with more certainty.

- Near the suspected source area at Site 32, a monitoring well will be installed down to the top of the lower clay layer [up to 360 feet below land surface (bls)] to identify free-phase DNAPLs, if present.

When practicable, a minimum of 10 samples (per medium), considered by USEPA to be a minimum for upper confidence limit (UCL) calculation based on the normal or lognormal distributions, will be collected. If data are not distributed in normal or lognormal fashion, a nonparametric (distribution-free) statistic, the approximate 95-percent UCL for the median, will be used.

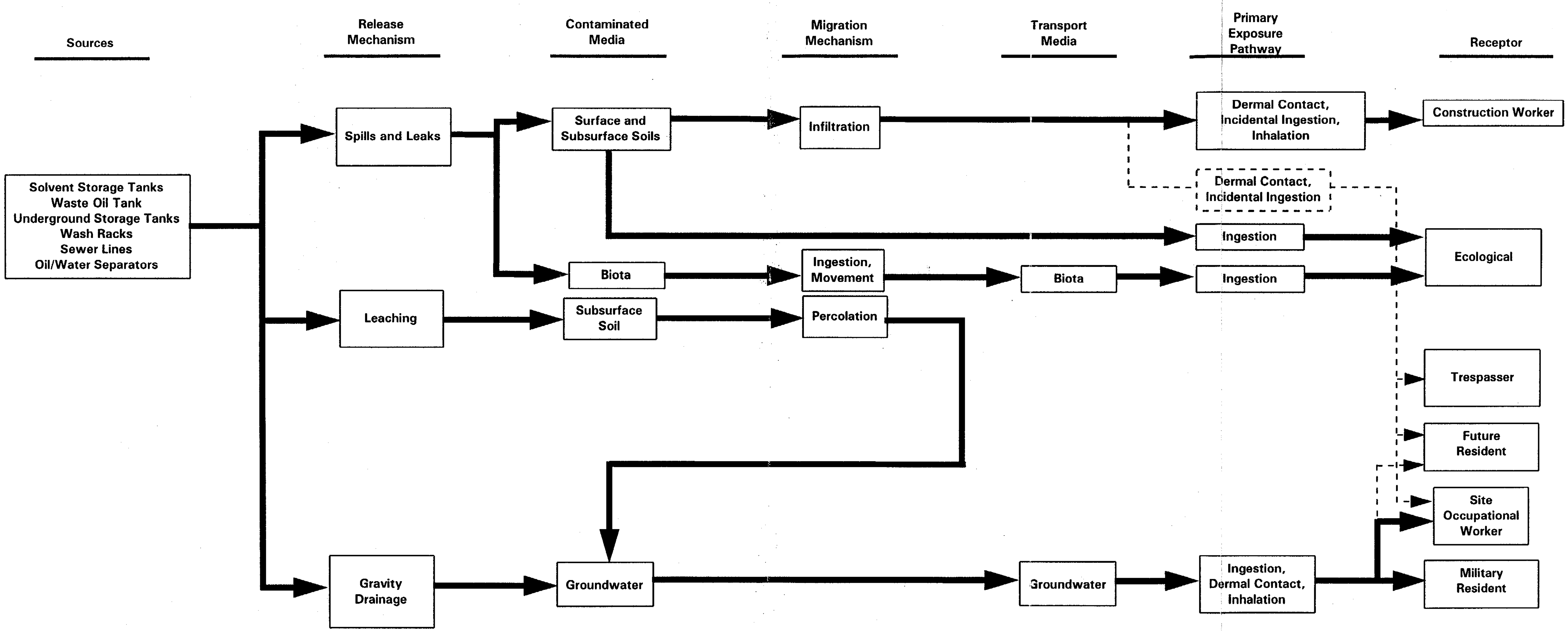
2.7 DATA NEEDS EVALUATION

2.7.1 Conceptual Site Model

The CSM is a framework within which the environmental pathways of potential concern are identified and illustrated. The media to be sampled to evaluate whether a release has occurred can be identified from the model. The CSM also serves as a framework for conceptualizing response actions. The CSM includes a set of hypotheses about the contaminated media and environmental pathways selected on the basis of existing data and understanding of the site. The source areas are identified as the areas of suspected waste disposal. A contaminant release mechanism is defined as a process that results in migration of a contaminant from a source area into the immediate environment. Once in the environment, contaminants can be transferred between media and transported away from the source and/or site.

Figure 2-8 illustrates the various media, transport pathways, and exposure pathways that could be affected by release of the source material from Sites 3, 4, 30, 32, and 33. This model represents current and predicted future conditions at the site, assuming that the site remains an industrial area. In the CSM a distinction is made between probable conditions and reasonable deviations. For the most part, data collected will be used to characterize the current nature and extent of contamination to support the human and ecological risk assessments and the FS.

Contamination at Sites 3, 4, and 32 includes commingled TCE and BTEX groundwater plumes as well as VOCs, polynuclear aromatic hydrocarbons (PAHs), and potentially inorganics in soil. Only soil contamination (volatiles, PAHs, and inorganics) will be investigated at Sites 30 and 33 because an



Legend

Probable Condition

Potential Deviation

FIGURE 2-8

CONCEPTUAL SITE MODEL

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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investigation of the groundwater is being performed as part of the Phase II-B investigation by another CLEAN contractor. No surface water or sediment is known to be affected by Sites 3, 4, 30, 32, and 33. The CSM identifies the three probable release mechanisms for contaminants described below.

1. Spills and leaks. Human and ecological receptors may come in contact with contaminated material and be exposed by dermal contact or incidental ingestion. Potential human receptors are construction workers, trespassers, future residents, and site occupational workers.

2. Leaching to groundwater. Contaminants can leach from contaminated soil into the groundwater. Both military and future residents as well as occupational workers could be exposed to the groundwater by ingestion, dermal contact, and inhalation because the potable water source for NAS Whiting Field is groundwater pumped from on-base wells that draw water from the affected aquifer. The potable water produced by NAS Whiting Field is currently treated using granular activated carbon (GAC) to remove contaminants, if present.

3. Gravity drainage of DNAPLs to groundwater. Contaminants can dissolve from free-phase DNAPLs (if present) that have flowed through the soil profile down into the groundwater. Residents and occupational workers could be exposed to the groundwater by ingestion, dermal contact, and inhalation because the potable water source for NAS Whiting Field is groundwater pumped from on-base wells. The potable water produced by NAS Whiting Field is currently treated using GAC to remove contaminants, if present.

The exposure potential of these contaminated media is discussed in Section 5.0, Baseline Risk Assessment.

2.7.2 Preliminary Identification of Remedial Action Technologies

The identification of preliminary remedial action technologies requires the identification of ARARs, remedial action objectives (RAOs), and probable treatment technologies.

2.7.3.1 Applicable or Relevant and Appropriate Requirements

ARARs must be identified and complied with to determine the appropriate extent of the required remedial action, develop remedial action alternatives, and direct the remedial action. The NCP and Section 121 of SARA specify that remedial action for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws that are ARARs to the hazardous substances or particular circumstances at a site. NAS Whiting Field is classified as an NPL site; therefore, the identification of ARARs will follow CERCLA guidance to ensure strict conformance with regulatory criteria.

Applicable requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site" [55 FR 8814, March 8, 1990 (NCP)]. Examples of applicable requirements include cleanup standards and standards of control for a hazardous substance.

Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting law that, while not (legally) applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (55 FR 8814). For example, the Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act would be considered relevant and appropriate at a site where surface or groundwater contamination could affect a potential (not actual) drinking water source.

Requirements under federal or state law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both; however, requirements must be both relevant and appropriate for compliance to be required. For cases in which federal and state ARARs are available, or when there are two potential ARARs addressing the same issue, the more stringent requirements must be met.

In the absence of federal- or state-promulgated regulations, there are other criteria, advisories, guidance values, and proposed standards that are not legally binding, but that may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs, but are "to-be-considered" guidance.

Tables A-1 and A-2 presented in Appendix A of this Work Plan are preliminary compilations of potential federal and state ARARs, of which subsets will be used or to which additional ARARs will be added as site-specific contaminants are identified and remedial actions are evaluated during the FS. The ARARs are characterized as: chemical-, location-, and action-specific ARARs.

- "Chemical-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants" (55 FR 8814). These requirements generally set protective cleanup levels for the chemicals of potential concern (COPCs) in the designated media or indicate a safe level of discharge that may be incorporated when considering a specific remedial activity.

- Location-specific requirements "are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats" (53 FR 51437, proposed NCP, 1988).

- Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (55 FR 8814). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies as well as specific environmental levels for discharge or residual chemicals.

The list of ARARs in Appendix A was used for the development of the probable remedial actions required at Sites 3, 4, 30, 32, and 33.

2.7.3.2 Preliminary Remedial Action Objectives

Preliminary RAOs were identified through the development of the CSM and the preliminary list of ARARs for Sites 3, 4, 30, 32, and 33. The intent of the RAOs is to determine the specific media, contaminants, and probable exposure pathways that must be addressed through a remedial action to protect the public and environment. These RAOs were developed to protect the public and environment for both existing and future site conditions as presented by the CSM. Under CERCLA guidance, RAOs required to protect the public health and environment are calculated based on the list of COPCs detected in the media, the corresponding acceptable exposure levels calculated on a cumulative basis, and the exposure routes. During the RI evaluation these criteria will be used to establish specific maximum allowable concentrations for each COPC detected at Sites 3, 4, 30, 32, and 33.

The probable contaminated media are surface and subsurface soil and groundwater. The probable exposure pathways include direct contact or incidental ingestion of surface soil by a trespasser, future resident (adult and child), or site occupational worker; dermal contact with, ingestion of, or inhalation of contaminated soil by a construction worker; and dermal contact, ingestion, or inhalation associated with residential or occupational use of groundwater. The only potentially contaminated media requiring remedial action are the groundwater, surface soil, and subsurface soil. A detailed description of the current and future land use exposure pathways and receptors proposed for evaluation at Sites 3, 4, 30, 32, and 33 is included in Section 5.1.3.2.

The likely COPCs at Sites 3, 4, 30, 32, and 33 include volatile organics, PAHs, and inorganics. Based on the list of ARARs, probable contaminated media, and exposure pathways, specific RAOs for each of the COPCs will be developed for the sites and presented within the FS; however, general RAOs have been assumed based on probable exposure pathways to support the development of the RI sampling requirements and contingent actions. The RAOs for Sites 3, 4, 30, 32, and 33 include:

- Limit dermal contact, incidental ingestion, and inhalation of soil by containment (maintain concrete cover) or treatment;

- Prevent further spread of the aqueous plume, and restore the maximum aerial extent of the aquifer to those cleanup levels appropriate for beneficial uses; and

- Reduce, to the extent practicable, the free-phase DNAPL zone, if present, and control further migration of subsurface DNAPLs to the surrounding groundwater.

Because removal of DNAPLs from the subsurface is often not practicable and no treatment technologies are currently available that can attain ARARs where subsurface DNAPLs are present, however, restoration of the aquifer in the DNAPL zone in a reasonable time frame may not be attainable. For this reason, an ARAR waiver due to technical impracticability may be appropriate for the DNAPL sites at NAS Whiting Field.

2.7.3.3 Preliminary Remedial Action Technologies

Potential remedial response actions that meet the RAOs have been identified for NAS Whiting Field Sites 3, 4, 30, 32, and 33. These response actions are based on the CSM and on USEPA guidance on presumptive remedies for sites with contaminated groundwater (USEPA 1996a) and volatile organics in soils (USEPA 1993a). The presumptive remedies listed by USEPA in these documents are based on an historical evaluation of the most commonly implemented and effective remedial technologies included in RODs for CERCLA sites with similar contaminants. Based on the existing site data, the preliminary remedial actions fall into the following general categories:

- institutional controls,
- soil treatment or containment,

- aqueous groundwater plume containment/treatment, and
- groundwater source (DNAPLs, if present) containment/removal.

The potential remedial actions are discussed in the following paragraphs:

Institutional Controls. Institutional controls include the implementation of land use restrictions for specific areas and can include limitations on intrusive activities such as trenching and well installation. Institutional controls may also require well-head treatment on potable water supply and irrigation wells and may specify monitoring and maintenance requirements. Other limited actions that might be required are the installation of fencing and warning signs around a site.

Soil Treatment or Containment. Treatment or containment of contaminated soil is assumed to be required for several of the sites. Potential remedial actions include in situ SVE and excavation and treatment by thermal desorption or incineration. Containment of the contaminated soil by the existing concrete pavement is assumed to adequately limit exposure at several of the sites.

Aqueous Groundwater Plume Containment/Treatment. Natural attenuation, which is defined in the NCP as "biodegradation, dispersion, dilution, and adsorption" of contaminants, is assumed to be able to effectively reduce contaminants in the aqueous groundwater plume to levels protective of human health. If site-specific data indicate that natural attenuation will not effectively contain and treat the groundwater, extraction wells with ex situ treatment may be employed to hydraulically control the migration of the contaminant plume. Potential ex situ treatments will include air stripping, carbon adsorption, and biological treatment, among others.

Groundwater Source Containment/Removal. Free-phase DNAPLs, if present, will be removed to the extent practicable using extraction wells or other similar technology. Because free-phase DNAPLs have not been found during previous investigations at NAS Whiting Field, it is not anticipated that DNAPLs will be identified during the Phase II-C RI/FS. Even if free-phase DNAPLs are not found, however, hydraulic containment of the source areas with high concentrations through the use of extraction wells may be a feasible method of controlling plume migration.

These potential remedial actions technologies include several process options that are shown on Figure 2-9. Additional technologies and process options may be evaluated in the FS, based on information collected during the RI. Development and evaluation of remedial alternatives are discussed in Section 8.0 of this Work Plan.

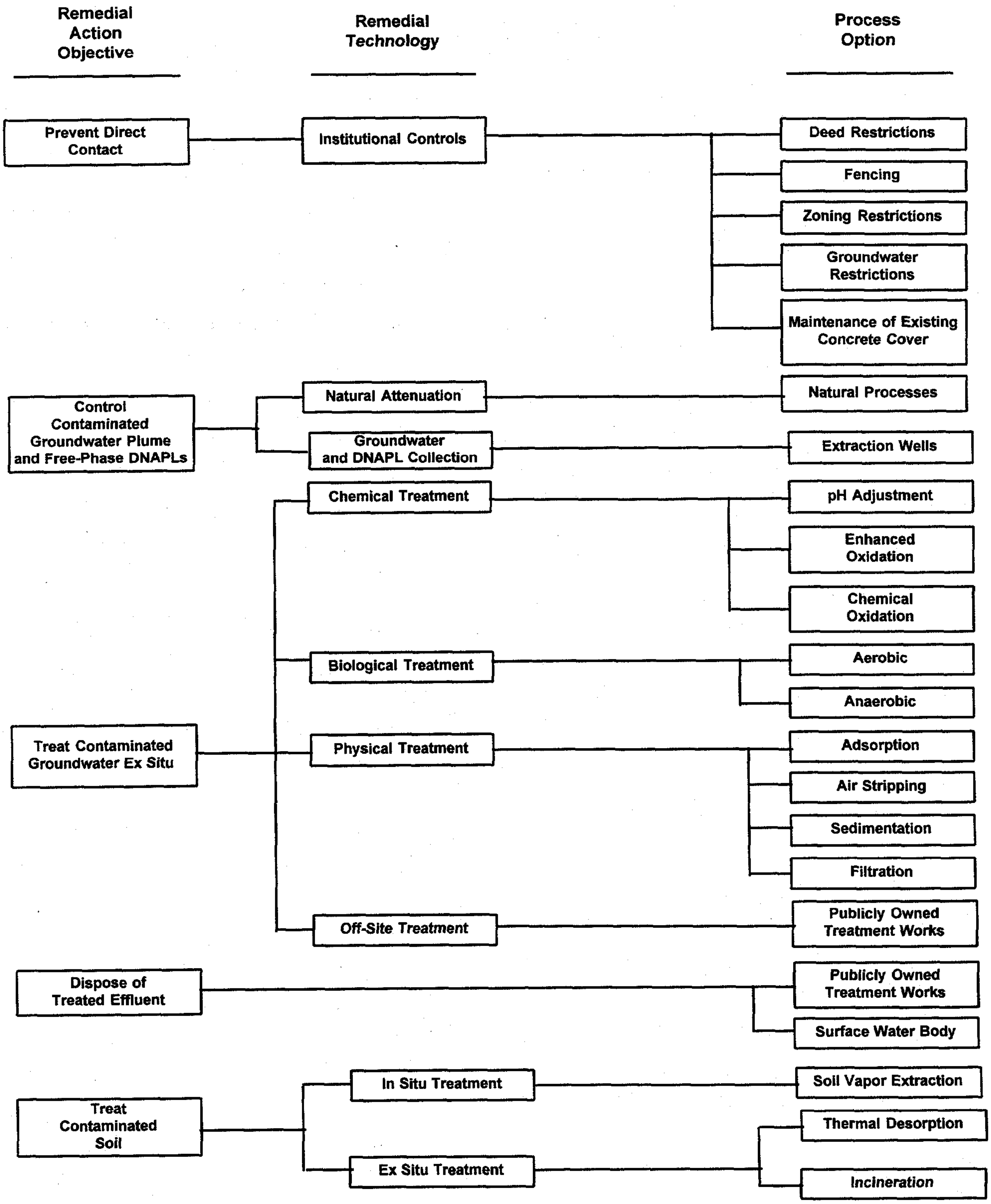


FIGURE 2-9

PRELIMINARY REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

2.8 TREATABILITY STUDIES/PILOT TESTING

Potential remedial technologies for contaminated soil and groundwater may require treatability studies and/or pilot testing to determine their effectiveness and applicability under existing site conditions. At the present time, no treatability studies or pilot testing are proposed for Phase II-C RI/FS activities at Sites 3, 4, 30, 32, and 33.

The need for treatability studies and/or pilot testing will be reevaluated following completion of data validation/evaluation and the initial evaluation of remedial technologies. Existing site data, available literature, and case studies will be explored before treatability studies are recommended. Treatability studies, if proposed, would be used to determine the site-specific suitability of the technologies and provide operational data to evaluate the technology during the FS.

2.9 SUMMARY OF DATA NEEDS

The three purposes for collecting data at Sites 3, 4, 30, 32, and 33 are to

- verify the probable conditions and reasonable deviations (i.e., verify the CSM and nature and extent of contamination);
- support the human health risk assessment and ecological evaluation; and
- support the FS.

Only those probable conditions and reasonable deviations that will affect the outcome of the risk assessment and evaluation or the FS will be identified.

To determine the data to be collected during the RI, uncertainties in terms of probable conditions and reasonable deviations have been identified with respect to technology performance (Table 2-3) and site conditions (Table 2-4). Preliminary base actions and contingent actions to address the deviations have also been identified. To resolve unacceptable uncertainties with respect to site conditions, technology performance, and regulatory issues, data needs are identified in Tables 2-3 and 2-4. These data needs are consolidated with existing information to identify what data should be collected during the RI.

TABLE 2-3

TECHNOLOGY PERFORMANCE UNCERTAINTIES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Technology	Probable Conditions	Data Needs	Potential Deviation	Contingent Action	Additional Data Needs
Institutional Controls	Implementation of zoning and deed restrictions for future land use provides for groundwater restrictions and maintenance of existing concrete cover.	Determine regulatory requirements for implementation of land and groundwater use restrictions.	Groundwater and land use restrictions are not implemented that restrict future use of groundwater and maintain existing concrete and asphalt pavements in industrial areas.	Potable water supply may need to be provided to area residents, and contaminated soil beneath existing concrete and asphalt pavements may require treatment.	Characterization of groundwater and soil necessary to evaluate human health and ecological risks and to evaluate potential treatment technologies.
Soil Containment or Treatment	Soil treatment may be required only at Site 4 because existing concrete or asphalt pavements prevent direct exposure to contaminated soil at other sites except under the construction scenario.	Verify/determine nature and extent of contamination at all sites. Assess soil properties and lithology to evaluate soil treatment technologies at Site 4. Operational data from Site 2894 will be used to design the soil treatment system, and a pilot test may not be required.	Soil treatment or containment is required at sites other than Site 4.	Assess soil properties and lithology at all site with unacceptable human health or ecological risk. Pilot tests may be required to design treatment or containment systems.	Soil properties and treatment system parameters such as air permeability, air flow rates, influent concentrations, etc., that are necessary to design soil treatment systems.
Groundwater Source (DNAPLs) Containment/ Removal	A free-phase DNAPL groundwater source is not found or, if a source is found, removal of the DNAPLs may not be practicable.	Investigate the groundwater near the suspected release area to identify free-phase DNAPLs. If free-phase DNAPLs are found, perform pilot test to see if DNAPLs can practicably be recovered.	Free-phase DNAPLs are found in the soil or groundwater near the suspected release area, and they can practicably be removed.	Based on pilot test data, design either a DNAPL recovery system or groundwater extraction system to reduce downgradient migration of the DNAPL source area.	Characterization of the free-phase DNAPL plume. DNAPL and groundwater extraction rates, contaminant concentrations, etc., will be required for design of a treatment system.
Aqueous Groundwater Plume Containment/ Treatment	The aqueous plume migrates downgradient toward Clear Creek. Engineering controls and natural attenuation may be used to contain the plume.	Determine groundwater chemistry parameters necessary to evaluate redox conditions and microbial processes (Chapelle List) and hydrologic parameters required to model groundwater flow and design groundwater containment/treatment system.	Natural attenuation prevents further migration of the aqueous plume, and other treatment technologies are not required to prevent migration of the plume.	Long-term monitoring will be required to demonstrate natural attenuation effectiveness.	No additional data required.

DNAPL–dense, nonaqueous-phase liquid

TABLE 2-4

SITE CONDITION UNCERTAINTIES AND DATA NEEDS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Media	Probable Conditions	Base Action	Data Needs	Reasonable Deviation	Contingent Action	Additional Data Needs
Surface and Subsurface Soil	Soil at Site 4 may require treatment or removal. Treatment may not be required at the other sites.	Treat or contain surface soil at Site 4. Maintain existing concrete or asphalt pavement at other sites.	Verify nature and extent of contamination at all sites, and collect/evaluate soil air permeability data and soil lithology data at Site 4.	Existing concrete and asphalt pavement will not be maintained, which will require soil treatment at one or more of the other sites.	Evaluate treatment and containment alternatives for all sites	Collect/evaluate soil air permeability data and soil lithology data required to design soil containment or treatment systems.
Groundwater	Implementation of engineering controls and natural attenuation is required to contain the aqueous groundwater plume. No free-phase DNAPLs are found.	Monitor chemical and natural attenuation groundwater parameters. Perform groundwater modeling necessary to design engineering controls.	Hydrologic and groundwater data to model and design a system to contain the groundwater plume. Groundwater chemistry parameters necessary to evaluate redox conditions and microbial processes (natural attenuation list).	Migration of the aqueous groundwater plume is controlled by natural attenuation, and engineering controls are not required.	Long-term monitoring will be required to demonstrate the effectiveness of natural attenuation.	No additional data required.
Biota	Biota does not pose a risk to human health or terrestrial fauna because of the soil cover and current and future land uses.	No action.	Ecological survey and nature and extent of surface soil contaminants.	Terrestrial fauna are being exposed to contaminated materials, thereby producing a possible ecological risk.	Prevent fauna and flora exposure to contaminated material by capping or removal actions.	No additional data required.

The information listed below will be collected during the RI.

- Soil. *Surface and subsurface soil samples will be collected from hot spots and suspected source areas to determine the nature and extent of contamination and to fill in data gaps identified during previous investigations.*

- Groundwater. Groundwater quality data and hydrologic information from previous investigations, sampling of existing monitoring wells, and installation of monitoring wells will be used to evaluate the nature and extent of groundwater plumes; to evaluate the hydrogeologic environment surrounding Sites 3, 4, 30, 32, and 33; and to facilitate possible groundwater modeling. This information will be used to support the risk assessment and the FS.

- Biota. An ecological characterization will be conducted in areas impacted by and surrounding Sites 3, 4, 30, 32, and 33. This information will support the qualitative ecological risk evaluation.

Background concentrations of constituents have been determined during previous investigation at Whiting Field; therefore, background values will not be determined as part of this investigation.

2.10 PROJECT DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data activity to support specific decisions. The DQOs are the starting points in the design of an investigation. The DQO development process matches sampling and analytical capabilities to the data targeted for specific uses and ensures that the quality of the data satisfies project requirements. USEPA has identified five general levels of analytical data quality as being potentially applicable to field investigations under CERCLA at potential hazardous waste sites. The Navy has adopted three of the analytical levels as quality control (QC) requirements. They are C, D, and E, which correlate to Levels III, IV, and V described in *Data Quality Objectives for Remedial Response Activities Development Process* (USEPA 1987). These levels are based on the type of site to be investigated, the level of accuracy and precision required, and the intended use of the data. Analytical requirements for USEPA Levels I and II have not yet been defined by the Navy.

A brief description (as presented in *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program*, Energy Systems 1988) of each level is provided below.

USEPA Level I: Field Screening. This level of data quality is the lowest, but provides the most rapid results. It is used to assist in the optimization of sampling locations and for health and safety support. Data generated provide information on the presence or absence of certain constituents and are generally qualitative rather than quantitative.

USEPA Level II: Field Analysis. This level of data quality is characterized by the use of analytical instruments that are carried in the field and the use of mobile laboratories. Depending on factors such as instrumentation and environmental matrix, data may be either qualitative or quantitative.

Navy Level C QC. A site requiring Level C QC would be a site near a populated area, not on the NPL, and not likely to be undergoing litigation. Level C QC includes review and approval of the laboratory quality assurance (QA) plan and of the site Work Plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports on QA. The laboratory that performs Level C QC must have passed the performance sample furnished by the Superfund Contract Laboratory Program (CLP) in the past year. The laboratory does not need to be receiving CLP bid lots of samples. Level C allows the use of non–CLP methods, but requires that the methods be accepted USEPA methods or be equivalent to such methods. The Navy audit and performance samples are required in addition to any specified by the USEPA Superfund Program.

Navy Level D QC. Level D QC is to be used for sites that are on or about to be on the NPL. These sites are typically near populated areas and are likely to undergo litigation. Level D QC includes review and approval of the laboratory QA plan, the site Work Plan, and the field QA plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide MPRs on QA. These activities will be administered and evaluated by the Navy Energy and Environmental Support Activity Contract Representative. This audit and the analysis performance sample are in addition to those related to the USEPA Superfund Program. The laboratory that performs Level D QC must have successfully analyzed the performance sample furnished through the Superfund CLP and must be able to generate CLP deliverables. For a Level D site, CLP methods are used and the CLP data package is generated. The Navy audit and performance samples are required in addition to any specified by the USEPA Superfund program.

Navy Level E QC. A site requiring Level E QC will be located away from a populated area, will not be an NPL site, and will have a low probability of litigation. Level E QC includes review and approval of the laboratory QA plan and the site Work Plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide MPRs on QA. For

Level E, the laboratory is not required to have successfully analyzed a CLP performance sample. Level E allows the use of non–CLP methods, but requires that all methods used must be USEPA or equivalent.

Specifics regarding QA/QC, validation, and uses of each level of data are described in the Navy's *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program* (Energy Systems 1988) and *Navy Installation Restoration Laboratory Quality Assurance Guide* [Naval Facilities Engineering Service Center (NFESC) 1996] and in the USEPA Office of Emergency and Remedial Response and Office of Waste Programs Environmental Enforcement Guidance's *Data Quality Objectives for Remedial Response Activities Development Process* (USEPA 1987).

At NAS Whiting Field, which is an NPL site, Data Quality Level D is intended for most laboratory sample analyses. Table 2-5 summarizes the analytical parameters, DQOs, and data use for each task to be undertaken during Phase II-C RI activities at NAS Whiting Field.

TABLE 2-5

DATA QUALITY OBJECTIVES
RI/FS PHASE II-C WORK PLAN FOR
NAS WHITING FIELD SITES 3, 4, 30, 32, AND 33
MILTON, FLORIDA

Activity	Objectives	Data Quality Objective: QC Level	Data Quality Objective: Rationale
Groundwater Analysis	Data will be used to characterize and define extent of groundwater contamination.	D	Data necessary for Human Health Risk Assessment and Feasibility Study
Soil Analysis	Data will be used to evaluate exposure potential and to characterize and define the extent of soil contamination.	D	Data necessary for Human Health Risk Assessment, Ecological Risk Assessment, and Feasibility Study
Receptors Survey	Data will be used to establish potential receptors.	II	Data mandatory for Ecological Risk Assessment
Air Survey	Health and safety breathing space monitoring	I	Health and Safety

3.0 TECHNICAL APPROACH

3.1 FIELD INVESTIGATION METHODS

The planned Phase II-C work for Sites 3, 4, 30, 32, and 33 focuses primarily on defining the lateral and vertical extents of soil contamination and groundwater plumes previously investigated. Analysis of the previous investigation data suggests that additional data are needed to define the concentrations of constituents in soil and groundwater to regulatory-defined or risk-based concentrations and to improve the certainty of data interpretation in support of the FS engineering analysis and design.

The Scope of Work (SOW) for Phase II-C has been planned based on a review of the existing data, regulatory guidance [e.g., FDEP Soil Cleanup Guidance, USEPA Risk Assessment Guidance for Superfund (RAGS) and addenda], and in consultation with USEPA, FDEP, and Navy personnel. Adjustments to the planned SOW may be necessary, however, as new data become available. If new field investigation methods or changes to existing methods become necessary as a result of adjustments to the SOW, then the proposed revisions will be presented by B&R Environmental to the Southern Division's Remedial Project Manager, FDEP and USEPA Region 4 regulatory representatives, and NAS Whiting Field's Environmental Coordinator for review and approval.

3.1.1 Standard Operating Procedures

A variety of field investigation activities will be conducted at NAS Whiting Field to meet the objectives of the RI/FS. To ensure that all data are consistent with regulatory requirements and meet the DQOs, all data collection activities will follow the Standard Operating Procedures (SOPs) issued by the QA Section of the FDEP *Comprehensive Quality Assurance Plan (COMPQAP)* (DEP-QA-001/92, B&R Environmental 1997b) and by USEPA in *Environmental Investigations Standard Operating Procedures Quality Assurance Manual* (1996b). As such all activities will comply with B&R Environmental's FDEP COMPQAP #870055G (1997), which was approved by FDEP on March 14, 1997.

In some instances the planned investigation activities (e.g., well construction) may not be specifically addressed in the Comprehensive Quality Assurance Plan (COMPQAP); in other cases a methodology presented in the COMPQAP, or a specific step thereof, may be deemed inconsistent with site-specific conditions or previous investigation methods used at NAS Whiting Field. In these cases the USEPA Region 4 Environmental Investigations SOPs (USEPA 1996b), Navy technical guidance, or project-specific SOPs adopted by or prepared by B&R Environmental will be invoked.

A copy of all above-referenced guidance documents along with this Work Plan will be maintained in the B&R Environmental field office at NAS Whiting Field and will be reviewed with the field team before work begins. Project-specific SOPs that are adopted by or prepared by B&R Environmental for Phase II-C of the RI/FS at NAS Whiting Field are presented in this Work Plan and are discussed in the following sections.

3.1.2 General Site Operations

3.1.2.1 Field Team Organization

The B&R Environmental RI/FS field team will consist of staff members who will be assigned temporary duty at NAS Whiting Field and who will conduct the field investigation activities. The organization of the field team is described below.

- The Field Operations Leader (FOL) is responsible for the day-to-day direction of personnel in the field. The FOL will assign tasks to field team personnel, direct the sequence of activities, coordinate with NAS Whiting Field personnel, coordinate subcontractors, and review tasks in progress and those completed. The FOL will ensure that project-specific plans are implemented and that activities are in compliance with appropriate guidelines.

- The Project Safety Officer is responsible for ensuring that proper health and safety procedures are identified and implemented for the project and that project-related health and safety incidents are properly investigated. In the event that only a small number of project staff are required on site, the duties of the Project Safety Officer may be assigned to the FOL or another member of the field team. The Project Safety Officer or designee will report directly to the B&R Environmental Corporate Director of Health and Safety.

- The Field Geologist will oversee soil boring and monitoring well installation activities and may conduct various environmental sampling activities. Duties will include logging and documentation of drilling and well construction, environmental sample collection and handling, and ensuring that the approved methods are implemented. The field geologist may also conduct tests for identifying subsurface conditions and characterizing the groundwater flow regime.

- The Sampling Personnel will be responsible for properly locating, collecting, preserving, packaging, documenting, and shipping environmental samples to the laboratory.

3.1.2.2 Mobilization

Several internal tasks must be performed by B&R Environmental before the field mobilization. These tasks include the following:

- preparation of technical and subcontractor bid specifications,
- selection and mobilization of subcontractors,
- acquisition and preparation of equipment for transportation to the field,
- acquisition and preparation of expendable supplies for transportation to the field, and
- arrangement of transportation and lodging for field personnel.

In addition to internal efforts, external mobilization efforts will be coordinated with the NAS Whiting Field Point of Contact (POC). A list of the steps to be taken includes the following:

- obtain keys to existing locks on wells (other than those installed by B&R Environmental),
- set up the investigation field office and coordinate utilities hookup,
- select staging areas for equipment and IDWs,
- select decontamination area(s) with electrical hookup, potable water, and drainage to an oil/water separator,
- complete security procedures for project and subcontractor personnel to gain access to the Base,
- ensure that supplies of potable water are accessible, and
- coordinate with Base personnel to locate buried utilities.

A location will be assigned by the Base POC to be used as a personnel/communication field office. Multiple decontamination facilities may be selected or constructed by the drilling subcontractor before the beginning of field activities at locations deemed appropriate by the Base POC and B&R Environmental.

Site reconnaissance will be performed before initiation of field activities. Some of these activities will be performed with the assistance of NAS Whiting Field personnel. These activities are listed below:

- Locating and setting up of decontamination facilities.
- Identifying the potable water source(s), electrical outlets, and other utilities to be used during field activities.
- Collecting and shipping to the laboratory a field blank of the potable water source to be used for field decontamination activities.
- Locating temporary storage for soil cuttings and purge/development water drums as well as solid wastes generated during field activities (e.g., Tyvek suites, gloves, plastic sheeting).
- Reconnoitering and marking/staking sample locations.
- Locating underground and aboveground utilities within the work areas (including water, gas, sanitary sewer lines, drainage lines, telephone cable, and electric lines). Electric lines may be shielded, if necessary.
- Erecting any necessary barricades and/or temporary fencing.

3.1.3 Field Investigation Activities

The planned SOW for Phase II-C of the RI includes the following general categories of field investigation activities:

- collection of surface soil samples;
- installation of soil borings and collection of subsurface soil samples using direct-push or conventional drilling techniques;

- installation of groundwater monitoring wells in the perched groundwater zone and in the shallow, intermediate, and deep zones of the alluvial aquifer;
- collection of groundwater samples;
- measurement of groundwater potentiometric level;
- field measurement of physical and chemical properties of soil and groundwater samples;
- decontamination of investigation equipment;
- sample management;
- field QC, documentation, and recordkeeping;
- IDW management; and
- location survey.

As described in Section 3.1.1, all field investigation activities will be performed in accordance with the appropriate regulatory and project-specific SOPs. Project-specific SOPs will be given priority, followed by the FDEP COMPQAP and then USEPA Region 4 SOPs when SOPs for the same task differ. Copies of all guidance documents will be located in the B&R Environmental field office at NAS Whiting Field. Table 3-1 presents a cross-reference guide to the applicable SOPs for the general field activities listed above. Table 3-1 focuses on the SOPs deemed most likely to be used by the field investigation team. If activities arise that are not referenced in Table 3-1, then the project-specific SOPs, COMPQAP, the USEPA Region 4 SOPs, or Navy guidance will be invoked (in that order) with approval by USEPA, FDEP, and Navy personnel. Project-specific SOPs referenced in Table 3-1 are discussed in the following sections.

3.1.3.1 Direct-Push Sampling

A direct-push technology (DPT) soil sampling device (e.g., Geoprobe® system) may be used to obtain subsurface soil samples at NAS Whiting Field. Unlike conventional drilling techniques, DPT probing tools do not create an open borehole into which soil sampling devices are inserted. DPT allows investigators to

TABLE 3-1

STANDARD OPERATING PROCEDURES CROSS REFERENCE[a]
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

ACTIVITY	FDEP[b]		EPA-4[c]		B&R ENVIRONMENTAL[d]	
SOIL SAMPLING						
General	A	4.0 / 4.3.1-4.3.2	A	12.3		
Manual Sampling	A	4.3.4	A	12.3.1		
Power-Driven Sampling	A	4.3.4.5	A	12.3.2		
VOC Samples	A	4.3.2	A	5.13.9 / 12.4.1		
Sample Mixing	A	4.3.2	A	5.13.8		
DRILLING						
Safety			A	6.7		
Direct-Push					A	3.1.3.1
Augering			A	6.3.1		
Rotary			A	6.3.3		
Abandonment			A	6.9		
WELL CONSTRUCTION						
Overdrilling			A	6.4.2		
Annular Space			A	6..4.1		
Casing and Screen			M	6.6.2	A	3.1.3.2
Installing the Well			M	6.5.1 / 6.5.2		3.1.3.3
Filter Pack			A	6.4.3 / 6.6.3		
Filter Pack and Screen Design			M	6.6.4	A	3.1.3.4
Well Seal and Grouting			A	6.4.4 / 6.4.5		
Surface Completion			A	6.4.6 / 6.4.7 / 6.4.8		3.1.3.3.4
Development			A	6.8		3.1.3.3.6
Temporary Wells			A	6.1		
GROUNDWATER SAMPLING						
General	A	4.0 / 4.2.1 / 4.2.5.2				
Purging		4.2.5.3-4.2.5.5	A	7.2.1 / 7.2.2 / 7.2.4		
Sample Methods		4.2.5.6	A	7.3.1 / 7.3.3		
Sample Containers / Preservation	A	4.2.2	A	7.3.4		
Trace Organic and Metals	A	4.2.5.6 (g)	M	5.13.9 / 7.3.5	A	3.1.3.5
Temporary Wells	A	4.2.9				
Auxillary Data			A	7.3.7		
FIELD MEASUREMENTS						
Groundwater Levels	A	4.2.5.4	M	15.8	A	3.1.3.6
pH, Temperature, Conductivity	A	7.5.2 / 7.5.3 / 7.5.5	A	16.2-16.4		
Dissolved Oxygen	A	7.5.4	A	16.7		3.1.3.11
Turbidity			A	16.5		
Redox Potential					A	3.1.3.7
Ferrous Iron (Fe++)					A	3.1.3.8
Air Monitoring / Head Space	A	7.5.7			A	3.1.3.9
Residual Product Detection					A	3.1.3.10

TABLE 3-1

**STANDARD OPERATING PROCEDURES CROSS REFERENCE[a]
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2**

ACTIVITY	FDEP[b]		EPA-4[c]		B&R ENVIRONMENTAL[d]	
DECONTAMINATION						
General	A	4.1.1 / 4.1.3				
Reagents	A	4.1.2				
Sampling Equipment	A	4.1.4			A	3.1.3.3.8–9
Filters	A	4.1.6				
Tubing	A	4.1.7.1-4.1.7.5				
Pumps	A	4.1.8				
Field Equipment	A	4.1.9.1 / 4.1.9.2			A	3.1.3.3.10
Analyte-Free Water Containers	A	4.1.10				
Ice Chests / Shipping Containers	A	4.1.11				
SAMPLE HANDLING						
General			A	5.13.3 / 5.13.7		
Sample Containers	A	4.4.1				
Preservation and Holding Times	A	4.4.2	A	5.13.6		
Documentation	A	5.0 / 5.3	A	3.3		
Sample Identification	A	5.3.2	A	3.2.1	A	3.1.12
Packing and Transportation	A	4.4.3.2				
FIELD QUALITY ASSURANCE/QUALITY CONTROL						
Field Calibration	A	7.5				
Field Equipment Decontamination		7.5..1				
Quality Control Samples	A	9.1				
Control Limits	A	7.5			A	3.1.13
Corrective Action	A	11			A	3.1.14
INVESTIGATION-DERIVED WASTE						
Investigation Waste Disposal	A	4.4.5			A	3.1.15
Nonhazardous Waste			A	5.15 / 5.15.1		
Hazardous Waste			A	5.15 / 5.15.2		
RECORDKEEPING						
Field Logbooks and Forms			A	3.5	A	3.1.16
Manufacturer's Specifications					A	3.1.17
Chain-of-Custody Forms	A	5.3				
Field Calibration Records	A	7.8				
SURVEYING						
GPS Surveys					A	3.1.18
NGVD Surveys					A	3.1.18

(a) Annotations found in this reference table indicate the following:
A – Standard Operating Procedure (SOP) that is fully adopted.
M – Modification of existing Florida Department of Environmental Protection (FDEP) or U.S. Environmental Protection Agency (EPA) SOP documented in project-specific SOP.

(b) Denotes FDEP SOPs adopted by Brown & Root Environmental, source: FDEP Comprehensive Quality Assurance Plan #870055G, March 1996. Number shown indicates the chapter and section in the FDEP SOPs.

(c) Denotes EPA Region 4 Environmental Investigations SOPs and Quality Assurance Manual, May 1996. Number shown indicates the section in the EPA SOPs.

(d) Denotes project-specific SOPs adopted by or prepared by Brown & Root Environmental for the conduct of work at Naval Air Station Whiting Field. Number shown indicates the text section in which the SOP may be found.

GPS – Global Postioning System
NGVD – Natural Geodetic Vertical Datum
VOC – volatile organic compound

push a closed sampler to depth, open the sampler, and obtain a discrete soil sample that is relatively undisturbed. For this project a DPT sampler may be used for collecting shallow soil samples (typically less than 30 feet).

The samples may be collected from any discrete depth interval, but will typically be used above the zone of perched groundwater saturation. The DPT sampler usually has an inner diameter of 1 to 2 inches and recovers a soil core measuring 2 to 4 feet in length. If deemed necessary, liners made of material compatible with the contaminants of interest will be used inside the soil sampler to keep the sample intact after it is extruded from the sampler and to reduce the likelihood of cross-contamination or false-positive laboratory results.

To collect a sample the DPT sampler is attached to the leading end of the pushing rods and driven in a closed and sealed position into the subsurface soil using an hydraulic and/or percussion driver. At the top of the desired sampling interval, the pushing is temporarily stopped and an internal release mechanism in the sampler is triggered using extension rods inserted down the inside of the push rods. After the release is activated, the sampler is again driven forward, collecting soil in the sample tube as a piston retracts. The probe assembly is then retrieved and the soil sample is removed for examination.

After removal from the sampler barrel, the sample is extracted and placed on a fresh, clean surface. If a liner is used, it is separated into four 6-inch-long sections (along perforations in the brass liners), and the exposed soil is screened with a flame ionization detector (FID). Samples selected for laboratory analyses will be immediately placed into laboratory-supplied containers. If liners were used, the open ends will be covered with clean, Teflon™ tape, capped, and sealed with exterior tape. The samples will be labeled, preserved on ice, and transported to the laboratory. All portions of the probe assembly that are inserted into the ground will be decontaminated before each use using standard decontamination procedures (see Table 3-1). An equipment rinsate blank will be collected from the decontaminated sampler at the prescribed frequency.

3.1.3.2 Well Casing and Screen Materials

All permanent and temporary monitoring wells will be constructed of Schedule 40 polyvinyl chloride (PVC) casing and screen manufactured for environmental applications (i.e., no inked markings, shipped clean in individual, sealed wrappings) and meeting the requirements of the American Society for Testing and Materials (ASTM) F 480 and D 1785. This variance from the USEPA Region 4 SOPs' requirement for stainless steel casing and screen materials is based on previous investigation results that show that background groundwater quality (e.g., pH) and dissolved contaminants in groundwater (e.g., petroleum hydrocarbons) are not present at concentrations detrimental to the use of PVC. Furthermore, the use of PVC will make the construction of these wells consistent with that of wells previously installed at NAS Whiting Field. If conditions are encountered for which PVC is inappropriate, then stainless steel or an other suitable material will be selected and presented to USEPA, FDEP, and Navy personnel for approval before being used.

3.1.3.3 Monitoring Well Installation

3.1.3.3.1 Perched and Shallow Well Installation

The perched and shallow wells will be drilled by either hollow-stem auger (HSA) or mud rotary dependent on field conditions. The wells will be constructed of 2-inch-diameter, Schedule 40 PVC, flush-threaded casing with 15-feet, 0.01-in. slotted, PVC screens. The well screens will be placed such that the screens bracket the water table. If HSA drilling is used, the wells will be constructed inside the auger. Once the screen and riser pipe are in place, the annulus of the boring will be backfilled with clean, 20/30, silica sand from the bottom of the borehole to 2 feet above the top of the screen. If the well is constructed inside augers, the sand will be maintained at a depth of several inches inside the augers to ensure an adequate sand pack around the well. A fine sand seal at least 4 feet thick, will be installed on top of the 20/30 silica sand. The remainder of the annulus of the borehole will be grouted by pumping a cement/bentonite slurry through a tremie pipe up to 2 feet bls.

3.1.3.3.2 Intermediate and Deep Well Installation

The intermediate and deep wells will be drilled by the mud rotary technique. The intermediate wells will be installed approximately 30 to 50 feet below the bottom of the shallow well. The bottom of each borehole is expected to be between 120 and 150 feet bls. The wells will be constructed of 2-inch-diameter, Schedule 40 PVC, flush-threaded casing with 10-feet, 0.01-inch slotted, PVC screens. Centralizers will be placed at approximately 25-foot intervals above the top of the screen and at the bottom of the screen to ensure that the well is centered in the borehole. The annulus between the well and the borehole wall will be backfilled using a tremie pipe with 20/30 clean silica sand to at least 2 feet above the top of the screen. A 4-foot-thick fine sand seal will be installed above the sand pack. The remained of the annulus will be backfilled with cement/bentonite grout.

The deep wells will be installed approximately 30 to 50 feet below the bottom of the intermediate well. The bottom of the each deep borehole is expected to be between 180 and 200 feet bls with the exception of proposed monitoring well WHF-32-3D, which will end at between 240 and 360 feet. The wells will be constructed of Schedule 40 PVC, flush-threaded casing with 10 feet of 0.01-in slotted, PVC screens. Centralizers will be placed at approximately 25-foot intervals above the top of the screen and at the bottom of the screen to ensure that the well is centered in the borehole. The annulus between the well and the borehole wall will be backfilled using a tremie pipe with 20/30 clean silica sand to at least 3 feet above the top of the screen. Because of the depth of the wells, fine sand seals will be installed to 4 feet above the sand pack. The remaining annulus will be backfilled with cement/bentonite grout.

As appropriate, a 6-inch PVC surface casing will be installed at each intermediate and deep well location to seal off the upper portion of the aquifer to prevent carry-down of possible contaminants to its lower sections. The surface casings will be set in confining layers below the bottom of the shallow well. The casings will be pressure-grouted in place and allowed to cure for at least 24 hours before the borehole is advanced below the casing.

3.1.3.3.3 Deep Well Installation Near Suspected Source Areas

An exploratory hole will be drilled by mud rotary before drilling and installation of deep wells near suspected source areas (e.g., proposed well WHF-32-3D). The purpose of this borehole will be to collect depth discreet groundwater samples at 40- to 50-foot intervals (hydropunch samples), to determine elevation and thickness of significant clay units, to collect geotechnical samples from aquifer zones and confining units, and to collect soil samples for laboratory analysis and field DNAPL screening. The boring will be logged or sampled continuously to the termination depth. If a significant clay layer (more than 10 feet thick) is encountered below 250 feet, the borehole may be terminated and a 4-inch-diameter schedule 40 PVC flush-threaded casing with a 10-foot, 0.01 slotted PVC screen will be installed. If no significant clay layer is encountered by 360 feet, the monitoring well will be installed in the exploratory borehole.

Deep wells installed near suspected source areas (proposed well WHF32-3D) will be double-cased with a 6-inch casing installed across the shallow and intermediate aquifer zones. Exact casing placement will be determined by depth, lithology, or field screening results.

3.1.3.3.4 Well Surface Completion

The surface completion of the monitoring wells may be constructed by aboveground completion methods. Wells constructed aboveground will have steel protector casing with a diameter at least 6-inches greater than the diameter of the well riser. Each aboveground completion will have a 3-foot x 3-foot x 5-inch steel-reinforced concrete pad sloping at 0.25 inch/foot away from the steel casing. The bottom of the pad will be 2 inches bls. Four 5-foot-long, 4-inch-diameter guardposts or concrete car stops will be installed at the corners (sides for concrete car stops) of each well head pad. Each post will be recessed 2 feet into the ground and set in concrete. Each will be installed outside the surface pad. The steel protective casing will be painted with exterior white enamel. Well identification will be permanently marked on the well lid and protective casing.

When requested by the NAS Whiting Field POC, surface completions will be flush with the ground. The well riser will be cut approximately 3 inches bls. A freely draining valve box (or equivalent) with a locking cover shall be placed over the well head. The top of the well riser will be at least 1 foot above the bottom of the box. The box lid will be centered in a 3-foot x 3-foot, 5-inch-thick concrete pad sloping at 0.25 inch/foot away from the box. If the pad is expected to have heavy traffic passing over it, steel-reinforcing bars will be used. Concrete curbs may be installed at each side of the concrete pads adjacent to high traffic areas. Well identification will be permanently marked on the box lid and casing cap (if possible).

3.1.3.3.5 General Drilling Requirements

The only drilling fluids used will be water or drilling mud. The drilling mud will carry a chemical analysis from the manufacturer. In addition, lubricants used on the rig will not introduce or mask chemicals of concern (COCs) at the site being investigated. All trash, waste, grout, cuttings, and drilling fluids associated with the drilling activities will be disposed of by the drilling subcontractor in accordance with the NAS Whiting Field IDW Management Plan (Appendix D).

The items listed below will also be part of the SOP for drilling.

- All data related to well construction will be documented on a monitoring well sheet (Appendix B-2).
- Each well will be constructed by a driller and drilling company certified by the State of Florida.
- Well locations will be approved by the Base POC before installation.
- Glue will not be used to join screen or casing.
- At each well nest location, the deep well will be installed first to prevent invasion of drilling fluids into the shallower wells.

- At each well nest location, lithologic soil samples will be taken continuously by using 5-foot continuous samplers or at 5-foot intervals using 2-foot split spoons at the deep well location only. Installation of the shallow and intermediate surface casings wells will then be based on the lithologic description of the deep boring.

- A notch will be cut into the top of the casing to be used as a reference point for the elevation survey and for measuring water levels.

3.1.3.3.6 Well Development

Monitoring wells will be developed to remove fine-grained sediments and to break down the filter cake or smearing along the borehole well. The preferred method of development will be surging alternating with pumping. All development equipment will be decontaminated before being placed in the well. Throughout the development procedure, discharge water color and volume shall be documented. Wells will be developed until the following criteria are achieved:

- Turbidity remains within a 10 Nephelometric Turbidity Unit (NTU) range for 2 consecutive readings;

- Stabilization of the following parameters occurs:
  - temperature plus or minus 1°C,
  - pH plus or minus 1 unit, and
  - electrical conductivity plus or minus 5 percent of scale; and

- Accumulated sediment is removed from the well.

In general, the following will be conducted or considered during the well development process:

- Development will begin no sooner than 24 hours after well installation;
- If drilling mud is used during drilling, the total drilling fluid volume will be removed; and
- No detergents, bleaches, soaps, or other such items will be used to develop a well.

After development and after the water levels have been allowed to stabilize a minimum of 24 hours, the static water level will be measured and recorded. All data related to well development, including alternate development methodologies and their justification, will be written on the well development sheet (Appendix B-2) or in the field logbook.

3.1.3.3.7 Decontamination Procedures

The decontamination of major equipment (e.g., drilling rigs, dump trucks, backhoes) and sampling equipment is necessary to minimize the spread of contamination to clean zones, to reduce exposure to personnel, and to reduce cross-contamination of samples when equipment is used at more than one sampling location.

Major equipment will be decontaminated in the existing NAS Whiting Field equipment decontamination area. Sampling equipment will be decontaminated in tubs or drainage pans so that solvents can be collected and disposed of. Rinsate samples will be collected, as required, from the decontaminated sampling equipment by rinsing the clean equipment with analyte-free water. The sampling equipment will then be wrapped in aluminum foil and stored in a clean area until use. Clean sampling equipment will not be allowed to come into contact with the ground or any potentially contaminated surfaces before use at the sampling location.

Disposable material (e.g., gloves, Tyvek suits) generated during decontamination will be bagged and stored in drums for proper disposal at an off-base location.

3.1.3.3.8 Soil Sampling Equipment

All stainless steel spoons, bowls, and other soil-sampling equipment will be decontaminated after each use. The decontamination procedure outlined below will be used.

- Wash and scrub the equipment with a solution of Liquinox (or equivalent) and potable water.
- Rinse with potable water
- Rinse non-steel equipment with 10 to 15 percent reagent-grade nitric acid ($HN0^3$) when sampling for trace metals.
- Rinse with analyte-free water.
- Rinse twice with isopropanol.
- Air dry (if possible).
- Wrap in oil-free aluminum foil (if appropriate).

3.1.3.3.9 Water Sampling Equipment

Submersible and peristaltic pumps may be used to purge and collect water samples. Purging and sampling performed with pumps will use dedicated discharge lines for each sampling location. Submersible pumps will be cleaned inside and outside between uses at each sampling location. Peristaltic pumps will be cleaned outside between uses at each sampling location. Pump decontamination procedures are as follows:

- Wash with Liquinox and potable water,
- Rinse with potable water, and
- Rinse with analyte-free water.

Bailers will be decontaminated after each use. Stainless steel or Teflon™-coated lines will be dedicated to each well for each sampling event or will be decontaminated between uses. Equipment will be decontaminated in the manner outlined below.

- Wash and scrub equipment with a solution of Liquinox (or equivalent) and potable water.
- Rinse with potable water.
- Rinse non-steel equipment with 10 to 15 percent reagent-grade $HN0^3$ when sampling for trace metals.
- Rinse with analyte-free water.
- Rinse twice with isopropanol.
- Air dry (if possible).
- Wrap in oil-free aluminum foil.

Any additional equipment used in sampling will be decontaminated by following the procedure outlined above.

3.1.3.3.10 Major Equipment

Between each well or boring, all major equipment used for sample collection such as drill rigs and backhoes will be decontaminated at the existing NAS Whiting Field equipment decontamination area. Decontamination will consist of steam-cleaning, washing with Liquinox (or equivalent), and rinsing with potable water. If necessary, surfaces will be scrubbed until all visible soil and possible contaminants have been removed. All dirt, grime, grease, oil, loose paint, and rust flakes shall be removed. The inside surfaces of the casing, drill rods, and auger flights will be similarly cleaned. The decontamination area will be constructed and operated to contain all solids and liquids produced. Liquids will be directed to an oil/water separator before release to the Base's sanitary sewer system. Solids will be retained and tested to determine appropriate disposal.

3.1.3.4 Filter Pack and Screen Design

The USEPA Region 4 SOPs (USEPA 1996b) require that the filter pack used for monitoring well annular space be selected based on grain size analysis of the formation interval adjacent to the well screen interval. This guidance will be followed during RI Phase II-C for aquifer zones where previous investigations have analyzed the formation intervals of interest and for which the grain size data are available. When this information is not available, Phase II-C well construction will follow the previous investigation practice of using a 20/30-size gradation filter material coupled with a 0.010-inch, machine-slotted well screen. This filter pack size and screen slot size combination has previously been used at NAS Whiting Field in the sand-and-gravel aquifer, and groundwater samples of acceptable quality have been obtained.

The 20/30 filter size is compatible with a formation that has a D30 size (i.e., 30 percent finer by weight than the D30 sieve size) in the range of fine sand. If visual inspection of the drill cuttings or split-spoon samples indicates that the D30 size of the formation is significantly coarser than this range (e.g., uniform medium to coarse sand and/or gravel), then an alternate filter pack and screen slot size combination will be recommended in accordance with the USEPA Region 4 SOPs (USEPA 1996b).

3.1.3.5 Trace Metals Sampling in Groundwater

Groundwater samples to be analyzed for trace levels of inorganics will be collected in a manner consistent with the procedure developed during previous investigations at NAS Whiting Field. A copy of the technical memorandum dated July 14, 1995, from ABB-ES to SOUTHNAVFACENGCOM detailing the technical approach for groundwater sampling at NAS Whiting Field is provided in Appendix B-1. The process can be summarized as follows: purging and sample collection will be performed using low-flow/low-stress techniques, and if turbidity exceeds 10 NTUs, then a second filtered sample will be collected for analysis. This procedure may be at variance with USEPA Region 4 SOP guidance, which states that filtered groundwater sampling and analyses should be used only in support of geochemical speciation studies unless certain criteria are met. The data collected at NAS Whiting Field will be used to support RA evaluations.

3.1.3.6 Groundwater Level Measurements

Measurement of the depth to water in monitoring wells will be performed according to the COMPQAP and USEPA Region 4 SOPs, with the exception that measuring devices will not be calibrated against an Invar steel surveyor's chain. All devices used during a given measuring event will, however, be calibrated against each other to ensure that accurate relative measurements are made during the data collection event. The results of the calibration will be recorded in the field logbook.

A minimum of one complete round of water level measurements will be obtained from existing North Field monitoring wells and the monitoring wells installed during the RI Phase II-C investigation. All measurements will be collected within a 48-hour period of consistent weather conditions to minimize atmospheric/precipitation effects on groundwater conditions. Measurements will be collected at least 24 hours after well development using an electrical water level indicator. A permanent reference point on the top of each well casing will be used for determining the depth to water. Water level measurements will be recorded in the field logbook to the nearest 0.01 foot. Static water levels will be measured in each well before any fluid is withdrawn. If floating hydrocarbon is detected in the monitoring wells, the thickness of the free product will be measured with an electronic interface probe.

3.1.3.6 Oxidation-Reduction Potential of Groundwater

The oxidation-reduction (Redox) potential of groundwater will be measured to support an evaluation of the potential for natural attenuation of organic contaminants in groundwater. Redox potential will be determined in the field using a portable field meter at selected monitoring wells. Because of the sensitivity of Redox potential to oxygenation and disturbance of the groundwater sample, care will be used to obtain the sample, and the analysis will be performed at the well head immediately after sample collection.

Calibration and maintenance of the Redox meter will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on an equipment calibration log as presented in Appendix B-2.

3.1.3.8 Ferrous Iron in Groundwater

The concentration of ferrous iron (Fe^{++}) in groundwater will be measured to support an evaluation of the potential for natural attenuation of organic contaminants in groundwater. Ferrous iron will be determined in the field at selected monitoring wells using a field test kit. Because of the sensitivity of the iron valence state to oxygenation and disturbance of the groundwater sample, care will be used to obtain the sample, and the analysis will be performed at the well head immediately after sample collection.

Use of the field test kit will be performed in accordance with the manufacturer's instructions. These actions will be documented in the field logbook and/or on the appropriate field forms as required by the SOPs (see Table 3-1).

3.1.3.9 Sample Head Space Analysis

Soil vapor head space analyses will be performed according to the method prescribed in FDEP Rule 62-770.200(2) of the Florida Administrative Code (FAC). Soil samples will be analyzed for their total hydrocarbon content using an organic vapor analyzer (OVA) equipped with a FID. A photoionization detector (PID) may be used only after a determination of the instrument's equivalent response to a FID has been made. Charcoal filters will be used to differentiate between methane (a naturally occurring gas) and petroleum hydrocarbon vapors. The calibration of the FID will be checked before the analyses. The following steps will be used to prepare soil samples for head space analysis:

- Each soil sample to be analyzed will be equally split and placed into 2 clean, 16-ounce glass jars;
- Each sample jar will filled to approximately one-half of its volume, if sufficient sample volume is available;
- Aluminum foil covers will be sealed over the open end of the glass jar using a threaded, metal ring;
- The sample jars will be allowed to equilibrate under a temperature range of 20–30°C for approximately 5 minutes;
- The head space will be measured by piercing the aluminum foil with the FID probe and recording the highest sustained reading; and

- If FID readings above background are detected in the first jar, the second sample jar will be measured using an in-line charcoal filter to determine the portion of the total reading attributable to methane gas.

3.1.3.10 Residual Free Product Detection in Soils

Residual free product field detection techniques using ultraviolet (UV) light or red dye will be used for soil borings and monitoring wells installed near suspected DNAPL source areas. UV light or red dye field tests will be performed on soil samples collected from the top of significant clay layers (greater than 4 feet thick) and other suspected locations based on field observations (i.e., elevated FID readings, odors, staining). Some petroleum-based, light nonaqueous-phase liquid (NAPLs) and some solvent-based DNALPs will fluoresce when exposed to UV light. Other NAPLs that may not fluoresce may be detected by mixing the soil sample with a colored, hydrophobic dye and watching for the presence of colored NAPL.

When a UV light is used to detect NAPLs, the suspect soil sample will be placed in a light-tight box containing a UV light. The box will be equipped with a shaded viewing port to eliminate ambient light, and the sample reaction will be directly observed for the presence of fluorescence. Alternatively, a darkened, well-ventilated room equipped with a UV light may be used if conveniently located near the sample collection site.

When samples are to be dye-tested, a portion of the suspect soil (e.g., 8-ounces volume, if available) will be placed into a clear, 1-liter jar. A volume of potable water and Red Oil (commercially available low-toxicity dye) sufficient to create a separate liquid phase following mixing (i.e., approximately 16 ounces) will be added to the sample, and the mixture will be agitated for a sufficient time to desegregate the majority of the soil sample. Following mixing the jar will be allowed to sit and will be observed for the presence of a colored NAPL fraction. Because of their natural cohesiveness, clay-rich samples may not readily desegregate, and mechanical breakage of the sample before mixing may be necessary.

Since high concentrations of contaminants are anticipated in the samples described above, health and safety precautions [e.g., increased level of personal protective equipment (PPE)] will be carefully selected to prevent exposure of the observers and surrounding public.

3.1.3.11 Dissolved Oxygen in Groundwater

Dissolved oxygen (DO) in groundwater will be measured to support an evaluation of the potential for natural attenuation of organic contaminants. DO will be measured using a DO meter or Digital Titrator/Modified Wrinkler (Hach Kit Model Number OX-DT, catalog number 20631-00). In general, the digital titrator method will be used to measure low levels of DO (less than approximately 0.5 mg/L, while a DO meter will be used to measure higher DO concentrations. Digital titrator and DO meter analyses will be performed in accordance with the manufacturers' instructions. Because titration results are based on color change and, therefore, are somewhat operator-dependent, the same person will generally perform all titration analyses during a sampling round.

Care will be exercised to avoid entrainment of atmospheric oxygen or loss of DO in groundwater samples. Shallow water samples (collected less than 5 feet below the water surface) should be collected using a DO Dunker (APHA–type)) or a bailer. Deeper water samples should be collected using a Kemmerer-type sampler or low-flow peristaltic or bladder pump.

DO meter analyses will be performed by placing the probe in a 300-mL biochemical oxygen demand flask or other similar container and then slowly overfilling (three volumes minimum) it using a tube connected to the sampler. The fill tube will extend to the bottom of the container to prevent turbulence.

3.1.3.12 Laboratory Sample Identification

The sample identification system to be used in the field to identify each sample taken during RI Phase II-C will be in accordance with B&R Environmental SOP CT-O4, contained in Appendix B-3. The coding system provides a tracking record to allow the retrieval of information about a particular sample and to ensure that each sample is uniquely identified.

Each sample is assigned a series of codes indicating the site (e.g., WHF-32), sample type, sample location, sample depth, and sample round (i.e., sequential order or date). The sample nomenclature system has been designed to maintain consistency between field, laboratory, and database sample numbers. In addition, the system facilitates cost-effective data evaluation because data can be easily sorted by matrix and/or depth or by other such parameters.

3.1.3.13 Field Instrument Control Limits

QA/QC specifications for field measurements are summarized in Table 3-2. This table shows the control parameters to be assessed, control limits, and corrective actions to be implemented.

The B&R Environmental representative on site at each well and boring will confirm measurements of total depth of holes, dimensions and placement of well screens and casings, and volume and placement of filter pack and grout materials by independent observation or measurement. The FOL will review field forms and field logbook entries for indications of measurement data outside of the control range.

3.1.3.14 Corrective Actions

Comprehensive QA activities will be conducted by B&R Environmental to ensure that the data obtained from the sampling program as well as the resultant work products are technically valid. Any staff member engaged in project work who discovers or suspects a nonconformance is responsible for identifying and segregating (if applicable) the nonconforming item as well for forwarding a report to the Task Order Manager and QA Manager for investigation and corrective action. The QA Manager has the responsibility for assuring the overall adequacy of corrective actions and summarizing this information in a status report to B&R Environmental management.

Before its use in the field, each instrument will be calibrated to ensure that it is capable of producing usable data indicative of site conditions. While in the field, QC data, such as duplicate field measurements or QC check standards, will be collected for field instruments and used to evaluate the continued acceptable performance of each instrument. Table 3-2 lists corrective actions to be implemented whenever field instruments fail to meet the established control limit criteria.

Field data will be reviewed by the site geologist while in the field. Extreme readings (i.e., readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and the readings have been verified by retesting (with an alternate instrument, if possible).

QC data obtained from field duplicates, field blanks, trip blanks, or equipment blanks will be collected while in the field and assessed by the QA Manager or the cognitive Task Order Manager to evaluate the overall quality of the sample collected. Whenever the results of the field QC samples fail to meet the acceptance criteria, as identified in Table 3-2, corrective actions will be initiated.

TABLE 3-2

FIELD QA/QC SPECIFICATIONS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Analysis	Control Parameter	Control Limit	Corrective Action
Air monitoring using an organic vapor analyzer (FID)	Daily check of calibration of FID	Calibration to manufacturer's specifications	Recalibrate. If unable to calibrate, replace.
pH of water	Continuing calibration check of pH 7.0 buffer	pH = 7.0 ± 0.1	Recalibrate. If unable to calibrate, replace electrode.
Specific conductance of water	Continuing calibration check of standard solution	± 1% of standard	Recalibrate.
Temperature of water	Check against NIST precision thermometer	± 0.1°C at two different temperatures	Reset thermistors in accordance with manufacturer's specifications; dispose of inaccurate thermometer.

FID – flame ionization detector
NIST – National Institute of Standards and Technology

Potential corrective actions will be dependent upon the final use of the data; however, appropriate corrective actions may include the following, as determined by the Task Order Manager in conjunction with the QA Manager:

- Evaluation of the suspect QC data by comparison to other QC samples taken at the same site or on the same date or analyzed by the same equipment/technician for similar contamination,
- Reanalysis of the QC sample in question (if possible),
- Qualification of the results, and
- Resampling.

Non–B&R Environmental parties involved in identified nonconformances will be notified initially by telephone with a follow-up formal correspondence explaining the deficiency. The responsible outside parties will be required to investigate the nonconformance and offer an appropriate corrective action. Notification, tracking, and ultimate closure of reported nonconformances and the review/approval of submitted corrective actions will be the responsibility of the B&R Environmental QA Manager.

3.1.3.15 Investigation-Derived Waste

All IDW generated during RI Phase II-C activities will be handled and disposed of in accordance with the *Revised Investigation-Derived Waste Management Plan* (ABB-ES 1996a). IDW management is discussed in Section 6.0, and a copy of the management plan is included in Appendix D.

3.1.3.16 Field Logbooks and Forms

Field logbooks and standard data collection forms will be completed for field investigation, sample description, and data collection activities. These will include sample log sheets (for soil and groundwater samples), a daily record of drilling activities, and equipment calibration logs. An example of these forms can be found in Appendix B-2.

A bound, weatherproof field logbook shall be maintained by each sampling event leader. The FOL or designee will record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events (e.g., well tampering), field measurements, descriptions of photographs, or other such details.

A site logbook shall be maintained by the FOL. The requirements of the site logbook are outlined in SOP SA-6.3, attached in Appendix B-4. This book will contain a summary of the day's activities and will reference the field logbooks when applicable.

Each field team member who is supervising a drilling subcontractor must complete a daily record of drilling activity. This form documents the stage, hours, methods, materials, and supplies used during daily drilling activities. The information contained on this form is used for billing verification and progress reports. The driller's signature is required at the end of each working day to verify work accomplished, hours worked, standby time, and material used. An example of this form is provided in Appendix B-2.

At the completion of field activities, the FOL will submit to the Task Order Manager all field records, data, field logbooks, site logbooks, chain-of-custody receipts, sample log sheets, drilling logs, daily logs, and other such forms.

3.1.3.17 Manufacturers' Specifications

The FOL shall collect a copy of the available manufacturers' specifications for all supplies and equipment that are used in the collection of environmental samples. This shall apply to, but not be limited to, the following:

- Calibration gases;
- Sample containers;
- Decontamination solvents and detergents;
- Laboratory-grade/analyte-free water;
- Reagents;
- Drilling additives;
- Bentonite and cement;
- Filter pack materials;
- Well casing and screen; and
- Disposable bailers, filters, tubing.

The manufacturers' specifications will be included in the project files at the end of the field mobilization.

3.1.3.18 Surveying

3.1.3.18.1 Global Positioning Survey Locations

The locations of sample points, soil borings, and wells may initially be determined during the field investigation using a portable Global Positioning Survey (GPS) instrument with sub-meter accuracy. This information may be helpful in plotting results and analyzing the data coverage in real-time to make data acquisition decisions during RI Phase II-C. The GPS instrument will be used in accordance with the manufacturer's instructions, and the results will be recorded in the field records. Monitoring wells and other selected points, however, will be permanently located using a NGVD survey at the close of the field mobilization.

3.1.3.18.2 National Geodetic Vertical Datum Survey Locations

The locations of monitoring wells installed during RI/FS Phase II-C will be measured by a certified land surveyor. Each point will be measured from a reference location that is tied to the Florida State Plane Coordinate System. The surveys shall be third-order according to the methods prescribed in the *Civil Engineering Handbook* (Urquhart 1962). An X–Y coordinate system shall be used to identify locations. The X coordinate will be the east–west axis; the Y coordinate will be the north–south axis. The reference location will be the origin.

All surveyed locations will be reported using the Florida State Plane Coordinate System. Existing installation benchmarks will serve as the horizontal and vertical datums for the survey. Elevations and horizontal locations will be recorded to the nearest hundredth of a foot. The elevations of all monitoring wells will be surveyed at the water level measuring reference point on the top of the well casing and on the undisturbed ground surface adjacent to the well pad.

3.2 SITE-SPECIFIC RI/FS ACTIVITIES

The technical approaches to all of the individual tasks constituting the field investigation are described in the following sections.

3.2.1 Site 3: Underground Waste Solvent Storage Area

3.2.1.1 Site 3 Location and Description

Site 3 is located adjacent to Building 2941 [Aircraft Intermediate Maintenance Department (AIMD)] and just north of the Paint Locker, Building 2987 (Figure 3-1). Two 500-gallon underground metal tanks were used from 1980 to April 1984 for the storage of waste solvents and residue generated from paint-stripping operations conducted at Building 2941. Wastes from the tanks were periodically pumped out for off-base disposal. Another underground waste oil tank was located at the southwestern corner of Building 2941. The location of the waste oil tank is shown in Figure 3-1. This tank was used for storage of airframe, power plant, and ground support equipment liquid waste from 1968, and possibly earlier, until 1987.

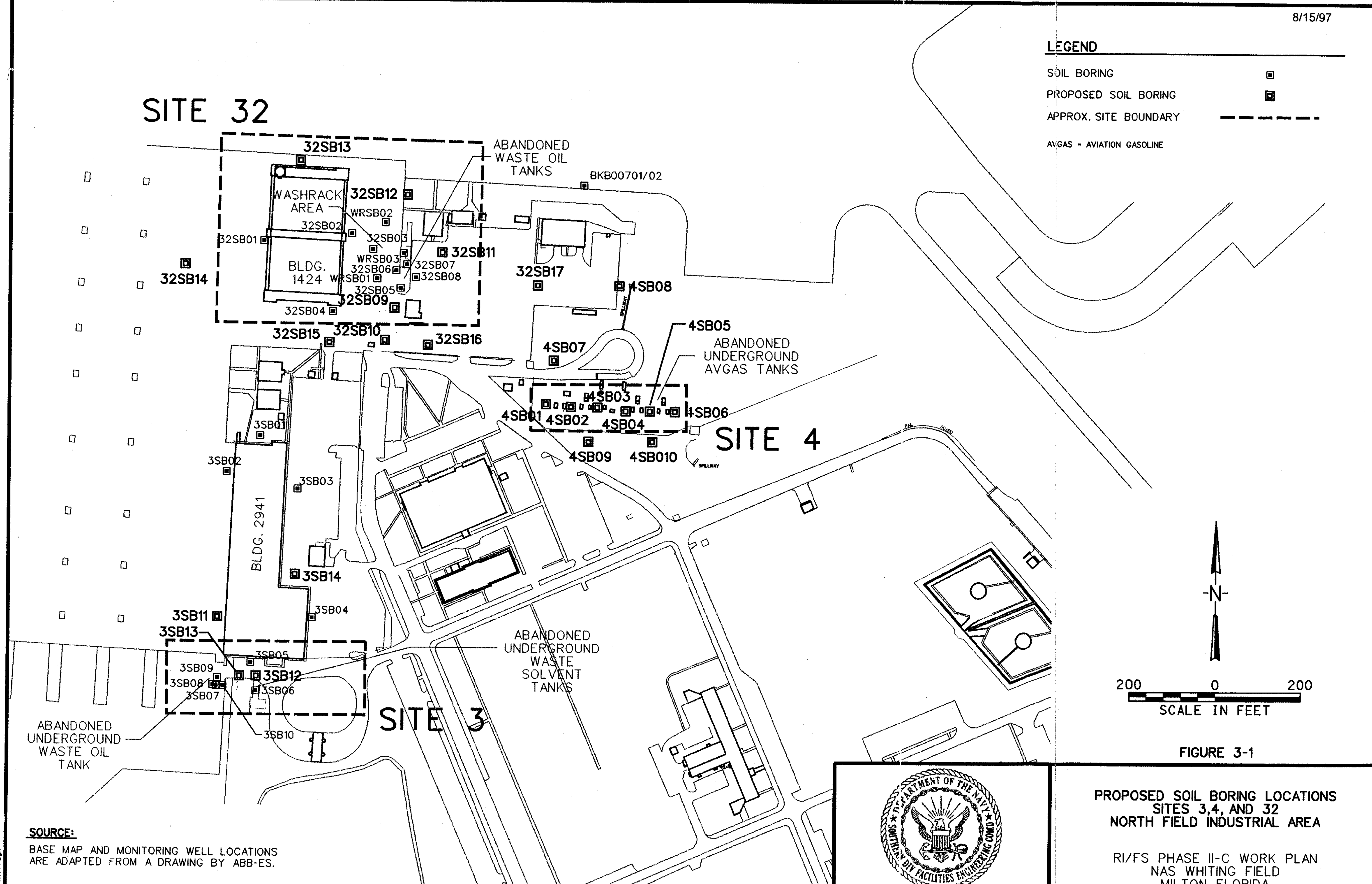
3.2.1.2 Site 3 History

Building 2941 has been used since the 1960s for aircraft intermediate maintenance activities. Before 1968, all AIMD activities were conducted in hangars; since that time, airframe, power plant, and painting activities have been conducted in Building 2941. Before 1968, intermediate maintenance was conducted at Hangar 1424, immediately north of Building 2941.

In April 1984, use of the underground waste solvent tanks was discontinued and the two tanks were removed from the site. During tank removal one of the tanks was punctured by a backhoe, resulting in the spilling of approximately 120 gallons of waste solvents onto the ground. Cleanup operations recovered approximately 50 gallons of waste solvent and approximately 6 cubic yards of contaminated soil. This material was taken off-base for disposal. Examination of the tanks revealed holes up to 0.5 inches in diameter that had apparently been caused by the waste solvents corroding through the metal tanks. The extent of leakage from the tanks before their removal is not known. A sample of the sludge material was collected from the tanks and analyzed before their removal. High concentrations of solvents were detected in the sludge sample.

The waste oil tank southwest of Building 2941 was reportedly removed in 1987 during expansion of the hardstand.

During the Verification Study performed by Geraghty & Miller in 1986, a soil boring was drilled at the spill site, and subsurface soil samples were collected at 5-foot intervals to a total depth of 25 feet. The only organic analytes detected in the soil samples were phenols at the surface, which were attributed to



SOURCE:
BASE MAP AND MONITORING WELL LOCATIONS ARE ADAPTED FROM A DRAWING BY ABB-ES.

FIGURE 3-1

PROPOSED SOIL BORING LOCATIONS
SITES 3,4, AND 32
NORTH FIELD INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

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vegetative matter in the soil. Five metals (zinc, silver, chromium, cadmium, and mercury) were detected at varying concentrations.

During the Verification Study, two monitoring wells (WHF-3-1 and WHF-3-2) were installed near the USTs in the intermediate water-bearing zone at a depth of approximately 153 feet bls. Groundwater samples were analyzed for priority pollutants. Except for trace concentrations of arsenic and lead, no priority pollutants were detected in the groundwater from WHF-3-2. Three VOCs [1,1,1-trichloroethane (TCA) at 13 μg/L; 1,1,2-TCA at 111 μg/L; and TCE at 18 μg/L] were found at concentrations that exceeded federal and Florida MCLs at WHF-3-1.

Monitoring well WHF-3-3 was installed in the intermediate zone at a depth of approximately 154 feet bls during Phase I RI/FS. Bengt-Arne-Torstensson (BAT) groundwater samples were also collected at Site 3 during this phase of the investigation using a cone penetrometer rig. Analysis of groundwater samples revealed VOC contamination in the shallow and intermediate zones.

Phase II-A RI/FS activities conducted by ABB-ES at Site 3 included a soil gas survey, soil borings, subsurface soil sampling, monitoring well installation, and groundwater sampling.

Results of the soil gas survey conducted in locations considered to be potential source areas indicated the presence of the following groups of target organic compounds: BTEX, perchloroethene (PCE), cycloalkanes, and naphthalenes. Details of the soil gas investigation are presented in the *Soil Gas Survey Technical Report* (ABB-ES 1993b).

Ten soil borings (3SB01 through 3SB10) were drilled, and 33 subsurface soil samples were collected around Building 2941 during Phase II-A. Three VOCs, 10 semivolatile organic compounds (SVOCs), 7 pesticide compounds, and total petroleum hydrocarbons (TPH) were detected in the subsurface soil samples. TPH were present in 4 of the 10 soil borings at depths less than 7 feet bls. The maximum TPH concentration of 27.8 mg/kg was observed at 3SB02 at a depth of 1–2 feet. Twenty-three inorganic analytes were detected in subsurface soil samples. Concentrations of organic and inorganic analytes in soil are presented in Tables 3-3 and 3-4, respectively.

Five shallow, one intermediate, and five deep monitoring wells were installed in the sand-and-gravel aquifer during Phase II-A at Site 3. TCE; 1,2-dichloroethene; tetrachloroethane; benzene; toluene; and ethylbenzene were present in groundwater samples from the shallow monitoring wells at concentrations that exceeded federal and Florida MCLs. TCE and benzene were detected in intermediate monitoring wells at concentrations exceeding federal and Florida MCLs. The only SVOC detected,

TABLE 3-3

ORGANIC COMPOUNDS DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 23, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 5

Locator:	3SB1-0-2	3SB1(1-2)	3SB1-5-7	3SB1-15-17	3SB1-25-27	3SB2-10-12A*	3SB2-1-2	3SB2-5-7	3SB2-10-12	3SB2-10-12A*	3SB3-0-2	3SB3-5-7
Collection Date:	20-JAN-93	20-JAN-93	20-JAN-93	20-JAN-93	20-JAN-93	09-JAN-93	09-JAN-93	09-JAN-93	09-JAN-93	09-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34938001	34938001	34938002	34938003	34939001	34836004	34836001	34836002	34836003	34836004	34848004	34848003
Target Compound List (TCL) Volatile Organic Compounds (VOCs) (mg/kg)												
Acetone	--	--	--	--	--	--	--	7 J	3 J	1 J	100	90
2-Butanone	--	--	--	--	--	--	--	--	--	--	6 J	--
Trichloroethene	--	2 J	--	--	--	--	--	--	--	--	--	--
TCL Semivolatile Organic Compounds (SVOCs) (mg/kg)												
Diethylphthalate	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthra-cene	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoran-thene	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoran-thene	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	0.98 J	37 J	--	--	--	--	--
TCL Pesticides and Polychlorinated Biphenyls (PCBs) (mg/kg)												
Heptachlor epoxide	26	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	9.8	--	26	--	--	--	0.9 J	--	--	--	44	--
4,4'-DDE	2.9 J	--	--	--	--	--	0.5 J	--	--	--	3.4 J	--
4,4'-DDD	--	--	--	--	--	--	--	--	--	--	4.2	--
4,4'-DDT	--	--	--	--	--	--	0.9 J	--	--	--	--	--
alpha-Chlordane	10	--	--	--	--	--	--	--	--	--	--	--
gamma-Chlordane	17	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg)												
	11.5	--	16.6	--	--	--	27.8	--	--	--	7.6	--

TABLE 3-3

ORGANIC COMPOUNDS DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 23, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 5

Locator:	3SB3-10-12	3SB4-0-2	3SB4-5-7	3SB4-10-12	3SB5-1-2	3SB5-5-7	3SB5-10-12	3SB6-1-2	3SB6-5-7	3SB6-10-12
Collection Date:	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93
Laboratory Sample No.:	34848002	34848007	34848006	34848005	34833008	34833009	34833010	34906001	34906002	34906003
TCL VOCs (mg/kg)										
Acetone	59	16	23	69	--	--	--	--	15 J	13 J
2-Butanone	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	3 J	3 J	--	--	--	--
TCL SVOCs (mg/kg)										
Diethylphthalate	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)-phthalate	--	--	--	--	--	--	--	--	--	--
TCL Pesticides and PCBs (mg/kg)										
Heptachlor epoxide	--	--	--	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	--	--	--	--	--
4,4'-DDE	--	--	--	--	--	--	--	--	--	--
4,4'-DDD	--	--	--	--	--	--	--	--	--	--
4,4'-DDT	--	--	--	--	--	--	--	--	--	--
alpha-Chlordane	--	--	--	--	--	--	--	--	--	--
gamma-Chlordane	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg)										
	--	--	--	--	11.6	4.9	--	--	--	--

TABLE 3-3

ORGANIC COMPOUNDS DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 23, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 5

Locator:	3SB6-15-17	3SB6-25-27	3SB6-70-72	3SB6-70-72A*	3SB6-100-102	3SB6-100-102A*	3SB7-10-12	3SB8-10-12
Collection Date:	18-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93	27-JAN-93	08-JAN-93
Laboratory Sample No.:	34906004	34906005	34909001	34909002	34906010	34906011	35015001	34833007
TCL VOCs (mg/kg)								
Acetone	22 J	23 J	12 J	–	14 J	14 J	11 J	–
2-Butanone	–	–	–	–	–	–	–	–
Trichloroethene	–	–	–	–	2 J	–	–	–
TCL SVOCs (mg/kg)								
Diethylphthalate	–	–	–	–	–	–	–	–
Phenanthrene	–	–	–	–	–	–	–	–
Fluoranthene	–	–	–	–	–	–	–	–
Pyrene	–	–	–	–	–	–	–	–
Benzo(a)anthracene	–	–	–	–	–	–	–	–
Chrysene	–	–	–	–	–	–	–	–
Benzo(b)fluoranthene	–	–	–	–	–	–	–	–
Benzo(k)fluoranthene	–	–	–	–	–	–	–	–
Benzo(a)pyrene	–	–	–	–	–	–	–	–
bis(2-Ethylhexyl)-phthalate	–	–	–	–	–	–	–	–
TCL Pesticides and PCBs (mg/kg)								
Heptachlor epoxide	–	–	–	–	–	–	–	–
Dieldrin	–	–	–	–	–	–	–	–
4,4'-DDE	–	–	–	–	–	–	–	–
4,4'-DDD	–	9.6 J	–	–	–	–	5 J	–
4,4'-DDT	–	–	–	–	–	–	5 J	–
alpha-Chlordane	–	–	–	–	–	–	–	–
gamma-Chlordane	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg)	–	–	–	–	–	–	–	–

TABLE 3-3

ORGANIC COMPOUNDS DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 23, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 4 OF 5

Locator:	3SB8-15-17	3SB8-15–17A*	3SB9-1-2	3SB9-5-7	3SB9-15-17	3SB9-30-32	3SB10-10-12	3SB10-15-17
Collection Date:	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93
Laboratory Sample No.:	34834001	34834002	34833003	34833004	34833005	34833006	34833001	34833002
TCL VOCs (mg/kg)								
Acetone	–	–	–	–	–	–	–	–
2-Butanone	–	–	–	–	–	–	–	–
Trichloroethene	–	–	–	–	–	–	–	–
TCL SVOCs (mg/kg)								
Diethylphthalate	–	97 J	–	–	–	–	–	–
Phenanthrene	–	–	48 J	–	–	–	–	–
Fluoranthene	–	–	220 J	–	–	–	–	–
Pyrene	–	–	180 J	–	–	–	–	–
Benzo(a)anthracene	–	–	98 J	–	–	–	–	–
Chrysene	–	–	130 J	–	–	–	–	–
Benzo(b)fluoranthene	–	–	84 J	–	–	–	–	–
Benzo(k)fluoranthene	–	–	81 J	–	–	–	–	–
Benzo(a)pyrene	–	–	40 J	–	–	–	–	–
bis(2-Ethylhexyl)phthalate	–	–	–	–	–	–	–	–
TCL Pesticides and PCBs (mg/kg)								
Heptachlor epoxide	–	–	–	–	–	–	–	–
Dieldrin	–	–	–	–	–	–	–	–
4,4'-DDE	–	–	–	–	–	–	–	–
4,4'-DDD	–	–	–	–	–	–	–	–
4,4'-DDT	–	–	–	–	–	–	–	–
alpha-Chlordane	–	–	–	–	–	–	–	–
gamma-Chlordane	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg)								
	–	–	11.5	–	–	–	–	–

TABLE 3-3

ORGANIC COMPOUNDS DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 23, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 5 OF 5

*The "A" in the sample locator indicates a duplicate sample.

Notes: -- – The analyte was not detected in laboratory analysis.
DDD – Dichlorodiphenyldichloroethane
DDE – Dichlorodiphenyldichloroethene
DDT – Dichlorodiphenyltrichloroethane
J – The associated numerical value is an estimated quantity.

TABLE 3-4

INORGANIC ANALYTES DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Locator:	3SB1-0-2	3SB1-5-7	3SB1-15-17	3SB1-25-27	3SB1-25-27A*	3SB2-1-2	3SB2-5-7	3SB2-10-12	3SB2-10-12A*	3SB3-0-2	3SB3-5-7
Collection Date:	20-JAN-93	20-JAN-93	20-JAN-93	20-JAN-93	20-JAN-93	09-JAN-93	09-JAN-93	09-JAN-93	09-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34938001	34938002	34938003	34939001	34939002	34836001	34836002	34836003	34836004	34848004	34848003
Aluminum	8,990	26,700	4,640	1,280	406 J	9,940	26,300	2,130	1,780 J	21,500	20,400
Arsenic	5.5	7.7	1.9 J	0.29 J	0.45 J	3.5	6.8	0.62 J	--	3.2	0.96 J
Barium	8.7 J	8.7 J	10.6 J	2.2 J	--	6.5 J	8.8 J	1.4 J	1.3	14.9 J	4.2 J
Beryllium	0.09 J	--	--	--	--	--	0.07 J	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	0.72 J	0.61 J
Calcium	636 J	258 J	195 J	25.7 J	8.7 J	412 J	243 J	13.7 J	10.7 J	1,130	214 J
Chromium	9.6	37.2	4.6	1.8 J	--	12.7	34.5	4.3	3.6	42.7	27.6
Cobalt	1.3 J	3.2 J	0.96 J	--	--	1.2 J	2.6 J	--	--	1.6 J	--
Copper	9.6	2 J	2.7 J	--	--	1.4 J	1 J	--	3.4 J	9.6	7.3
Iron	7,540	28,900	2,210	1,220	673	12,900	32,600	5,010	4,380	12,700	29,500
Lead	14.5	6.6	1.3 J	--	--	5.8	4.4	1.1	0.94	5.6	3.2
Magnesium	207 J	84.9 J	74.8 J	22.6 J	10.9 J	61.3 J	85.9 J	20.5 J	17.3 J	218 J	33 J
Manganese	72.8	20.8	8.4	2.6 J	--	25	15.2	7.9	7.5	61.1	8
Mercury	0.02 J	0.02 J	--	--	--	0.03 J	0.1	0.02 J	0.03 J	0.04 J	0.04 J
Nickel	--	--	--	--	--	--	--	--	--	15.7	--
Potassium	--	172 J	332 J	--	--	146 J	152 J	151 J	--	152 J	92.8 J
Selenium	2.7	3.3	--	1.7 J	1.2 J	1 J	1.9	--	--	--	--
Silver	0.57 J	1.8 J	--	--	--	1 J	2.1 J	0.98 J	0.55 J	--	--
Sodium	--	--	--	--	--	--	12.7 J	--	--	212 J	187 J
Thallium	--	--	--	--	--	--	--	--	--	--	--
Vanadium	19.8	76.6	14.4	10.1 J	10 J	33.9	77.2	15.4	14.5	34	60.5
Zinc	10.2	1.8 J	0.64 J	2.9 J	--	1.5 J	--	--	--	9.6	7.4 J
Cyanide	0.51 J	0.53 J	0.5 J	0.48 J	--	0.47 J	0.48 J	2.6	0.52 J	--	--

TABLE 3-4

INORGANIC ANALYTES DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 5

Locator:	3SB3-10-12	3SB4-0-2	3SB4-5-7	3SB4-10-12	3SB5-1-2	3SB5-5-7	3SB5-10-12	3SB6-1-2	3SB6-5-7	3SB6-10-12
Collection Date:	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93
Laboratory Sample No.:	34848002	34848007	34848006	34848005	34833008	34833009	34833010	34906001	34906002	34906003
Aluminum	8,850	5,200	12,500	13,400	20,400	14,100	38,300	5,180	59,600	41,000
Arsenic	1.5 J	0.58 J	1.3 J	1.5 J	1.7 J	2.8	1.2 J	1.1 J	16	1.8 J
Barium	2.5 J	9.7 J	11 J	4.2 J	16.2 J	10.4 J	8.7 J	8.9 J	13.5 J	6.8 J
Beryllium	--	--	--	--	--	--	--	0.06 J	0.09 J	--
Cadmium	--	--	--	--	0.36 J	0.31 J	0.79 J	--	--	--
Calcium	183 J	1,380	245 J	131 J	385 J	265 J	180 J	261 J	64.9 J	--
Chromium	10	3.7	12.1	15.3	15.4	11.2	36.1	4.4	37.9	29.7
Cobalt	--	1.7 J	--	--	--	--	--	1 J	2.2 J	1.9 J
Copper	4.2 J	3.2 J	3.9 J	4.7 J	8.5	5.4 J	11.1	7.3	8.3	4.6 J
Iron	9,220	3,060	8,910	12,300	10,300	8,970	29,700	2,730	20,400	25,000
Lead	2	3	1.8	1.9	4.4	3.8	3.1	1.5 J	4.3	3.5
Magnesium	35.3 J	104 J	66.6 J	55.4 J	177 J	109 J	117 J	226 J	265 J	92.4 J
Manganese	12.1	151	4.2	12.3	67.7	39.4	12.5	36	21.7	22.6
Mercury	--	0.04 J	0.04 J	--	0.06	0.04 J	0.05 J	--	--	--
Nickel	2.1 J	2.2 J	2.3 J	2.8 J	2.2 J	--	2.8 J	--	5 J	4.3 J
Potassium	55.6 J	99.4 J	98.8 J	73.2 J	175 J	116 J	175 J	--	190 J	--
Selenium	--	--	0.13 J	--	0.41 J	0.5 J	0.51 J	1.7	1.7	1 J
Silver	--	--	--	--	--	--	--	--	--	--
Sodium	161 J	172 J	163 J	214 J	171 J	189 J	206 J	--	--	--
Thallium	--	--	--	--	--	--	--	--	--	--
Vanadium	27.5	7 J	24.9	36.8	26.4	22.7	72.5	6.7 J	56.3	64.8
Zinc	3.3 J	3.9 J	4.4 J	5 J	12.2	7.3	11.1	3.6 J	7.5	2.3 J
Cyanide	--	--	--	--	--	--	--	0.41 J	0.51 J	0.53 J

TABLE 3-4

INORGANIC ANALYTES DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 5

Locator:	3SB6-15-17	3SB6-25-27	3SB6-70-72	3SB6-70-72A*	3SB6-100-102	3SB6-100-102A*	3SB7-10-12	3SB8-10-12	3SB8-15-17	35B8-15-17A1*
Collection Date:	18-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93	18-JAN-93	27-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93
Laboratory Sample No.:	34906004	34906005	34909001	34909002	34906010	34906011	35015001	34833007	34834001	34834002
Aluminum	12,300	1,160	214 J	487 J	3,030	3,250	5,640	21,500	2,250 J	5,320 J
Arsenic	2.6 J	1.5 J	0.96 J	1.1 J	1.3 J	1.3 J	4.8	1.1 J	1.2 J	1.4 J
Barium	18.3 J	1.5 J	--	--	34.7 J	14.5 J	4.3 J	4.3 J	5.8 J	8.6 J
Beryllium	--	--	--	--	0.06 J	--	0.13 J	--	--	--
Cadmium	--	--	--	--	--	--	--	0.39 J	--	--
Calcium	29.1 J	13.7 J	--	--	142 J	136 J	--	233 J	116 J	146 J
Chromium	9.6	3.3	0.9 J	1.8 J	6.2	6.5	9.6	25.9	3.3	5.8
Cobalt	--	--	--	--	--	--	0.87 J	--	--	--
Copper	2.7 J	0.36 J	--	--	1.6 J	2.1 J	2.1 J	7.9	2.4 J	3.4 J
Iron	4,610	784	245 J	222 J	2,100	2,240	9,630	20,800	2,840	4,750
Lead	3.2	0.67 J	--	--	2 J	2.9	4.5	3.1	2.4	2.6
Magnesium	142 J	8.4 J	--	--	89.2 J	91.5 J	72.8 J	54 J	--	80.7 J
Manganese	12.5	2.4 J	--	--	2.5 J	3.5 J	4.6	9.7	4.5	6.3
Mercury	--	--	--	1.4 J	--	--	0.06	0.04 J	--	--
Nickel	--	--	--	--	--	--	--	2.1 J	--	--
Potassium	377 J	--	--	--	271 J	310 J	--	123 J	--	--
Selenium	0.67 J	0.8 J	--	0.77 J	2.2	2.1	4.9	0.73 J	--	--
Silver	--	--	--	--	--	--	--	--	--	--
Sodium	15.7 J	--	--	--	--	--	--	189 J	214 J	214 J
Thallium	--	--	--	--	--	--	--	--	--	--
Vanadium	22.6	5.4 J	--	--	15.1	15.6	29	55	13.7	18.8
Zinc	2.2 J	3.9 J	--	--	3.3 J	8.0	--	6.2	2.3 J	4.3 J
Cyanide	0.47 J	0.45 J	--	--	0.55 J	0.53 J	0.59 J	0.19 J	--	--

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TABLE 3-4

INORGANIC ANALYTES DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 4 OF 5

Locator:	3SB9-1-2	3SB9-5-7	3SB9-15-17	3SB9-30-32	3SB10-10-12	3SB10-15-17
Collection Date:	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93	08-JAN-93
Laboratory Sample No.:	34833003	34833004	34833005	34833006	34833001	34833002
Aluminum	4,380	26,300	6,700	803	6,290	5,880
Arsenic	0.9 J	0.78 J	1.1 J	--	1.4 J	0.82 J
Barium	6.4 J	16.4 J	4.4 J	1.3 J	3.2 J	8.2 J
Beryllium	--	--	--	--	--	--
Cadmium	0.59 J	0.31 J	--	--	0.34 J	--
Calcium	392 J	429	178 J	71.6 J	250 J	224 J
Chromium	3.2	23.5	8.2	--	15.8	11.2
Cobalt	--	--	--	--	--	--
Copper	3.8 J	8.6	5.5 J	0.96 J	7.3	6.6
Iron	2,590	15,500	7,160	86.1	15,400	10,700
Lead	3.8	2.6	2.5	0.6 J	3.3	2.4
Magnesium	80.6 J	157 J	59.5 J	23.6 J	45.1 J	106 J
Manganese	104	13.2	6.5	0.88 J	9.4	5.9
Mercury	--	0.07 J	0.03 J	--	--	0.04 J
Nickel	1.7 J	3.4 J	--	--	--	--
Potassium	93 J	142 J	116 J	79.5 J	53.2 J	102 J
Selenium	--	--	0.7 J	0.31 J	--	--
Silver	--	--	--	--	--	--
Sodium	165 J	217 J	192 J	158 J	195 J	211 J
Thallium	0.15 J	--	--	--	--	--
Vanadium	5.9 J	38.9	25.2	0.88 J	42	29.7
Zinc	4 J	8.5	3 J	1.8 J	4.4 J	4.2 J
Cyanide	--	--	--	--	0.19 J	--

TABLE 3-4

INORGANIC ANALYTES DETECTED IN SITE 3 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 5 OF 5

*The “A” in the sample locator indicates a duplicate sample.

Notes: Inorganic concentrations are reported in mg/kg.
-- – The analyte was not detected in laboratory analysis.
J – The associated numerical value is an estimated quantity.

bis(2-ethylhexyl)phthalate, was found in groundwater samples from the shallow, intermediate, and deep zones. Five inorganic analytes (aluminum, cadmium, iron, lead, and manganese) detected in Site 3 monitoring wells exceeded federal and Florida MCLs. Concentrations of organic and inorganic analytes in groundwater are presented in Tables 3-5 and 3-6, respectively.

Additional groundwater samples were collected in 1995, and the analytical results are discussed in the *Remedial Investigation Industrial Area Groundwater Investigation, Interim Report, Naval Air Station Whiting Field* (ABB-ES 1996b). Figures 3-2 and 3-3 demonstrate the areal extent of impacted groundwater (i.e., BTEX and TCE plumes) at the North Field Industrial Area based on the 1995 groundwater results.

3.2.1.3 Proposed Investigation

Additional records searching and source exploration will be conducted in the vicinity of Building 2941 to evaluate the nature of the spill area at the former waste solvent tanks and the former waste oil tank and to locate areas of residual soil contamination. The investigation of impacted groundwater at the North Field Area, which includes commingled BTEX and TCE plumes at Sites 3, 4, and 32, will be addressed in the proposed investigation at Site 32 (Section 3.2.3.3). The investigation activities proposed for soils at Site 3 are described in the following sections.

Investigation Scope

- Define extent of "excessively contaminated soils" around former USTs in accordance with FDEP regulations [i.e., total organic vapors > 50 parts per million (ppm) for kerosene group, > 500 ppm for gasoline group petroleum hydrocarbon release areas].

- Define extent of soil contamination that exceeds applicable "risk benchmarks" as defined by USEPA [e.g., USEPA Region III risk-based concentrations (RBCs) and soil screening levels (SSLs) (USEPA 1996d)].

Source Areas of Concern

- Spill area at former waste solvent USTs south of Building 2941.
- Former waste oil UST southwest of Building 2941.
- Soil gas hot spot at wash area adjacent to Building 2941.
- Leaks from unidentified buried piping.

TABLE 3-5

ORGANIC COMPOUNDS DETECTED IN SITE 3 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

	Shallow Monitoring Wells					Intermediate Monitoring Wells			
Well Identifier:	WHF-3-1S	WHF-3-2S	WHF-3-3S	WHF-3-4	WHF-3-7S	WHF3-1	WHF3-1A		
Sample Identifier:	WHF3-1B	WHF3-2B	WHF3-3B	WHF3-4	WHF3-7B	WHF-3-1	WHF-3-1 DUP	**Background**	
Collection Date:	12-JAN-94	13-JAN-94	18-JAN-94	20-JAN-94	19-JAN-94	12-JAN-94	12-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90330002	90333002	90337003	90353005	90343001	90331001	90331002	**Criteria**	**Standards**
Volatile Organic Compounds (µg/L)									
Chloromethane	2/--	--	--	--	--	--	--	ND	NA/2.7[c]
Acetone	380 J/--	--	--	--	--	--	--	ND	NA/700[c]
1,1-Dichloroethene	2/--	--	1 J	--	--	--	--	ND	7[a]/7[a]
1,1-Dichloroethane	2/--	--	2 J	--	--	--	--	ND	NA/700[c,d]
1,2-Dichloroethene (total)	230 J[e]/240 J	--	--	34 J	190 J	4 J	3 J	ND	70[a,d]/70[a,d]
Chloroform	2/--	--	4 J	--	--	--	--	ND	100[a]/6[c]
1,1,1-Trichloroethane	2/--	--	4 J	--	--	--	--	ND	200[a]/200[a]
Trichloroethene	74 J[e]/93 J	16	76	570[e]/250 J	220 J	53	52	ND	5[a]/3[a]
Tetrachloroethene	2/--	--	3 J	--	--	--	--	ND	5[a]/3[a]
Benzene	3,600[e]/3,900	--	3 J	4,500[e]/4,500	4,100	3 J	2 J	8	5[a]/1[a]
Toluene	7,200[e]/7,200	--	2 J	15,000[e]/15,000	1,100	41	39	26	1,000[a]/1,000[a], 40[b]
Ethylbenzene	680[e]/710	--	--	2,800[e]/1,500	1,100	3 J	3 J	ND	700[a]/700[a], 30[b]
Xylenes (total)f	1,700[e]/1,700	--	--	5,300/3,000	--	6 J	6 J	ND	10,000[a]/10,000[a], 20[b]
Semivolatile Organic Compounds (µg/L)									
Phenol	27 J	--	--	26	39	2/--	--	ND	NA/10[c]
2-Methylphenol	35	--	--	30	5 J	2/--	--	ND	NA/350[c]
4-Methylphenol	20	--	--	34	10	2/--	--	ND	NA/35[c]
Naphthalene	4 J	--	--	7 J	5 J	2/--	--	ND	NA/6.8[c]
2-Methylnaphthalene	1 J	--	--	2 J	1 J	2/--	--	ND	NA/NA
Carbazole	2 J	--	--	--	1 J	2/--	--	ND	NA/7.5[c]
bis(2-Ethylhexyl)phthalate	2	--	--	11	3 J	490 J[e]/490 J	--	ND	6[a]/6[a]
Pesticides and Polychlorinated Biphenyls (µg/L)									
Heptachlor epoxide	R[f]	--	0.28	--	--	--	--	ND	0.2[a]/0.2[a]

TABLE 3-5

**ORGANIC COMPOUNDS DETECTED IN SITE 3 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 3**

	Intermediate Monitoring Wells			Deep Monitoring Wells					
Well Identifier:	WHF-3-2	WHF-3-3	WHF-3-7I	WHF-3-1D	WHF-3-2D	WHF-3-3D	WHF-3-7D		
Sample Identifier:	WHF3-2	WHF3-3	WHF3-7C	WHF3-1D	WHF3-2D	WHF3-3D	WHF3-7D		
Collection Date:	13-JAN-94	14-JAN-94	18-JAN-94	11-JAN-94	16-DEC-93	11-JAN-94	11-JAN-94		
Laboratory Sample No.:	90333001	90334002	90337004	90325001	90299001	90325002	90325003	**Background Screening Criteria**	**Federal/State Standards**
Volatile Organic Compounds (µg/L)									
Chloromethane	--	--	--	--	--	--	2 J	ND	NA/2.7[c]
Acetone	--	--	16	--	--	--	--	ND	NA/700[c]
1,1-Dichloroethene	--	--	--	--	--	--	--	ND	7[a]/7[a]
1,1-Dichloroethane	--	--	--	--	--	--	--	ND	NA/700[c]
1,2-Dichloroethene (total)	--	--	6 J	--	--	--	--	ND	70[a,d]/70[a,d]
Chloroform	--	--	--	--	--	--	--	ND	100[a]/6[c]
1,1,1-Trichloroethane	--	--	--	--	--	--	--	ND	200[a]/200[a]
Trichloroethene	--	2 J	79	--	--	--	1 J	ND	5[a]/3[a]
Tetrachloroethene	--	--	--	--	--	--	--	ND	5[a]/3[a]
Benzene	1 J	--	14	--	--	--	--	8	5[a]/1[a]
Toluene	2 J	--	130	--	--	--	1 J	26	1,000[a]/1,000[a], 40[b]
Ethylbenzene	--	--	9 J	--	--	--	--	ND	700[a]/700[a], 30[b]
Xylenes (total)	--	--	28	--	--	--	--	ND	10,000[a]/10,000[a], 20[b]
Semivolatile Organic Compounds (µg/L)									
Phenol	--	--	--	--	--	--	--	ND	NA/10[c]
2-Methylphenol	--	--	--	--	--	--	--	ND	NA/35[c]
4-Methylphenol	--	--	--	--	--	--	--	ND	NA/35[c]
Naphthalene	--	--	--	--	--	--	--	ND	NA/6.8[c]
2-Methylnaphthalene	--	--	--	--	--	--	--	ND	NA/NA
Carbazole	--	--	--	--	--	--	--	ND	NA/7.5[c]
bis(2-Ethylhexyl)phthalate	--	2/3 J	220[e]/220	2 J	16	7 J	2 J	ND	6[a]/6[a]

TABLE 3-5

ORGANIC COMPOUNDS DETECTED IN SITE 3 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3OF 3

	Intermediate Monitoring Wells			Deep Monitoring Wells					
Well Identifier:	WHF-3-2	WHF-3-3	WHF-3-7I	WHF-3-1D	WHF-3-2D	WHF-3-3D	WHF-3-7D		
Sample Identifier:	WHF3-2	WHF3-3	WHF3-7C	WHF3-1D	WHF3-2D	WHF3-3D	WHF3-7D	**Background**	
Collection Date:	13-JAN-94	14-JAN-94	18-JAN-94	11-JAN-94	16-DEC-93	11-JAN-94	11-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90333001	90334002	90337004	90325001	90299001	90325002	90325003	**Criteria**	**MCLs**
Pesticides and Polychlorinated Biphenyls (μg/L)									
Heptachlor epoxide	--	--	--	--	--	--	--	ND	0.2[a]/0.2[a]

[a] Primary MCL.
[b] Secondary MCL.
[c] Florida groundwater guidance concentration.
[d] cis-1,2-Dichloroethene was used for comparison.
[e] Second value from reanalysis of diluted sample.
[f] All pesticides and polychlorinated biphenyl results for this sample were rejected during the data validation process due to poor recoveries as a result of column interference.

Notes:

Shading – Concentration meets or exceeds primary or secondary federal or state MCLs.
– – Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.

TABLE 3-6

INORGANIC ANALYTES DETECTED IN SITE 3 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

	Shallow Monitoring Wells					Intermediate Monitoring Wells			
Well Identifier:	WHF-3-1S	WHF-3-2S	WHF-3-3S	WHF-3-4	WHF-3-7S	WHF-3-1	WHF-3-1 DUP		
Sample Identifier:	WHF3-1B	WHF3-2B	WHF3-3B	WHF3-4	WHF3-7B	WHF3-1	WHF3-1A		
Collection Date:	12-JAN-94	13-JAN-94	18-JAN-94	20-JAN-94	19-JAN-94	12-JAN-94	12-JAN-94		
Laboratory Sample No.:	90330002	90333002	90337003	90353005	90343001	90331001	90331002	**Background Screening Criteria**	**Federal/State MCLs**
Metals and Cyanide (µg/L)									
Aluminum	195 J	10,800	3,230	779	1,370	--	--	53,360	200(b)/200(b)
Arsenic	16.3	--	--	6.1 J	3.3 J	--	--	ND	50(a)/50(a)
Barium	66.8 J	47.8 J	59.6 J	80.7 J	56.7 J	37.4 J	37.9 J	126.8	2,000(a)/2,000(a)
Beryllium	--	0.86 J	--	--	--	--	--	3.6	4(a)/4(a)
Cadmium	13.2	7	3.9 J	9.3	--	17.8	18.8	ND	5(a)/5(a)
Calcium	10,900	3,460 J	1,500 J	13,300	5,080	6,190	6,410	4,702	NA/NA
Chromium	--	82.4	22	9.1 J	4.5 J	--	--	872	100/100(a)
Copper	3 J	23.6 J	10.4 J	2.5 J	--	--	--	67.6	TT 1,300 1,000(b)/1,000(b)
Iron	31,100	57,300	15,800	24,500	23,100	368	364	80,066	300(b)/300(b)
Lead	201	6.6	2.3 J	126	27.8	14.8	17.5	20.6	TT 15/15(a)
Magnesium	7,830	1,140 J	1,330 J	4,650 J	3,430 J	722 J	715 J	2,922	NA/NA
Manganese	99.6	39.1	45.7	96.4	71.5	33.5	33.3	188	50(b)/50(b)
Mercury	--	19.8	0.16 J	--	--	--	--	0.32	2(a)/2(a)
Nickel	9.9 J	26.4 J	--	--	--	--	--	744	100(a)/100(a)
Potassium	7,090	3,710 J	822 J	3,040 J	1,780 J	3,900 J	4,660 J	17,270	NA/NA
Selenium	--	--	--	2.6 J	10.3	--	--	4	50(a)/50(a)
Silver	--	3.2 J	--	--	--	--	--	ND	100(b)/100(b)
Sodium	6,760	2,860 J	2,620 J	4,070 J	4,360 J	4,310 J	4,640 J	5,740	NA/160,000(a)
Vanadium	--	114	36.4 J	4.6 J	6.5 J	--	--	335	NA/49(c)
Zinc	14.8 J	35.4	9.4 J	8.8 J	3.6 J	--	--	140	5,000(a)/5,000(a)
Cyanide	--	--	--	--	--	--	--	4.2	200(a)/200(a)

TABLE 3-6

INORGANIC ANALYTES DETECTED IN SITE 3 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 3

	Intermediate Monitoring Wells			Deep Monitoring Wells					
Well Identifier:	WHF-3-2	WHF-3-3	WHF-3-7I	WHF-3-1D	WHF-3-2D	WHF-3-3D	WHF-3-7D		
Sample Identifier:	WHF3-2	WHF3-3	WHF3-7C	WHF3-1D	WHF3-2D	WHF3-3D	WHF3-7D	**Background**	
Collection Date:	13-JAN-94	14-JAN-94	18-JAN-94	11-JAN-94	16-DEC-93	11-JAN-94	11-JAN-94	**Screening**	
Laboratory Sample No.:	90333001	90334002	90337004	90325001	90299001	90325002	90325003	**Criteria**	**Federal/State MCLs**
Metals and Cyanide (µg/L)									
Aluminum	76.1 J	328	87.7 J	49.8 J	3,570 J	455	1,400	53,360	200[b]/200[b]
Arsenic	--	--	--	--	--	--	--	ND	50[a]/50[a]
Barium	27.9 J	25.3 J	27.2 J	10.8 J	26.4 J	22.6 J	22.6 J	126.8	2,000[a]/2,000[a]
Beryllium	--	--	--	--	--	--	--	3.6	4[a]/4[a]
Cadmium	34.4	29.9	--	5.7	6.2	3.6 J	10.9	ND	5[a]/5[a]
Calcium	1,810 J	967 J	2,520 J	2,550 J	2,750 J	4,750 J	1,260 J	4,706	NA/NA
Chromium	--	--	--	4.6 J	8.1 J	4.2 J	--	872	100/100[a]
Copper	--	--	--	--	--	--	2.9 J	67.6	TT 1,300 1,000[b]/ 1,000[b]
Iron	112	293	258	79.9 J	3,600 J	530	2,350	80,066	300[b]/300[b]
Lead	--	2.9 J	1.9 J	--	2.8 J	--	1.3 J	20.6	TT 15/15[a]
Magnesium	731 J	682 J	619 J	364 J	533 J	495 J	659 J	2,922	NA/NA
Manganese	5.6 J	9.8 J	17.8	19.6	55	40.2	16.9	188	50[b]/50[b]
Mercury	--	--	--	--	--	--	--	0.32	2[a]/2[a]
Nickel	--	--	--	--	--	--	--	744	100[a]/100[a]
Potassium	2,460 J	2,110 J	13,900	2,480 J	--	2,140 J	2,180 J	17,270	NA/NA
Selenium	--	--	--	--	--	--	--	4	50[a]/50[a]
Silver	--	--	--	--	--	--	--	ND	100[b]/100[b]
Sodium	3,350 J	2,020 J	3,080 J	2,890 J	6,070	4,690 J	2,460 J	5,740	NA/160,000[a]
Vanadium	--	--	--	--	6.9 J	--	3.2 J	335	NA/49[c]

TABLE 3-6

INORGANIC ANALYTES DETECTED IN SITE 3 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 3

	Intermediate Monitoring Wells			Deep Monitoring Wells					
Well Identifier:	WHF-3-2	WHF-3-3	WHF-3-7I	WHF-3-1D	WHF-3-2D	WHF-3-3D	WHF-3-7D		
Sample Identifier:	WHF3-2	WHF3-3	WHF3-7C	WHF3-1D	WHF3-2D	WHF3-3D	WHF3-7D	**Background**	
Collection Date:	13-JAN-94	14-JAN-94	18-JAN-94	11-JAN-94	16-DEC-93	11-JAN-94	11-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90333001	90334002	90337004	90325001	90299001	90325002	90325003	**Criteria**	**MCLs**
Zinc	10.5 J	7.8 J	4.1 J	11.8 J	--	8.2 J	10.8 J	140	5,000[a]/5,000[a]
Cyanide	--	--	--	1.9 J	--	2.4 J	--	4.2	200[a]/200[a]

[a] Primary MCL.
[b] Secondary MCL.
[c] Florida groundwater guidance concentration.

Notes:

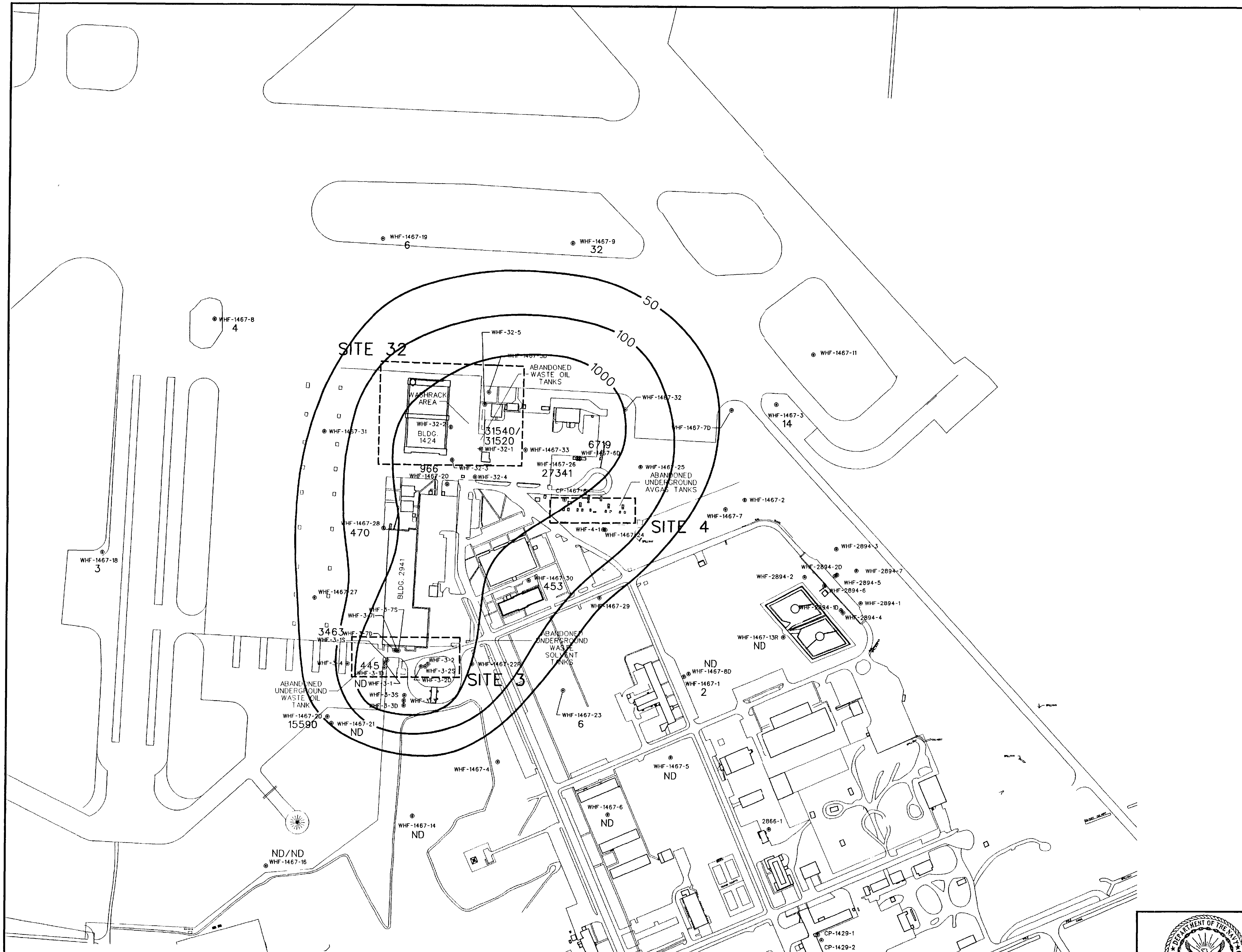
Shading indicates that the concentration meets or exceeds federal or state primary or secondary MCLs.
-- – Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.
TT – Treatment techniques.

LEGEND

MONITORING WELL	⊛
PERCHED MONITORING WELL	WHF-32-11P
SHALLOW MONITORING WELL	WHF-32-12S
INTERMEDIATE MONITORING WELL	WHF-32-13I
DEEP MONITORING WELL	WHF-32-14D
BTEX CONCENTRATION [1]	15590
BTEX ISOCON [1]	———
DUPLICATE BTEX SAMPLE [1]	31540/ 31520
NOT DETECTED	ND

1 - CONCENTRATION IN MICROGRAMS PER LITER (μg/L)
BTEX - BENZENE, TOLUENE, ETHYLBENZENE, AND XYLENES
AVGAS - AVIATION GASOLINE

NOTE:
SAMPLES COLLECTED DURING OCT.-NOV. 1995.



SOURCE:
BASE MAP AND MONITORING WELL LOCATIONS ARE ADAPTED FROM A DRAWING BY ABB-ES.

-N-

200 0 200 400 600
SCALE IN FEET

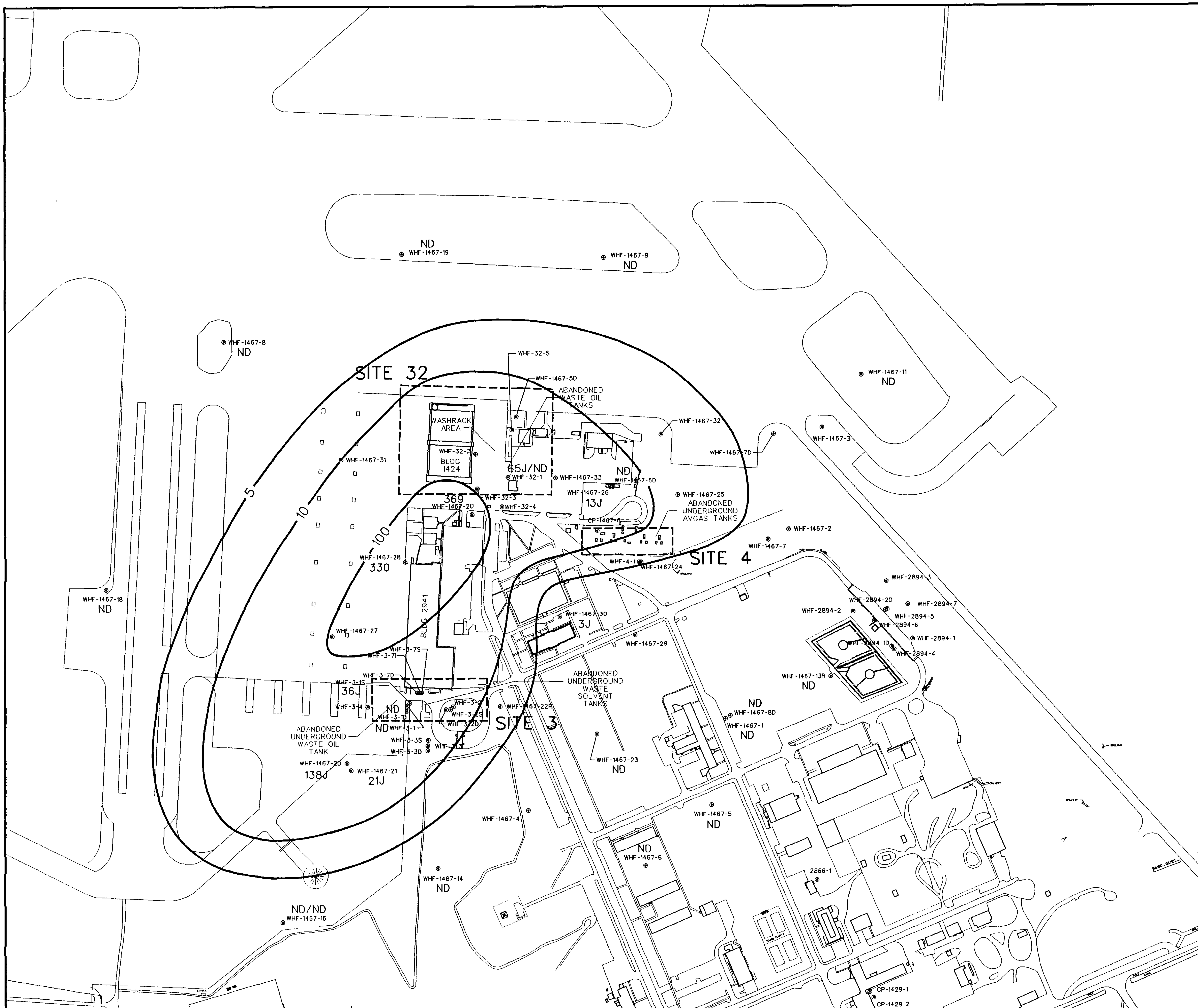
FIGURE 3-2

BTEX ISOCONCENTRATION MAP
NORTH FIELD INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 7541A013.dgn/8-20-97

22X34.dgn



SOURCE:
BASE MAP AND MONITORING WELL LOCATIONS ARE ADAPTED FROM A DRAWING BY ABB-ES

LEGEND

MONITORING WELL	⊛
PERCHED MONITORING WELL	WHF-32-11P
SHALLOW MONITORING WELL	WHF-32-12S
INTERMEDIATE MONITORING WELL	WHF-32-13I
DEEP MONITORING WELL	WHF-32-14D
TCE CONCENTRATION [1]	369
TCE ISOCON [1]	———
INDICATES ESTIMATED CONCENTRATION	J
DUPLICATE TCE SAMPLE [1]	65J/ND
NOT DETECTED	ND

1 - CONCENTRATION IN MICROGRAMS PER LITER (µg/L)
TCE - TRICHLOROETHENE
AVGAS - AVIATION GASOLINE

NOTE:
SAMPLES COLLECTED DURING OCT.-NOV. 1995.

N

200 0 200 400 600
SCALE IN FEET

FIGURE 3-3

TRICHLOROETHENE ISOCONCENTRATION MAP
NORTH FIELD INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 7541A014.dgn/8-20-97

22X34.dgn

The Phase II-C RI/FS investigation at Site 3 will consist of four additional soil borings and associated subsurface soil sampling to help characterize the nature and extent of soil contamination. The supporting rationale for these borings is presented in the box below. Figure 3-1 shows the approximate locations of the soil borings.

RI/FS Rationale for Soil Borings at Site 3	
Soil Boring Location	**Rationale**
3SB11, 3SB14	Uninvestigated soil gas hot spot.
3SB12, 3SB13	Determine lateral extent of contamination around former USTs.
Optional	Pending identification of potential source areas such as floor drains, subgrade piping, sumps, oil/water separators or to define extent of contamination.

Soil Sampling Criteria

Soil samples will be collected in all borings using either nominal 2-inch-diameter split spoons or a 5-foot-long continuous-core barrel. In general, 5-foot continuous-core barrel samples will be collected from soil borings and monitoring wells located near source areas. Split-spoon samples 2 inch in diameter by 2-foot in length may be collected at 5-foot intervals from monitoring wells near the perimeter of the contaminant plume.

All borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Soil samples will be selected for laboratory analysis from the surface soil in unpaved areas; each 30-foot depth interval based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. A surface soil sample will not be collected from borings in paved areas. Soil sample quantities are based on 1 soil boring being installed to 90 feet bls and 3 soil borings to a depth of 30 feet bls. Soil samples will be analyzed for: VOCs, SVOCs, TPH, pesticides, PCBs, and inorganics. Three soil samples will be collected using a thin-walled Shelby tube (ASTM D1587) for analysis of the geotechnical and natural attenuation indicator parameters shown below.

Geotechnical And Natural Attenuation Analyses		
Parameters	**Method**	**Soil Type[a]**
Moisture Content	ASTM D2216	VS, SS
Dry Bulk Density	Agronomy #9	VS, SS
Undisturbed Permeability	ASTM D2434	VS, SS
Soil Classification	ASTM D2487	VS, SS
Total Organic Carbon (TOC)	SW9060	VS, SS
Specific Gravity of Soil Solids	ASTM D854	VS, SS
Microbial Content[b]	SM 907	VS
Cation Exchange Capacity	SW9080	VS, SS
pH	SW9045	VS, SS
Vertical Permeability	ASTM D5084	VS, SS

(a) SS – saturated-zone soil
VS – vadose-zone soil
(b) Only a few selected samples will be analyzed for this parameter.

3.2.2 Site 4: North AVGAS Tank Sludge Disposal Area

3.2.2.1 Site 4 Location and Description

Site 4 is a former UST facility located north of Tow Lane at North Field (Figure 3-1). The former tank farm covers an area of approximately 2.5 acres and is surrounded by a fence. The area is currently covered with grass. Site 4 contained nine 23,700-gallon steel tanks.

3.2.2.2 Site 4 History

The tanks at the North Fuel Farm date back to 1943 when NAS Whiting Field first began operations. Eight of the nine USTs at this site were used in the past for AVGAS storage. Past use(s) of the ninth tank for anything other than storage of contaminated jet fuel is unknown. All USTs and associated piping were removed in 1992.

From 1943 to 1968, the nine AVGAS tanks were cleaned out approximately every 4 years. The tank bottom sludge that probably contained tetraethyl lead was buried at shallow depths in the area immediately adjacent to the surrounding tanks. Navy personnel estimated that 1,000 to 2,000 gallons of sludge were disposed of in this manner (Geraghty & Miller 1986).

Twenty-eight surface soil samples were collected and mixed to produce one composite sample during the 1986 Verification Study by Geraghty & Miller. This sample was split into two parts and analyzed for total lead content and Extraction Procedure Toxicity (EP Tox) for lead. Laboratory analytical results of the soil samples showed total lead concentrations were 15 and 27 mg/kg. Lead was not detected in the EP Tox test above the method detection limit of 0.01 mg/L.

Monitoring well WHF-4-1 was installed along the southern perimeter of the USTs during the 1986 Geraghty & Miller study. This well was installed in the intermediate zone of the upper sand-and-gravel aquifer at a depth of 152 feet bls. One groundwater sample was collected from this well and analyzed for BTEX, naphthalene, EDB, and lead. Benzene (17 μg/L) and toluene (10 μg/L) were detected in the water samples. Trace concentrations of lead below FDEP's drinking water standard were also detected.

After the 1986 study, Site 4 was transferred from the IR program to the UST program and renamed Site 1467. During the contamination assessment of Site 1467 in 1991 and 1992, 33 shallow monitoring wells and 8 intermediate monitoring wells were installed. Excessively contaminated soil (organic vapor concentrations greater than 500 ppm for gasoline products) was found from the land surface down to the water table during contamination assessment activities at Site 4. In a July 1992 Task Order Managers' meeting, it was determined that a decision regarding the transfer of Site 1467 from the UST program back to the IR program was needed. To support this decision, additional fieldwork was recommended to assess the site jurisdiction. The fieldwork included collection of groundwater samples from 19 monitoring wells at Site 1467. Groundwater sampling was completed in August 1993. Field gas chromatograph (GC) analytical results of groundwater samples collected during monitoring well installation were used to decide which monitoring wells would be sampled for laboratory analysis of CLP/TCL and CLP/TAL parameters. Monitoring wells that contained high concentrations of BTEX and TCE were selected for sampling during the site jurisdiction assessment. The samples were analyzed for CLP/TCL VOCs, SVOCs, pesticides, and PCBs as well as for CLP/TAL inorganics. The results of the groundwater sampling are provided in the *Jurisdiction Assessment Report, Underground Storage Tank Program Sites 1466 and 1467, Installation Restoration Program Sites 7 and 4, Naval Air Station Whiting Field* (ABB-ES 1994a) and the *Remedial Investigation and Feasibility Study Technical Memorandum No. 5, Groundwater Assessment* (ABB-ES 1995c). Because solvents were detected in groundwater at Site 4, it was transferred back to the IR program.

Concentrations of organic and inorganic analytes in groundwater are presented in Tables 3-7 and 3-8, respectively. TCE, benzene, toluene, and ethylbenzene were detected in groundwater samples collected from shallow and intermediate-depth monitoring wells at concentrations exceeding federal and Florida MCLs. In addition, 1,2-dichloroethene was detected in the groundwater samples from shallow monitoring wells at concentrations exceeding federal and Florida MCLs. Eleven of the groundwater samples

TABLE 3-7

ORGANIC COMPOUNDS DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 4

	Shallow Monitoring Wells								
Well Identifier:	WHF-1467-2	WHF-1467-20	WHF-1467-21	WHF-1467-23	WHF-1467-24	WHF-1467-25	WHF-1467-26		
Sample Identifier:	WHF14672	WHF146720	WHF146721	WHF146723	WHF146724	WHF146725	WHF146726	**Background**	
Collection Date:	29-AUG-93	27-AUG-93	29-AUG-93	26-AUG-93	29-AUG-93	27-AUG-93	29-AUG-93	**Screening**	**Federal/State**
Laboratory Sample No.:	90128010	90125006	90128003	90121004	90128008	90125002	90128006	**Criteria**	**Standards**
Volatile Organic Compounds µg/L)									
Methylene chloride	--	--	--	--	--	--	--	ND	5[a]/5[a]
Acetone	--	--	--	--	--	--	--	ND	NA/700[c]
1,2-Dichloroethene (total)	--	80	--	--	--	--	--	ND	70[a,e]/70[a,e]
Chloroform	--	--	--	--	--	--	--	ND	100[a]/6[c]
2-Butanone	--	--	--	8 J	--	--	--	ND	NA/4,200[c]
Trichloroethene	--	200	14	--	--	--	--	ND	5[a]/3[a]
Benzene	--	130	--	1 J	820	38	5,500	8	5[a]/1[a]
Toluene	--	78	--	6 J	1,900	75	24,000	26	1,000[a]/1,000[a], 40[b]
Ethylbenzene	4 J	110	--	--	410	19	1,200 J	ND	700[a]/700[a], 30[b]
Xylenes (total)	3 J	340 E	--	2 J	1,500	67	2,000 J	ND	10,000[a]/10,000[a], 20[b]
Total BTEX	7	658	--	9	4,630	199	32,700	34	NA/50[d]
Semivolatile Organic Compounds (µg/L)									
Phenol	--	5 J	--	--	9 J	1 J	26	ND	NA/10[c]
bis(2-Chloroethyl)ether	--	--	--	--	--	--	--	ND	NA/7.5[c]
2-Methylphenol	--	2 J	--	--	13	1 J	46	ND	NA/350[c]
4-Methylphenol	--	2 J	--	--	16	--	45	ND	NA/35[c]
2,4-Dimethylphenol	--	5 J	--	--	6 J	--	2 J	ND	NA/400[c]
Naphthalene	--	3 J	--	--	6 J	--	6 J	ND	NA/6.8[c]
2-Methylnaphthalene	--	1 J	--	--	4 J	--	2 J	ND	NA/NA
Phenanthrene	--	--	--	--	--	--	--	ND	NA/10[c]
Carbazole	--	--	--	--	--	--	--	ND	NA/7.5[c]
Fluoranthene	--	--	--	--	--	--	--	ND	NA/280[c]
bis(2-Ethylhexyl)phthalate	--	32	--	--	--	--	--	ND	6[a]/6[a]
Pesticides and Polychlorinated Biphenyls (µg/L)									
None detected									

TABLE 3-7

ORGANIC COMPOUNDS DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 4

	Shallow Monitoring Wells								
Well Identifier:	WHF-1467-27	WHF-1467-27DUP	WHF-1467-28	WHF-2467-29	WHF-1467-31	WHF-1467-32	WHF-1467-33	Background Screening Criteria	Federal/State Standards
Sample Identifier:	WHF146727	WHFDUP3	WHF146728	WHF146729	WHF146731	WHF146732	WHF146733		
Collection Date:	28-AUG-93	28-AUG-93	29-AUG-93	27-AUG-93	28-AUG-93	29-AUG-93	28-AUG-93		
Laboratory Sample No.:	90127002	90127007	90128009	90125003	90127003	90128005	90127001		
Volatile Organic Compounds (µg/L)									
Methylene chloride	2 J	--	--	--	3 J	--	--	ND	5[a]/15[a]
Acetone	1	--	--	--	--	--	49 J	ND	NA/700[c]
1,2-Dichloroethene (total)	5 J	5 J	12 J	--	--	--	61 J	ND	70[a,e]/70[a,e]
Chloroform	2	1 J	7 J	--	--	--	--	ND	100[a]/6[c]
2-Butanone	1	--	--	--	--	--	--	ND	NA/4,200[c]
Trichloroethene	100	110	510	--	5 J	--	78 J	ND	5[a]/3[a]
Benzene	650	700	210	170	36	500 D	1,200	8	5[a]/1[a]
Toluene	340	370	460	9 J	86	4,200 D	830	26	1,000[a]/1,000[a], 40[b]
Ethylbenzene	130	130	160	47	9 J	870 D	390	ND	700[a]/700[a], 30[b]
Xylenes (total)	310	340	490	230	13	2,600 D	1,400	ND	10,000[a]/10,000[a], 20[b]
Total BTEX	1,430	1,540	1,320	1,776	1,920	8,170	3,820	34	NA/50[d]
Semivolatile Organic Compounds (µg/L)									
Phenol	--	--	--	--	--	1 J	22	ND	NA/10[c]
bis(2-Chloroethyl)ether	--	--	--	--	--	--	18	ND	NA/7.5[c]
2-Methylphenol	--	--	--	--	--	4 J	17	ND	NA/350[c]
4-Methylphenol	--	--	--	--	--	5 J	6 J	ND	NA/35[c]
2,4-Dimethylphenol	--	--	--	--	--	2 J	6 J	ND	NA/400[c]
Naphthalene	7 J	6 J	--	1 J	--	3 J	--	ND	NA/6.8[c]
2-Methylnaphthalene	1 J	1 J	2 J	1 J	--	3 J	--	ND	NA/NA
Phenanthrene	--	--	1 J	--	--	2 J	--	ND	NA/10[c]
Carbazole	--	--	--	--	--	--	--	ND	NA/7.5[c]
Fluoranthene	--	--	--	--	--	1 J	--	ND	NA/280[c]
bis(2-Ethylhexyl)phthalate	1 J	--	--	1 J	1 J	--	2 J	ND	6[a]/6[a]
Pesticides and Polychlorinated Biphenyls (µg/L)									
None detected									

TABLE 3-7

ORGANIC COMPOUNDS DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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	Intermediate Monitoring Wells						
Well Identifier:	WHF-1467-2D	WHF-1467-5D	WHF-1467-6D	WHF-1467-7D	WHF-4-1		
Sample Identifier:	WHF14672D	WHF14675D	WHF14676D	WHF14677D	WHF4-1	**Background**	
Collection Date:	29-AUG-93	27-AUG-93	27-AUG-93	29-AUG-93	19-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90128004	90125004	90125005	90128007	90343002	**Criteria**	**Standards**
Volatile Organic Compounds (μg/L)							
Methylene chloride	--	--	--	--	--	ND	5[a]/15[a]
Acetone	--	--	--	--	--	ND	NA/700[c]
1,2-Dichloroethene (total)	--	--	--	--	--	ND	70[a,e]/70[a,e]
Chloroform	25 J	--	--	--	--	ND	100[a]/6[c]
2-Butanone	190	8 J	--	--	--	ND	NA/4,200[c]
Trichloroethene	38 J	--	--	--	--	ND	5[a]/3[a]
Benzene	1,800	--	3,100	--	--	8	5[a]/1[a]
Toluene	1,600 D	--	18,000	--	--	26	1,000[a]/1,000[a], 40[b]
Ethylbenzene	440	--	2,000	1 J	--	ND	700[a]/700[a], 30[b]
Xylenes (total)	440	--	5,100	4 J	--	ND	10,000[a]/10,000[a], 20[b]
Total BTEX	4,280	--	28,200	5	--	34	NA/50
Semivolatile Organic Compounds (μg/L)							
Phenol	43	--	23	--	--	ND	NA/10[c]
bis(2-Chloroethyl)ether	--	--	--	--	--	ND	NA/7.5[c]
2-Methylphenol	18	--	44	--	--	ND	NA/350[c]
4-Methylphenol	58	--	57	--	--	ND	NA/35[c]
2,4-Dimethylphenol	1 J	--	--	--	--	ND	NA/400[c]
Naphthalene	--	--	10	--	--	ND	NA/6.8[c]
2-Methylnaphthalene	--	--	2 J	--	--	ND	NA/NA
Phenanthrene	--	--	--	--	--	ND	NA/10[c]
Carbazole	--	--	4 J	--	--	ND	NA/7.5[c]

TABLE 3-7

ORGANIC COMPOUNDS DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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	Intermediate Monitoring Wells						
Well Identifier:	WHF-1467-2D	WHF-1467-5D	WHF-1467-6D	WHF-1467-7D	WHF-4-1	Background Screening Criteria	Federal/State Standards
Sample Identifier:	WHF14672D	WHF14675D	WHF14676D	WHF14677D	WHF4-1		
Collection Date:	29-AUG-93	27-AUG-93	27-AUG-93	29-AUG-93	19-JAN-94		
Laboratory Sample No.:	90128004	90125004	90125005	90128007	90343002		
Semivolatile Organic Compounds (µg/L) (continued)							
Fluoranthene	--	--	--	--	--	ND	NA/280[c]
bis(2-Ethylhexyl)phthalate	--	2 J	2 J	--	--	ND	6/6[a]
Pesticides and Polychlorinated Biphenyls (µg/L)							
None detected							

[a] Primary MCL.
[b] Secondary MCL.
[c] Groundwater guidance concentration.
[d] Florida petroleum investigation action level (Chapter 62-770.730 Florida Administrative Code).
[e] cis-1,2-Dichloroethene was used for comparison.

Notes: Shading indicates that the concentration meets or exceeds federal or state maximum primary or secondary contaminant levels or Florida petroleum investigation action level.
-- – Compound was not detected above instrument detection limits.
BTEX – Benzene, toluene, ethylbenzene, and xylenes.
D – Sample was diluted and reanalyzed.
E – The reported value is estimated because of interference.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.

TABLE 3-8

INORGANIC ANALYTES DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 4

	Shallow Monitoring Wells								
Well Identifier:	WHF-1467-2	WHF-1467-20	WHF-1467-21	WHF-1467-23	WHF-1467-24	WHF-1467-25	WHF-1467-26		
Sample Identifier:	WHF14672	WHF146720	WHF146721	WHF146723	WHF146724	WHF146725	WHF146726	**Background**	
Collection Date:	29-AUG-93	27-AUG-93	29-AUG-93	26-AUG-93	29-AUG-93	27-AUG-93	29-AUG-93	**Screening**	**Federal/State**
Laboratory Sample No.:	90128010	90125006	90128003	90121004	90128008	90125002	90128006	**Criteria**	**Standards**
Metals and Cyanide (μg/L)									
Aluminum	7,250	2,600 J	22,500	7,110 J	14,800	12,900 J	12,400	53,360	200[b]/200[b]
Antimony	--	12.5 J	--	--	--	--	--	ND	6[a]/6[a]
Arsenic	--	12 J	--	--	4.3 J	3.1 J	17.2	ND	50[a]/50[a]
Barium	35.6 J	78.7 J	56.8 J	35 J	52.2 J	58.2 J	58.3 J	126.8	2,000[a]/2,000[a]
Beryllium	0.46 J	--	1.6 J	0.24 J	0.79 J	0.76 J	0.33 J	3.6	4[a]/4[a]
Cadmium	4.5 J	--	--	--	--	--	3.1 J	ND	5[a]/5[a]
Calcium	908 J	20,700	5,850	4,320 J	9,840	8,980	3,950 J	4,706	NA/NA
Chromium	26.4	7 J	84	45.4	46	52.9	35.9	872	100[a]/100[a]
Cobalt	4.9 J	--	3.4 J	--	5.1 J	--	30.1 J	20.7	NA/NA
Copper	43.1	22.6 J	33.3 J	22.6 J	22.3 J	30.8	18.4 J	67.6	TT 1,300 1,000[b]/1,000[b]
Iron	64,300	33,300	58,000	36,600	78,300	45,400	64,200	80,066	300[b]/300[b]
Lead	4.8	107	6.3	3.5	16	9.3	481	20.6	TT 15/15[a]
Magnesium	999 J	3,170 J	1,800 J	1,280 J	3,520 J	3,530 J	2,610 J	2,922	NA/NA
Manganese	79.9	605	137	59.6	241	21.4	153	188	50[b]/50[b]
Mercury	--	--	--	0.05 J	--	0.25	--	0.32	2[a]/2[a]
Nickel	--	14.2 J	--	--	--	--	17.9 J	744	100[a]/100[a]
Potassium	--	17,900	4,400 J	2,350 J	3,170 J	1,360 J	2,740 J	17,270	NA/NA
Sodium	5,030	54,200	4,450 J	4,620 J	2,960 J	3,330 J	4,000 J	5,740	NA/160,000[a]
Vanadium	53.3	4.4 J	196	71	80	112	53.8	335	NA/49[c]
Zinc	74.6 J	186	81.6 J	100	46.4 J	67.1	66.9 J	140	5,000[b]/5,000[b]

TABLE 3-8

INORGANIC ANALYTES DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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	Shallow Monitoring Wells								
Well Identifier:	WHF-1467-27	WHF-1467-27 DUP	WHF-1467-28	WHF-1467-29	WHF-1467-31	WHF-1467-32	WHF-1467-33		
Sample Identifier:	WHF146727	WHFDUP3	WHF146728	WHF146729	WHF146731	WHF146732	WHF146733	**Background**	
Collection Date:	28-AUG-93	28-AUG-93	29-AUG-93	27-AUG-93	28-AUG-93	29-AUG-93	28-AUG-93	**Screening**	**Federal/State**
Laboratory Sample No.:	90127002	90127007	90128009	90125003	90127003	90128005	90127001	**Criteria**	**Standards**
Metals and Cyanide (μg/L)									
Aluminum	1,590 J	1,000	29,200	3,380 J	2,530 J	4,090	32.6 J	53,360	200[b]/200[b]
Antimony	--	--	--	--	--	--	--	ND	6[a]/6[a]
Arsenic	3.2 J	2.6 J	12.1	4 J	--	16.9	--	ND	50[a]/50[a]
Barium	51.1 J	61.7 J	79.6 J	39.1 J	18.2 J	82.3 J	0.49 J	126.8	2,000[a]/2,000[a]
Beryllium	--	--	1.1 J	0.21 J	--	--	0.2 J	3.6	4[a]/4[a]
Cadmium	3.8 J	--	17.2	--	4.6 J	--	--	ND	5[a]/5[a]
Calcium	4,510 J	6,090	3,780 J	2,640 J	1,010 J	1,800 J	20 J	4,706	NA/NA
Chromium	5.1 J	4.7 J	62.8	14.4	9.6 J	25.6	--	872	100[a]/100[a]
Cobalt	3.8 J	--	4.6 J	--	--	--	--	20.7	NA/NA
Copper	5.6 J	8.8 J	60.3	13.5 J	8.5 J	22.3 J	4.4 J	67.6	TT 1,300 1,000[b]/1,000[b]
Iron	5,770	6,020	29,300	15,400	6,810	33,700	7.9 J	80,066	300[b]/300[b]
Lead	9.2	9.5	128	3.2	9.3	67	--	20.6	TT 15/15[a]
Magnesium	1,150 J	1,220 J	1,470 J	3,270 J	582 J	801 J	--	2,922	NA/NA
Manganese	15.3	17.4	64.1	13.7 J	11.9 J	362	--	188	50[b]/50[b]
Mercury	0.04 J	0.04 J	--	0.06 J	0.08 J	--	0.1 J	0.32	2[a]/2[a]
Nickel	--	--	25.9 J	--	--	--	--	744	100[a]/100[a]
Potassium	844 J	877 J	1,170 J	1,780 J	--	--	--	17,270	NA/NA
Sodium	3,680 J	3,660 J	7,410	1,670 J	1,980 J	5,120	9,490	5,740	NA/160,000[a]
Vanadium	7 J	3.3 J	146	27.8 J	15.9 J	47.5 J	--	335	NA/49[c]
Zinc	--	31.3	161 J	45.7	--	52.2 J	--	140	5,000[b]/5,000[b]

TABLE 3-8

INORGANIC ANALYTES DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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	Intermediate Monitoring Wells						
Well Identifier:	WHF-1467-2D	WHF-1467-5D	WHF-1467-6D	WHF-1467-7D	WHF-4-1		
Sample Identifier:	WHF14672D	WHF14675D	WHF14676D	WHF14677D	WHF4-1	**Background**	
Collection Date:	29-AUG-93	27-AUG-93	27-AUG-93	29-AUG-93	19-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90128004	90125004	90125005	90128007	90343002	**Criteria**	**Standards**
Metals and Cyanide (μg/L)							
Aluminum	566	77.2 J	8,460 J	2,950	--	53,360	200[b]/200[b]
Antimony	--	--	--	--	--	ND	6[a]/6[a]
Arsenic	7.6 J	1.7 J	8.5 J	--	4.2 J	ND	50[a]/50[a]
Barium	41.5 J	5.6 J	92.8 J	53.3 J	39.4 J	126.8	2,000[a]/2,000[a]
Beryllium	--	--	0.48 J	0.48 J	--	3.6	4[a]/4[a]
Cadmium	--	--	--	--	--	3.2	5[a]/5[a]
Calcium	14,700	2,070 J	8,270	1,340 J	592 J	4,706	NA/NA
Chromium	--	--	24.9	9.1 J	--	872	100[a]/100[a]
Cobalt	--	--	3.6 J	3.5 J	--	20.7	NA/NA
Copper	19.9 J	--	47.2	22.3 J	--	67.6	TT 1,300 1,000[b]/1,000[b]
Iron	4,750	60.9 J	76,600	6,230	13,100	80,066	300[b]/300[b]
Lead	44.2	--	43	4.8	--	20.6	TT 15/15[a]
Magnesium	1,670 J	270 J	2,580 J	1,230 J	825 J	2,922	NA/NA
Manganese	140	33.7	128	19.7	95.8	188	50[b]/50[b]
Mercury	--	--	0.07 J	--	--	0.32	2[a]/2[a]
Nickel	--	--	33.6 J	--	--	744	100[a]/100[a]
Potassium	5,650	1,580 J	13,000	4,210 J	--	17,270	NA/NA

TABLE 3-8

INORGANIC ANALYTES DETECTED IN SITE 4 (UNDERGROUND STORAGE TANK SITE 1467) GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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	Intermediate Monitoring Wells					Background Screening Criteria	Federal/State Standards
Well Identifier:	WHF-1467-2D	WHF-1467-5D	WHF-1467-6D	WHF-1467-7D	WHF-4-1		
Sample Identifier:	WHF14672D	WHF14675D	WHF14676D	WHF14677D	WHF4-1		
Collection Date:	29-AUG-93	27-AUG-93	27-AUG-93	29-AUG-93	19-JAN-94		
Laboratory Sample No.:	90128004	90125004	90125005	90128007	90343002		
Metals and Cyanide (µg/L) (continued)							
Sodium	5,580	4,500 J	3,890 J	2,390 J	1790 J	5,740	NA/160,000(a)
Vanadium	--	--	29.2 J	16.7 J	--	335	NA/49(c)
Zinc	30.4 J	18.6 J	251	68.4 J	0.98	140	5,000(b)/5,000(b)

(a) Primary MCL.
(b) Secondary MCL.
(c) Groundwater guidance concentration.

Notes:
Shading indicates that the concentration meets or exceeds federal or state MCLs
-- – Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.
TT – Treatment techniques.

collected from shallow monitoring wells and two samples collected from intermediate-depth monitoring wells contained BTEX concentrations exceeding the Florida UST cleanup goal of 50 μg/L.

Bis(2-ethylhexyl)phthalate was detected in only a groundwater sample collected from a shallow monitoring well, but its concentration exceeded federal and Florida MCLs. Pesticides and PCBs were not detected in Site 4 groundwater samples.

Aluminum, arsenic, cadmium, iron, lead, and manganese were detected in groundwater samples collected from shallow monitoring wells at concentrations exceeding federal and Florida MCLs. Aluminum, iron, lead, and manganese were also detected in groundwater samples collected from intermediate-depth monitoring wells at concentrations exceeding federal and Florida MCLs.

Additional groundwater samples were taken in 1995, and details of the analytical results are presented in the *Remedial Investigation, Industrial Area Groundwater Investigation, Interim Report, Naval Air Station Whiting Field* (ABB-ES 1996b). Figures 3-2 and 3-3 show the areal extent of impacted groundwater (i.e., BTEX and TCE plumes) at the North Field Industrial Area based on the 1995 groundwater results.

3.2.2.3 Proposed Investigation

Additional records searching and source exploration in the vicinity of Site 4 will be conducted to evaluate the status of any residual soil contamination at the former sludge disposal area and North Fuel Farm. The investigation of impacted groundwater at the North Field Industrial Area, which includes commingled BTEX and TCE plumes at Sites 3, 4, and 32, will be addressed in the proposed investigation at Site 32 (Section 3.2.3.3).

The investigation activities to be performed for the soils at Site 4 are described in the following sections.

Investigation Scope

- Define extent of "excessively contaminated soils" around former USTs in accordance with FDEP regulations (i.e., total organic vapors > 50 ppm for kerosene group, > 500 ppm for gasoline group petroleum hydrocarbon release areas).
- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region III RBCs and SSLs (USEPA 1996d)].

Source Areas of Concern

- Former USTs and associated piping.
- Tank-bottom sludge disposal areas.

The RI/FS investigation at Site 4 will consist of 10 soil borings and associated subsurface soil sampling to help characterize the nature and extent of soil contamination. Surface soils will also be collected to support a risk assessment for potential exposure at the site. The supporting rationale for these borings is presented in the box below. Figure 3-1 shows the approximate locations of the soil borings.

RI/FS Rationale for Soil Borings at Site 4

Soil Boring Location	Rationale
4SB01, 4SB02, 4SB03, 4SB04, 4SB05, 4SB06, 4SB09, 4SB10	Determine extent of contamination around former USTs and investigate high OVA readings from soil borings.
4SB07	Uninvestigated high OVA readings from soil borings.
4SB08	Waste oil line and sump.
Optional	Pending identification of potential source areas such as floor drains, subgrade piping, sumps, oil/water separators or to define extent of contamination.

Soil Sampling Criteria

Soil samples will be collected in all borings using either nominal 2-inch-diameter split spoons or a 5-foot-long continuous-core barrel. In general, 5-foot continuous-core barrel samples will be collected from soil borings and monitoring wells located near source areas. Split-spoon samples 2 inch in diameter by 2-foot in length may be collected at 5-foot intervals from monitoring wells near the perimeter of the contaminant plum.

All borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Soil samples will be selected for laboratory analysis from the surface soil in unpaved areas; each 30-foot depth interval based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. A surface soil sample will not be collected from borings in paved areas. Soil sample quantities are based on 2 soil borings being installed to 90 feet bls, 1 boring being installed to a depth of 60 feet, and 7 borings being installed to total depths of 30 feet. Soil samples will be analyzed for: VOCs, SVOCs, TPH, pesticides, PCBs, and inorganics. Three or more soil samples will be collected using a thin-walled Shelby tube (ASTM D1587) for analysis of the geotechnical and natural attenuation indicator parameters listed in Section 3.2.1.3.

3.2.3 Site 32: North Field Maintenance Hangar

3.2.3.1 Site 32 Location and Description

Site 32 is located at the North Field Maintenance Hangar, Building 1424 (Figure 3-1). The site includes Building 1424, the adjacent washrack area, and the location of the abandoned waste oil tanks east of Building 1424.

3.2.3.2 Site 32 History

The North Field Maintenance Hangar was constructed in the middle 1940s to support maintenance service to training aircraft. These activities included engine maintenance, corrosion control, and aircraft cleaning. Maintenance activities generated waste stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids. Before AIMD activities began, aircraft maintenance wastes from Hangar 1424 reportedly were sent to base landfills; however, spills and uncontrolled disposals of solvents at or near the sites of generation were common occurrences in the 1940s and 1950s.

Oil changes were routinely performed on the fixed-wing aircraft as part of the normal maintenance activities. The oil was changed about every 250 hours of operation and required approximately 10 gallons of oil. Earlier investigations (e.g., IAS) concluded that about 700 gallons of waste engine oil were generated each month. The waste oil volume was dramatically reduced in the late 1970s with the introduction of the T-34c "Turbo Mentor." Waste volumes were reduced to about 1,500 to 2,000 gallons/year. The waste oil was reportedly poured into the underground waste oil tanks located adjacent to the washrack (Figure 3-1) until the tanks were abandoned in the 1980s. The waste oil was removed from the tanks by a contractor for off-base disposal.

Other wastes generated by maintenance activities included: mineral spirits, methyl ethyl ketone, hydraulic fluids, APU thinner, and paint strippers. Contaminated fuel obtained during the collection of fuel samples was placed in a line shack tank or 55-gallon drums. The fuel was routinely collected by the fuels contractor and hauled to the Firefighter Training Area for use in fire drills. A summary of the estimated quantities and ultimate disposition of these wastes is presented in the IAS (Envirodyne 1985).

Fixed-wing aircraft are still washed at the washrack area located east of Building 1424. Aircraft washing is performed on each aircraft on a 14-day cycle. The aircraft cleaning solution is consumed at a rate of about 4,200 gallons/year. Before approximately 1972, the wastewater from this operation was discharged to the storm sewer. Subsequently the washrack was disconnected from the storm sewer and connected to the sanitary sewer system, allowing the wastewater to be treated at the sewage treatment plant.

At the completion of the Phase I RI field investigation, Site 32 was added to the Phase II-A RI program for contamination assessment. Phase II-A activities at Site 32 included a soil gas survey, soil borings and subsurface soil sampling, monitoring well installation, and groundwater sampling.

Soil gas samplers were placed on approximately 80-foot centers surrounding Building 1424. Soil gas screening indicated several hot spots with ion counts over 100,000 for BTEX, PCE, TCE, and cycloalkanes/naphthalenes. Details of the soil gas investigation are presented in *Soil Gas Survey Technical Report* (ABB-ES 1993b).

Eight soil borings (32SB01 through 32SB08) were drilled in January 1993 during Phase II-A. The soil borings were drilled around the abandoned waste oil tanks, Building 1424, and the washrack area (Figure 3-1). Three additional soil borings (WRSB01 through WRSBB03) were drilled at the abandoned waste oil tanks and washrack locations in August 1993 during Phase II-A. Fifty-three subsurface soil samples were collected during Phase II-A. Six VOCs, 13 SVOCs, 2 pesticides, 1 PCB, and TPH were detected in the subsurface soil samples (ABB-ES 1995a). Twenty-three inorganic analytes were detected in the subsurface soil samples. Detected concentrations of organic and inorganic analytes from borings 32SB01 through 32SB08 are presented in Tables 3-9 and 3-10, respectively. Table 3-11 presents the detected analytes from soil borings WRSB01 through WRSB03

In 1994, 13 shallow soil borings were drilled and soil samples were collected at a dry well inlet and a buried fuel trench as part of a contamination assessment of shallow soils in preparation for construction activities. Results of the investigation were presented in a letter report (ABB-ES 1994b). Six VOCs were detected in the soil samples collected for GC screening Five VOCs and four SVOCs were detected in the soil samples collected for fixed-base analysis.

Four shallow monitoring wells were installed and sampled during Phase II-A. Five VOCs including 1,2-dichloroethene; TCE; benzene; toluene; and ethylbenzene were detected at concentrations exceeding federal and Florida MCLs (ABB-ES 1995a). Bis(2-ethylhexyl)phthalate was the only SVOC detected in groundwater; its concentration exceeded the federal and Florida MCLs. No pesticide or PCB compounds were detected in the groundwater samples at Site 32; however, 21 inorganic analytes were detected.

TABLE 3-9

ORGANIC COMPOUNDS DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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Locator:	32SB1-1-2	32SB1-5-7	32SB1-10-12	32SB1-15-17	32SB1-15-17A[a]	32SB1-20-22	32SB1-25-27	32SB1-35-37	32SB1-35-37A[a]	32SB1-50-52
Collection Date:	09-JAN-93	09-JAN-93	09-JAN-93	10-JAN-93	10-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34836005	34836008	34836009	[b]34837001	[b]34831002	34848016	34846009	34848017	34848018	34846010
Target Compound List (TCL) Volatile Organic Compounds (VOCs) (mg/kg)										
Methylene chloride	–	–	–	3 J	4 J	–	–	–	–	–
Acetone	–	2 J	–	3 J	8 J	65	34	69	44	44
2-Butanone	–	–	–	–	–	–	–	–	–	–
Trichloroethene	–	–	–	–		–	–	–	–	–
Toluene	–	–	–	–	–	–	–	–	–	–
Xylenes (total)	–	–	–	–	–	–	–	–	–	–
TCL Semivolatile Organic Compounds (SVOCs) (mg/kg)										
2,4-Dimethylphenol	–	–	–	–	–	–	–	–	–	–
Naphthalene	–	–	–	–	–	–	–	–	–	–
2-Methylnaphthalene	–	–	–	–	–	–	–	–	–	–
Acenaphthene	–	–	–	–	–	–	–	–	–	–
Fluorene	–	–	–	–	–	–	–	–	–	–
N-Nitrosodiphenyl-amine	–	–	–	–	–	–	–	–	–	–
Phenanthrene	–	–	–	–	–	–	–	–	–	–
Anthracene	–	–	–	–	–	–	–	–	–	–
Fluoranthene	–	–	–	–	–	–	–	–	–	–
Pyrene	–	–	–	–	–	–	–	–	–	–
bis(2-Ethylhexyl)-phthalate	–	–	–	–	–	–	–	–	–	–
Carbazole	–	–	–	–		–	–	–	–	–
Di-n-octylphthalate	–	–	–	–		–	–	–	–	–
TCL Pesticides and Polychlorinated Biphenyls (PCBs) (mg/kg)										
4,4'-DDE	–	–	–	–	–	–	–	–	–	–
4,4'-DDD	–	–	–	–	–	–	–	–	–	–
Aroclor-1254	–	–	–	–	–	–	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg)										
	–	–	–	–	–	–	–	–	–	–

TABLE 3-9

ORGANIC COMPOUNDS DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 5

Locator:	32SB2-0-2	32SB2-5-7	32SB2-12-14	32SB3-0-2	32SB3-0-2A[(a)]	32SB3-5-7	32SB3-10-12	32SB3-20-22	32SB3-30-32	32SB4-0-2
Collection Date:	09-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34836010	34846006	34846008	34846002	34846003	34846001	34846004	34846005	34848001	34848008
TCL VOCs (mg/kg)										
Methylene chloride	--	--	--	--	--	--	--	--	--	--
Acetone	3 J	110	130	200	150	170	230	110	58	18
2-Butanone	--	--	--	--	--	6 J	8 J	--	--	--
Trichloroethene	1 J	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--
Xylenes (total)	--	--	--	11 J	--	--	--	--	--	--
TCL SVOCs (mg/kg)										
4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	1,700	1,400	--	--	--	--	--
2-Methylnaphthalene	--	--	--	810	620	--	--	--	--	--
Acenaphthene	--	--	--	--	--	--	--	--	--	--
Fluorene	--	--	--	--	—	--	--	--	--	--
N-Nitrosodiphenyl-amine	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	120 J	63 J	--	--	--	--	--
Anthracene	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	53 J	--	39 J	--	--	--	--
Pyrene	--	--	--	36 J	--	--	--	--	--	--
bis(2-Ethylhexyl)-phthalate	--	--	--	--	--	--	--	--	--	--
Carbazole	--	39 J	--	--	--	--	--	--	--	--
Di-n-octylphthalate	--	40 J	--	--	--	--	--	--	--	--
TCL Pesticides and PCBs (mg/kg)										
4,4'-DDE			--	--	--	--	--	--	--	--
4,4'-DDD	--	--	--	--	--	--	--	--	--	--
Aroclor-1254	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg)	--	--	--	401	--	13	63.2	--	--	--

TABLE 3-9

ORGANIC COMPOUNDS DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Locator:	32SB4-15-17	32SB4-20-22	32SB4-20-22A[(a)]	32SB4-25-27	32SB4-35-37	32SB4-45-47	32SB5-1-2	32SB5-5-7	32SB5-10-12	32SB5-20-22
Collection Date:	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	19-JAN-93	19-JAN-93	19-JAN-93	19-JAN-93
Laboratory Sample No.:	34848009	34848010	3484011	34848012	34848013	34848014	34925008	34925009	34925011	34925010
TCL VOCs (mg/kg)										
Methylene chloride	--	--	--	--	--	--	--	--	--	--
Acetone	55	100	58	48	53	33	--	--	34	20
2-Butanone	--	--	--	--	--	--	--	--	4 J	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--
Xylenes (total)	--	--	--	--	--	--	--	--	--	--
TCL SVOCs (mg/kg)										
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--	--
Acenaphthene	--	--	--	--	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--	--
Anthracene	--	--	--	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)-phthalate	--	--	--	--	--	--	--	--	--	--
Di-n-octylphthalate	--	--	--	--	--	--	--	--	--	--
TCL Pesticides and PCBs (mg/kg)										
4,4'-DDE	--	--	--	--	--	--	--	--	--	--
4,4'-DDD	--	--	--	--	--	--	--	--	--	--
Aroclor-1254	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg)	--	--	--	--	2	--	27.1	5.8	--	--

TABLE 3-9

ORGANIC COMPOUNDS DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 4 OF 5

Locator:	32SB5-45-47	32SB5-45-47A[(a)]	32SB5-61-63	32SB5-95-97	32SB6-0-2	32SB6-5-7	32SB6-5-7A[(a)]	32SB6-10-12	32SB6-20-22
Collection Date:	19-JAN-93	12-JAN-93	20-JAN-93	20-JAN-93	12-JAN-93	11-JAN-93	11-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34925012	34846012	34938007	34938008	34846016	34847001	34847002	34846014	34846015
TCL VOCs (mg/kg)									
Methylene chloride	–	–	–	–	–	–	–	–	–
Acetone	22 J	95	57 J	35 J	–	54 J	75	75	47
2-Butanone	13 J	–	50 J	–	–	–	3 J	–	–
Trichloroethene	–	–	–	–	–	–	–	–	–
Toluene	–	–	–	–	–	–	–	–	–
Xylenes (total)	–	–	–	–	–	–	–	–	–
TCL SVOCs (mg/kg)									
2,4-Dimethylphenol	–	–	–	–	1,500 J	–	–	–	–
Naphthalene	–	–	–	–	2,500 J	–	–	–	–
2-Methylnaphthalene	–	–	–	–	15,000	52 J	–	–	–
Acenaphthene	–	–	–	–	1,400	–	–	–	–
Fluorene	–	–	–	–	2,600 J	–	–	–	–
N-Nitroso-di-n-phenylamine	–	–	–	–	1,600 J	–	–	–	–
Phenanthrene	–	–	–	–	5,100 J	59 J	–	–	–
Anthracene	–	–	–	–	–	–	–	–	–
Carbazole	–	–	–	–	–	–	–	–	–
Fluoranthene	–	–	–	–	–	–	–	–	–
Pyrene	–	–	–	–	1,200 J	–	–	–	–
bis(2-Ethylhexyl)phthalate	–	–	–	600 J	–	73 J	–	–	–
Di-n-octylphthalate	–	–	–	–	–	–	–	–	–
TCL Pesticides and PCBs (mg/kg)									
4,4'-DDE	–	–	–	–	–	–	–	–	–
4,4'-DDD	–	–	–	–	–	–	–	–	–
Aroclor-1254	–	–	–	–	160 J	–	–	–	–
Total Petroleum Hydrocarbons (mg/kg)	–	–	–	–	12,300	104	–	62.5	–

TABLE 3-9

ORGANIC COMPOUNDS DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Locator:	32SB6-30-32	32SB6-45-47	32SB6-45-47A[a]	32SB7-0-2	32SB7-5-7	32SB7-15-17	32SB7-30-32	32SB8-5-7	3SSB8-13-15
Collection Date:	12-JAN-93	12-JAN-93	12-JAN-93	20-JAN-93	20-JAN-93	20-JAN-93	21-JAN-93	21-JAN-93	21-JAN-93
Laboratory Sample No.:	34846013	34846011	34846012	34938004	34938005	34938006	34956001	34956004	34956005
TCL VOCs (mg/kg)									
Methylene chloride	--	--	--	--	--	--	--	--	--
Acetone	49	72	95	15 J	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	1,100 J	--	--	--
Xylenes (total)	--	--	--	--	--	11,000	770 J	--	--
TCL SVOCs (mg/kg)									
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	7,200	21,000	1,100	--	--
2-Methylnaphthalene	--	--	--	--	2,300	27,000	2,600	--	--
Acenaphthene	--	--	--	--	--	--	--	--	--
Fluorene	--	--	--	--	--	980	220 J	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	340 J	79 J	--	--
Anthracene	--	--	--	--	--	53 J	--	--	--
Carbazole	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	40 J	--	--	--
Pyrene	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--	--	--	--
Di-n-octylphthalate	--	--	--	--	--	--	--	--	--
TCL Pesticides and PCBs (mg/kg)									
4,4'-DDE	--	--	--	0.69 J	--	--	--	--	--
4,4'-DDD	--	--	--	2.2 J	--	--	--	--	--
Aroclor-1254	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (mg/kg)									
	--	--	--	7,180	2,310	2,580	2,650	--	--

(a) The "A" in the sample locator indicates a duplicate sample.
(b) Data not validated.

Notes: -- The analyte was not detected in laboratory analysis.
DDD – Dichlorodiphenyldichloroethane.
DDE – Dichlorodiphenyldichloroethene.
J – The associated numerical value is an estimated quantity.

TABLE 3-10

INORGANIC ANALYTES DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Locator:	32SB1-1-2	32SB1-5-7	32SB1-10-12	32SB1-15-17	32SB1-15-17A*	32SB1-20-22	32SB1-25-27	32SB1-35-37	32SB1-35-37A*
Collection Date:	09-JAN-93	09-JAN-93	09-JAN-93	12-JAN-93	10-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34836005	34836008	34836009	01090001	01090002	34848016	34846009	34848017	34848018
Aluminum	11,000	2,630	4,450	2,410	3,120	277	376	379	6.9 J
Antimony	--	--	--	--	--	--	--	--	--
Arsenic	0.76 J	0.91 J	--	--	--	--	--	--	--
Barium	11.1 J	5.5 J	6 J	5.6	5.9	0.47 J	1.1 J	0.06 J	--
Beryllium	0.06 J	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	0.4 J
Calcium	257 J	42.6 J	32 J	28.6	25.5	93.1 J	77.9 J	82.6 J	--
Chromium	22.5	4.3	4.3	4.6	4.2	--	0.91 J	1.1 J	--
Cobalt	1.1 J	1 J	0.53 J	--	--	--	--	--	--
Copper	1.6 J	0.71 J	0.98 J	0.49	1.1	0.85 J	1.1 J	0.8 J	--
Iron	9,290	5,520	7,120	3,540	1,970	121	232	176	--
Lead	2.8	3.1	2	2.0	2.1	0.6 J	0.38 J	0.42 J	0.43 J
Magnesium	81.7 J	59 J	60.9 J	52.0	65.6	15.4 J	24.6 J	13.1 J	20 J
Manganese	37.4	8.2	6.7	4.3	4.7	0.86 J	1.7 J	1.8 J	--
Mercury	0.03 J	0.03 J	0.02 J	0.02	--	0.04 J	0.03 J	0.04 J	0.06 J
Nickel	3.9 J	--	--	--	--	--	--	--	--
Potassium	198 J	281 J	320 J	242	412	41.9 J	72.3 J	54.2 J	75.7 J
Selenium	--	1.2	--	--	--	--	--	--	--
Silver	0.69 J	0.89 J	0.96 J	0.91	0.91	--	--	--	--
Sodium	--	75.6 J	76.8 J	19.7	20.1	160 J	184 J	166 J	--
Vanadium	25.3	18.7	28.3	--	12.5	0.53 J	1.4 J	0.56 J	0.5 J
Zinc	1.9 J	0.52 J	--	0.42	0.8	2.1 J	2.8 J	2 J	--
Cyanide	0.58 J	0.51 J	0.55 J	0.48	0.68	--	--	--	--

TABLE 3-10

INORGANIC ANALYTES DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Locator:	32SB1-50-52	32SB2-0-2	32SB2-5-7	32SB2-12-14	32SB3-0-2	32SB3-0-2A*	32SB3-5-7	32SB3-10-12	32SB3-20-22
Collection Date:	12-JAN-93	09-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34846010	34836010	34846006	34846008	34846002	34848018	34846001	34846004	34846005
Aluminum	215	21,900	14,500	3,920	5,740	9,280	10,800	6,070	1,940
Antimony	--	6 J	--	--	--	--	--	--	--
Arsenic	--	--	0.81 J	1 J	0.91 J	0.71 J	1.1 J	1.3 J	0.18 J
Barium	0.12 J	10.6 J	13.1 J	6.2 J	7.6 J	9.9 J	13.7 J	6.5 J	3.6 J
Beryllium	--	0.12 J	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--
Calcium	63 J	611 J	308 J	204 J	493 J	931 J	155 J	132 J	77.8 J1
Chromium	--	18	10	10.2	4.9	7.1	8.9	5.5	2.7
Cobalt	--	1.8 J	--	--	--	--	1.5 J	--	--
Copper	0.79 J	3 J	4 J	2.1 J	3.1 J	5.7	4.3 J	4.2 J	1.3 J
Iron	29.8	13,200	8,950	4,960	4,160	5,250	6,130	3,950	647
Lead	0.13 J	3.9	3.3	3	3	2.6	3.8	3.8	1.1
Magnesium	14.7 J	130 J	119 J	52.1 J	44.4 J	84.4 J	117 J	81.5 J	42.7 J
Manganese	0.56 J	32.9	39.3	14.4	91.5	95	21.2	6.2	3.5
Mercury	0.03 J	0.03 J	0.04	0.04	0.03	0.04	0.03	0.03	0.03 J
Nickel	--	4 J	2 J	--	--	--	2.3 J	2.3 J	--
Potassium	63.8 J	273 J	165 J	130 J	180 J	210 J	541 J	672 J	144 J
Selenium	--	--	0.11 J	--	0.22 J	--	--	--	--
Silver	--	1.2 J	--	--	--	--	--	--	--
Sodium	140 J	13 J	181 J	234 J	172 J	159 J	196 J	214 J	196 J
Vanadium	--	36.8	20.4	15.2	9.8 J	13.2	15.5	15.8	6.6 J
Zinc	2.9 J	3.5 J	7.5 J	4.1 J	3.5 J	4.9 J	5.6	2.9 J	2.6 J
Cyanide	--	0.47 J	--	--	--	--	--	--	--

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TABLE 3-10

INORGANIC ANALYTES DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 6

Locator:	32SB3-30-32	32SB4-0-2	32SB4-15-17	32SB4-20-22	32SB4-20-22A*	32SB4-25-27	32SB4-35-37	32SB4-45-47	32SB5-45-47A*
Collection Date:	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93
Laboratory Sample No.:	34848001	34848008	34848009	34848010	34848011	34848012	34848013	34848014	34846012
Aluminum	640	6,580	8,900	951	1,100	751	458	156	419
Antimony	--	--	--	--	--	--	--	--	--
Arsenic	--	0.71 J	2.1 J	--	0.18 J	--	--	--	--
Barium	1.2 J	10.1 J	7 J	2.5 J	2.8 J	2.1 J	1.1 J	0.06 J	0.13 J
Beryllium	--	--	--	--	--	--	--	--	--
Cadmium	0.26	--	--	--	--	--	--	--	--
Calcium	33 J	293 J	151 J	98 J	95.6 J	96.5 J	105 J	91.1 J	76.4 J
Chromium	0.94 J	5.6	24.6	1.7 J	1.6 J	--	0.92 J	--	0.88 J
Cobalt	--	--	--	--	--	--	--	--	--
Copper	7.8	3.3 J	5.3 J	1.1 J	1.4 J	1.4 J	0.97 J	0.8 J	0.77 J
Iron	88.8	3,970	13,300	1,230	1,190	324	75.7	44.6 J	114
Lead	0.32 J	2.5	2.8	1.2	1.2	0.7	0.25 J	0.19 J	0.37 J
Magnesium	24.5 J	114 J	74.6 J	31 J	31 J	28.6 J	14.7 J	10.4 J	18.8 J
Manganese	0.87 J	11.2	8.9	2.3 J	2.1 J	--	0.21 J	--	3.5
Mercury	0.03 J	0.04 J	0.04 J	--	--	0.04 J	0.03 J	0.05 J	0.03 J
Nickel	1.7 J	4 J	--	--	--	--	2.2 J	1.8 J	--
Potassium	--	161 J	76.5 J	116 J	69.4 J	59.4 J	43.4 J	54.3 J	74 J
Selenium	--	--	0.12 J	--	--	--	--	--	--
Silver	--	--	--	--	--	--	--	--	--
Sodium	173 J	175 J	209 J	162 J	183 J	199 J	174 J	157 J	179 J
Vanadium	0.6 J	9.7 J	50.5	8.4 J	7.8 J	2.3 J	--	--	1.5 J
Zinc	2.7 J	5.1	5.9 J	1.9 J	2.5 J	1.8 J	1.9 J	3.7 J	3 J
Cyanide	--	--	--	--	--	--	--	--	--

TABLE 3-10

INORGANIC ANALYTES DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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Locator:	32SB5-1-2	32SB5-5-7	32SB5-10-12	32SB5-20-22	32SB5-45-47	32SB5-61-63	32SB5-95-97	32SB6-0-2	32SB6-5-7
Collection Date:	19-JAN-93	19-JAN-93	19-JAN-93	19-JAN-93	19-JAN-93	20-JAN-93	20-JAN-93	12-JAN-93	11-JAN-93
Laboratory Sample No.:	34925008	34925009	34925011	34925010	34925012	34938007	34938008	34846016	34847001
Aluminum	21,600	33,200	6,650	4,920	1,500	343	789	6,980	10,200
Antimony	--	--	--	--	--	--	--	--	--
Arsenic	2.3 J	2.1 J	1.8 J	1.6 J	1.1 J	0.4 J	0.37 J	0.46 J	1.8 J
Barium	15.9 J	16.5 J	6.3 J	6.4 J	1.3 J	0.14 J	1.9 J	10.1 J	12.7 J
Beryllium	0.22 J	0.21 J	0.08 J	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--
Calcium		251 J	355 J	24.5 J	--	32 J	8.2 J	497 J	335 J
Chromium	16.1	26.3	7.4	5.4	1.4 J	2.3	2 J	8.4	11.2
Cobalt	0.75 J	--	--	--	--	0.51 J	0.88 J	1.4 J	--
Copper	5.1 J	7.2	2.1 J	0.98 J	--	0.53 J	1.3 J	3.9 J	5.2 J
Iron	10,800	16,000	5,440	1,420	79.7	190	98.2	3,350	9,470
Lead	3.1	3	2.1 J	1.7	0.42 J	0.2 J	1.2 J	9.8	3.7
Magnesium	207 J	243 J	54.2 J	53.4 J	--	8.7 J	16.6 J	131 J	125 J
Manganese	95.5	53.5	27.1	4.6	1.3 J	1.1 J	1.1 J	61.4	20
Mercury	0.02 J	0.02 J	--	--	--	--	--	0.04	--
Nickel	--	4.4 J	--	--	--	--	--	2.5 J	1.9 J
Potassium	119 J	146 J	223 J	145 J	--	--	--	203 J	315 J
Selenium	3.7	0.97 J	0.53 J	0.59 J	--	--	0.99 J	--	--
Silver	--	--	--	--	--	--	0.77 J	--	--
Sodium	14 J	23.5 J	18 J	20.4 J	14.9 J	--	--	193 J	197 J
Vanadium	29.3	43.1	25.4	11.6 J	0.95 J	0.9 J	1.4 J	8.8 J	23.2
Zinc	6.8	9.1	1.9 J	1.1 J	0.91 J	3.4 J	0.44 J	8.5	--
Cyanide	0.48 J	0.56 J	0.56 J	0.58 J	0.51 J	0.4 J	0.45 J	--	--

TABLE 3-10

INORGANIC ANALYTES DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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Locator:	32SB6-5-7A*	32SB6-10-12	32SB6-20-22	32SB6-30-32	32SB6-45-47	32SB6-45-47A*	32SB7-0-2	32SB7-5-7
Collection Date:	11-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	12-JAN-93	20-JAN-93	20-JAN-93
Laboratory Sample No.:	34847002	34846014	34846015	34846013	34846011	34864012	34938004	34938006
Aluminum	13,900	26,100	245	429	369	419	9,970	14,700
Antimony	--	--	--	--	--	--	--	--
Arsenic	1.7 J	3.3	--	--	0.2 J	--	2.8	2.7
Barium	16.7 J	14.7 J	0.12 J	0.12 J	1.1 J	0.13 J	11.1 J	18.7 J
Beryllium	--	--	--	--	--	--	0.09 J	0.11 J
Cadmium	--	0.44 J	--	--	--	--	--	--
Calcium	502 J	138 J	62.7 J	57.2 J	83.9 J	76.4 J	277 J	168 J
Chromium	12.9	24	--	1.3 J	1.5 J	0.88 J	9.3	14.7
Cobalt	--	--	--	--	--	--	1.5 J	2.5 J
Copper	7.8	8.4	0.75 J	0.79 J	1.2 J	0.77 J	4.7 J	3.6 J
Iron	9,630	12,100	82	64.8	102	114	5,100	7,250
Lead	3.3	3.4	0.23 J	0.19 J	0.61 J	0.37 J	30.7	3.5
Magnesium	264 J	234 J	19.9 J	12.6 J	21.3 J	18.8 J	147 J	284 J
Manganese	29.5	10.7	0.51 J	0.82 J	2.4 J	3.5	71	48.1
Mercury	--	0.04	0.03	0.03	0.03 J	0.03 J	--	--
Nickel	2.2 J	2.8 J	--	--	--	--	2.8 J	4.7 J
Potassium	382 J	474 J	70.1 J	81.7 J	84.5 J	74 J	257 J	331 J
Selenium	--	0.23 J	--	--	--	--	--	1.4
Silver	--	--	--	--	--	--	--	0.7 J
Sodium	180 J	235 J	155 J	164 J	205 J	179 J	21.3 J	24.1 J
Vanadium	24.3	42.4	0.59 J	--	1.4 J	1.5 J	13.7	19.2
Zinc	11.8	8.5	1.8 J	1.5 J	3.4 J	3 J	10.6	6.4
Cyanide	--	--	--	--	--	--	0.46 J	0.52 J

TABLE 3-10

INORGANIC ANALYTES DETECTED IN SITE 32 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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Locator:	32SB7-15-17	32SB7-30-32	32SB8-5-7	32SB8-13-15
Collection Date:	20-JAN-93	21-JAN-93	21-JAN-93	21-JAN-93
Laboratory Sample No.:	34938005	34938006	34956001	34956005
Aluminum	2,780	302	5,470	1,630
Antimony	--	--	--	--
Arsenic	1.8 J	0.41 J	2.5	1.2 J
Barium	4.4 J	0.43 J	10.9 J	3.8 J
Beryllium	0.07 J	--	0.15 J	--
Cadmium	--	--	--	--
Calcium	11.6 J	--	63 J	18.8 J
Chromium	2.9	0.87 J	4.3	1.2 J
Cobalt	0.99 J	--	0.69 J	--
Copper	0.85 J	0.64 J	1.6 J	0.64 J
Iron	1,600	77.4	3,950	448
Lead	2.1 J	0.45 J	3.8	2.8
Magnesium	43.5 J	--	67.2 J	41.5 J
Manganese	2.3 J	0.47 J	18.1	3.5
Mercury	--	--	--	0.02 J
Nickel	--	--	--	--
Potassium	191 J	--	--	--
Selenium	--	1.5	2.2	--
Silver	--	--	--	--
Sodium	30 J	--	--	--
Vanadium	9.3 J	0.69 J	9.3 J	5.1 J
Zinc	0.6 J	--	1.8 J	--
Cyanide	0.49 J	0.49 J	0.41 J	0.46 J

* The "A" in the sample locator indicates a duplicate sample.

Notes: Inorganic concentrations are reported in mg/kg.
-- – The analyte was not detected in laboratory analysis.
J – The associated numerical value is an estimated quantity.

TABLE 3-11

ANALYTES DETECTED IN SITE 32 (WASHRACK) SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

Locator:	WRSB01(5-7)	WRSB01(5-7)D*	WRSB01(10-12)	WRSB02(5-7)	WRSB02(10-12)	WRSB03(5-7)	WRSB03(10-12)
Collection Date:	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93
Laboratory Sample No.:	94015010	94015011	94015012	94015015	94015016	94015019	94015020
Target Compound List (TCL) Volatile Organic Compounds (VOCs) (mg/kg)							
Methylene chloride	--	610 J	250 J	--	160 J	160 J	170 J
Acetone	2,000 J	--	1,000 J	--	1,500 J	2,000 J	2,100 J
1,2-Dichloroethene (total)	430 J	--	290 J	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--
Tetrachloroethene	--	1,700	1,300 J	--	--	--	--
Toluene	13,000	11,000	8,100 J	--	260 J	--	--
Ethylbenzene	4,900	5,100	3,700 J	--	790 J	440	--
Xylenes (total)	32,000	32,000	23,000 J	--	3,900	210	--
TCL Semivolatile Organic Compounds (SVOCs) (mg/kg)							
Naphthalene	26,000 J	22,000 J	21,000 J	8,900	19,000 J	6,900 J	1,600 J
2-Methylnaphthalene	43,000 J	37,000 J	37,000 J	4,400	26,000 J	24,000 J	6,500 J
Dibenzofuran	--	--	1,400 J	--	--	1,500 J	--
Fluorene	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	970 J	590 J	--	--	--
Total Chromium (mg/kg)							
	20.3	14.1	13.4	4.8	13.6	9.5	7.6

TABLE 3-11

ANALYTES DETECTED IN SITE 32 (WASHRACK) SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2OF 2

Locator:	WRSB01(15-17)	WRSB01(20-22)	WRSB02(15-17)	WRSB02(20-22)	WRSB03(15-17)	WRSB03(20-22)
Collection Date:	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93	30-JUL-93
Laboratory Sample No.:	94015017	94015014	94015017	94015018	94015021	94015022
TCL VOCs (mg/kg)						
Methylene chloride	380 J	--	--	--	--	--
Acetone	--	--	--	700 J	--	--
1,2-Dichloroethene	--	--	--	--	--	--
Trichloroethene	1,300 J	290 J	--	--	--	--
Tetrachloroethene	390	--	--	--	--	--
Toluene	2,300 J	--	--	--	--	--
Ethylbenzene	1,700 J	170 J	--	--	150 J	--
Xylenes (total)	12,000 J	1,600	480 J	540 J	--	--
TCL SVOCs (mg/kg)						
Naphthalene	8,600	8,900 J	3,700	13,000 J	1,400 J	--
2-Methylnaphthalene	18,000	23,000 J	6,200	18,000 J	5,200 J	990 J
Dibenzofuran	980 J	1,100 J	--	--	--	--
Fluorene	640 J	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--
Total Chromium (mg/kg)						
	10.0	1.4 J	9.0	8.0	9.0	2.5

* The "D" in the sample locator represents a duplicate sample.

Notes: -- – The analyte was not detected in laboratory analysis.
J – The associated numerical value is an estimated quantity.

Concentrations of organic and inorganic analytes in groundwater are presented in Tables 3-12 and 3-13, respectively.

Additional groundwater samples were taken in 1995, and details of the analytical results are presented in the *Remedial Investigation Industrial Area Groundwater Investigation, Interim Report, Naval Air Station Whiting Field* (ABB-ES 1996b). Figures 3-2 and 3-3 summarize the areal extent of impacted groundwater (i.e., the BTEX and TCE plumes) at the North Field Industrial Area based on the 1995 groundwater results.

3.2.3.3 Proposed Investigation

The investigation activities proposed for the soils at Site 32 are described in the following sections.

Soil Investigation Scope

- Define extent of "excessively contaminated soils" around former USTs in accordance with FDEP regulations (i.e., total organic vapors > 50 ppm for kerosene group, > 500 ppm for gasoline group petroleum hydrocarbon release areas).

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region III RBCs and SSLs (USEPA 1996d)].

Source Areas of Concern

- Former USTs east of Building 1424.
- Washracks east of Building 1424.
- Soil gas hot spots.
- Leaks from buried storm and sanitary sewer lines.
- Leaks from unidentified buried piping and lines.

The RI/FS investigation at the North Field Maintenance Hangar will consist of nine additional soil borings and associated subsurface soil sampling to help characterize the nature and extent of soil contamination. The supporting rationale for these borings is presented in the box below. Figure 3-1 shows approximate locations of the soil borings.

TABLE 3-12

ORGANIC COMPOUNDS DETECTED IN GROUNDWATER SAMPLES AT SITE 32
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

	Shallow Monitoring Wells							
Well Identifier:	WHF-32-1	WHF-32-1DUP	WHF-32-2	WHF-32-3	WHF-32-4	WHF-32-5		
Sample Identifier:	WHF32-1	WHF32-1DUP	WHF32-2	WHF32-3	WHF32-4	WHF32-5	**Background**	
Collection Date:	20-JAN-94	20-JAN-94	19-JAN-94	19-JAN-94	20-JAN-94	20-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90353003	90353004	90343003	90343005	90353006	90353002	**Criteria**	**MCLs**
Volatile Organic Compounds (µg/L)								
1,2-Dichloroethene (total)	110	110	1,000	630	--	7 J	ND	70[a,d]/70[a,d]
Trichloroethene	95	96	1,600	590	--	10	ND	5[a]/3[a]
Benzene	760	670	340	660	1,900	170	8	5[a]/1[a]
Toluene	1,600	1,400	66 J	25 J	16,000	--	26	1,000[a]/1,000[a], 40[b]
Ethylbenzene	970	820	33 J	210	1,800	14	ND	700[a]/700[a], 30[b]
Xylenes (total)	1,700	1,500	190 J	460	6,400	57	ND	10,000[a]/10,000[a], 20[b]
Semivolatile Organic Compounds (µg/L)								
Phenol	14	--	--	--	42	--	ND	NA/10[c]
2-Methylphenol	13	13	--	--	110	--	ND	NA/350[c]
4-Methylphenol	13	14	--	--	80	--	ND	NA/35[c]
2,4-Dimethylphenol	8 J	9 J	--	--	44	--	ND	NA/NA
Naphthalene	10	8 J	4 J	18	12 J	0.5 J	ND	NA/6.8[c]
2-Methylnaphthalene	4 J	4 J	1 J	9 J	6 J	--	ND	NA/NA
Acenaphthene	--	--	--	--	1 J	--	ND	NA/2,100[c]
Fluorene	--	--	--	--	1 J	--	ND	NA/280[c]
Phenanthrene	1 J	1 J	--	--	6 J	--	ND	NA/10[c]
Fluoranthene	--	--	--	--	4 J	--	ND	NA/280[c]
Pyrene	--	--	--	--	3 J	--	ND	NA/10[c]
bis(2-Ethylhexyl)phthalate	--	--	2 J	2 J	6 J	--	ND	6[a]/6[a]
Pesticides and Polychlorinated Biphenyls (µg/L)								
None detected								

[a] Primary MCL.
[b] Secondary MCL.
[c] Groundwater guidance concentration.
[d] cis-1,2 Dichloroethene was used for comparison.

Notes: Shading indicates that the concentration meets or exceeds federal or state Primary or Secondary MCLs.
-- Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.

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TABLE 3-13

INORGANIC ANALYTES DETECTED IN GROUNDWATER SAMPLES AT SITE 32
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

	Shallow Monitoring Wells							
Well Identifier:	WHF-32-1	WHF-32-1DUP	WHF-32-2	WHF-32-3	WHF-32-4	WHF-32-5		
Sample Identifier:	WHF32-1	WHF32-1A	WHF32-2	WHF32-3	WHF32-4	WHF32-5	**Background**	
Collection Date:	20-JAN-94	20-JAN-94	19-JAN-94	19-JAN-94	20-JAN-94	20-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90353003	90353004	90343003	90343005	90353006	90353002	**Criteria**	**Standards**
Inorganic Analytes (µg/L)								
Aluminum	53,900	49,800	1,890	10,400	40,900	44,700	53.360	200[b]/200[b]
Antimony	--	--	--	--	--	21.9 J	ND	6[a]/6[a]
Arsenic	4.1 J	5 J	--	3.4 J	4.3 J	--	ND	50[a]/50[a]
Barium	143 J	138 J	35.6 J	53.8 J	119 J	123 J	126.8	2,000[a]/2,000[a]
Beryllium	1.2 J	1 J	--	--	0.4 J	0.77 J	3.6	4[a]/4[a]
Cadmium	4.6 J	3.6 J	--	5.7	12.5	7	ND	5[a]/5[a]
Calcium	1,320 J	1,270 J	600 J	554 J	8,160	3,380 J	4,706	NA/NA
Chromium	212	201	8 J	124	61.2	133	872	100[a]/100[a]
Cobalt	18.6 J	17.9 J	--	--	2.7 J	6.8 J	20.7	NA/NA
Copper	195	181	--	14.5 J	46	48.5	67.6	TT 1,300 1,000[b]/1,000[b]
Iron	110,000	108,000	2,660	11,000	86,900	64,900	80,066	300[b]/300[b]
Lead	41.3	51.7	1.5 J	22.3	265	19.8	20.6	TT 15/15[a]
Magnesium	1,650 J	1,630 J	767 J	878 J	2,140 J	1,430 J	2,922	NA/NA
Manganese	3,220	3,020	9.2 J	232	1,140	729	188	50[b]/50[b]
Mercury	0.47	0.48	--	--	0.22	0.23	0.32	2[a]/2[a]
Nickel	48.3	49.4	--	70.9	16.8 J	25.4 J	744	100[a]/100[a]
Potassium	2,160 J	1,860 J	--	670 J	2,400 J	1,780 J	17,270	NA/NA
Silver	--	--	--	--	2.7 J	--	ND	100[b]/100[b]

TABLE 3-13

INORGANIC ANALYTES DETECTED IN GROUNDWATER SAMPLES AT SITE 32
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

	Shallow Monitoring Wells							
Well Identifier:	WHF-32-1	WHF-32-1DUP	WHF-32-2	WHF-32-3	WHF-32-4	WHF-32-5		
Sample Identifier:	WHF32-1	WHF32-1A	WHF32-2	WHF32-3	WHF32-4	WHF32-5	**Background**	
Collection Date:	20-JAN-94	20-JAN-94	19-JAN-94	19-JAN-94	20-JAN-94	20-JAN-94	**Screening**	**Federal/State**
Laboratory Sample No.:	90353003	90353004	90343003	90343005	90353006	90353002	**Criteria**	**Standards**
Inorganic Analytes (µg/L) (continued)								
Sodium	5,410	5,050	1,980 J	4,390 J	5,310	2,760 J	5,740	NA/160,000[a]
Vanadium	515	510	11.3 J	26 J	80.3	269	335	NA/49[c]
Zinc	1,270	1,200	5.5 J	14.7 J	230	81.9	140	5,000[b]/5,000[b]

[a] Primary MCL.
[b] Secondary MCL.
[c] Groundwater guidance concentration.

Notes: Shading indicates that the concentration meets or exceeds federal or state Primary or Secondary MCLs.
– – Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.
TT – Treatment techniques.

RI/FS Rationale for Soil Borings at Site 32	
Soil Boring Location	**Rationale**
32SB09, 32SB11, 32SB12	Determine lateral extent of contamination around former USTs and north and south end of washrack; 1,500 ppm OVA reading at 32SB05; and chromium and selenium > background but < RBCs/SSLs.
32SB13	Soil gas hot spot at diesel tank location.
32SB10, 32SB14, 32SB15, 32SB16, 32SB17	Soil gas hot spots and sewer line locations.
Optional	Pending identification of potential source areas such as floor drains, subgrade piping, sumps, oil/water separators or to define extent of contamination.

Soil Sampling Criteria

Soil samples will be collected in all borings using either nominal 2-inch-diameter split spoons or a 5-foot-long continuous-core barrel. In general, 5-foot continuous-core barrel samples will be collected from soil borings and monitoring wells located near source areas. Split-spoon samples 2 inch in diameter by 2-foot in length may be collected at 5-foot intervals from monitoring wells near the perimeter of the contaminant plum.

All borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Soil samples will be selected for laboratory analysis from the surface soils in unpaved areas; each 30-foot depth interval based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. A surface soil sample will not be collected from borings in paved areas. Soil sample quantities are based on 1 boring being installed to the water table (approximately 90 feet bls) and the other 8 borings being installed to depths of 30 feet bls. Soil samples will be analyzed for: VOCs, SVOCs, TPH, pesticides, PCBs, and inorganics. Three or more aquifer matrix soil (saturated soil) and two unsaturated soil samples will be collected using a thin-walled Shelby tube (ASTM D1587) for analysis of the geotechnical and natural attenuation indicator parameters listed in Section 3.2.1.3.

Groundwater Investigation Scope

The investigation activities proposed for groundwater at Sites 3, 4, and 32 are described below.

- Characterize extent of groundwater contamination that exceeds regulatory criteria (e.g., USEPA and Florida MCLs) for the commingled plume from Sites 3, 4, and 32.
- Investigate potential for off-site plume migration toward Clear Creek.
- Collect supporting data to evaluate risk and natural attenuation of groundwater plume.

Source Areas of Concern

The source areas of concern at Sites 3, 4, and 32 are listed below.

- Former waste oil USTs east of Building 1424.
- Washrack area east of Building 1424.
- Former north AVGAS tank farm (Site 4).
- Former underground waste solvent storage tanks (Site 3).
- Former underground waste oil UST southwest of Building 2941 (Site 3).
- Leaks from buried storm and sanitary sewer lines.
- Leaks from unidentified buried piping.

Proposed Investigation

The RI/FS investigation at Sites 3, 4, and 32 will include 17 additional monitoring wells (including 1 optional well) to help characterize the nature and extent of groundwater contamination. The supporting rationale for these borings is presented below. Figure 3-4 shows the approximate locations of the proposed monitoring wells.

RI/FS Rationale for Monitoring Wells at Site 32	
Monitoring Well Location	**Rationale**
WHF-32-3I, WHF-32-3D	Intermediate and deep well pair at existing shallow well location: to investigate the vertical extent of contamination in the intermediate and deep aquifer zones at the source area; additional potentiometric control points to determine intermediate and deep groundwater flow directions.
WHF-32-7P	Investigate downgradient extent of groundwater contamination in perched groundwater; this zone appears to be pathway to underlying aquifer zones.
WHF-32-6I, WHF-32-6D, WHF-32-9I, WHF-32-9D, WHF-32-8S, WHF-32-8I, WHF-32-8D	Intermediate and deep well pairs at existing shallow well locations: to investigate downgradient extent of groundwater contamination and potential for off-site plume migration; additional potentiometric control points to determine intermediate and deep groundwater flow directions.
WHF-32-11P	Investigate extent of groundwater contamination in perched groundwater.
WHF-32-10I, WHF-32-10D	Intermediate and deep well pairs at existing shallow well locations: to investigate concentration gradient in direction of active base supply wells; additional potentiometric control points to map intermediate and deep aquifer zone flow directions and to investigate potential capture zone of active base supply wells.
WHF-32-12S, WHF-32-12I, WHF-32-12D	Shallow well to investigate lateral extent of BTEX plume at WHF-1467-9; intermediate and deep wells to provide background quality data for intermediate and deep aquifer zones; additional potentiometric control points to determine intermediate and deep groundwater flow directions.
Optional	Pending groundwater analytical results.

Groundwater Sampling Criteria

Groundwater from all new wells will be analyzed for: TCL VOCs, TCL SVOCs, TPH, TAL inorganics, PCBs, pesticides, and natural attenuation parameters. If possible, water samples will be collected and analyzed for TCL VOCs from two or three intervals between the deep screen of proposed well WHF-32-3D and the screened interval of existing well WHF-32-3 using a hydropunch tool. These samples will be used to estimate the vertical contaminant gradient in the source area. Groundwater from existing wells will be analyzed for contaminants of interest based on previous analytical results and natural attenuation indicator parameters. The analyses to be performed on groundwater samples from both the proposed new wells and existing wells are shown on Table 3-14. Natural attenuation and water quality parameters to be analyzed are shown below.

TABLE 3-14

**GROUNDWATER ANALYSES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2**

Site Number	Well Number	TCL–VOCs SW8260	TCL–SVOCs SW8270	TAL–Inorganics[(a)]	Pesticides/PCBs SW8081	TPH SW8015m	Nat. Attenuation[(b)]
3	WHF-3-1	X	X	X	-		X
3	WHF-3-1D	X	X	X	-		X
3	WHF-3-1S	X	X	X	X		X
3	WHF-3-2	X	X	X	-		X
3	WHF-3-2D	X	X	X	-		X
3	WHF-3-2S	X	X	X	-		X
3	WHF-3-3	X	X	X	-		X
3	WHF-3-3D	X	X	X	-		X
3	WHF-3-3S	X	X	X	X		X
3	WHF-3-4	X	X	X	-		X
3	WHF-3-7D	X	X	X	-		X
3	WHF-3-7I	X	X	X	-		X
3	WHF-3-7S	X	X	X	-		X
4	WHF-4-1	X	X	X	-	X	X
4	WHF-1467-1	X	X	X	X	X	X
4	WHF-1467-2	X	X	X	-	X	X
4	WHF-1467-2D	X	X	X	-	X	X
4	WHF-1467-3	X	X	X	X	X	X
4	WHF-1467-4	X	X	X	X	X	X
4	WHF-1467-5	X	X	X	X	X	X
4	WHF-1467-5D	X	X	X	-	X	X
4	WHF-1467-6	X	X	X	X	X	X
4	WHF-1467-6D	X	X	X	-	X	X
4	WHF-1467-7	X	X	X	X	X	X
4	WHF-1467-7D	X	X	X	-	X	X
4	WHF-1467-8	X	X	X	X	X	X
4	WHF-1467-8D	X	X	X	X	X	X
4	WHF-1467-9	X	X	X	X	X	X
4	WHF-1467-11	X	X	X	X	X	X
4	WHF-1467-13R	X	X	X	X	X	X
4	WHF-1467-14	X	X	X	X	X	X
4	WHF-1467-16	X	X	X	X	X	X
4	WHF-1467-18	X	X	X	X	X	X
4	WHF-1467-19	X	X	X	X	X	X
4	WHF-1467-20	X	X	X	-	X	X
4	WHF-1467-21	X	X	X	-	X	X
4	WHF-1467-22R	X	X	X	-	X	X
4	WHF-1467-23	X	X	X	-	X	X
4	WHF-1467-24	X	X	X	-	X	X
4	WHF-1467-25	X	X	X	-	X	X
4	WHF-1467-26	X	X	X	-	X	X
4	WHF-1467-27	X	X	X	-	X	X
4	WHF-1467-28	X	X	X	-	X	X
4	WHF-1467-29	X	X	X	-	X	X

TABLE 3-14

GROUNDWATER ANALYSES
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

Site Number	Well Number	TCL–VOCs SW8260	TCL–SVOCs SW8270	TAL–Inorganics[(a)]	Pesticides/PCBs SW8081	TPH SW8015m	Nat. Attenuation.(b)
4	WHF-1467-30	X	X	X	X	X	X
4	WHF-1467-31	X	X	X	-	X	X
4	WHF-1467-32	X	X	X	-	X	X
4	WHF-1467-33	X	X	X	-	X	X
4 (2894)	WHF-2894-2	X	X	X		X	X
4 (2894)	WHF-2894-3	X	X	X		X	X
32	WHF-32-1	X	X	X	-	X	X
32	WHF-32-2	X	X	X	-	X	X
32	WHF-32-3	X	X	X	-	X	X
32	WHF-32-4	X	X	X	-	X	X
32	WHF-32-5	X	X	X	-	X	X
32 [(c)]	WHF-32-3D	X	X	X	X	X	X
32 [(c)]	WHF-32-3I	X	X	X	X	X	X
32 [(c)]	WHF-32-6D	X	X	X	X	X	X
32 [(c)]	WHF-32-6I	X	X	X	X	X	X
32 [(c)]	WHF-32-7P	X	X	X	X	X	X
32 [(c)]	WHF-32-8D	X	X	X	X	X	X
32 [(c)]	WHF-32-8I	X	X	X	X	X	X
32 [(c)]	WHF-32-8S	X	X	X	X	X	X
32 [(c)]	WHF-32-9D	X	X	X	X	X	X
32 [(c)]	WHF-32-9I	X	X	X	X	X	X
32 [(c)]	WHF-32-10D	X	X	X	X	X	X
32 [(c)]	WHF-32-10I	X	X	X	X	X	X
32 [(c)]	WHF-32-11P	X	X	X	X	X	X
32 [(c)]	WHF-32-12D	X	X	X	X	X	X
32 [(c)]	WHF-32-12I	X	X	X	X	X	X
32 [(c)]	WHF-32-12S	X	X	X	X	X	X

(a) TAL inorganics will be analyzed by SW 6010, SW 7471 or 7470, SW 9010, and SW 9065
(b) Methods used for analysis of natural attenuation parameters are listed in Section 3.2.3.3.
(c) New wells to be installed during Phase II-C field activities.

PCB–polychlorinated biphenyl
SVOC–semivolatile organic compound
TAL–Target Analyte List
TCL–Target Compound List
VOC–volatile organic compound

Groundwater Natural Attenuation and Water Quality Parameter Analyses		
Parameter	**Test Method**	**Test Location**
Dissolved Oxygen (DO)	DO Meter (DO >0.5 mg/L) Field Titration Kit (DO <0.5 mg/L)	Field
Nitrate	E300	Laboratory
Iron II (Fe^{+2})	Hach Method 8146	Field
Sulfate	E300	Laboratory
Sulfide	E300	Laboratory
Methane	SW3810, Modified	Laboratory
Oxidation-Reduction Potential (Redox)	Redox Meter	Field
pH	pH Meter	Field
Temperature	Meter	Field
Specific Conductance	Meter	Field
Dissolved Organic Carbon	SW9060	Laboratory
Alkalinity	Hach Kit AL, AP, MG-L	Field
Chloride	E300 or SW9050	Laboratory

3.2.4 Site 33: Midfield Maintenance Hangar

3.2.4.1 Site 33 Location and Description

Site 33 is located at the Midfield Maintenance Hangar, Building 1454 (Figure 3-5). The site includes Building 1454 and the location of the abandoned waste oil tank north of Building 1454.

3.2.4.2 Site 33 History

The Midfield Maintenance Hangar was constructed in the middle 1940s to support maintenance service of assigned aircraft and line maintenance on transient aircraft. These activities included engine maintenance, corrosion control, and aircraft cleaning. Maintenance activities typically generated less than 5 gallons/month of mixed waste paint and stripper, methyl isobutyl ketone (MIBK), methyl ethyl ketone, toluene, and naphtha.

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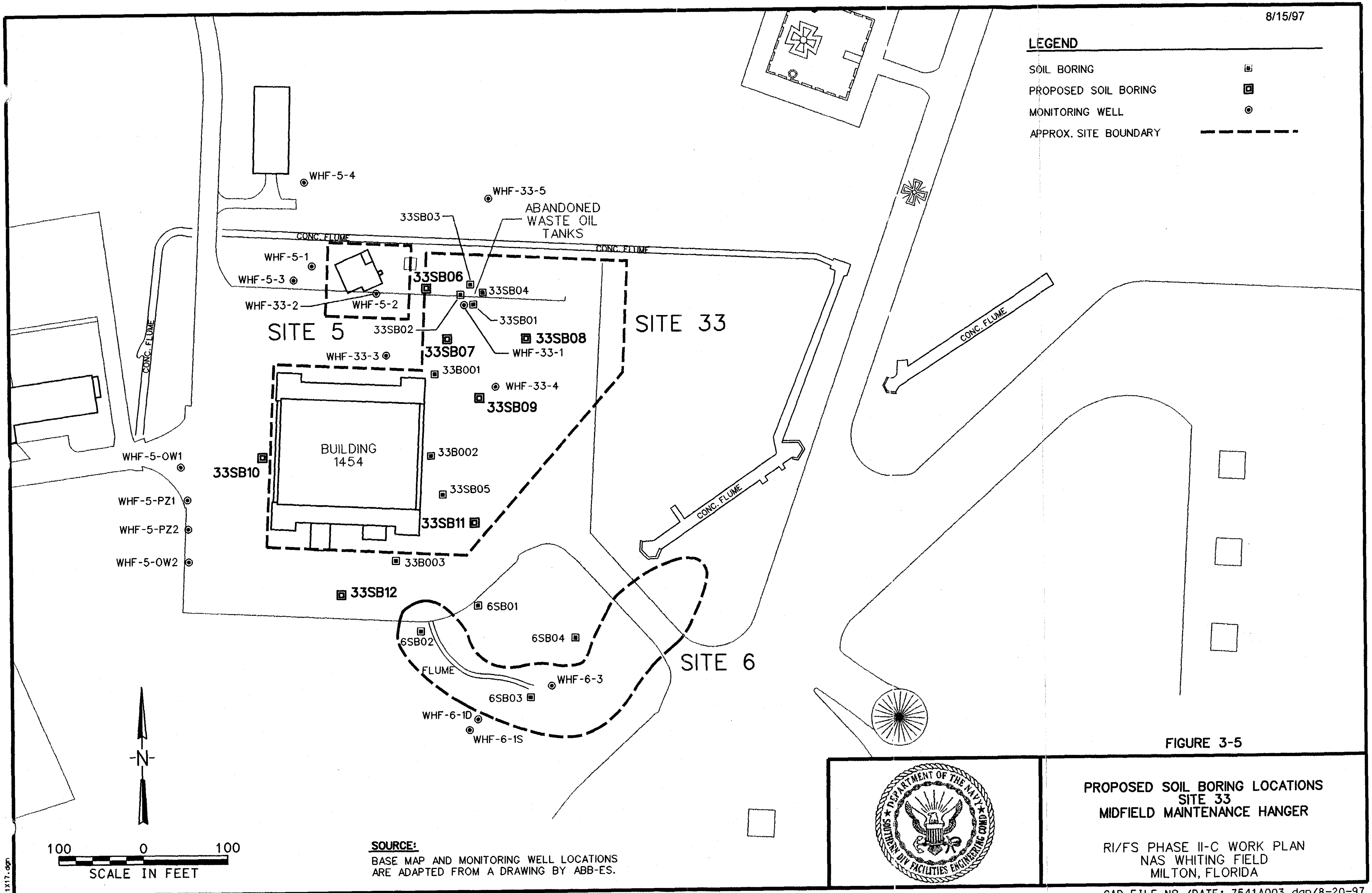

SOURCE:
BASE MAP AND MONITORING WELL LOCATIONS ARE ADAPTED FROM A DRAWING BY ABB-ES.

FIGURE 3-5

PROPOSED SOIL BORING LOCATIONS SITE 33 MIDFIELD MAINTENANCE HANGER

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

11X17.dgn

R472977

CAD FILE NO./DATE: 7541A003.dgn/8-20-97

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LEGEND

MONITORING WELL	⊙
PROPOSED MONITORING WELL	●
PERCHED MONITORING WELL	WHF-32-11P
SHALLOW MONITORING WELL	WHF-32-12S
INTERMEDIATE MONITORING WELL	WHF-32-13I
DEEP MONITORING WELL	WHF-32-14D
APPROX. SITE BOUNDARY	- - - - - - - -

AVGAS - AVIATION GASOLINE

SOURCE:
BASE MAP AND MONITORING WELL LOCATIONS ARE ADAPTED FROM A DRAWING BY ABB-ES.

FIGURE 3-4

PROPOSED MONITORING WELL LOCATIONS
SITES 3, 4, AND 32
NORTH FIELD INDUSTRIAL AREA

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

CAD FILE NO./DATE: 7541A001.dgn/8-20-97

22X34.dgn

Oil changes were routinely performed on aircraft as part of the normal maintenance activities. The waste oil from aircraft maintenance was reportedly poured into bowsers or the underground waste oil tank located north of Building 1454 (Figure 3-5) until the tank was abandoned in the 1980s. The waste oil was removed from the tank by a contractor for off-base disposal. Approximately 400 gallons of waste oil were generated annually. Contaminated fuel obtained during the collection of fuel samples was placed in drums. The fuel was routinely collected by the fuels contractor and hauled to the Firefighter Training Area for use in fire drills.

In the early 1970s the Ground Support Equipment shop moved from Hangar Building 2941 to the Midfield Maintenance Hangar. The Ground Support Equipment shop was responsible for the maintenance on all ground support equipment (e.g., tow tractors, aircraft jacks, and maintenance stands). The shop routinely generated an estimated 30 gallons of waste PD-680 cleaning solvent per month and about 15 gallons of waste aircraft cleaning compound per month. Other wastes generated included lubricating oil (20 gallons/month), antifreeze (9 gallons/month), hydraulic fluid (25 gallons/month), and transmission fluid (6 gallons/month). All of these wastes were disposed of either in a bowser or in the underground waste oil tank.

At the completion of the Phase I RI field investigation, Site 33 was added to the Phase II-A RI program for contamination assessment. Phase II-A activities at Site 33 included a soil gas survey, soil borings and subsurface soil sampling, monitoring well installation, and groundwater sampling.

Forty-four soil gas samplers were placed on approximately 80-foot centers in the area surrounding Building 1454. Sampler density was increased surrounding the aboveground and underground waste oil tanks and in an area south of Building 1454. Soil gas screening indicated several hot spots with ion counts over 10,000 for PCE and over 50,000 for BTEX, TCE, and cycloalkanes/naphthalenes. Details of the soil gas investigation are presented in *Soil Gas Survey Technical Report* (ABB-ES 1993b).

Five soil borings (33SB01 through 33SB05) were drilled, and 22 subsurface soil samples were collected during Phase II-A. The soil borings were drilled around the abandoned waste oil tanks and Building 1454 (Figure 3-5). Four VOCs, seven SVOCs, six pesticides, and TPH were detected in the subsurface soil samples from Phase II-A (ABB-ES 1995a). The pesticides were all detected in samples from one boring that was located in a grass-covered area. Twenty inorganic analytes were also detected in the subsurface soils. None of the metal concentrations analyzed by Toxicity Characteristic Leaching Procedure (TCLP) exceeded the regulatory criteria. Concentrations of organic and inorganic analytes are presented in Tables 3-15 and 3-16, respectively.

TABLE 3-15

ORGANIC COMPOUNDS DETECTED IN SITE 33 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

Locator:	33SB1-3-5	33SB1-10-12	33SB1-25-27	33SB2-2-4	33SB2-5-7	33SB2-10-12	33SB215-17	33SB235-37	33SB2-35-37A*	33SB2-60-62
Collection Date:	03-DEC-92	03-DEC-92	03-DEC-92	01-DEC-92	01-DEC-92	01-DEC-92	01-DEC-92	03-DEC-92	03-DEC-92	03-DEC-92
Laboratory Sample No.:	34576001	34576002	34576003	34553001	34553002	34553003	34553004	34578001	34578002	34576004
Target Compound List (TCL) Volatile Organic Compounds (mg/kg)										
Acetone	–	17 J	–	–	–	–	150 J	14 J	–	40 J
Trichloroethene	–	–	–	–	–	–	–	–	–	–
Ethylbenzene	–	–	–	–	1,500	–	–	–	–	–
Xylenes (total)	–	–	–	–	4,800	380 J	–	–	–	–
TCL Semivolatile Organic Compounds (SVOCs) (mg/kg)										
Naphthalene	–	–	–	–	610	370 J	–	–	–	–
2-Methylnaphthalene	–	–	–	–	2,100	–	–	–	–	–
Fluorene	–	–	–	–	–	150 J	–	–	–	–
Phenanthrene	–	–	–	–	240 J	69 J	–	–	–	–
Pyrene	–	–	–	–	40 J	–	–	–	–	–
Butylbenzylphthalate	–	–	37 J	–	–	–	–	–	–	–
bis(2-Ethylhexyl)phthalate	–	–	–	61 J	–	–	–	–	–	–
TCL Pesticides and Polychlorinated Biphenyls (PCBs) (mg/kg)										
Heptachlor	–	–	–	3.5 J	–	–	–	–	–	–
Dieldrin	–	–	–	13 J	–	–	–	–	–	–
4,4'-DDE	–	–	–	–	–	–	–	–	–	–
4,4'-DDT	–	–	–	–	–	–	–	–	–	–
alpha-Chlordane	–	–	–	50 J	3.3 J	–	–	–	–	–
gamma-Chlordane	–	–	–	64 J	4.7 J	–	–	–	–	–
Total Petroleum Hydrocarbon (mg/kg)										
	–	9.2	10.2	17.7	7,790	1,310	610	2,110	2,980	222
Total Organic Carbon (TOC) (mg/kg)										
	NA	NA	NA	NA	15,100	NA	NA	NA	NA	NA

TABLE 3-15

ORGANIC COMPOUNDS DETECTED IN SITE 33 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 3

Locator:	33SB2-80-82	33SB2-95-97	33SB2-120-122	33SB3-4-6	33SB3-10-12	33SB3-15-17	33SB4-3-5	33SB4-5-7	33SB4-15-17	33SB5-0-2
Collection Date:	03-DEC-92	03-DEC-92	03-DEC-92	01-DEC-92	01-DEC-92	01-DEC-92	02-DEC-92	02-DEC-92	02-DEC-92	06-DEC-92
Laboratory Sample No.:	34576005	34576006	34576007	34553005	34553006	34553007	34566001	34566002	34566003	34607001
TCL VOCs (mg/kg)										
Acetone	--	3 J	--	3 J	5 J	35 J	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	48
Ethylbenzene	--	--	--	--	--	--	--	--	--	--
Xylenes (total)	--	--	--	--	--	--	--	--	--	--
TCL SVOCs (mg/kg)										
Naphthalene	--	--	--	--	--	--	--	--	--	270 J
2-Methyl-naphthalene	--	--	--	--	--	--	--	--	--	2,000
Fluorene	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--	--	--
Butylbenzyl-phthalate	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)-phthalate	--	--	2.4 J	--	--	190 J	410 J	--	56 J	--
TCL Pesticides and PCBs (mg/kg)										
Heptachlor	--	--	--	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	--	--	--	--	--
4-4'-DDE	--	--	2.4 J	--	--	--	--	--	--	--
4-4'-DDT	--	--	13 J	--	--	--	--	--	--	--
alpha-Chlordane	--	--	--	--	--	--	--	--	--	--
gamma-Chlordane	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbon (mg/kg)										
	862	27.2	2.3	--	--	4.3	14.1	--	5.6	2,340
TOC (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3-15

ORGANIC COMPOUNDS DETECTED IN SITE 33 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 3

Locator:	33SB5-0-2A*	33SB5-5-7	33SB5-10-15	33SB5-20-22
Collection Date:	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92
Laboratory Sample No.:	34607002	34607003	34607004	34607005
TCL VOCs (mg/kg)				
Acetone	--	--	--	--
Trichloroethene	29	--	--	--
Ethylbenzene	--	--	--	--
Xylenes (total)	11 J	--	--	--
TCL (SVOCs) (mg/kg)				
Naphthalene	350 J	--	--	--
2-Methylnaphthalene	2,500	--	--	--
Fluorene	68 J	--	--	--
Phenanthrene	--	--	--	--
Pyrene	--	--	--	--
Butylbenzylphthalate	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--
TCL Pesticides and PCBs (mg/kg)				
Heptachlor	--	--	--	--
Dieldrin	--	--	--	--
4,4'-DDE	--	--	--	--
4,4'-DDT	--	--	--	--
alpha-Chlordane	--	--	--	--
gamma-Chlordane	--	--	--	--
Total Petroleum Hydrocarbon (mg/kg)	2,260	18.2	4.8	--
TOC (mg/kg)	NA	NA	NA	NA

* The "A" in the sample locator indicates a duplicate sample.

Notes:

-- – The analyte was not detected in laboratory analysis.
DDE – Dichlorodiphenyldichloroethene.
DDT – Dichlorodiphenyltrichloroethane.
J – The associated numerical value is an estimated quantity.
NA – Not analyzed for these samples.

TABLE 3-16

INORGANIC ANALYTES DETECTED IN SITE 33 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

Locator:	33SB1-3-5	33SB1-10-12	33SB1-25-27	33SB2-2-4	33SB2-5-7	33SB2-10-12	33SB2-15-17	33SB2-35-37	33SB2-35-37A[(a)]	33SB2-60-62
Collection Date:	03-DEC-92	03-DEC-92	03-DEC-92	01-DEC-92	01-DEC-92	01-DEC-92	01-DEC-92	03-DEC-92	03-DEC-92	03-DEC-92
Laboratory Sample No.:	34576001	34576002	34576003	34553001	34553002	34553003	34553004	34578001	34578002	34576004
Aluminum	13,700	29,900	3,190	9,590	5,610	8,070	8,920	616	233	575
Arsenic	0.76 J	1.5 J	1.2 J	11.5	5.2	3.8	1.4 J	0.43 J	--	0.36 J
Barium	14.9 J	9.1 J	3.4 J	10.8 J	8.9 J	4.8 J	3.6 J	--	--	0.63 J
Beryllium	--	--	--	--	--	--	--	--	--	--
Cadmium	0.6 J	0.88 J	0.45 J	0.39 J	0.77 J	0.65 J	0.65 J	--	--	--
Calcium	374 J	399 J	141 J	617 J	655 J	234 J	147 J	92.3 J	75.1 J	88.6 J
Chromium	8.6	20	5.4	8.6	21.5	12.3	12.8	--	--	1.3 J
Cobalt	1.4 J	1.3 J	--	--	--	--	--	--	--	--
Copper	4.2 J	6.6	2.1 J	6.5	3.1 J	3 J	3.7 J	1.3 J	0.62 J	0.62 J
Iron	6,970	15,100	5,830	5,970	8,490	13,200	13,900	828 J	324 J	318
Lead	2.7	3.7	0.92	16.7	24.3	21.1	4.9	1.9 J	1.1 J	0.45 J
Magnesium	139 J	99 J	25.1 J	125 J	58.1 J	40.6 J	33.9 J	--	--	19 J
Manganese	114	84.1	15.3	41.4	93.3	31.7	26.4	1.7 J	--	1.8 J
Mercury	0.03 J	0.03 J	--	0.05 J	0.04 J	--	--	--	--	--
Nickel	--	3.6 J	--	--	--	--	--	--	--	--
Potassium	129 J	119 J	82.6 J	124 J	90 J	83.6 J	77 J	--	--	42.2 J
Selenium	0.48 J	0.49 J	0.17 J	--	--	--	--	--	--	0.25 J
Sodium	156 J	186 J	179 J	179 J	171 J	249 J	202 J	162 J	147 J	159 J
Vanadium	17.6	39.6	16.7	16.3	17.1	34.5	37.1	2.4 J	1.1 J	1.2 J
Zinc	8.5 J	8.6 J	4 J	19.3	7.6	6.9	6.2 J	--	--	4.9 J

TABLE 3-16

INORGANIC ANALYTES DETECTED IN SITE 33 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 3

Locator:	33SB2-80-82	33SB2-95-97	33SB2-120-122	33SB3-4-6	33SB3-10-12	33SB3-15-17	33SB4-3-5	33SB4-5-7	33SB4-15-17	33SB5-0-2
Collection Date:	03-DEC-92	03-DEC-92	03-DEC-92	01-DEC-92	01-DEC-92	01-DEC-92	02-DEC-92	02-DEC-92	02-DEC-92	06-DEC-92
Laboratory Sample No.:	34576005	34576006	34576007	34553005	34553006	34553007	34566001	34566002	34566003	34607001
Aluminum	597	138	36.8 J	11,000	25,100	14,400	9,960	27,000	3,740	11,400
Arsenic	--	--	--	1.9 J	2.9	0.73 J	0.7 J	2.1 J	2.6	2.6
Barium	0.64 J	0.54 J	0.45 J	12.5 J	3.3 J	3.7 J	14.3 J	14.5 J	2.2 J	11.2 J
Beryllium	--	--	--	--	0.13 J	--	--	--	--	--
Cadmium	--	--	--	0.57 J	0.52 J	0.68 J	0.45 J	0.72 J	0.5 J	0.39 J
Calcium	82.4 J	56 J	81.9 J	351 J	209 J	284 J	691 J	548 J	263 J	720 J
Chromium	2.9	0.85 J	2 J	6.9	16.6	12.8	6.9	18.5	10.2	11.9
Cobalt	--	--	--	1.5 J	--	--	1.8 J	1.3 J	--	--
Copper	0.93 J	0.65 J	0.54 J	2.9 J	4.9 J	4.2 J	2.9 J	5.9	2.3 J	4.7 J
Iron	1,500	333	67.4	6,590	12,800	13,000	5,880	14,900	12,700	13,700
Lead	0.57 J	0.29 J	0.26 J	3.2	3.3	3.5	7.5	4.7	4.8	6.1
Magnesium	20.1 J	11 J	15.1 J	124 J	62.2 J	69.5 J	95.8 J	148 J	24.9 J	74.2 J
Manganese	2.3 J	1.5 J	0.32 J	87.7	24.3	27.7	169	46.8	21.8	93.4
Mercury	--	--	--	--	--	--	0.04 J	0.03 J	--	0.17
Nickel	--	--	--	2.7 J	--	--	--	3.8 J	--	--
Potassium	49.1 J	--	--	93.3 J	60 J	--	107 J	180 J	43.5 J	123 J
Selenium	--	--	--	--	--	0.22 J	0.43 J	0.64 J	0.52 J	--
Sodium	163 J	128 J	157 J	165 J	193 J	186 J	218 J	214 J	217 J	239 J
Vanadium	6.7 J	0.97 J	--	15.9	34.9	34.8	14.4	38.2	34.5	37.2
Zinc	4.8 J	1.9 J	15.4	5.8 J	5.2	6.7	5.9	8.6	4 J	6.1 J

TABLE 3-16

INORGANIC ANALYTES DETECTED IN SITE 33 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 3

Locator:	33SB5-0-2A[(a)]	33SB5-5-7	33SB5-10-12	33SB5-20-22	33SB2-5-7TCLP[(b)]
Collection Date:	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	01-DEC-92
Laboratory Sample No.:	34607002	34607003	34607004	34607005	34553002TC
Aluminum	28,400	47,800	36,100	6,320	NA
Arsenic	2.8	4.9	0.89 J	2.3	--
Barium	18.1 J	13.5 J	7.2 J	2.8 J	0.4381
Beryllium	--	--	--	--	NA
Cadmium	0.9 J	1 J	0.74 J	0.55 J	0.0014 J
Calcium	870 J	434 J	254 J	100 J	NA
Chromium	19	30.6	34.7	11.9	0.0055 J
Cobalt	1.7 J	1.8 J	--	--	NA
Copper	7.4	11.1	7.8	3.6 J	NA
Iron	14,400	22,300	20,600	15,100	NA
Lead	6.4	9.5	4.2	4.7	0.0897
Magnesium	204 J	170 J	80.3 J	35.5 J	NA
Manganese	89.7	60	31.7	17.9	NA
Mercury	0.07 J	0.05 J	--	--	--
Nickel	3.2 J	3.2 J	--	--	NA
Potassium	197 J	205 J	154 J	116 J	NA
Selenium	--	--	--	--	--
Sodium	172 J	160 J	248 J	181 J	NA
Vanadium	39.6	61.5	57.1	40.4	NA
Zinc	10.9	13.6	7.4	5.2 J	NA

[(a)] The "A" in the sample locator indicates a duplicate sample.
[(b)] Analytes for TCLP are in mg/L.

Notes: Inorganic concentrations are reported in mg/kg.
-- – The analyte was not detected in laboratory analysis.
J – The associated numerical value is an estimated quantity.
NA – These analytes are not included in the TCLP list of metal analytes.
TCLP – Toxicity Characteristic Leaching Procedure.

In 1994, 20 shallow soil borings were drilled (1 to 8 feet bls, 3 to 4 feet bls, and 16 from 0.5 to 3 feet bls), and soil samples were collected by ABB-ES at the apron located east of Building 1454 as part of a contamination assessment of shallow soils for construction activities. Results of the investigation were presented in a letter report (ABB-ES 1994b; ABB-ES 1994c). Two VOCs (benzene and TCE) were detected in the soil samples taken for GC screening. Three VOCs and one SVOC (di-n-butylphthalate) were detected in the soil samples collected for fixed-base analysis. Di-n-butylphthalate is a common laboratory contaminant and was detected in the laboratory blank. Consequently, the detections of di-n-butylphthalate were not believed to be site derived.

Three additional soil borings (33B001 through 33B003) were drilled along the eastern side of Building 1454 in June 1996 during Phase II-B. Six VOCs and lead were detected in 16 subsurface soil samples (including 2 duplicates) collected from these borings. The highest VOC concentration was of TCE (130 μg/kg) in a soil sample near the surface at 33SB002.

Five shallow monitoring wells were installed and sampled during Phase II-A. Four VOCs—chloromethane, 1,1-dichloroethene; 1,2-dichloroethene; and TCE—were detected in the groundwater samples. TCE (in five wells) and 1,1-dichloroethene (in one well) were detected at concentrations exceeding federal and Florida MCLs (ABB-ES 1995c). One SVOC, bis(2-ethylhexyl)phthalate, was detected at one well, but at a concentration below federal and Florida MCLs. Two pesticides, heptachlor epoxide and gamma-chlordane, were detected in the groundwater samples at Site 33. Concentrations for both constituents were below federal or Florida MCLs. Five inorganic analytes including aluminum, cadmium, iron, manganese, and thallium were detected at concentrations exceeding federal and Florida MCLs. Concentrations of organic and inorganic analytes in groundwater at Site 33 are presented in Table 3-17. The groundwater investigation at Site 33 is being conducted by ABB-ES and will not be incorporated into the proposed Phase II-C RI/FS.

3.2.4.3 Proposed Investigation

The proposed investigation activities to be performed at Site 33 are described in the following sections.

Investigation Scope

- Define extent of soil contamination that exceeds applicable FDEP regulation (e.g., Florida Soil Cleanup Goals (1995), Chapter 62770 FAC and Soil Cleanup Target Levels from Revised Chapter 62-770 FAC, if adopted).

TABLE 3-17

ANALYTES DETECTED IN SITE 33 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

	Shallow Monitoring Wells							
Well Identifier:	WHF-33-1	WHF-33-1DUP	WHF-33-2	WHF-33-3	WHF-33-4	WHF-33-5	**Background Screening Criteria**	**Federal/State Standards**
Sample Identifier:	WHF33-1	WHF33-1A	WHF33-2	WHF33-3	WHF33-4	WHF33-5		
Collection Date:	10-JAN-94	10-JAN-94	14-DEC-93	10-JAN-94	14-DEC-93	14-DEC-93		
Laboratory Sample No.:	90320003	90320004	90291002	90320002	90291003	90291001		
Volatile Organic Compounds (µg/L)								
Chloromethane	--	--	1 J/--	3 J/--	--	--	ND	NA/2.7[c]
1,1-Dichloroethene	2 J	2 J	3 J[e]/3 J	8 J[e]/10 J	--	--	ND	7[a]/7[a]
1,2-Dichloroethene (total)	2 J	2 J	1 J[e]/--	5 J[e]/6 J	--	--	ND	70[a,d]/70[a,d]
Trichloroethene	120	120	190[e]/190	470[e]/470	12	--	ND	5[a]/3[a]
Semivolatile Organic Compounds (µg/L)								
bis(2-Ethylhexyl)phthalate	--	--	--	1 J	--	--	ND	6[a]/6[a]
Pesticides and Polychlorinated Biphenyls (µg/L)								
Heptachlor epoxide	--	--	--	--	--	0.035 J	ND	0.2[a]/0.2[a]
gamma-Chlordane	--	--	--	--	--	0.031 J	ND	NA/NA
Inorganic Analytes (µg/L)								
Aluminum	10,700	8,490	4,360	4,770	5,550	45,700	53,360	200[b]/200[b]
Barium	87.6 J	89.5 J	75.7 J	38.7 J	82.4 J	109 J	126.8	2,000[a]/2,000[a]
Beryllium	0.55 J	0.55 J	--	--	--	0.24 J	30.6	4[a]/4[a]
Cadmium	6.4	6.7	4.5 J	20.4	6	19.4	ND	5[a]/5[a]
Calcium	2,560 J	2,870 J	3,890 J	3,300 J	2,380 J	2,800 J	4,706	NA/NA
Chromium	22.7	20.5	11.8	18.7	14.2	61.9	872	100[a]/100[a]
Cobalt	--	4.8 J	2.1 J	--	--	4.5 J	20.7	NA/NA
Copper	9.9 J	11.2 J	7.7 J	5.8 J	9.4 J	27.2 J	67.6	TT 1,300 1,000[b]/1,000[b]
Iron	17,500	18,100	3,570	8,050	3,920	28,300	80,066	300[b]/300[b]
Lead	4.8	5.6	13.4	2.6 J	3.4	8.6	20.6	TT 15/15[a]
Magnesium	1,970 J	2,160 J	1,850 J	1,390 J	2,200 J	1,880 J	2,922	NA/NA
Manganese	27.1	29.5	41.3	25.7	19.6	120	188	50[b]/50[b]
Nickel	16.1 J	12.7 J	--	--	--	12.6 J	744	100[a]/100[a]

TABLE 3-17

ANALYTES DETECTED IN SITE 33 GROUNDWATER SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

	Shallow Monitoring Wells							
Well Identifier:	WHF-33-1	WHF-33-1DUP	WHF-33-2	WHF-33-3	WHF-33-4	WHF-33-5		
Sample Identifier:	WHF33-1	WHF33-1A	WHF33-2	WHF33-3	WHF33-4	WHF33-5	**Background**	
Collection Date:	10-JAN-94	10-JAN-94	14-DEC-93	10-JAN-94	14-DEC-93	14-DEC-93	**Screening**	**Federal/State**
Laboratory Sample No.:	90320003	90320004	90291002	90320002	90291003	90291001	**Criteria**	**MCLs**
Inorganic Analytes (µg/L) (continued)								
Potassium	1,250 J	1,050 J	1,720 J	833 J	1,260 J	2,070 J	17,270	NA/NA
Sodium	2,960 J	3,390 J	4,460 J	4,150 J	3,140 J	2,970 J	5,740	NA/160,000[(a)]
Thallium	--	--	--	6 J	--	--	ND	2[(a)]/2[(a)]
Vanadium	64.9	72.1	11.6 J	27 J	13.7 J	61.3	335	NA/NA
Zinc	31.2	38.1	35.8	18.5 J	33.1	148	140	5,000[(b)]/5,000[(b)]
Cyanide	1.8 J	1.9 J	--	2 J	--	--	4.2	200[(a)]/200[(a)]

(a) Primary MCL.
(b) Secondary MCL.
(c) Groundwater guidance concentration.
(d) cis-1,2-Dichloroethene was used for comparison.
(e) Second value is from diluted sample analysis.

Notes: Shading indicates that the concentration meets or exceeds federal or state Primary or Secondary MCLs.
-- – Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.
TT – Treatment techniques.

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996d)].

Source Areas of Concern

- Former USTs northeast of Building 1454.
- Soil gas hot spots.
- Leaks from unidentified buried piping.

The Phase II-C RI/FS investigation at the Midfield Maintenance Hangar will consist of seven additional soil borings and associated subsurface soil sampling to help characterize the nature and extent of soil contamination. The supporting rationale for these borings is presented in the box below. Figure 3-5 shows the approximate locations of the soil borings.

RI/FS Rationale for Soil Borings at Site 33

Soil Boring Location	Rationale
33SB06, 33SB07	Determine lateral extent of contaminated soils west and south of abandoned UST; 900 ppm OVA reading at 33SB02; arsenic> background and RBC; lead > background.
33SB08, 33SB10	Uninvestigated soil gas hot spot.
33SB09, 33SB11, 33SB12	Determine lateral extent of contaminated soils at 33B001, 33B002 at apron, and 33B003 at steam pit; TCE > SSL_{gw}.
Optional	Pending identification of potential source areas such as floor drains, subgrade piping, sumps, oil/water separators or to define extent of contamination.

Soil Sampling Criteria

Soil samples will be collected in all borings using either nominal 2-inch-diameter split spoons or a 5-foot-long continuous-core barrel. In general, 5-foot continuous-core barrel samples will be collected from soil borings and monitoring wells located near source areas. Split-spoon samples 2 inch in diameter by 2-foot in length may be collected at 5-foot intervals from monitoring wells near the perimeter of the contaminant plum.

All borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Soil samples will be selected for laboratory analysis from surface soil in unpaved areas; each 30-foot depth interval based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. A surface soil sample will not be collected from borings in paved areas. It is assumed that 1 boring will be installed to a depth of approximately 90 feet bls and that 6 borings will extend to depths of only 30 feet bls. Soil samples will be analyzed for: VOCs, SVOCs, TPH, pesticides, PCBs, and inorganics. Three soil samples will be collected using a thin-walled Shelby tube (ASTM D1587) for analysis of geotechnical and natural attenuation indicator parameters listed in Section 3.2.1.3.

3.2.5 Site 30: South Field Maintenance Hangar

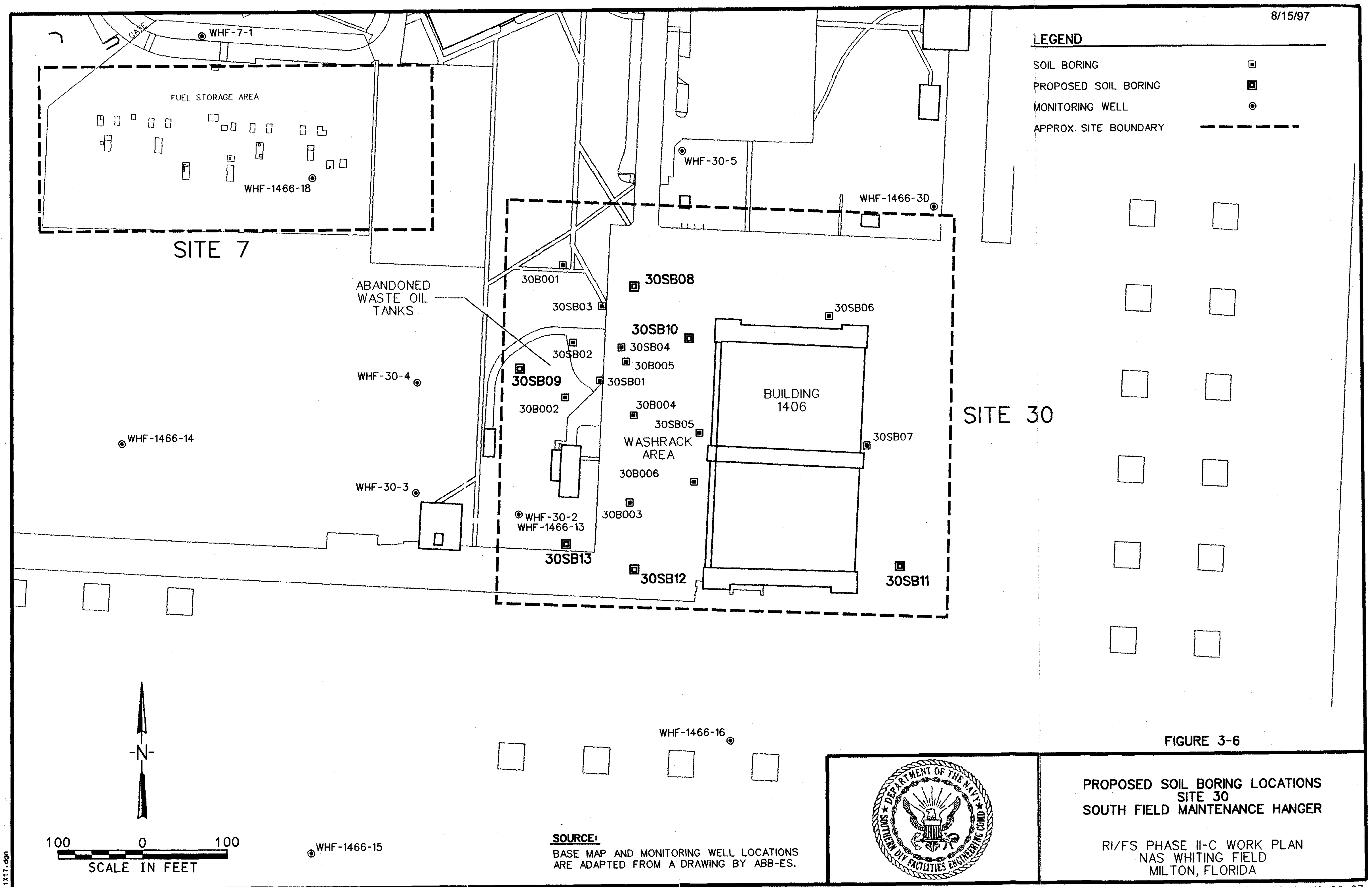
3.2.5.1 Site 30 Location and Description

Site 30 is located at the South Field Maintenance Hangar, Building 1406 (Figure 3-6). The site includes Building 1406, the adjacent washrack area, and the location of the abandoned waste oil tanks west of Building 1406.

3.2.5.2 Site 30 History

The South Field Maintenance Hangar was constructed in the middle 1940s to support maintenance service to training aircraft. These activities included engine maintenance, corrosion control, and aircraft cleaning. Maintenance activities generated waste stripping compounds, cleaning solvents, paint wastes, alkaline cleaners, detergents, oil, and hydraulic fluids. From the 1940s until 1972, fixed-wing aircraft comprised the training squadrons stationed at South Field. In 1972, two helicopter squadrons were stationed at South Field to provide basic and advanced training to student pilots. This reorganization necessitated the transfer of the fixed-wing aircraft of Training Squadron Three (VT-3) to North Field.

Oil changes were routinely performed on the fixed-wing aircraft as part of the normal maintenance activities. The oil was changed about every 250 hours of operation and required approximately 10 gallons of oil. Earlier investigations (e.g., IAS) concluded that about 700 gallons of waste engine oil were generated each month. Helicopter engine oil was changed after approximately 200 hours of operation. Each helicopter contained approximately 1 gallon of oil. It has been estimated that 350 gallons of waste oil were generated annually from helicopter maintenance. The waste oil from fixed-wing and helicopter maintenance was reportedly poured into the underground waste oil tanks located adjacent to the washrack (Figure 3-6) until the tanks were abandoned in the 1980s. The waste oil was removed from the tanks by a contractor for off-base disposal.



SOURCE:
BASE MAP AND MONITORING WELL LOCATIONS ARE ADAPTED FROM A DRAWING BY ABB-ES.

FIGURE 3-6

PROPOSED SOIL BORING LOCATIONS
SITE 30
SOUTH FIELD MAINTENANCE HANGER

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

11X17.dgn

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CAD FILE NO./DATE: 7541A004.dgn/8-20-97

Other wastes generated by maintenance activities included: mineral spirits, methyl ethyl ketone, lacolene, APU thinner, and paint strippers. Contaminated fuel obtained during the collection of fuel samples was placed in a line shack tank or 55-gallon drums. The fuel was routinely collected by the fuels contractor and hauled to the Firefighter Training Area for use in fire drills. A summary of the estimated quantities and ultimate disposition of these wastes is presented in the IAS (Envirodyne 1985).

Fixed-wing aircraft were and helicopters are washed at the washrack area located on the west side of Building 1406. Aircraft and helicopter washing is performed on each aircraft on a 14-day cycle. Before approximately 1972, the wastewater from this operation was discharged to the storm sewer. Subsequently the washrack was disconnected from the storm sewer and connected to the sanitary sewer system, allowing the wastewater to be treated at the sewage treatment plant. Approximately 10 helicopters are cleaned each day, generating about 100 gallons of wastewater per aircraft. The aircraft cleaning compound is consumed at a rate of approximately 10 gallons/day.

At the completion of the Phase I RI field investigation, Site 30 was added to the Phase II-A RI program for contamination assessment. Phase II-A activities at Site 30 included a soil gas survey, soil borings and subsurface soil sampling, monitoring well installation, and groundwater sampling.

Fifty-six soil gas samplers were placed on approximately 80-foot centers surrounding Building 1406. Soil gas screening indicated several hot spots with ion counts over 100,000 for BTEX, PCE, TCE, and cycloalkanes/naphthalenes. Details of the soil gas investigation are presented in *Soil Gas Survey Technical Report* (ABB-ES 1993b).

Seven soil borings (30SB01 through 30SB07) were drilled, and 23 subsurface soil samples were collected during Phase II-A. The soil borings were drilled around the abandoned waste oil tanks, Building 1406, and the helicopter washrack area (Figure 3-6). Three VOCs, 12 SVOCs, 2 pesticides, and TPH were detected in the subsurface soil samples from Phase II-A (ABB-ES 1995a). Concentrations of organic and inorganic analytes detected in soil are presented in Tables 3-18 and 3-19, respectively.

In 1994, nine soil borings were drilled and soil samples were collected by ABB-ES at the washrack area as part of a contamination assessment of shallow soils for construction activities. Results of the investigation were presented in a letter report (ABB-ES 1994b). Five VOCs were detected in the soil samples taken for GC screening. Six VOCs and one SVOC were detected in the soil samples collected for fixed-base analysis.

TABLE 3-18

ORGANIC COMPOUNDS DETECTED IN SITE 30 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

Locator:	30SB1-2-4	30SB1-2-4A[(a)]	30SB1-5-7	30SB1-10-12	30SB1-15-17	30SB1-35-37	30SB1-60-62	30SB1-120-122
Collection Date:	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	08-DEC-92
Laboratory Sample No.:	34607006	34607007	34607008	34607009	34607010	34607013	34607014	34617001
Target Compound List (TCL) Volatile Organic Compounds (VOCs) (mg/kg)								
Acetone	--	--	64 J	690 J	53 J	--	--	--
Trichloroethene	38	41	160	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	--
TCL Semivolatile Organic Compounds (SVOCs) (mg/kg)								
4-Methylphenol	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--
Dimethylphthalate	--	--	--	330 J	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)-phthalate	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	92 J	--	--	--	150 J	--	2 J
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--
TCL Pesticides and Polychlorinated Biphenyls (mg/kg)								
Dieldrin	--	--	--	--	--	--	--	--
4,4'-DDD	--	--	--	6.3 J	--	--	--	--
Total Petroleum Hydrocarbon (mg/kg)								
	244	122	65.8	5,300	460	21.6	5.7	--

TABLE 3-18

ORGANIC COMPOUNDS DETECTED IN SITE 30 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 3

Locator:	30SB02-0-2	30SB02-10-12	30SB02-20-22	30SB03-0-2	30SB03-10-12	30SB04-0-2	30SB04-5-7	30SB4-10-12	30SB4-15-17	30SB4-25-27
Collection Date:	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93
Laboratory Sample No.:	34799009	34799010	34799011	34799007	34799008	34799012	34799013	34807008	34807009	34807010
TCL VOCs (mg/kg)										
Acetone	--	26	9 J	--	380 J	--	--	86	--	52
Trichloroethene	180 J	--	--	--	--	--	--	--	--	--
2-Butanone	--	--	--	--	--	--	--	6 J	--	--
TCL SVOCs (mg/kg)										
4-Methylphenol	--	44 J	--	--	--	--	--	--	--	--
2-Methylnaphthalene	4,400 J	--	--	69 J	--	--	--	--	--	--
Naphthalene	970	--	--	--	--	--	20,000	--	--	--
Dimethylphthalate	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--	--	36 J
Benzo(b)fluoranthene	--	62 J	--	--		--	--	--	--	--
Benzo(g,h,i)perylene	--	65 J	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	47 J	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	71 J	--	--	--	--	--	--	--	--
Fluorene	350 J	--	--	--	--	--	--	--	--	--
Phenanthrene	120 J	--	--	--	--	--	680 J	--	--	--
Pyrene	--	--	--	--	--	--	--	--	330 J	--
bis(2-Ethylhexyl)phthalate	160 J	--	--	--	--	110 J	830 J	--	--	--
TCL Pesticides and PCBs (mg/kg)										
Dieldrin	1.9	--	--	13 J	--	--	--	--	--	--
4,4'-DDD	2.6 J	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbon (mg/kg)										
	9,610	865	103	2,660	50.2	855	21,200	89.7	3,760	97.8

TABLE 3-18

ORGANIC COMPOUNDS DETECTED IN SITE 30 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 3 OF 3

Locator:	30SB5-0-2	30SB5-15-17	30SB6-0-2	30SB6-10-12	30SB7-0-2	30SB7-10-12
Collection Date:	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93
Laboratory Sample No.:	34807023	34807024	34807021	34807022	34807011	34807012
TCL VOCs (mg/kg)						
Acetone	32	27	60	45	--	--/370[b]
Trichloroethene	5 J	--	--	--	30	--
TCL SVOCs (mg/kg)						
4-Methylphenol	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--
Dimethylphthalate	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--	--
TCL Pesticides and PCBs (µg/kg)						
Dieldrin	--	--	--	--	--	--
4,4'-DDD	--	--	--	--	--	--
Total Petroleum Hydrocarbon (mg/kg)						
	--	2.7	20.8	--	2.7	4.3

[a] The "A" following the sample locator indicates a duplicate sample.
[b] Original sample extract analyzed was rejected and sample was reextracted and reanalyzed.

Notes: -- The analyte was not detected in laboratory analysis.
DDD – Dichlorodiphenyldichloroethane.
J – The associated numerical value is an estimated quantity.

TABLE 3-19

INORGANIC ANALYTES DETECTED IN SITE 30 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 3

Locator	30SB1-2-4	30SB1-2-4A*	30SB1-5-7	30SB1-10-12	30SB1-15-17	30SB1-35-37	30SB1-60-62	30SB1-120-122
Collection Date:	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	06-DEC-92	08-DEC-92
Laboratory Sample No.:	34607006	34607007	34607008	34607009	34607010	34607013	34607014	34617001
Aluminum	14,600	15,700	11,000	999	814	138	618	1,270
Arsenic	2.5	1.5 J	1.3 J	1 J	0.19 J	--	--	--
Barium	15.8 J	17.4 J	17.1 J	0.8 J	0.51 J	0.37 J	0.6 J	3.3 J
Beryllium	--	--	--	--	--	--	--	--
Cadmium	0.5 J	0.65 J	0.4 J	--	--	--	--	0.71 J
Calcium	567 J	548 J	787 J	250 J	116 J	118 J	108 J	175 J
Chromium	14.6	15.3	11.1	2.2 J	2.7	1.1 J	1.5 J	4.4
Cobalt	--	--	1.8 J	--	--	--	--	--
Copper	4.8 J	5 J	3.9 J	1.9 J	0.98 J	0.62 J	0.83 J	3 J
Iron	12,800	13,800	10,400	2,390	846	199	104	17,800
Lead	7.7	7.8	8.1	1.5	0.36 J	0.23 J	0.3 J	1.4
Magnesium	180 J	191 J	146 J	22.1 J	10.4 J	11.3 J	13.5 J	50.5 J
Manganese	82.3	140	177	2.4 J	2.4 J	0.96 J	1.2 J	4.4
Mercury	0.04 J	0.05 J	0.04 J	--	--	--	--	--
Nickel	--	2.3 J	--	--	--	--	--	--
Potassium	171 J	215 J	97.8 J	98.2 J	65.9 J	49.2 J	83.8 J	135 J
Selenium	0.76 J	0.15 J	0.18 J	--	--	--	--	0.4 J
Silver	0.52	--	--	--	--	--	--	--
Sodium	201 J	168 J	214 J	199 J	172 J	203 J	134 J	257 J
Vanadium	34.6	36.2	27.3	11.5	3.1 J	0.77 J	0.87 J	12.3 J
Zinc	7.7	6.8	6.7	2 J	1.9 J	3 J	1.4 J	10.5 J
Cyanide	--	--	--	--	--	--	--	--

TABLE 3-19

INORGANIC ANALYTES DETECTED IN SITE 30 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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Locator	30SB02-0-2	30SB02-10-12	30SB02-20-22	30SB03-0-2	30SB03-10-12	30SB04-0-2	30SB04-5-7	30SB4-10-12
Collection Date:	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	04-JAN-93	05-JAN-93
Laboratory Sample No.:	34799009	34799010	34199011	34799007	34799008	34799012	34799013	34807008
Aluminum	8,190	965	127	18,000	5,000	12,000	6,550	15,900
Arsenic	4	2.2 J	--	4.5	1.1 J	5.2	0.67 J	2.1 J
Barium	13.1 J	1.2 J	--	12 J	2.7 J	10 J	8.4 J	4.5 J
Beryllium	0.08 J	--	--	--	--	0.09 J	--	--
Cadmium	--	--	--	--	--	0.95	--	--
Calcium	606 J	156 J	34.4 J	473 J	131 J	137 J	190 J	99.5 J
Chromium	17.2	0.93 J	0.63 J	20.6	5.1	14.8	9.5	15.6
Cobalt	1.6 J	--	--	1.8 J	--	2 J	1 J	1.2 J
Copper	1.1 J	--	0.6 J	2.2 J	1.1 J	1.8 J	1.1 J	4.4 J
Iron	13,800	1,770	113	18,500	5,520	16,300	12,400	13,900
Lead	26.2	2.1	0.27 J	9.3	2.2	66	22	4
Magnesium	112 J	14 J	--	237 J	31.7 J	61.2 J	36 J	56.6 J
Manganese	146	1.9 J	0.29 J	23.2	7.5	15.9	26.3	10
Mercury	0.03 J	--	--	0.02 J	--	--	0.03 J	--
Nickel	--	--	--	--	--	--	--	--
Potassium	--	--	--	122 J	--	202 J	--	--
Selenium	2.1	--	--	1.7	--	2.1	--	0.97 J
Silver	0.9 J	--	--	0.89 J	0.67 J	0.77 J	0.94 J	--
Sodium	--	--	33.9 J	--	--	--	--	--
Vanadium	37.4	7.2 J	0.73 J	55	21.4	44.6	32.6	39.7
Zinc	1.6 J	--	2.5 J	2.5 J	0.64 J	3.1 J	1.2 J	0.86 J
Cyanide	0.48 J	0.53 J	0.51 J	0.44 J	0.37 J	0.49 J	0.51 J	0.45 J

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TABLE 3-19

INORGANIC ANALYTES DETECTED IN SITE 30 SUBSURFACE SOIL SAMPLES
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
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Locator	30SB4-15-17	30SB4-25-27	30SB5-0-2	30SB5-15-17	30SB6-0-2	30SB6-10-12	30SB7-0-2	30SB7-10-12
Collection Date:	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93	05-JAN-93
Laboratory Sample No.:	34807009	34807010	34807023	34807024	34807021	34807022	34807011	34807012
Aluminum	115	105	12,200	2,720	12,600	3,230	12,200	5,720
Arsenic	--	--	2.8	2 J	4.4	8.6	3.3	6
Barium	0.2 J	--	22.3 J	1.8 J	20.4 J	4.7 J	26.1 J	6.8 J
Beryllium	--	--	0.13 J	--	0.14 J	--	0.13 J	--
Cadmium	--	--	--	--	--	--	--	--
Calcium	139 J	16.5 J	1,850	--	262 J	--	976 J	65.4 J
Chromium	1.5 J	1.7 J	12.1	4.4	10.5	7.5	8.4	15.4
Cobalt	--	--	2.3 J	--	4.4 J	2.3 J	2.4 J	1.9 J
Copper	4.6 J	0.75 J	2.5 J	0.48 J	1.4 J	--	2.7 J	--
Iron	231	114	11,100	4,500	12,700	19,800	8,250	15,900
Lead	--	--	16	1.9	9.5	9.4	7.4	7.1
Magnesium	70.7 J	--	126 J	8.9 J	87.2 J	43.9 J	110 J	49.7 J
Manganese	0.7 J	--	558	9	336	88.1	898	26.7
Mercury	--	--	0.06	0.04 J	0.04 J	0.02 J	0.05 J	0.02 J
Nickel	--	--	3 J	--	--	--	3.3 J	--
Potassium	--	--	127 J	--	--	--	185 J	--
Selenium	--	--	--	--	1.4	1.8	1.9	3.1
Silver	--	--	--	--	--	0.84 J	--	--
Sodium	--	--	14.3 J	--	--	--	13.7 J	--
Vanadium	0.99 J	1.1 J	29.3	12.4	33	40.4	21.1	43.9
Zinc	2.3 J	0.56 J	4.6	0.5 J	2.2 J	--	4.1 J	0.88 J
Cyanide	0.48 J	0.48 J	0.53 J	0.46 J	0.55 J	0.53 J	0.6 J	0.52 J

* The "A" following the sample locator indicates a duplicate sample.

Notes: Inorganic concentrations are reported in mg/kg.
-- – The analyte was not detected in laboratory analysis.
J – The associated numerical value is an estimated quantity.

Six additional soil borings (30B001 through 30B006) were drilled at the abandoned waste oil tanks and washrack locations in May 1996 during Phase II-B. Eight VOCs, 7 SVOCs, and lead were detected in 23 subsurface soil samples (including 4 duplicates) collected from these borings.

Four shallow monitoring wells were installed and sampled during Phase II-A. Three VOCs—1,1-dichloroethene; TCE; and benzene—were detected at concentrations exceeding federal and Florida MCLs (ABB 1995a). No SVOCs, pesticides, or PCBs were detected in the groundwater samples at Site 30; however, six inorganic analytes were detected at concentrations exceeding federal and Florida MCLs. Concentrations of organic and inorganic analytes at Site 30 are presented in Tables 3-20 and 3-21, respectively. The groundwater investigation at Site 30 is being conducted by ABB-ES and will not be incorporated into the proposed Phase II-C soil investigation.

3.2.5.3 Proposed Investigation

The investigation activities proposed for Site 30 are described below.

Investigation Scope

- Define extent of soil contamination that exceeds applicable FDEP regulations (e.g., Florida Soil Cleanup Goals (1995), Chapter 62-770 FAC and Soil Cleanup Target Levels from Revised Chapter 62-770 FAC, if adopted).

- Define extent of soil contamination that exceeds applicable "risk benchmarks" defined by USEPA [e.g., USEPA Region VI RBCs and SSLs (USEPA 1996d)].

Source Areas of Concern

- Former USTs west of Building 1406.
- Washracks west of Building 1406.
- Soil gas hot spots.
- Leaks from unidentified buried piping.

The RI/FS investigation at the South Field Maintenance Hangar will consist of six additional soil borings and associated subsurface soil sampling to help characterize the nature and extent of soil contamination. The supporting rationale for these borings is presented in the box below. Figure 3-6 shows the approximate locations of the soil borings.

TABLE 3-20

ORGANIC COMPOUNDS DETECTED IN GROUNDWATER SAMPLES AT SITE 30
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

	Shallow Monitoring Wells					
Well Identifier:	WHF-30-2	WHF-30-3	WHF-30-4	WHF-30-5		
Sample Identifier:	WHF30-2	WHF30-3	WHF30-4	WHF30-5	**Background**	
Collection Date:	09-DEC-93	10-DEC-93	13-DEC-93	09-DEC-93	**Screening**	**Federal/State**
Laboratory Sample No.:	90285003	90286002	90289002	90285002	**Criteria**	**Standards**
Volatile Organic Compounds (µg/L)						
1,1-Dichloroethene	--/--	--/--	--	24[d]/27 J	ND	7[a]/7[a]
1,2-Dichloroethene (total)	22[d]/23 J	57[d]/62	--	5 J/--	ND	70[a,e]/70[a,e]
Chloroform	--/--	4 J/--	--	--/--	ND	100[a]/6[c]
Trichloroethene	620[d]/620	560[d]/560	71	360[d]/360	ND	5[a]/3[a]
Benzene	--/--	--/--	48	--/--	8	5[a]/1[a]
Ethylbenzene	--/--	--/--	16	--/--	ND	700[a]/700[a], 30[b]
Xylenes (total)	--/--	--/--	70	--/--	ND	10,000[a]/10,000[a], 20[b]
Total BTEX	--/--	--/--	134	--/--	NA	NA/50
Semivolatile Organic Compounds (µg/L)						
None detected						
Pesticides and Polychlorinated Biphenyls (µg/L)						
None detected						

(a) Primary MCL.
(b) Secondary MCL.
(c) Groundwater guidance concentration.
(d) Second value is from reanalysis of diluted sample.
(e) cis-1,2-Dichloroethene was used for comparison.

Notes:

Shading indicates that the concentration meets or exceeds federal or state Primary or Secondary MCLs.
-- -- Compound was not detected above instrument detection limits.
BTEX – Benzene, toluene, ethylbenzene, and xylenes (total).
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.

TABLE 3-21

INORGANIC ANALYTES DETECTED IN GROUNDWATER SAMPLES AT SITE 30
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

	Shallow Monitoring Wells					
Well Identifier:	WHF-30-2	WHF-30-3	WHF-30-4	WHF-30-5	**Background Screening Criteria**	**Federal/State Standards**
Sample Identifier:	WHF30-2	WHF30-3	WHF30-4	WHF30-5		
Collection Date:	09-DEC-93	10-DEC-93	13-DEC-93	09-DEC-93		
Laboratory Sample No.:	90285003	90286002	90289002	90285002		
Inorganic Analytes (µg/L)						
Aluminum	549	6,870	2,610	3,890	53,360	200[b]/200[b]
Arsenic	5.7 J	--	3.8 J	6.4 J	ND	50[a]/50[a]
Barium	35.9 J	129 J	21 J	41 J	126.8	2,000[a]/2,000[a]
Beryllium	--	--	--	0.18 J	3.6	4[a]/4[a]
Cadmium	5.1	31.4	3.9 J	8.7	ND	5[a]/5[a]
Calcium	700 J	34,700	758 J	7,860	4,706	NA/NA
Chromium	3.7 J	34	16.2	40.8	872	100[a]/100[a]
Cobalt	--	--	3 J	2.9 J	20.7	NA/NA
Copper	2.1 J	24.2 J	7.7 J	45.4	67.6	TT 1,300 1,000[b]/1,000[b]
Iron	1,530	9,450	15,000	18,500	80,066	300[b]/300[b]
Lead	--	4	18.4	2 J	20.6	TT 15/15[a]
Magnesium	928 J	1,220 J	987 J	1,110 J	2,922	NA/NA
Manganese	5.8 J	40.9	436	42.9	188	50[b]/50[b]
Nickel	5.1 J	9.5 J	6.2 J	31.4 J	744	100[a]/100[a]
Potassium	932 J	3,880 J	1,540 J	2,640 J	17,270	NA/NA
Selenium	--	--	1.6 J	--	4	50[a]/50[a]
Silver	--	--	--	2.2 J	ND	100[b]/100[b]
Sodium	4,280 J	6,830	4,330 J	3,770 J	5,740	NA/160,000[a]

TABLE 3-21

INORGANIC ANALYTES DETECTED IN GROUNDWATER SAMPLES AT SITE 30
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

	Shallow Monitoring Wells					
Well Identifier:	WHF-30-2	WHF-30-3	WHF-30-4	WHF-30-5		
Sample Identifier:	WHF30-2	WHF30-3	WHF30-4	WHF30-5		
Collection Date:	09-DEC-93	10-DEC-93	13-DEC-93	09-DEC-93		
Laboratory Sample No.:	90285003	90286002	90289002	90285002	**Background Screening Criteria**	**Federal/State Standards**
Inorganic Analytes (µg/L) (continued)						
Vanadium	7.8 J	38.5 J	24.9 J	45.2 J	335	NA/NA
Zinc	12 J	32	20 J	276	140	5,000[b]/5,000[b]
Cyanide	1.4 J	--	--	--	4.2	200[a]/200[a]

(a) Primary MCL
(b) Secondary MCL.
(c) Groundwater guidance concentration.

Notes: Shading indicates that the concentration meets or exceeds federal or state Primary or Secondary MCLs.
-- – Compound was not detected above instrument detection limits.
J – Estimated concentration.
MCL – Maximum Contaminant Level.
NA – No applicable standard currently exists.
ND – Compound was not detected in background sample.
TT – Treatment techniques.

RI/FS Rationale for Soil Borings at Site 30	
Soil Boring Location	**Rationale**
30SB08, 30SB09, 30SB10, 30SB12, 30SB13	Determine lateral extent of contamination around former USTs and north and south end of washrack; 200 ppm OVA reading at 30SB04; TCE, benzene > SSL_{gw} at 30SB02, 30SB04, and north end of washrack; arsenic > background and RBC; lead, selenium > background; dichloroethene, methlyene chloride, and naphthalene > SSL_{gw} at 30B00301, south end of washrack.
30SB11	Uninvestigated soil gas hot spot; TCE > SSL_{gw} at 30SB07; arsenic > background and RBC.
Optional	Pending identification of potential source areas such as floor drains, subgrade piping, sumps, oil/water separators or to define extent of contamination.

Soil Sampling Criteria

Soil samples will be collected in all borings using either nominal 2-inch-diameter split spoons or a 5-foot-long continuous-core barrel. In general, 5-foot continuous-core barrel samples will be collected from soil borings and monitoring wells located near source areas. Split-spoon samples 2 inch in diameter by 2-foot in length may be collected at 5-foot intervals from monitoring wells near the perimeter of the contaminant plume.

All borings will be drilled to a minimum depth of 30 feet bls. If at 30 feet bls the total OVA readings are greater than 50 ppm, then the boring will be continued to a depth 10 feet below the depth when OVA readings decrease to < 50 ppm or to the water table, whichever occurs first. Soil samples will be selected for laboratory analysis from surface soil in unpaved areas; each 30-foot depth interval based on high OVA readings, changes in lithology, or at the discretion of the site geologist based on other field observations; and the bottom of the hole. A surface soil sample will not be collected from borings in paved areas. Soil sample quantities are estimated based on 1 boring being installed to a depth of 90 feet bls and the other 5 borings being installed to depths of 30 feet bls. Soil samples will be analyzed for: VOCs, SVOCs, TPH, pesticides, PCBs, and inorganics. Three aquifer matrix soil sample will be collected using a thin-walled Shelby tube (ASTM D1587) for analysis of the geotechnical and natural attenuation indicator parameters listed in Section 3.2.1.3.

3.2.6 Quality Assurance/Quality Control Samples

All environmental sampling will be performed in accordance with procedures outlined in the COMPQAP. QC samples including equipment blanks, trip blanks, and field duplicates will be collected as outlined in

Section 9.1 of the COMPQAP (B&R Environmental 1997). The frequency with which these QC samples will be collected is summarized in the box below. At least one field blank will also be collected during each field sampling event.

Number of Samples	Precleaned Equipment Blank	Field-Cleaned Equipment Blank	Trip Blank (VOCs)	Duplicate
10+	minimum of one, then 5%	minimum of one, then 5%	one per cooler	minimum of one, then 10%
5-9	one*	one*	not required	one
<5	one*	one*	not required	not required

*Note: For nine or fewer samples, a precleaned equipment blank and/or a field-cleaned equipment blank is required. A field-cleaned equipment blank must be collected if equipment is cleaned in the field.

3.2.7 Sampling Summary

Waste characterization samples will be collected from the investigation-derived soil and water. An estimated 10 soil samples will be collected and analyzed for TCLP parameters to determine the appropriate method of disposal. Several soil samples will be collected from the staged soil that is most likely to be impacted based on the location of the boring and observations recorded during drilling (i.e., headspace readings, visual observations, and odors). Additional soil samples will be collected from the staged soil that is less likely to be impacted based on the location of the boring and observations recorded during drilling.

Water samples will be collected and analyzed for TCLP from each of the tanks used to contain and store investigation-derived water. Investigation-derived water will be containerized and segregated in the following categories: decontamination fluids, development and purge water from wells with low probabilities of highly impacted groundwater, and development and purge water from wells with high probabilities of highly impacted groundwater.

A summary of the RI/FS Phase II-C sampling and analysis program is presented in Table 3-22.

TABLE 3-22

ANALYTICAL PROGRAM SUMMARY
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, 33
NAS WHITING FIELD
MILTON, FLORIDA
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Sample Identification	Estimated Quantity	CLP/TCL VOCs	CLP/TCL SVOCs	CLP/TAL Inorganics	CLP/TCL Pesticides/PCBs	TPH	TCLP	Geotechnical/Natural Attenuation Parameters
Analysis Method		SW8260	SW8270	(b)	SW8081	SW8015m	SW1311(c)	(a)
SURFACE SOIL								
Site 3	1	1	1	1	1	1		1
Site 4	10	10	10	10	10	10		1
Site 30	1	1	1	1	1	1		1
Site 33	1	1	1	1	1	1		1
SUBSURFACE SOIL								
Site 3	10	10	10	10	10	10		2
Site 4	30	30	30	30	30	30		3
Site 30	14	14	14	14	14	14		2
Site 32	20	20	20	20	20	20		2
Site 33	16	16	16	16	16	16		2
WASTE CHARACTERIZATION SAMPLES							10	
QC SAMPLES								
Duplicate	11	11	11	11	11	11	1	
Matrix Spike	6	6	6	6	6	6		
Matrix Spike Duplicate	6	6	6	6	6	6		
Trip Blanks	20	20						
Equipment Blanks	8	8	8	8	8	8		
Field Banks	3	3	3	3	3	3		3
TOTAL SOIL SAMPLES	157	157	137	137	137	137	11	18

TABLE 3-22

ANALYTICAL PROGRAM SUMMARY
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, 33
NAS WHITING FIELD
MILTON, FLORIDA
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Sample Identification	Estimated Quantity	CLP/TCL VOCs	CLP/TCL SVOCs	CLP/TAL Inorganics	CLP/TCL Pesticides/PCBs	TPH	TCLP	Geotechnical/Natural Attenuation Parameters
Analysis Method		SW8260	SW8270	(b)	SW8081	SW8015m	SW1311(c)	(a)
GROUNDWATER								
Site 32	19	19	16	16	16	16		16
Existing Wells	55	55	55	55	18	42		55
WASTE CHARACTERIZATION SAMPLES							3	
QC SAMPLES								
Duplicate	8	8	8	8	4	6		8
Matrix Spike	4	4	4	4	2	3		4
Matrix Spike Duplicate	4	4	4	4	2	3		4
Trip Blanks	18	18						
Equipment Blank	6	6	6	6	6	6		6
Field Blank	3	3	3	3	3	3		3
TOTAL WATER	117	117	96	96	51	79	3	96

(a)Soil Geotechnical and Natural Attenuation Parameters and analytical methods are listed in Section 3.2.1.3. Groundwater Natural Attenuation Parameters are listed in Section 3.2.3.3.
(b)CLP/TAL Inorganics analyses by Methods SW6010, SW7471 or SW7470, SW9010, and SW9065.
(c)TCLP analyses for inorganics, volatiles, semivolatiles, pesticides, and herbicides.

Notes:

ASTM – American Society for Testing and Materials
CLP – Contract Laboratory Program
PCB – Polychlorinated biphenyls
QC – Quality control
SVOC – Semivolatile organic compound
TAL – Target analyte list
TCL – Target compound list
TCLP – Toxicity Characteristic Leaching Procedure
TPH – Total petroleum hydrocarbons
USEPA – U.S. Environmental Protection Agency
VOCs – Volatile organic compound

4.0 SAMPLE ANALYSES AND VALIDATION

4.1 DATA VALIDATION

The approach to providing reliable data that meet the DQOs will include QA/QC requirements for each type of analytical data generated during the field investigation. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratories. Analytical data will be subjected to independent data validation in accordance with the following guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1994d);
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 1994e); and
- *Navy Installation Restoration Laboratory Quality Assurance Guide* (NFESC 1996).

Sample Analysis

Samples collected during the Phase II-C RI field activities will be analyzed in accordance with the DQOs established in Section 2.0. The number of samples (including QA/QC samples) and analyses planned for the NAS Whiting Field Phase II-C RI are summarized in Section 3.0.

Data quality indicators include the precision, accuracy, representativeness, comparability, and completeness parameters. These parameters will be used within the data validation process to evaluate data quality. The achievable limits for these parameters vary with the DQO level of the data. The limits used for laboratory analytical data in this program will be those set by the CLP for Level D DQOs.

4.2 DATA EVALUATION

The purpose of this task is to assess the usability of validated data results based upon data comparisons to non-site-related conditions. Results that meet the DQO requirements and are considered usable will be compared to background sampling results. Results of the data evaluation will be documented in the RI report. The following data evaluations and comparisons will be made:

- evaluation of detection limits,
- evaluation of counting errors,
- evaluation of equilibrium data,
- evaluation of qualified data,
- comparison of laboratory and field blanks to sample results, and
- comparison of laboratory and field duplicate results.

COPCs will be identified through evaluation of the following criteria:

- background sampling results,
- frequency of detection, and
- extent of contamination.

COPCs will be used throughout the data evaluation, fate and transport assessment, risk assessment, and FS.

Statistical analyses will be used in the data evaluation process and will involve a variety of analytical methods including exploratory analyses and the use of the standard *t* test and/or the Mann-Whitney test. The following paragraphs briefly describe each of the methods along with its application.

Exploratory analyses include evaluation of tables and graphs, including histograms, probability plots, and boxplots. Histograms and probability plots are used to understand and classify data distributions. In addition, tables of descriptive statistics (e.g., frequency of detection, minimum, quartiles, mean, maximum) will be evaluated. These tables alone may provide an adequate understanding of the distributions of some analytes, particularly those with few detected concentrations. Boxplots are used for side-by-side comparisons of different data sets (e.g., background versus potentially contaminated media); they graphically indicate quartiles, means, potential outliers, and properties such as skew in distributions.

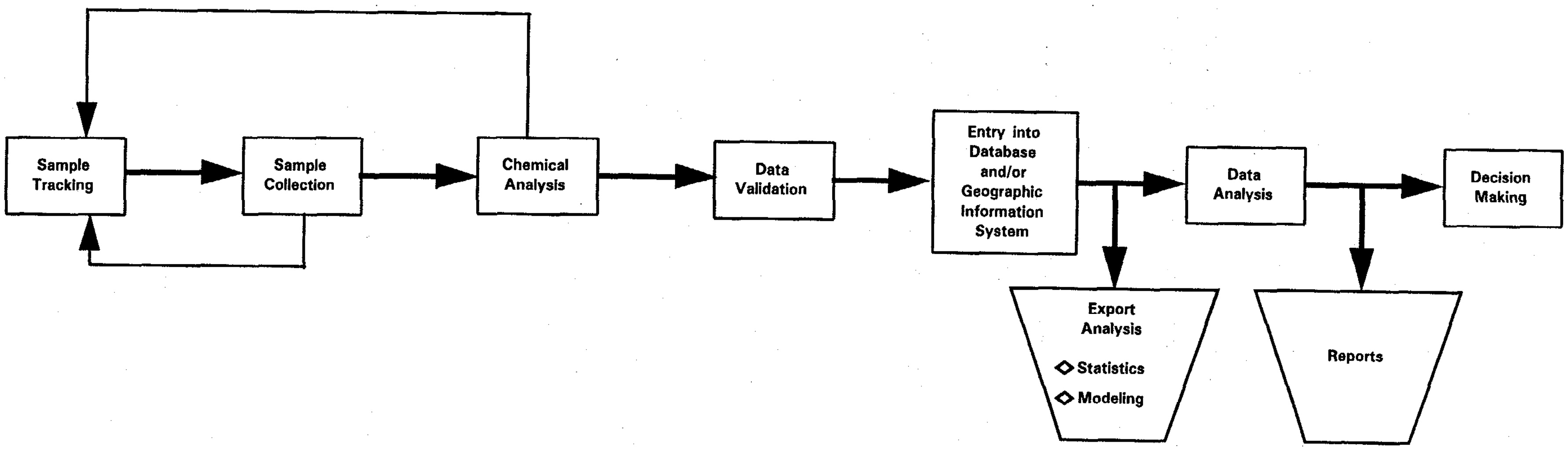
Background will be compared to site data using several numerical approaches in addition to the graphical techniques described above. Site data will be compared to two times the background mean as well as the background maximum and other descriptive statistics. If necessary, statistical testing will be performed using the *t* test, Mann-Whitney test, or both. Results of the *t* test will be used when the data have a normal distribution or can be made to approximate the normal through transformation (taking the logarithm of each datum transforms a lognormal distribution to the normal). Results of the Mann-Whitney test will be used when at least one of the distributions being compared cannot be classified. Although not required to draw conclusions about the difference between background and site data, performing both tests simultaneously can provide a better understanding of the distributional patterns affecting test results.

4.3 DATA MANAGEMENT

The purpose of this task is to track and manage environmental and QC data collected during the field investigation from the time the data are obtained through data analysis and report evaluation. Coordination and management of environmental and QC sample analysis by the contracted laboratories is also part of this task. RI activities generate data including sample locations, measurements of field parameters, and the results of laboratory analyses. Reports regarding the collection and analyses of sample data will also be generated. The RI process entails the flow of data collected in the field and generated by the analytical laboratory work to those involved in project evaluation and decision making. Figure 4-1 illustrates the data management life cycle and project information flow. Management of data collected during RI activities will ensure accessibility of data to support environmental data analysis, risk assessments, and the evaluation of remedial action alternatives.

Samples will be tracked from field collection activities to analytical laboratories following standard chain-of-custody procedures. Sample information recorded on the chain-of-custody forms will be transferred (electronically or manually) into the sample tracking portion of the database management system (DMS), thereby enabling the samples to be tracked through final disposition.

Analytical results, applicable QA/QC data, validation flags, chain-of-custody information, and any other applicable information will be incorporated into the DMS. All data will be verified after uploading to ensure completeness and accuracy.



Legend

Flow Path (thick line)

Tracking Routine (thin line)

FIGURE 4-1

DATA MANAGEMENT FLOW PATH

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

5.0 BASELINE RISK ASSESSMENT

5.1 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment (HHRA) for Sites 3, 4, 30, 32, and 33 at Whiting Field will be performed to characterize the risks (current and future) associated with potential human exposures to site-related contaminants. The process consists of six basic components: (1) data evaluation and summarization, (2) selection of COPCs, (3) exposure assessment, (4) toxicity assessment, (5) risk characterization, and (6) uncertainty analysis. A brief description of each component is presented in the following subsections.

The HHRA will be conducted according to CERCLA methodology. The following federal and USEPA Region IV guidelines will be used to direct and support the HHRA:

- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)* (USEPA 1989a);
- *Supplemental Region 4 Risk Assessment Guidance* (USEPA 1991a);
- *New Interim Region 4 Risk Assessment Guidance* (USEPA 1992d);
- *Exposure Factors Handbook* (USEPA 1995a);
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors* (USEPA 1991b); and
- *Guidance for Data Usability in Risk Assessment* (Part A) (USEPA 1992b).

The HHRA also considers the following FDEP standards and guidance documents:

- *Florida Groundwater Guidance Concentrations* (FDEP 1994) and
- *Soil Cleanup Goals for Florida* (FDEP 1995).

Preliminary screening evaluations will be conducted to indicate the nature and extent of chemical contamination at the sites. The findings will be used to determine whether a full baseline risk assessment is needed, or whether the modified version of the process described below is more appropriate.

5.1.1 Data Evaluation and Summary

The data used in the risk assessment are the results from analyses conducted under the CLP with documented QA/QC procedures. Before analytical results are released by the laboratory, both the sample and QC data are carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. The QC data are reduced, spike recoveries are included in control charts, and the resulting data are reviewed to ascertain whether they are within the laboratory-defined limits for accuracy and precision. Any nonconforming data are discussed in the data package cover letter and case narrative.

The data will then be reviewed and validated in accordance with *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program* (NEESA 1988) and *Navy Installation Restoration Laboratory Quality Assurance Guide* (NFESC 1996). The data review and validation process is independent of the laboratory's checks.

5.1.1.1 Evaluation of Quantitation Limits

Sample quantitation limits (SQLs) are compared to corresponding standards and criteria. For soil, SQLs will be compared to the USEPA RBCs and State of Florida cleanup goals. The groundwater SQLs will be compared to federal and state MCLs and Florida guidance concentrations. SQLs in excess of those screening values represent an area of uncertainty in the analytical results. The effect of this uncertainty will be noted in the risk assessment.

5.1.1.2 Evaluation of Qualified and Coded Data

The laboratories and data validators may attach qualifiers and codes to the analytical data. The qualifiers may pertain to QA/QC variances in identification or quantitation of an analyte. When data have both laboratory and validation qualifiers, the validation qualifiers supersede the laboratory qualifiers. All positive detections (unqualified or qualified with a "J") are considered detected concentrations for the risk assessment. All nondetects (qualified with a "U" or "UJ") are retained in the risk assessment as samples without positive detections. If an analyte has all nondetect results for all samples in a given medium, it is not considered in the risk assessment for that medium. No sample results with an "R" validation qualifier are considered in the risk assessment because these values have been rejected and are unusable.

5.1.1.3 Evaluation of Tentatively Identified Compounds

Tentatively identified compounds (i.e., both identity and concentration are uncertain) will be reviewed. The uncertainty in the identities and concentrations of these analytes will be discussed in the uncertainty analysis.

5.1.1.4 Data Used in the Risk Assessment

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 COPCs (HHCOPCs) as described in Section 5.2.

5.1.2 Identification of Human Health Chemicals of Potential Concern

HHCOPCs are selected from all analytes detected at the site. The selection of HHCOPCs from all detected analytes in each medium is based on the analyte concentrations, frequency of detection, comparison to background (inorganics only), and USEPA and Florida medium-specific screening criteria. HHCOPCs include contaminants that are

- positively identified in at least one sample and
- detected at levels significantly above blank concentrations.

Chemicals that do not contribute significantly to human health risks are removed or "screened" from further consideration as HHCOPCs, as recommended by USEPA (USEPA 1991a). Analytes are excluded as HHCOPCs if they meet any of the criteria below.

- The maximum detected concentration is less than twice the arithmetic mean of the background concentration (inorganics only) (USEPA 1991a).

- The maximum reported soil or water concentration is less than either the USEPA Region III RBC or State of Florida criteria and guidance values.

  USEPA Region III RBCs corresponding to an excess lifetime cancer risk (ELCR) of 1×10^{-6} or hazard quotient (HQ) of 0.1 for each analyte detected are used in the screening process. For noncarcinogenic chemicals the USEPA Region III RBC values (May 10, 1996) will be divided by 10 to represent an HQ of 0.1.

For surface and subsurface soil, the residential soil RBCs are used. No RBC is available for lead in soil due to a lack of dose-response values. Based on USEPA recommendations, a target level for cleanup at Superfund sites of 400 mg/kg is used as the RBC for lead in soil (USEPA 1994a).

For groundwater, tap water RBCs are used. No RBC is available for lead in groundwater; therefore, the treatment technology action level for drinking water of 15 µg/L is used (USEPA 1994b; FDEP 1994).

State of Florida cleanup criteria based on the aggregate resident are used to screen surface soil (FDEP 1995). For subsurface soil, State of Florida cleanup criteria based on leachability are used in the process. The target HQ for noncarcinogenic substances is 1.0, while the target cancer risk is 1×10^{-6} in the soil cleanup criteria. For groundwater, Florida guidance concentrations are used for screening (FDEP 1994).

- The average concentration of an essential nutrient (e.g., sodium, potassium, magnesium, iron, and calcium) in a medium is below a toxic screening level and consistent with or only slightly above the background concentration for that essential nutrient.
- The frequency of detection (i.e., the number of samples in which the analyte is detected divided by the number of samples analyzed for that analyte) is less than 5 percent (USEPA 1989a) and professional judgment is used to ensure that the analyte is probably an anomaly.

Tentatively identified compounds are screened based on their suspected presence at the sites under consideration, the contaminant concentration, the migration potential via each of the identified exposure pathways, and the chemical's toxicity. The tentatively identified compounds of concern are evaluated qualitatively in the HHRA.

5.1.3 Exposure Assessment

The exposure assessment estimates the types and magnitudes of potential human exposure to HHCOPCs. This process involves three steps:

- characterization of the exposure setting,
- identification of exposure pathways and receptors, and
- quantification of exposures.

5.1.3.1 Characterization of Exposure Setting

The physical characteristics of the site and the nature of the surrounding populations are evaluated to provide a basis for assessing potential exposures. The HHRA summarizes important site characteristics that may influence human contact with site contaminants including surface conditions, soil type, degree of vegetative cover, climate, geology, and conditions that affect the migration of contaminants, such as speed and direction of groundwater flow.

The evaluation of population characteristics includes the location of current populations relative to the site and the daily activities of these populations. The presence and location of potentially sensitive subpopulations, such as children or the elderly, are also evaluated.

5.1.3.2 Identification of Exposure Pathways and Receptors

This step involves the identification of all relevant exposure pathways through which specific populations may be exposed (currently or in the future) to contaminants at the site. An exposure pathway consists of four necessary elements: (1) a source or mechanism of chemical release, (2) a transport or retention medium, (3) a point of human contact, and (4) a route of exposure at the point of contact (USEPA 1989a).

The first step in defining potential exposure pathways is to identify all sources of contamination (i.e., groundwater and soil). Once sources are identified, relevant fate and transport mechanisms are evaluated to predict current and potential future exposures. Population characteristics are then used to identify where people may come into contact with contaminated media and the possible routes of exposure (i.e., inhalation, ingestion, or dermal absorption). The receptors to be evaluated are selected based on the current and realistic future use of the sites and surrounding areas. The human receptors that will be evaluated during the baseline HHRA of Sites 3, 4, 30, 32, and 33 are (1) military residents (adults); (2) future residents, both a young child (age 1–6) and an adult; (3) trespassers, both an older child (age 7–16) and an adult; (4) a construction worker; and (5) site occupational workers. These receptors are described below.

- Individuals (**military residents**) who live on base up to 3 years during their tour of duty at NAS Whiting Field. These residents will use groundwater extracted from NAS Whiting Field's on-base water supply wells; however, NAS Whiting Field treats the groundwater using activated carbon at the well head.

- Individuals (**future residents**) who may currently reside near Sites 3, 4, 30, 32, or 33 or may do so in the future. These residents may come into direct contact with contaminants in surface soils and may rely on the groundwater aquifer as a domestic water supply.

- Individuals (**trespassers**) who may from time to time enter a contaminated site without proper authorization and come into contact with contaminated soil.

- Individuals (**construction workers**) who may come into contact with surface or subsurface soils while excavating or performing construction activities near contaminated sites.

- Individuals (**site occupational workers**) who during their 8-hour work shifts may come into contact with contaminated surface soils or may use groundwater as a domestic water supply. Exposure of site occupational workers is very task dependent. For example, office workers may be minimally exposed to site-related contaminants when compared to landscapers.

Table 5-1 identifies the exposure pathways to be evaluated for the current land use population scenarios at Sites 3, 4, 30, 32, and 33, while Table 5-2 identifies the exposure pathways to be evaluated for the future land use population scenarios at those sites. These scenarios assume that Sites 3, 4, 30, 32, and 33 will continue to be used as an industrial area and that the concrete and asphalt pavement covering most of the ground surface at Sites 30, 32, and 33 will remain in place. These assumptions will be discussed in the uncertainty section of the baseline risk assessment.

The source of contamination or the initial receiving medium is usually the soil. Migration of contaminants from soil occurs through several different mechanisms including leaching to groundwater and water or wind erosion to other media. Mechanisms for migration into air include volatilization (primarily of VOCs) and wind erosion of contaminated soil (all types of contaminants). This process can also lead to relocation of the contaminants to other surface soil. Infiltration can result in migration into subsurface soil and into groundwater. Dissolved analytes (primarily soluble VOCs, SVOCs, and inorganics) are very mobile and may be transported to wells or discharged to surface water.

TABLE 5-1

PROPOSED HUMAN HEALTH RECEPTORS TO BE EVALUATED FOR CURRENT LAND USE AT SITES 3, 4, 30, 32, AND 33[a]
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Site	Name	Current Land Use Receptors	Exposure Media	Exposure Routes
Site No. 3	Underground Waste Solvent Storage Area	Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation[b]
		Military Resident (adult)	Groundwater	Ingestion Dermal Inhalation
Site No. 4	North AVGAS Tank Sludge Disposal Area	Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation[b]
		Military Resident (adult)	Groundwater	Ingestion Dermal Inhalation
Site No. 30	South Field Maintenance Hangar	Construction Worker	Soil	Inhalation Ingestion Dermal
			Groundwater	None[c]
Site No. 32	North Field Maintenance Hangar	Construction Worker	Soil	Ingestion Dermal Inhalation
		Military Resident (adult)	Groundwater	Ingestion Dermal Inhalation
Site No. 33	Midfield Maintenance Hangar	Construction Worker	Soil	Ingestion Dermal Inhalation
			Groundwater	None[c]

[a]This preliminary list of human health receptors will be refined following the human health characterization phase of the work.
[b]Exposure from soil inhalation will not be calculated for the trespasser and site occupational worker receptors because of the low probability of significant exposure.
[c]A Human Health Risk Assessment for groundwater at these sites is not currently included in Brown & Root Environmental's scope of work.

TABLE 5-2

PROPOSED HUMAN HEALTH RECEPTORS TO BE EVALUATED FOR FUTURE LAND USE AT SITES 3, 4, 30, 32, AND 33[a]
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Site	Name	Future Land Use Receptors	Exposure Media	Exposure Routes
Site No. 3	Underground Waste Solvent Storage Area	Future Resident (adult and child) Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation[b]
		Future Resident (adult and child) Site Occupational Worker	Groundwater	Ingestion Dermal Inhalation
Site No. 4	North AVGAS Tank Sludge Disposal Area	Future Resident (adult and child) Trespasser (older child and adult) Site Occupational Worker Construction Worker	Soil	Ingestion Dermal Inhalation[b]
		Future Resident (adult and child) Site Occupational Worker	Groundwater	Ingestion Dermal Inhalation
Site No. 30	South Field Maintenance Hangar	Construction Worker	Soil	Ingestion Dermal Inhalation
			Groundwater	None[c]
Site No. 32	North Field Maintenance Hangar	Construction Worker	Soil	Ingestion Dermal Inhalation
		Future Resident (adult and child) Site Occupational Worker	Groundwater	Ingestion Dermal Inhalation
Site No. 33	Midfield Maintenance Hangar	Construction Worker	Soil	Ingestion Dermal Inhalation
			Groundwater	None[c]

[a]This preliminary list of human health receptors will be refined following the human health characterization phase of the work.
[b]Exposure from soil inhalation will not be calculated for the trespasser and site occupational worker receptors because of the low probability of significant exposure.
[c]A Human Health Risk Assessment for groundwater at these sites is not currently included in Brown & Root Environmental's scope of work.

5.1.3.3 Quantification of Exposures

The next step is to calculate HHCOPC intakes, via each exposure pathway, for each of the potentially exposed populations. Population-related variables are selected that describe the characteristics associated with individual receptors in that population. For example, intake is dependent upon contact rate, age, body weight, body surface area, exposure frequency, exposure duration, and averaging time. When possible, variables such as age, body weight, and body surface area are selected from the following USEPA guidance documents: *Standard Default Exposure Factors* (USEPA 1991b), *Dermal Exposure Assessment: Principles and Applications* (USEPA 1992c), and the *Exposure Factors Handbook* (USEPA 1995a).

The general equation for calculating chemical intake from the various media is shown below.

$$Intake(mg/kg-day) = \frac{[CxCRxEFxEDxCF]}{[BWxAT]}$$

where

C	=	chemical concentration, medium-specific;
CR	=	contact rate, medium-specific;
EF	=	exposure frequency, population-specific;
ED	=	exposure duration, population-specific;
CF	=	conversion factor, medium-specific;
BW	=	body weight of hypothetically exposed individual; and
AT	=	averaging time (for carcinogens, AT=70 years x 365 days/year; for noncarcinogens, AT=ED x 365 days/year).

The specific equations used to calculate intakes from the different exposure pathways and, where possible, the default values used in the risk calculation spreadsheets for each site will be provided in an appendix to the RI report. Examples of the equations and parameter values that will be used in the risk calculations are provided in Appendix C.

Some exposure pathways require additional calculations before intake values can be calculated. The following are brief explanations of the additional calculations required for the inhalation of particulates, inhalation of vapors while showering, and dermal absorption.

Inhalation of Particulates from Soil

At sites having the potential for wind erosion, a three-step modeling process is conducted. In the first step, respirable particle-phase emission rates are calculated. In the second, contaminant emission rates are calculated on a unit surface area basis. In the third phase, downwind ambient concentrations are estimated using air dispersion modeling. A complete discussion of the three-step process and the associated equations is presented in Appendix C.

Inhalation of Vapors while Showering

For this exposure scenario, the contaminant concentrations in air are estimated based on release rates of volatiles from shower water. After reviewing the literature, the model selected to predict indoor (bathroom) concentrations is the Foster and Chrostowski (1987) model. The specific equations used to determine concentrations of contaminants in bathroom air are presented in Appendix C.

Dermal Absorption from Water

The absorbed dose is calculated in accordance with USEPA's *Dermal Exposure Assessment: Principles and Applications, Interim Report* (1992c). The permeability constant approach is used to describe the dermal absorption of contaminants in water. For all inorganic chemicals, the model assumes a permeability constant equal to that of water, and steady-state conditions for all analytes. For organic compounds, a nonsteady-state model is used to model the absorption that employs a dermal permeability constant estimated from the compound's octanol–water partition coefficient. A further description of the process used to determine absorption of contaminants from water is presented in Appendix C.

Dermal Absorption from Soil

The absorbed dose from soil is calculated in accordance with USEPA's *Dermal Exposure Assessment: Principles and Applications, Interim Report* (1992c). Percutaneous absorption of chemicals in soil is chemical- and matrix-dependent. According to USEPA Region 4 guidance (USEPA 1992d), absorption factors used in this risk assessment for organics and inorganics are 1.0 percent and 0.1 percent, respectively. A soil adherence factor of 1 mg/cm^2 per event is used in the dermal intake equations. The equations used to describe dermal absorption from soil are presented in Appendix C.

5.1.4 Toxicity Assessment

The toxicity assessment evaluates the evidence available on the potential adverse effects associated with exposure to each analyte. With this information, a relationship between the extent of exposure and the likelihood or severity of adverse human health effects is developed. Two steps are typically associated with toxicity assessment: hazard identification and dose-response assessment.

Hazard identification describes adverse effects that have been associated with exposure to an agent and, more importantly, whether those effects will occur in humans. Characterizing the nature and strength of causation is also a part of the hazard identification step. The HHRA contains a toxicity profile for each

HHCOPC found at each site. The toxicity profile describes the physical and toxicological properties of each contaminant.

A dose-response assessment is conducted to characterize and quantify the relationship between intake, or dose, of an HHCOPC and the likelihood or severity of a toxic effect or response. There are two major types of toxic effects evaluated in this risk assessment: carcinogenic and noncarcinogenic.

Following USEPA guidance (USEPA 1989a), these two endpoints are evaluated separately. USEPA's weight-of-evidence classifications and numerical toxicity factors for carcinogens have been developed and have undergone extensive peer review. Toxicity information used in the toxicity profile is primarily from the Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), Agency for Toxic Substances and Disease Registry (ATSDR) Toxicology Profiles, and the USEPA Environmental Criteria and Assessment Office.

A dose-response assessment will be completed to identify the relevant oral, dermal, and inhalation toxicity values for carcinogenic [cancer slope factors (CSFs)] and noncarcinogenic effects [reference doses (RfDs)] of the HHCOPCs. As required by USEPA Region IV guidance (USEPA 1991a), risks associated with soil and water dermal contact will be evaluated using RfDs and CSFs that are specific to absorbed doses. It will, therefore, be necessary to adjust toxicity values (commonly oral toxicity values) based on administered dosage so that they can be used for evaluation of absorbed doses. When appropriate published data are available on oral absorption of a specific chemical, such as the chemical-specific ATSDR Toxicological Profile, they are used to make the administered-to-absorbed dose adjustment. In the absence of chemical-specific data, the Region IV Office of Health Assessment (OHA) has adopted the following oral absorption efficiencies as interim default values: 80% for VOCs, 50% for SVOCs, and 20% for inorganic chemicals (USEPA 1995b).

5.1.5 <u>Human Health Risk Characterization</u>

Risk characterization involves the integration of the exposure and toxicity assessments into quantitative expressions of potential human health risks associated with HHCOPC exposure. Quantitative estimates of both carcinogenic and noncarcinogenic risks are made for each HHCOPC and each complete exposure pathway identified in the exposure assessment. A clear distinction will be made between risks associated with current land use and those risks associated with potential future land and groundwater uses.

Exposure Point Concentration

Because contaminant concentrations may vary over a site, an exposure point concentration (EPC) is used to express exposure as a reasonable maximum exposure (RME) for each exposure pathway.

An EPC is the lesser of the maximum detected or the 95th percent UCL on the arithmetic mean. The equation below for calculating the UCL on the arithmetic mean for a lognormal distribution is used to calculate all UCLs.

$$UCL = e^{\left(\bar{y} + 0.5\,(sy)^2 + \frac{syH}{\sqrt{n-1}}\right)}$$

where

UCL = upper confidence limit
e = constant (base of the natural log, equal to 2.718)
$\bar{y}$ = mean of transformed data
sy = standard deviation of the transformed data
H = H-statistic
n = number of samples

In calculating the 95 percent UCLs, nondetects are assigned a value of one-half the associated reporting limits in the calculation of the arithmetic mean. For cases in which there are fewer than 10 samples, the maximum detected concentration is identified as the EPC.

Carcinogenic Risks

Carcinogenic risks associated with exposure to individual chemicals will be estimated by multiplying the estimated chemical intake for each carcinogen (in units of mg/kg-day) by its USEPA CSF [in units of $(mg/kg\text{-}day)^{-1}$]. The result is a chemical-specific 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 (40 CFR Part 300) 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}. In accordance with FDEP (1995), remedial goals will be calculated for any risks greater than 10^{-6}, and risks greater than 10^{-6} for individual compounds in any medium will be identified.

Noncarcinogenic Risks

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 the HQ. The HQs for individual HHCOPCs within an exposure pathway are summed, resulting in a hazard index (HI) for that pathway. An HI less than or equal to 1.0 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 1.0, so does the risk of adverse effects. An HI above 1.0 will necessitate additional analyses to determine the likelihood of an adverse effect actually occurring if exposure were to occur. If the HI exceeds 1.0, then more specific HIs should be developed by summing HQs of COPCs with RfDs based on toxic effects on the same target organs. This specific target-organ-based HI should form the basis of COPC selection (USEPA 1995b).

Remedial Goal Options

The remedial goal options (RGOs) for chemicals and media of concern will be outlined and will include both ARARs and health-based cleanup goals. The purpose of this information is to provide decision makers with options upon which to develop the remedial approach.

Consistent with USEPA Region IV guidance (USEPA 1993c), if a given medium has a cumulative cancer risk greater than 10^{-4}, its noncarcinogenic HQ is greater than 1.0, and/or ARARs are exceeded, RGOs will be developed for that medium.

In accordance with FDEP (1995), any risks greater than 10^{-6} are worthy of further attention; therefore, risks greater than 10^{-6} for individual chemicals in any medium will also be identified, and RGOs will be developed for those chemicals. Chemicals need not be included if their individual carcinogenic risk contribution to the pathway is less than 10^{-6} or their noncarcinogenic HQ is less than 0.1. If a chemical is detected in groundwater and soil (either surface soil or subsurface soil), then the Florida leachability value will be presented as a separate column in the RGO table.

Media cleanup levels are risk-specific and medium- and exposure-scenario-specific analyte concentrations. They are based on the site-specific exposure parameters (combined ingestion, dermal, and inhalation exposures) and the toxicity information used in the baseline risk assessment.

5.1.6 Uncertainty Analyses

Uncertainties in the quantification of risk associated with the site are identified and their impacts on risk estimates are discussed in a separate section of the HHRA. These uncertainties can arise from several sources. Some of the more often encountered uncertainties include uncertainties in the analytical procedures to accurately define the contaminant concentration at the site, in obtaining EPCs and their use as representatives of the reasonable maximum contaminant concentration, in exposure scenarios, in exposure factors used to calculate intake, and in the appropriateness of toxicity values, as well as the potential for synergistic or antagonistic interaction between HHCOPCs.

The majority of the assumptions made in the risk assessment process are conservative; thus, the estimated risk is probably an overestimate of the actual risk associated with exposure at the site.

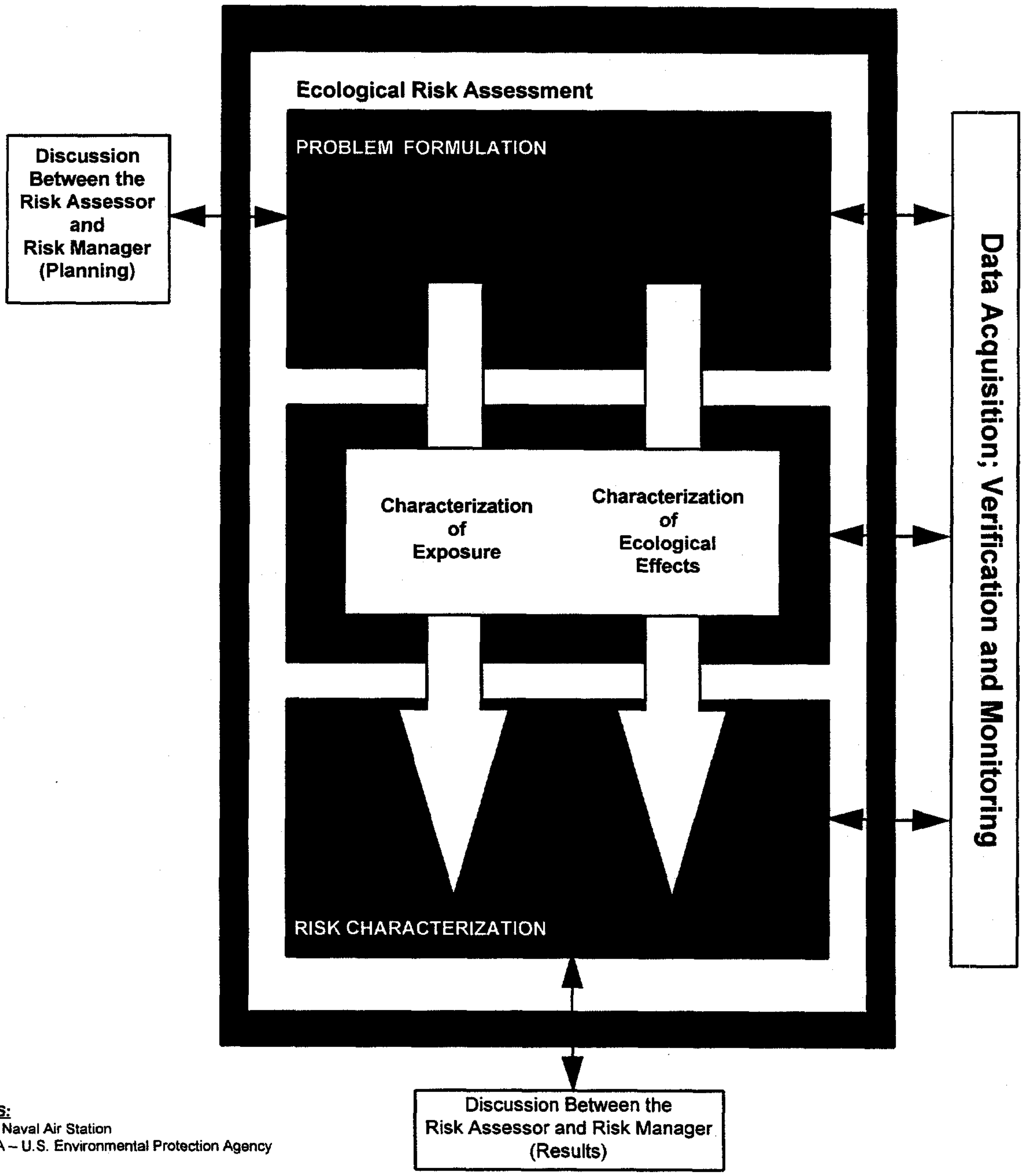
The uncertainty section of the HHRA may also include unusual site conditions or extenuating circumstances that may be pertinent to risk management decisions. The assumption that Sites 30, 32, and 33 will remain industrial with concrete or asphalt pavement covering the ground surface will be addressed in the uncertainty section. Other factors such as the inadequacy of toxicity factors to describe all possible HHCOPC–receptor interactions and individual differences within the human population may be included in this section.

5.2 ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment (ERA) at NAS Whiting Field will evaluate potential adverse effects on ecological receptors from exposure to contaminants associated with Sites 3, 4, 30, 32, and 33. This section provides an outline of the general approach that will be taken to assess the impacts of site contamination on ecological receptors and the habitats that support these organisms on and near the sites.

There are four primary components of the ERA process: (1) preliminary problem formulation, (2) preliminary exposure assessment, (3) preliminary effects assessment, and (4) risk characterization. When these steps are completed, the results can be interpreted, and the uncertainties associated with the ERA can be addressed. The process above represents the general ERA approach recommended in USEPA guidance (USEPA 1996c; USEPA 1994c), and is a summation of USEPA Region 4's recommended ERA guidelines (USEPA 1995c), which served as the basis for the ERA methodology for the Phase II-C RI/FS (Figure 5-1). Furthermore, the ERA will be conducted in accordance with other available ERA guidance documents and recent publications (Wentzel et al. 1996; Suter 1993; Calabrese and Baldwin 1993).

Due to the potential complexity of ERAs, they are often conducted using a tiered approach and punctuated with Scientific/Management Decision Points (SMDPs), which are meetings involving the risk assessors, risk managers, and client to control costs, prevent unnecessary analyses, and ensure that the ERA is proceeding in an efficient, timely manner. Information analyzed in one tier is evaluated to determine whether the objectives of the study have been met and then may be used to identify the data required for the next tier, if another tier is necessary. The ERA can be considered a "screening-level" assessment or "preliminary risk evaluation" because it is generally based on a conservative initial screening of contaminant concentrations against contaminant-specific ecological screening levels (USEPA 1995c). Tier 2 and Tier 3 assessments,



NOTES:
NAS – Naval Air Station
USEPA – U.S. Environmental Protection Agency

Source: *Ecological Risk Assessment for Superfund: Process for Designing and Conducting Ecological Risk Assessments*, USEPA, Edison, New Jersey, 1994.

FIGURE 5-1

FRAMEWORK FOR ECOLOGICAL RISK ASSESSMENT

RI/FS PHASE II-C WORK PLAN
NAS WHITING FIELD
MILTON, FLORIDA

referred to as "semiquantitative" and "quantitative" assessments, respectively, are more focused studies that incorporate the initial screening, but also encompass detailed laboratory and field studies or extensive modeling. The process summarized above was used to assess potential ecological risks at Sites 3, 4, 30, 32, and 33 and is described in further detail below.

5.2.1 Preliminary Problem Formulation

This section presents a brief overview of the major components of preliminary problem formulation for Sites 3, 4, 30, 32, and 33 at NAS Whiting Field.

5.2.1.1 Site Descriptions

Brief descriptions of each site to be investigated in this study are provided below. The ERA problem formulation will contain detailed descriptions of each site.

5.2.1.1.1 Site 3: Underground Waste Solvent Storage Area

Site 3 is the previous location of the underground waste solvent storage area (tank) and is located on the southern side of North Field adjacent to Building 2941, Aircraft Maintenance Hangar. The areas north, west, and east of the site are predominately covered with concrete or asphalt, and no surface water or wetlands exist in the immediate area of the site. The area south of the site is vegetated with turfgrass. The depth to groundwater at the site varies from 80–100 feet bls, and surface water from this site drains to Big Coldwater Creek via the storm sewer and drainage ditches.

Contaminated media at Site 3 include surface soil, subsurface soils, and groundwater. Analysis of surface soil samples (0–2 feet bls) identified the presence of low levels of TCE, acetone, 10 semivolatiles, TPH, and arsenic. TPH and arsenic were detected at maximum concentrations of 27.8 and 5.5 mg/kg, respectively. Chromium and lead were detected at concentrations slightly in excess of background levels. Based on the levels of TPH and arsenic detected in surface soils, risks to terrestrial ecological receptors are of potential concern.

5.2.1.1.2 Site 4: North AVGAS Tanks Sludge Disposal Area

Site 4 is the North AVGAS Tanks Sludge Disposal Area located on the eastern side of North Field. This site includes the former location of the underground AVGAS tanks as well as the areas adjacent to the tanks where tank-bottom sludge was disposed of in shallow holes. This area is predominately covered with turfgrass vegetation, and no surface water or wetlands exist in its immediate area. The depth to groundwater at the site varies from 80–100 feet bls, and surface water from this site drains to Big Coldwater Creek via the storm sewer and drainage ditches.

Contaminated media at Site 4 include surface soil, subsurface soils, and groundwater. Analysis of surface soil samples identified the presence of high concentrations of TPH and low concentrations of BTEX. Based on the levels of TPH detected in surface soils, risks to terrestrial ecological receptors are of potential concern.

5.2.1.1.3 Site 30: South Field Maintenance Hangar

Site 30 is the area around the South Hangar, Building 1406, which is located on the northern side of South Field. This site includes the former location of waste oil tanks and a washrack used to clean aircraft. Site 30 is predominately covered with concrete or asphalt, and no surface water or wetlands exist in its immediate area. The depth to groundwater at the site varies from 80–100 feet bls. Surface water from Site 30 flows to Clear Creek via the storm sewer and concrete and earthen drainage ditches.

Contaminated media at Site 30 include surface soil, subsurface soils, and groundwater. Analysis of surface soil samples identified the presence of low levels of TCE and arsenic and relatively high concentrations of five semivolatiles and TPH. TPH and 2-methylnaphthalene were detected at concentrations of 9,610 and 4.4 mg/kg, respectively. Based on the levels of TPH and semivolatiles detected in surface soils, risks to terrestrial ecological receptors are of potential concern.

5.2.1.1.4 Site 32: North Field Maintenance Hangar

Site 32 is the area around the North Hangar, Building 1424, which is located on the southern side of North Field. This site includes the former location of waste oil tanks and a washrack used to clean aircraft. Site 32 is predominately covered with concrete or asphalt, and no surface water or wetlands exist in the immediate area of the site. The depth to groundwater at the site varies from 80–100 feet bls. Surface water from Site 32 flows to Big Coldwater Creek via the storm sewer and drainage ditches.

Contaminated media at Site 32 include surface soil, subsurface soils, and groundwater. Analysis of surface soil samples identified the presence of low levels of TCE, acetone, Aroclor-1254, and arsenic. Moderate concentrations of TPH and five semivolatiles were also present. TPH and 2-methylnaphthalene were detected at concentrations of 12,300 and 15 mg/kg, respectively. Based on the levels of TPH and semivolatiles detected in surface soils, risks to terrestrial ecological receptors are of potential concern.

5.2.1.1.5 Site 33: Midfield Maintenance Hangar

Site 33 is the area around the Midfield Hangar, Building 1454, which is located on the southern side of North Field. This site includes the former location of waste oil tanks. Site 33 is predominately covered with concrete or asphalt, and no surface water or wetlands exist in its immediate area. The depth to groundwater at the site varies from 80–100 feet bls. Surface water from Site 33 flows to Clear Creek via concrete and earthen drainage ditches.

Contaminated media at Site 33 include surface soil and groundwater. Analysis of surface soil samples identified the presence of low levels of TCE and arsenic and high concentrations of TPH and semivolatiles. TPH and 2-methylnaphthalene were detected at concentrations of 2,340 and 2.0 mg/kg, respectively. Based on the levels of TPH and semivolatiles detected in surface soils, risks to terrestrial ecological receptors are of potential concern.

5.2.1.2 Selection of Ecological Chemicals of Potential Concern

Preliminary problem formulation will include a review of analytical data and selection of COPCs. COPCs represent the analytes detected in environmental media that are considered in the risk assessment process. The COPCs are assumed to be associated with hazardous waste practices at Sites 3, 4, 30, 32, and 33 and could present a potential risk for ecological receptors. Preliminary information indicates that surface soil may be the only medium of concern on and near the sites.

In accordance with USEPA national guidance (1989b and 1989c), analytical data for each site at NAS Whiting Field will be evaluated to determine their validity for use in risk assessment. Historical nonvalidated data will not be used quantitatively in the ERA. COPCs will be selected using the analytical data summary statistics. COPCs will be selected for each medium of concern for each site. Analytes will be excluded as COPCs if:

- they are common laboratory contaminants and site concentrations are less then 10 times the maximum detected in any blank,
- they are not common laboratory contaminants and site concentrations are less than five times the maximum amount detected in any blank, or
- they are detected in 5 percent or fewer of the samples analyzed.

Calcium, magnesium, potassium, and sodium will be excluded as COPCs for surface soil because they are considered to be essential nutrients and are toxic only at extremely high concentrations. Iron is a natural, major component of soil and will also not be considered a COPC.

Tentatively identified compounds will be evaluated based on their suspected presence at each site under consideration, their migration potential via each of the identified exposure pathways, and their toxicity. A list of tentatively identified compounds of concern will be formulated after consideration of these factors.

5.2.1.3 Identification and Characterization of Ecological Receptors and Habitats

Potential ecological receptors and habitats at each site will be identified through a qualitative field survey and literature review. As part of the ERA, a literature review will be conducted to evaluate the major floral and faunal receptors and ecological community types likely to be encountered at NAS Whiting Field. Existing information sources related to flora, fauna, and ecological communities in the area will be reviewed, and standard taxonomic sources and references will be identified. If he is available, the base ecologist or natural resources manager will be contacted during the ERA.

Following the information review, a limited field reconnaissance program will be initiated to characterize the habitats and ecological receptors at and in the vicinity of each site. This field program will involve a site walkover by ecologists who will identify the major vegetative cover types and dominant taxa at the site. Major ecological exposure routes will be identified during the initial walkover. Some sites may be identified as having no or limited complete exposure routes. These sites will include sites that are paved, covered with buildings, or otherwise provide minimal ecological habitat. Unless future exposure routes are identified (e.g., future groundwater discharge to surface water bodies), no additional ecological field characterization will be conducted at these sites. Preliminary information indicates that some of the sites exhibit the characteristics described above.

At each site with complete ecological exposure routes, limited habitat mapping will be completed. All cover types will be identified on not-surveyed-to-scale ecological cover type maps for each site. Standard cover type descriptions such as those provided by the Florida Natural Areas Inventory will be used to describe cover types. Observed evidence of ecological stress in plant populations (e.g., yellowing, wilting, insect infestations) and animal populations (e.g., disease, parasitism, death, and reduced diversity or abundance) will be noted. Any state- or federally listed threatened, rare, or endangered species identified during the survey will be documented.

5.2.1.4 Identification of Migration Pathways and Exposure Routes

Contaminant migration pathways at all sites will be identified based on information generated in the ecological survey, as will contaminant exposure routes. Exposure routes describe how ecological receptors may come into contact with contaminated media and include: (1) a contaminant source; (2) the means of transport from the source to the environmental medium (soil, water, or air); and (3) a point of receptor contact (soil, water, or food).

The primary potential exposure routes for terrestrial wildlife are ingestion of contaminated surface water or surface soil, and ingestion of food items that are contaminated as a result of the accumulation of contamination from the soil. Ingestion of contaminated surface water should be minimal, however, due to the general absence of surface water near Sites 3, 4, 30, 32, and 33. Exposures related to dermal contact are possible but will not be evaluated because 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 will not be evaluated because this pathway is generally considered an insignificant route of exposure except in unusual circumstances, such as following a spill or release.

5.2.1.5 Identification of Endpoints

As discussed in reports by USEPA (1994c) and Wentsel et al. (1996), one of the major tasks in problem formulation is the selection of assessment and measurement endpoints. An assessment endpoint is defined as "an explicit expression of actual environmental values that are to be protected" (USEPA 1994c). Measurement endpoints are "measurable ecological characteristics that are related to the valued characteristic chosen as the assessment endpoint" (USEPA 1994c). For this ERA, the most appropriate assessment endpoint is the maintenance of receptor populations; therefore, the specific objectives of this assessment will be to determine if exposure to contaminants present in surface soil on and near each site is likely to result in declines in ecological receptor populations. Declines in populations could result in a shift in community structure and possible elimination of resident species from terrestrial environments.

As indicated above, measurement endpoints are related to assessment endpoints, but these endpoints are more easily quantified or observed. In essence, measurement endpoints serve as surrogates for assessment endpoints. While declines in populations and shifts in community structure can be quantified, studies of this nature are generally time-consuming and difficult to interpret. On the other hand, measurement endpoints indicative of observed adverse effects on individuals are relatively easy to measure in toxicity studies and can be related to the assessment endpoint. For example, contaminant concentrations that lead to decreased reproductive success or increased mortality of individuals in toxicity tests could, if found in the environment, result in shifts in population structure, potentially altering the community composition associated with the sites investigated in this ERA. Table 5-3 summarizes the endpoints to be used in the ERA. If the results of the screening-level ERA indicate that additional investigations are necessary to fully characterize ecological risks, the endpoints will be refined, if necessary, to reflect the goals of the additional analyses. For example, these refined endpoints may be tailored to a specific class of contaminants and/or group of receptors.

5.2.1.6 Conceptual Model

The conceptual model is designed to diagrammatically identify potentially exposed receptor populations and applicable exposure pathways based on the physical nature of the sites and the potential contaminant source areas. Potential exposures of ecological receptors associated with each site will be determined by identifying the most likely pathways of contaminant release and transport. As mentioned above, a complete exposure route has three components: (1) a source of contaminants that can be released to the environment, (2) a route of contaminant transport through an environmental medium, and (3) an exposure or contact point for an ecological receptor. A comprehensive conceptual model will be included in the ERA report.

5.2.2 Ecological Exposure Assessment

Exposure assessment is the process of estimating or measuring the amount of a COPC in environmental media to which an ecological receptor may be exposed. The following subsections discuss how contaminant exposures will be estimated or measured for terrestrial wildlife, terrestrial plants, and terrestrial invertebrates at Sites 3, 4, 30, 32, and 33.

5.2.2.1 Exposure Point Contaminant Concentrations

EPCs for ecological receptors at Sites 3, 4, 30, 32, and 33 will include the maximum and average concentrations of COPCs measured in surface soil at each site. The actual dose of a COPC a receptor species receives as the result of indirect or direct exposure is dependent upon the habits of the species and other factors. A simple spreadsheet model will be used to predict dietary exposures for representative receptor species. Some of the receptors species identified during the literature review and qualitative field survey will be selected to represent the terrestrial wildlife populations potentially inhabiting the sites being investigated and the surrounding areas. These species will be chosen to represent the receptors most likely to be exposed to the highest contaminant concentrations because of their position in the food web, diet (ingestion rate and food type), home range (contained within the area of soil contamination), and body size. The species selected are assumed to be representative of other species within the same trophic level or guild. For each of the representative species, information on life history will be collected, including

TABLE 5-3

ENDPOINTS FOR ECOLOGICAL RISK ASSESSMENT OF SITES 3, 4, 30, 32, AND 33
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAVAL AIR STATION WHITING FIELD, MILTON, FLORIDA

Medium	Receptor	Assessment Endpoint	Measurement Endpoint
Surface soil	Terrestrial wildlife	Maintenance of wildlife populations and communities.	Contaminant doses associated with adverse effects to growth, reproduction, or survival of mammalian or avian laboratory test populations.
Surface soil	Terrestrial invertebrates	Maintenance of terrestrial invertebrate populations and communities.	Survival of earthworms exposed to site surface soil samples in laboratory toxicity tests. Contaminant concentrations in soils associated with adverse effects on growth, reproduction, or survival of terrestrial invertebrates.
Surface soil	Terrestrial plants	Maintenance of plant populations and communities.	Contaminant concentrations in soils associated with adverse effects on growth, reproduction, or survival of plants.

diet, average body weight, food ingestion rates, water ingestion rates, home range, and exposure durations (percent of total time that a receptor may reside at the site).

5.2.2.2 Toxicity Testing

Earthworms are in constant contact with the soil and are part of the prey base for terrestrial wildlife; potential habitats at the sites appear to be terrestrial. Toxicity tests with earthworms using soils collected from sites that are vegetated (i.e., the sites are not paved over most of their surfaces) will also be performed. These toxicity tests will include a 14-day earthworm survival test (Green et al. 1989). The objective of the screening-level toxicity tests is to obtain laboratory data to evaluate the potential for adverse effects associated with exposure of the earthworm (*Eisenia foetida)* to site soils. Soil sampling for analytical chemistry analysis and toxicity testing will be conducted concurrently, allowing for identification and evaluation of chemical, physical, and biological stressors during the ERA. Data from the toxicity tests will be used to help evaluate ecological risks to earthworms and potentially other soil invertebrates.

Fourteen-day subacute earthworm studies will be conducted to provide a screening-level spatial distribution of toxicity at the sites shown on Table 5-4; however, if little or no unpaved area is present at a site, the 14-day subacute earthworm studies will most likely not be performed. Earthworm mortality, growth, and health assessments will be conducted on test days 0, 7, and 14. At test termination, mortality and percent weight loss or gain data for earthworms exposed to each soil sample will be determined. Statistical analyses to assess the significance of any differences in survival and growth between the reference sample and/or negative control soil sample and the site soil samples will be performed.

TABLE 5-4

**TOXICITY TESTS TO BE COMPLETED AT SITES 3, 4, 30, 32, AND 33
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA**

Target Species		Surface Soil[a]				
Common Name	**Scientific Name**	**Site 3**	**Site 4**	**Site 30**	**Site 32**	**Site 33**
Earthworm [b]	*Eisenia foetida*	5–10	5–10	5–10	5–10	5–10

[a] Site and number of samples.
[b] Earthworm bioaccumulation data will also be collected using soils from all selected sites.

Analyses of contaminant concentrations in plant and animal tissue provide a direct measurement of contaminant exposure for ecological receptors. To determine bioaccumulation of pesticides or inorganic chemicals by terrestrial organisms, earthworms will be reared on NAS Whiting Field surface soils for an additional 14 days beyond the 14-day toxicity test described above. Following the 28-day study duration, earthworms from these samples will be analyzed for contaminants.

5.2.2.3 Tissue Analysis

In addition to the 28-day earthworm bioaccumulation study, bioaccumulation and biomagnification of environmental contaminants in plant tissues may need to be evaluated at sites with elevated surface soil concentrations of inorganics. Tissue contaminant burden analysis will provide information regarding those chemicals that bioaccumulate and/or bioconcentrate in plants that serve as the base of terrestrial food chains. Plant tissue concentrations at specific sites will be evaluated by collection of plant specimens from each site, followed by analysis of the plant tissues for TAL metals. Plant tissue of the same species collected at each site will be collected from a reference location. If little or no natural vegetation is present at a given site, it is unlikely that plant tissue will be collected.

5.2.3 Preliminary Ecological Effects Assessment

The preliminary ecological effects assessment describes the potential adverse effects associated with COPCs to ecological receptors and reflects the type of assessment endpoints selected. The methods that will be used to identify and characterize ecological effects for terrestrial receptors are described below.

5.2.3.1 Selection of Ecological Screening Levels

Screening levels to be compared to exposure point contaminant concentrations to assess risk to soil invertebrates will be gathered from the Oak Ridge National Laboratory (ORNL) On-Line Ecological Database (ORNL 1996). These screening levels were derived from toxicity studies involving earthworms and soil microbes. Screening levels for assessing potential risks to terrestrial plants will also be gathered from the ORNL database.

Reference toxicity values (RTVs) will be determined for each COPC for the representative terrestrial receptors described earlier. An RTV will be identified that represents a threshold for sublethal effects. Sublethal effects are defined as those based on the measurement endpoint, impairment of reproduction, growth, or survival. When the necessary data are available, RTVs will be derived separately for avian and mammalian species, if both those receptors are selected at a given site. Model runs will be performed with no observed adverse effect levels (NOAELs) and then with lowest observed adverse effect levels (LOAELs). The ORNL database as well as IRIS and ATSDR Toxicity Profiles will be used to determine suitable RTVs. If only a LOAEL can be identified for a given contaminant, it will be divided by a factor of 10 to extrapolate to a NOAEL for use in the NOAEL model run, as recommended by USEPA Region 4 (USEPA 1995c).

5.2.4 Preliminary Risk Characterization

As identified by USEPA (1995c), the preliminary risk characterization step in the ERA process compares exposure point contaminant concentrations with screening levels protective of ecological receptors, or contaminant doses with RTVs. Once this step is completed for this study, the results can be reviewed to determine whether little or no ecological risk is associated with activities at the sites or if additional information must be generated to verify that ecological receptors are at risk. Before conducting the comparisons described above, the maximum concentrations of inorganic contaminants at each site will be compared to two times the average concentrations in background samples. Inorganic COPCs that do not have maximum concentrations in excess of two times the background concentrations will be excluded from further consideration. This step is performed because concentrations of inorganics can be naturally high and not indicative of contaminant releases (USEPA 1996c).

The ratio of the exposure point contaminant concentration to the screening level is called the HQ, and is defined as shown below.

$$HQ_i = EPC_i / ESL_i$$

where

Hq_i = HQ for COPC "i" (unitless)
EPC_i = EPC for COPC "i" (µg/kg or mg/kg)
ESL_i = Ecological Screening Level for COPC "i" (µg/kg or mg/kg)

When the ratio of the EPC to its respective screening level exceeds 1.0, adverse impacts will be considered possible, and the COPC will be retained as a COC. The HQ value should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an EPC exceeds or is less than a screening level. When HQ values exceed 1.0, it is an indication that ecological receptors are potentially at risk; additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, however, especially since most screening levels are conservatively derived. Furthermore, other factors, such as low frequency of detection, may mitigate potential risks for a COC with an elevated HQ value. As a result of the conservatism inherent in most benchmark derivation, USEPA Region III (1994d) has suggested that HQs greater than 1.0 are indicative of low-to-moderate potential risk, HQs greater than 10 are indicative of moderate potential risk, and HQs greater than 100 are indicative of high potential risk.

The use of HQs is probably the most common method used for risk characterization in ERAs. Advantages of this method, according to Barnthouse et al. (1986), include the following:

- the HQ method is relatively easy to use, is generally accepted, and can be applied to any data and
- the method is useful when a large number of contaminants must be screened.

This method of risk characterization has some inherent limitations. One primary limitation is that it is a "no/maybe" method for relating toxicity to exposure. That is, it uses single values for exposure concentrations and benchmark values and does not account for the variability in both these parameters nor for incremental or cumulative toxicity. To address cumulative toxicity, HQs will summed for all contaminants with similar modes of action in a given medium to obtain an HI. Although similar to an HQ in that an HI value of 1.0 or greater indicates potential risk, the HI should be interpreted with caution. The HI value may exacerbate the preceding uncertainties in the assessment. For example, most of an HI value may be due to a single contaminant that has a high HQ but a low frequency of detection. Also, ecological toxicity is not necessarily additive, and modes of action for similar compounds may still differ. Multiple contaminants may have synergistic, and even ameliorating, effects.

The comparisons described above will be presented in site-specific screening tables to select COCs for each individual area assessment section. These screening tables will include the frequency of detection for each COPC, as well as the range of detections; EPC; and, as mentioned earlier, contaminant-specific screening levels and their sources. The HQ method will also be used for comparison of doses to RTV. HQ values will be summed for each exposure route for each contaminant to obtain an HI based on all exposure routes. Some contaminants may be present in some media for which no suitable screening values are available. In these instances these contaminants will be retained as COCs and qualitatively assessed to ensure a conservative assessment.

Potential risks to terrestrial receptors at sites that undergo toxicity testing will be characterized based on the following factors:

- presence or absence of analytes in surface soil samples;
- concentrations of analytes measured in surface soil samples;

- responses of earthworms in surface soil toxicity tests; and
- HIs calculated based on surface soil exposures to wildlife, plants, and invertebrates.

The samples for surface soil toxicity testing and chemical analysis will be collected concurrently and split for the two separate analyses; therefore, the chemical analyses results for the samples can be used to help interpret the contaminant exposures for the test species.

The ecological risk characterization section of the ERA report will also contain a discussion of visual observations of any ecosystem degradation or other symptoms of environmental stress observed during the qualitative ecological survey.

The results of all of the analyses discussed above will be used in a "weight-of-evidence" approach to assessing potential ecological risks. The results will indicate the nature of the potential risks at each site and identify data gaps that should be addressed in additional ecological investigations, if necessary.

5.2.5 Uncertainty Analyses

Uncertainties in all aspects of 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 screening-level ERA process that may influence the risk characterization results and assessment conclusions.

6.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW generated during Phase II-C RI/FS Work Plan investigation activities will be managed in accordance with the procedures described in the NAS Whiting Field *Revised Investigation-Derived Waste Management Plan* (ABB-ES 1996a). This document, which is included as Appendix D of this Work Plan, emphasizes management of all IDW in an environmentally responsible manner consistent with the CERCLA program, Resource Conservation and Recovery Act (RCRA) requirements, and the base's standard procedures. The objectives of the IDW management plan are

- management of IDW in a manner that prevents contamination of uncontaminated areas (by IDW) and that is protective of human health and the environment;
- minimization of IDW, thereby reducing costs and the potential for human or ecological exposure to contaminated materials; and
- compliance with federal and state requirements that are ARARs.

7.0 REMEDIAL INVESTIGATION REPORT

The draft RI report will be prepared in accordance with the guidance contained in *Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988a). The report will include appropriate sections concerning site background, investigation activities, physical characteristics, nature and extent of contamination, aquifer characterization, fate and transport, and risk evaluations (both human health and ecological assessments). Numerical modeling may be used to evaluate the nature and extent as well as the fate and transport of contaminants detected at Sites 3, 4, 30, 32, and 33. Probable conditions and reasonable deviations, as depicted in the current CSM, will be verified and/or revised and presented in the report. The suggested RI report format is presented in Table 7-1.

After internal review the draft RI report will be issued to the NAS Whiting Field Partnering Team for review. The final RI report will be issued upon incorporation of review comments.

TABLE 7-1

**REMEDIAL INVESTIGATION REPORT FORMAT
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
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Executive Summary

1.0 Introduction
- 1.1 Purpose of Report
- 1.2 Site Physical Description
  - 1.2.1 Site Description
  - 1.2.2 Site History
  - 1.23 Previous Investigations
- 1.3 Report Organization

2.0 Study Area Investigation
- 2.1 Includes field activities associated with site characterization. These may include physical and chemical monitoring of some, but not necessarily all, of the following.
  - 2.1.1 Surface Features (topographic mapping, etc.) natural and manmade features
  - 2.1.2 Contaminant Source Investigations
  - 2.1.3 Meteorological Investigations
  - 2.1.4 Surface Water and Sediment Investigations
  - 2.1.5 Geological Investigations
  - 2.1.6 Soil and Vadose Zone Investigations
  - 2.1.7 Groundwater Investigations
  - 2.1.8 Human Population Surveys
  - 2.1.9 Ecological Investigations
- 2.2 If technical memoranda documenting field activities were prepared, they may be included in an appendix and summarized in this report chapter.

3.0 Physical Characteristics of the Study Area
- 3.1 Includes results of field activities to determine physical characteristics. These may include some, but not necessarily all, of the following.
  - 3.1.1 Surface Features
  - 3.1.2 Meteorology
  - 3.1.3 Surface Water Hydrology
  - 3.1.4 Geology
  - 3.1.5 Soils
  - 3.1.6 Hydrogeology
  - 3.1.7 Demography and Land Use
  - 3.1.8 Ecology

TABLE 7-1

**REMEDIAL INVESTIGATION REPORT FORMAT
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
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4.0 Nature and Extent of Contamination
- 4.1 Presents results of site characterization, both natural chemical components and contaminants, in some, but not necessarily all, of the following media.
  - 4.1.1 Sources (lagoons, sludges, tanks, etc.)
  - 4.1.2 Soils and Vadose Zone
  - 4.1.3 Groundwater
  - 4.1.4 Surface Water and Sediments
  - 4.1.5 Air

5.0 Contaminant Fate and Transport
- 5.1 Potential Routes of Migration (i.e., air, groundwater, etc.)
- 5.2 Contaminant Persistence
  - 5.2.1 If they are applicable (i.e., for organic contaminants), describe estimated persistence in the study area environment and the physical, chemical, and/or biological factors of importance for the media of interest.
- 5.3 Contaminant Migration
  - 5.3.1 Discuss factors affecting contaminant migration for the media of importance (e.g., sorption on soils, solubility in water, movement of groundwater, etc.)
  - 5.3.2 Discuss modeling methods and results, if applicable

6.0 Baseline Risk Assessment
- 6.1 Human Health Evaluation
  - 6.1.1 Exposure Assessment
  - 6.1.2 Toxicity Assessment
  - 6.1.3 Risk Characterization
- 6.2 Environmental Evaluation

7.0 Summary and Conclusions
- 7.1 Summary
  - 7.1.1 Nature and Extent of Contamination
  - 7.1.2 Fate and Transport
  - 7.1.3 Risk Assessment
- 7.2 Conclusions
  - 7.2.1 Data Limitations and Recommendations for Future Work
  - 7.2.2 Recommended Remedial Action Objectives

Appendices

A - Technical Memoranda on Field Activities (if available)
B - Analytical Data and QA/QC Evaluation Results
C - Risk Assessment Methods

Source: U.S. Environmental Protection Agency's 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, EPA/540/G-89/004.

8.0 FOCUSED FEASIBILITY STUDY

The purpose of the Focused FS (FFS) is to evaluate and analyze remedial action alternatives to minimize or eliminate exposure to soil and groundwater contaminants at Sites 3, 4, and 32 and soil contaminants at Sites 30 and 33. The FFS will be streamlined to consider only "No Action" and presumptive-remedy remedial actions. The FFS report will include a summary of RI results for each medium, a summary of site risks, identification of ARARs, identification of RAOs and general response actions, and an analysis of presumptive remedial technologies and alternatives.

The approaches for screening remedial technologies, developing and screening remedial alternatives, and evaluating and analyzing alternatives in the FFS are presented in the following sections.

8.1 SCREENING OF TECHNOLOGIES AND REMEDIAL ALTERNATIVES

USEPA has reviewed and evaluated technologies that have consistently been selected for implementation at CERCLA sites. The presumptive remedies identified by USEPA for sites with VOCs in soils (USEPA 1993a) and contaminated groundwater (USEPA 1996a) will be considered for implementation at Sites 3, 4, 30, 32, and 33. The primary presumptive remedial technologies and process options that will be considered for Sites 3, 4, 30, 32, and 33 are listed in Table 8-1. Formal screening of other remedial technologies will not be performed unless data collected during the Phase II-C investigation indicate that site conditions differ from those assumed for the presumptive remedies.

Remedial alternatives will be assembled using the presumptive remedial technologies that address each response objective established for the site. In addition to the "No Action" alternative, which is required under CERCLA to establish a baseline for comparison of alternatives, a number of other alternatives may be developed that focus on source and plume containment of the VOCs and DNAPLs in the soil and groundwater. A brief description of the components of each alternative developed will be provided in the FFS report.

8.2 EVALUATION OF ALTERNATIVES

Remedial alternatives will be evaluated in the FFS to provide information that will help decision makers select an appropriate remedial action for Sites 30 and 33 (soil only) and Sites 3, 4, and 32 (soil and groundwater). The evaluation process will consist of (1) a detailed description of the alternative's

TABLE 8-1

PRESUMPTIVE REMEDIAL ACTIONS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
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Environmental Media	Presumptive Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Soil	No Action			No Action	Required by NCP to be carried through detailed analyses of alternatives for soil usage.
	Treatment	Soil Vapor Extraction	In Situ	A vacuum would be applied to wells screened in the contaminated zone to extract VOCs. Passive (barometic) or active (blower) vapor extraction could be used to extract VOCs.	Potentially viable.
		Thermal Desorption	Ex Situ	Contaminated soil would be excavated and transported off site for thermal desorption to remove the VOCs.	Potentially viable for near-surface soil.
		Incineration	Ex Situ	Contaminated soil would be excavated and transported off site for incineration to destroy VOCs.	Potentially viable for near-surface soil.
Groundwater	No Action			No Action.	Required by NCP to be carried through detailed analyses of alternatives for groundwater usage.
	Source Containment (DNAPLs)	Collection	Extraction Wells	A series of wells would be installed to extract free-phase DNAPLs.	Potentially viable. Source of free-phase DNAPLs would have to be identified.
	Plume Containment/ Restoration	Collection	Extraction Wells	A series of wells would be installed to extract contaminated groundwater.	Potentially viable. Might include wells in the plume to extract contaminated groundwater for treatment as well as downgradient wells to prevent migration of contaminated groundwater.
		In Situ Bioremediation	Natural Attenuation	Biodegradation, dispersion, dilution, and adsorption of contaminants in groundwater by natural processes would occur.	Potentially viable.
	Treatment	Biological Treatment	Aerobic	Aerobic microbes would be used to biodegrade organic waste.	Potentially viable for organics. Sludge produced.

TABLE 8-1

PRESUMPTIVE REMEDIAL ACTIONS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

Environmental Media	Presumptive Response Actions	Remedial Technologies	Process Options	Description	Evaluation Comments
Groundwater	Treatment (continued)	Biological Treatment	Anaerobic	Anaerobic microbes would be used to biodegrade organic wastes.	Potentially viable for organics. Sludge produced.
		Chemical Treatment	Chemical Oxidation	Oxidizing agents would be added to waste for oxidation of organics, sulfides, phenolics, and aromatic hydrocarbons to less toxic oxidation states.	Potentially viable.
			Enhanced Oxidation	Destruction of organic contaminants would be accomplished using oxidizing agents enhanced with, for example, ultraviolet light.	Potentially viable.
		Physical Treatment	GAC Adsorption	Contaminated water would be passed through a bed of adsorbent material so contaminants would adsorb on the surface.	Potentially viable.
			Air Stripping	Large volumes of air would be mixed with water in a packed column or through diffused aeration to promote the transfer of VOCs from liquid to air.	Potentially viable.
			Sedimentation	Suspended particles would be settled out as a pretreatment or primary treatment step.	Potentially viable.
			Filtration	Process would be used to filter out suspended particles. Might be preceded by a coagulation-and-flocculation step to increase the effectiveness of sand filtration.	Potentially viable.
	Disposal	Off-Site Discharge	POTW	Extracted groundwater would be discharged to the local POTW for further treatment.	Potentially viable. Would require extensive negotiations with POTW.
		On-Site Discharge	Surface Water Discharge	Treated effluent would be discharged to an adjacent surface water body. A federal and state NPDES permit would probably be required.	Potentially viable.

Source: U.S. Environmental Protection Agency's *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils* (EPA 540/F-93/048) and *Final Guidance: Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water of CERCLA Sites* (EPA 540/R-96/023)

Notes: DNAPL – Dense, nonaqueous-phase liquid
GAC – Granular activated carbon
NCP – National Oil and Hazardous Substances Contingency Plan
NPDES – National Pollutant Discharge Elimination System
POTW – Publicly owned treatment works
VOC – Volatile organic compound

components, sufficient to support a conceptual design and a cost estimate accurate to +50/-30 percent; (2) an evaluation of each alternative against seven of USEPA's nine evaluation criteria (40 CFR Part 300) (state and community acceptance will be addressed in the Proposed Plan and ROD); and (3) a comparison of the alternatives relative to one another, with respect to the evaluation criteria.

Where appropriate, the description of alternatives may present preliminary design calculations, process flow diagrams, sizing of key components, and preliminary layouts and cross sections. The description may also include a discussion of limitations, assumptions, and uncertainties associated with each alternative.

The seven criteria that will be used to evaluate each alternative are described below.

Overall protection of human health and the environment considers how risks identified in the CSM are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs identifies how the alternative meets the federal and state requirements regulating the chemical constituents, location of the site, and type of action to be implemented.

Long-term effectiveness and permanence considers the integrity of the system or component over time, long-term management of waste, and magnitude of risk associated with the waste's remaining in place.

Reduction of toxicity, mobility, or volume through treatment does not apply to the containment or other nontreatment components, but does apply to treatment components for "hot spots," groundwater, leachate, sediment, or landfill gas. This criterion considers the amount of material destroyed or treated and the degree of expected contaminant reduction. It also includes an evaluation of the irreversibility of the treatment technology.

Short-term effectiveness considers the impact on the surrounding community during construction and operation of the alternative. It also evaluates the amount of time required to achieve the response objectives.

Implementability includes several factors such as technical feasibility (i.e., the ability to construct and operate the alternative, the reliability of the technology, and the ability to monitor the effectiveness of the remedy); availability of materials and services; and administrative feasibility (i.e., the ease or difficulty of coordinating with or obtaining approvals from other agencies as well as the enforceability of deed restrictions).

Cost includes a line-item cost estimate for construction as well as operation and maintenance costs and a total-present-worth cost for the purpose of comparison with other alternatives. These cost estimates may be presented as a range of values with an accuracy of +50/-30 percent. The cost estimates will include a reasonable contingency factor to cover details and unforeseen circumstances. The estimates may be suitable for budgeting, but should not be considered the final construction cost estimates for the remedial action.

The comparative analysis of alternatives highlights the relative advantages and disadvantages of the alternatives for each of the seven evaluation criteria. This analysis will be presented as a written discussion for each alternative and will be summarized in tabular format for ease of comparison.

8.3 FINAL FOCUSED FEASIBILITY STUDY

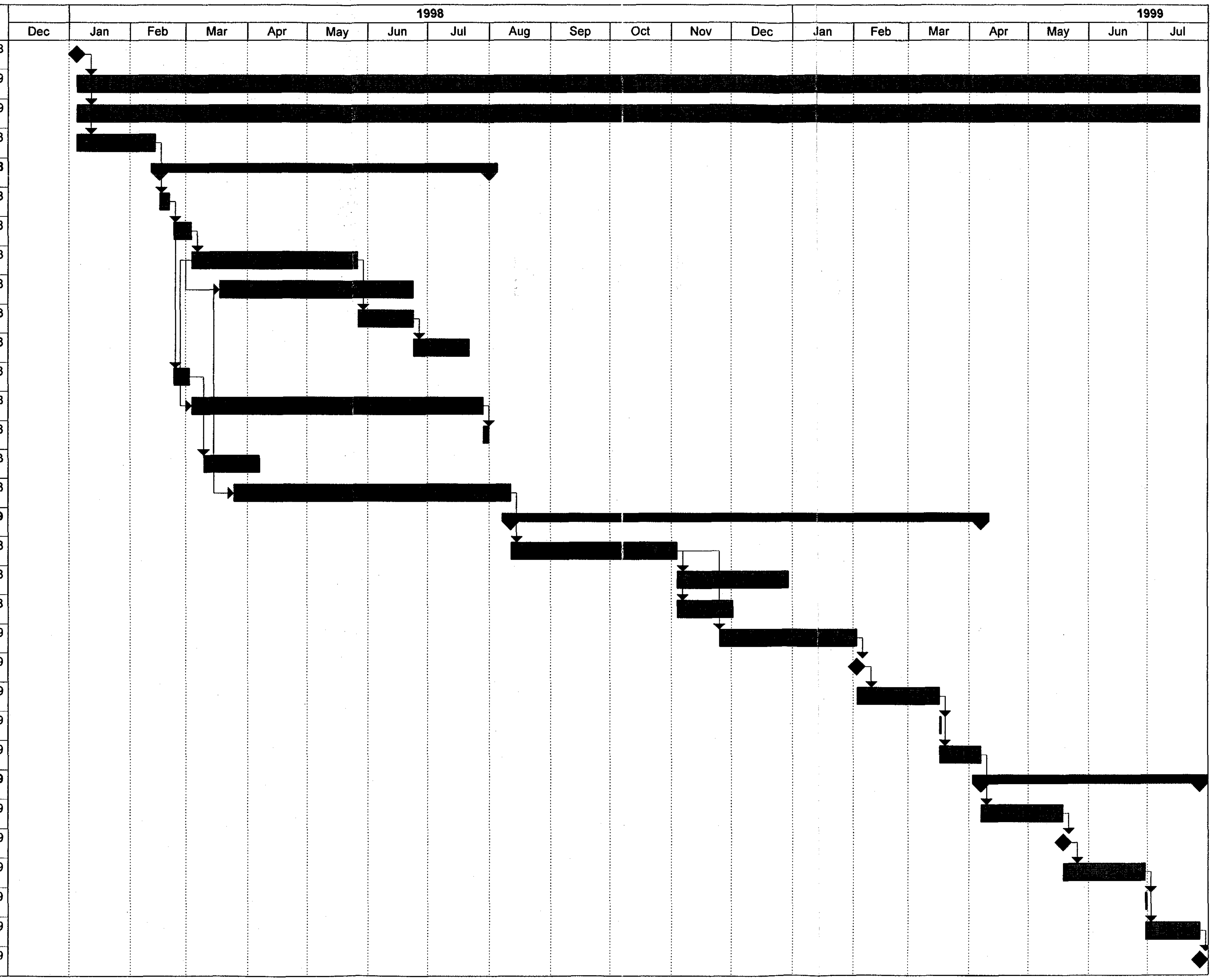
The final FFS will be signed, sealed, and dated by the Florida Registered Professional Engineer responsible for its preparation.

9.0 PROJECT SCHEDULE

The anticipated schedule for all major RI/FS Phase II-C Work Plan tasks is presented in Figure 9-1. This schedule is based on assumed site conditions and will be updated monthly to reflect actual progress during the project. The estimated start and finish dates as well as the duration of each task, in working days, are shown on the project schedule.

FIGURE 9-1
PROJECT SCHEDULE
RI/FS PHASE II-C WORK PLAN, NAS WHITING FIELD - MILTON, FLORIDA

ID	Task Name	Duration	Start	Finish
1	Notice to Proceed	0d	1/5/98	1/5/98
2	Project Management	407d	1/5/98	7/27/99
3	Community Relations	407d	1/5/98	7/27/99
4	Subcontractor Procurement	30d	1/5/98	2/13/98
5	**Field Activities**	**120d**	**2/16/98**	**7/31/98**
6	Mobilization	5d	2/16/98	2/20/98
7	Well/Boring Layout and Clearance	7d	2/23/98	3/3/98
8	Monitoring Well Installation/Development	60d	3/4/98	5/26/98
9	Groundwater Sampling	70d	3/18/98	6/23/98
10	Soil Boring Installation	20d	5/27/98	6/23/98
11	Survey Wells/Borings	20d	6/24/98	7/21/98
12	Ecological Survey/Sampling	6d	2/23/98	3/2/98
13	IDW Management	105d	3/4/98	7/28/98
14	Demobilization	3d	7/29/98	7/31/98
15	Ecological Analyses	20d	3/10/98	4/6/98
16	Chemical Analyses	100d	3/25/98	8/11/98
17	**Remedial Investigation (RI) Report**	**170d**	**8/12/98**	**4/6/99**
18	Data Validation	60d	8/12/98	11/3/98
19	Human Health Risk Assessment	40d	11/4/98	12/29/98
20	Ecological Risk Assessment	20d	11/4/98	12/1/98
21	Draft RI Report	50d	11/25/98	2/2/99
22	Submission of Draft RI Report to Navy	0d	2/2/99	2/2/99
23	Regulatory Review	30d	2/3/99	3/16/99
24	Draft RI Comment/Response Meeting	1d	3/17/99	3/17/99
25	Final RI Report	15d	3/17/99	4/6/99
26	**Focused Feasibility Study (FFS)**	**80d**	**4/7/99**	**7/27/99**
27	Draft FFS	30d	4/7/99	5/18/99
28	Submission of Draft FFS to Navy	0d	5/18/99	5/18/99
29	Regulatory Review	30d	5/19/99	6/29/99
30	Draft FFS Comment/Response Meeting	1d	6/30/99	6/30/99
31	Final FFS	20d	6/30/99	7/27/99
32	Project Completion	0d	7/27/99	7/27/99



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APPENDIX A

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS RI/FS PHASE II-C WORK PLAN FOR SITES 3, 4, 30, 32, AND 33 NAS WHITING FIELD MILTON, FLORIDA

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQs) [40 Code of Federal Regulations (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.	Action-specific	NAAQs are potential relevant and appropriate requirements for cleanup activities. The principal application of these standards is during remedial activities resulting in exposures through dust and vapors.
Clean Water Act (CWA) Regulations, National Pollutant Discharge Elimination System (NPDES) (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.	Action-specific	Discharge during remedial activities to surface waters may require that an NPDES permit be obtained and that both the substantive and administrative NPDES requirements be met.
CWA Regulations, 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 nondomestic sources into publicly owned treatment works (POTWs) to control pollutants that pass through, cause interference with, or are otherwise incompatible with treatment processes at a POTW.	Action-specific	If groundwater is discharged to a POTW, the discharge must meet local limits imposed by the POTW. A discharge from a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site must meet the POTW's pretreatment standards in the effluent to the POTW. Discharge to a POTW is considered an off-site activity and is, therefore, subject to both the substantive and administrative requirements of this rule.
CWA Regulations, Toxic Pollutant Effluent Standards (40 CFR Part 129)	Regulates the concentration of a toxic pollutant in navigable waters that shall not result in adverse impacts to aquatic life or to consumers of aquatic life.	Chemical-specific	This rule is a potential applicable or relevant and appropriate requirement (ARAR) for sites that may discharge regulated pollutants to surface water. These standards may be incorporated into NPDES permits where applicable for off-site discharge of surface water.
Occupational Safety and Health Act (OSHA) Regulations, General Industry Standards (29 CFR Part 1910)	Requires establishment of programs including employee training requirements to ensure worker health and safety at hazardous waste sites.	Action-specific	Under 40 CFR Part 300.38, requirements apply to all response activities under the National Oil and Hazardous Substances Contingency Plan.
OSHA Regulations (29 CFR Part 1910, Subpart Z)	Establishes permissible exposure limits for workplace exposure to a specific list of chemicals.	Chemical-specific	These standards are applicable for worker exposure to OSHA hazardous chemicals during remediation activities.
OSHA Regulations, Recordkeeping, Reporting, and Related Regulations (29 CFR Part 1904)	Provides recordkeeping and reporting requirements applicable to remediation activities.	Action-specific	These requirements apply to all site contractors and subcontractors and must be followed during all site work.

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
OSHA Regulations, 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.	Action-specific	All phases of the remedial response project should be executed in compliance with these regulations.
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Waste (40 CFR Part 261)	Defines those solid wastes that are subject to regulation as hazardous wastes under 40 CFR Parts 262–265.	Action-specific	These requirements define RCRA–regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into the characterization and remediation elements of remedial response projects.
RCRA Regulations, Contingency Plan and Emergency Procedures (40 CFR Part 264, Subpart D)	Outlines requirements for emergency procedures to be used following explosions, fires, etc.	Action-specific	These requirements are relevant and appropriate for remedial actions involving the management of hazardous waste.
RCRA Regulations, Use and Management of Containers (40 CFR Part 264, Subpart I)	Sets standards for the storage of containers of hazardous waste.	Action-specific	This requirement applies if a remedial alternative involves the storage of containers of RCRA hazardous waste. Additionally, the staging of study-generated RCRA wastes should meet the intent of the regulation.
RCRA Regulations, Land Disposal Restrictions (LDRs) (40 CFR Part 268)	Establishes restrictions on land disposal of untreated hazardous wastes and provides treatment standards for hazardous wastes.	Action-specific	Under the LDRs, treatment standards have been established for all listed wastes. If it is determined that hazardous wastes are considered subject to LDRs, the material must be handled and treated in compliance with these regulations. Universal Treatment Standards (UTSs) for organic constituents of hazardous wastes have been promulgated under this rule. The UTSs became effective on December 19, 1994.
Safe Drinking Water Act (SDWA) Regulations, Maximum Contaminant 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.	Chemical-specific	MCLGs greater than zero are relevant and appropriate standards for groundwater or surface waters that are current or potential sources of drinking water.
SDWA Regulations, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) (40 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 MCLGs, available treatment technologies, and cost data.	Chemical-specific	MCLs established by the SDWA are relevant and appropriate standards where the MCLGs are not determined to be ARARs. MCLs apply to groundwater or surface waters that are current or potential drinking water sources.

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS RI/FS PHASE II-C WORK PLAN FOR SITES 3, 4, 30, 32, AND 33 NAS WHITING FIELD MILTON, FLORIDA

Federal Standards and Requirements	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
SDWA Regulations, National Secondary Drinking Water Standards (SMLCs) (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.	Chemical-specific	SMCLs are nonenforceable limits intended as guidelines for use by states in regulating water supplies.
Toxic Substance Control Act Polychlorinated Biphenyl (PCB) Requirements (40 CFR 761)	Establishes criteria for the cleanup of PCBs.	Chemical-specific; location-specific	These requirements may be relevant and appropriate for sites contaminated with PCBs.
U.S. Environmental Protection Agency (USEPA) Region III Soil Risk-Based Concentrations (RBCs) (USEPA Region III Office of RCRA, Technical Memo, June 1996)	Establishes health-based screening criteria for chemicals of concern in soils.	Chemical-specific; guidance to be considered (TBC)	These guidelines are used in the screening process to determine chemicals of potential concern.

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TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

State Citations*	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-2, Florida Administrative Code (FAC), Florida Air Pollution Rules, October 1992	Establishes permitting requirements for owners or operators of any source that emits any air pollutant. This rules also establishes ambient air quality standards for sulfur dioxide, PM_{10}, carbon monoxide, and ozone.	Action-specific	Where remedial action could result in release of regulated contaminants to the atmosphere, such as may occur during air stripping, this regulation would be a potential ARAR.
Chapter 62-4, FAC, Florida Rules on Permits, February 1994	Establishes procedures for obtaining permits for sources of pollution.	Action-specific	The substantive permitting requirements must be met during a CERCLA remediation. Both substantive and administrative requirements must be met for non–CERCLA activities.
Chapter 62-302, FAC, Florida Surface Water Standards, August 1994	Defines classifications of surface waters and establishes water quality standards (WQSs) for surface water within the classifications. The state's antidegradation policy is also established in this rule.	Chemical-specific; location-specific	Remedial actions that potentially impact surface waters of the state will consider surface WQSs. WQSs may also be relevant and appropriate ARARs for groundwater if no MCL exists, groundwater discharges to surface water and contaminants are affecting aquatic organisms, or other health-based standards are not available.
Chapter 62-520, FAC, Florida Water Quality Standards, April 1994	Establishes the groundwater classification system for the state and provides qualitative minimum criteria for groundwater based on the classification.	Chemical-specific; location-specific	Drinking water standards are established in Rule 62-550 for current or potential sources of potable water. The classification system established in this rule defines potable water sources (F-I, G-I, and G-II waters).
Chapter 62-522, FAC, Groundwater Permitting and Monitoring Requirements, April 1994	Establishes permitting and monitoring requirements for installations discharging to groundwater.	Action-specific	This rule should be considered when discharge to groundwater is a possible remedial action.
Chapter 62-532, FAC, Florida Water Well Permitting and Construction Requirements, March 1992	Establishes the minimum standards for the location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established.	Action-specific	The substantive requirements for permitting may be potential ARARs for remedial actions involving the construction, repair, or abandonment of monitoring, extraction, or injection wells.
Chapter 62-550, FAC, Florida Drinking Water Standards, September 1994	Implements the federal SDWA by adopting the national primary and secondary drinking water standards and by creating additional rules to fulfill state and federal requirements.	Chemical-specific; location-specific	MCLs are commonly considered applicable regulations for aquifers and related groundwater classified as a current or potential potable water supply source. MCLs should be considered ARARs during a cleanup of groundwater or surface waters that are current or potential sources of drinking water.

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

State Citations*	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-650, FAC, Florida Water Quality-Based Effluent Limitations, November 1989	States that all activities and discharges, except dredge and fill, must meet effluent limitations based on technology or water quality.	Chemical-specific; action-specific	All activities and discharges, other than dredge and fill activities, are required to meet effluent limitations based on technology (technology-based effluent limit) and/or water quality (water-quality-based effluent limit), as defined in this rule. The substantive permitting requirement established in this rule may be potentially relevant and appropriate ARARs for remedial actions where treated water is discharged to a surface water body.
Chapter 62-660, FAC, Florida Industrial Wastewater Facilities Regulations, May 1994	Sets minimum treatment standards for effluent based on water quality considerations and technology. Also establishes general permit requirements for four specific operations.	Action-specific	This rule may be a potentially relevant and appropriate ARAR for remedial actions that involve discharge of treated water to surface waters of the state if surface water standards are either not available or are not sufficiently protective.
Chapter 62-730, FAC, Florida Hazardous Waste Rules, October 1993	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.	Action-specific	The substantive permitting requirements for hazardous waste must be met where applicable for remedial actions.
Chapter 62-736, FAC, Florida Rules on Hazardous Waste Warning Signs, July 1991	Requires warning signs at National Priority List (NPL) and Florida Department of Environmental Protection (FDEP)–identified hazardous waste sites to inform the public of the presence of potentially harmful conditions.	Action-specific	This requirement is applicable for sites that are on the NPL or that have been identified by the FDEP as potentially harmful.
Chapter 62-775, FAC, Florida Soil Thermal Treatment Facilities Regulations, November 1992	Establishes criteria for the thermal treatment of petroleum- or petroleum-product-contaminated soils. The rule further outlines procedures for excavating, receiving, handling, and stockpiling contaminated soils before thermal treatment in both stationary and mobile facilities.	Chemical-specific; action-specific	The soil cleanup values established in this rule for total recoverable petroleum hydrocarbons; volatile hydrocarbons; metals; and benzene, toluene, ethylbenzene, and xylenes may be potentially relevant and appropriate ARARs for contaminated soils. This requirement does not apply to soils classified as hazardous. Procedures for excavating, receiving, handling, and stockpiling contaminated soils before thermal treatment are ARARs for remedial alternatives involving thermal treatment of soils.

TABLE A-1

SUMMARY OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
RI/FS PHASE II-C WORK PLAN FOR
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

State Citations*	Requirements Synopsis	ARAR Type	Consideration in the Remedial Response Process
Chapter 62-770, FAC, Florida Petroleum Contamination Cleanup Criteria, September 1996	Establishes criteria for determining cleanup goals for petroleum-contaminated soil and water.	Chemical-specific; location-specific	The soil and groundwater cleanup criteria established in this rule are potential ARARs for sites with petroleum contamination.
Memorandum: Soil Cleanup Goals for Florida, dated September 29, 1995	Establishes the guidelines for determining cleanup goals. Establishment of cleanup goals is based on residential, industrial, or leaching considerations.	Chemical-specific; TBC	The soil cleanup goals for Florida are guidelines not legislatively mandated by the State of Florida. Soil cleanup goals in the guidance document are based on human toxicity using generalized exposure assumptions.
Chapter 40A-3, FAC, Regulation of Well, Northwest Florida Water Management District	Establishes well permitting regulations in the Northwest Florida Water Management District.	Action-specific; location-specific	Well permitting rules and regulations must be considered before installing wells.

* Date following the state citation is either the date originally promulgated or the date of the most recent amendment.

APPENDIX B

FIELD INVESTIGATION STANDARD OPERATING PROCEDURES

APPENDIX B-1

MEMORANDUM REGARDING TECHNICAL APPROACH FOR GROUNDWATER SAMPLING AT NAS WHITING FIELD

MEMORANDUM

Date: **July 14, 1995**

To: **Jeff Adams - SOUTHDIV**

From: **Gerry Walker - ABB-ES**

Subject: **Discussion of Technical Approach For Groundwater Sampling At NAS Whiting Field**

C.C. Terry Hansen - ABB-ES
Jim Holland - NAS Whiting Field PWD

As per your request the following presents the proposed groundwater sampling methodology to be used during future sampling events at NAS Whiting Field. Previous comments received from regulators on this and other projects have indicated a concern for turbid groundwater samples and methods to control turbidity. Turbid samples have previously been collected at during sampling operations at NAS Whiting Field. To address this concern the following sampling procedure is proposed:

1. The purging of monitoring wells will be completed using a Redi-Flo2®, variable speed submersible pump. The pump will be placed at the top of the water column and the water level in the wells will be monitored during purging operations so that the pump may be lowered as draw down occurs. Three to five well volumes will be purged and physical parameters including: pH, specific conductance, temperature, dissolved oxygen, and turbidity. The monitoring well will be purged until either the physical parameters stabilize (within 5%) or until five well volumes are removed. No more than five well volumes will be removed during purging operations so as not to overpurge the well.

2. Following well purging operations a groundwater sample will be collected using a teflon bailer. The bailer will be slowly inserted in the well so as to limit turbidity and the first bailer volume retrieved will be analyzed for total inorganic parameters. In addition a turbidity measurement will be completed on the initial bailer sample volume and if the turbidity measurement exceeds ~~5~~ 10 NTU a second sample for dissolved inorganic parameters (filtered through a 0.45 micron filter). The data collected from the separate analyses will be used in the risk assessment process to evaluate the risk posed to human and ecological receptors. The data will be used as follows:

   - The unfiltered data will be used in the initial calculations of the baseline risk assessment thereby presenting a conservative approach to quantifying the risk posed by the inorganic parameters. Because it is known that the concentrations of inorganic parameters will be over represented if any turbidity is present, and if the risk posed by the turbid unfiltered samples is acceptable, than all parties can be confident that the conclusions reached are conservative and protective of human health and the environment.

   - However if the risk assessment indicates that the unfiltered data represents that an unacceptable risk is present, the dissolved or filtered data and turbidity measurements collected during sampling operations will be incorporated into the risk assessment and a second less conservative evaluation of the data will be completed. This second less conservative evaluation may be more representative of the non-turbid water consumed by the general public.

3. Following the collection of the sample portion for inorganic parameter analysis, sample portions will b=e collected for the remaining analyses including VOCs, SVOCs, Pesticides and PCBs and secondary water quality parameter analyses.

APPENDIX B-2

BROWN & ROOT ENVIRONMENTAL FIELD FORMS

BORING LOG

PROJECT NAME: ______________________ BORING NUMBER: ______________
PROJECT NUMBER: ______________________ DATE: ______________
DRILLING COMPANY: ______________________ GEOLOGIST: ______________
DRILLING RIG: ______________________ DRILLER: ______________

					MATERIAL DESCRIPTION					PID/FID Reading (p		
Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	Sample	Sampler BZ	Borehole**

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: ______________________________________

Drilling Area Background (ppm): [ ]

Converted to Well: Yes ______ No ______ Well I.D. #: ______________

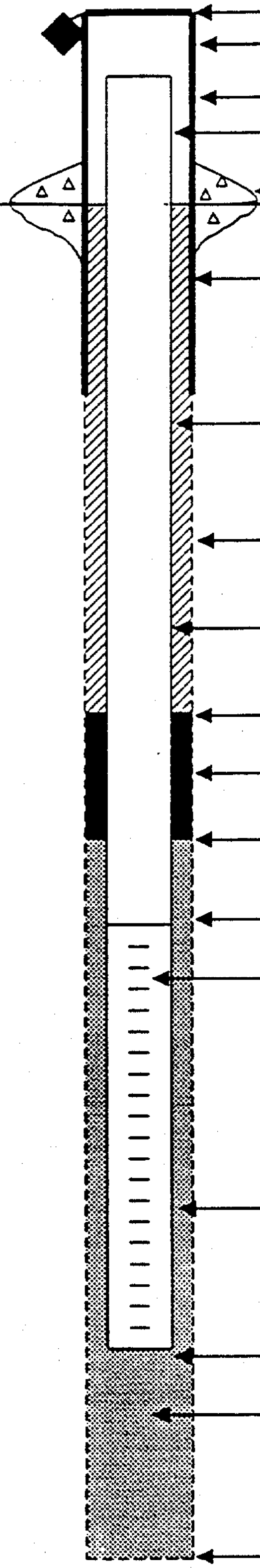
BORING NO.: ______

OVERBURDEN
MONITORING WELL SHEET

PROJECT ______ LOCATION ______
PROJECT NO. ______ BORING ______
ELEVATION ______ DATE ______
FIELD GEOLOGIST ______

DRILLER ______
DRILLING METHOD ______
DEVELOPMENT METHOD ______

GROUND ELEVATION



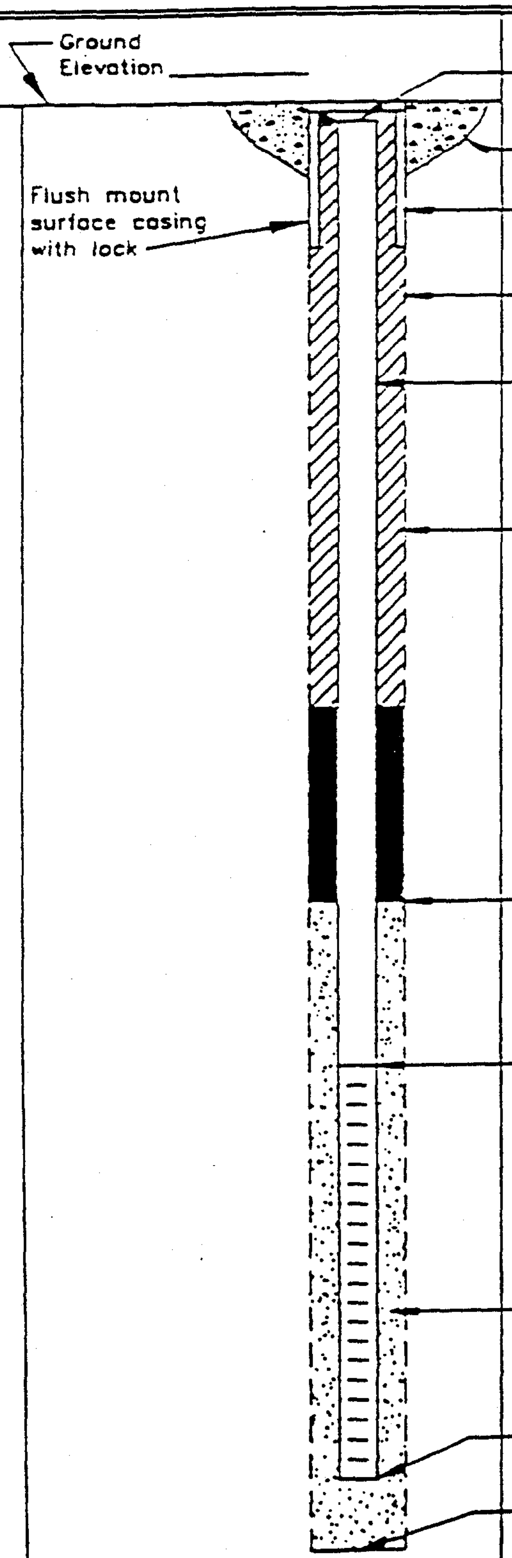
ELEVATION OF TOP OF SURFACE CASING : ______
ELEVATION OF TOP OF RISER PIPE: ______
STICK - UP TOP OF SURFACE CASING: ______
STICK - UP RISER PIPE : ______
TYPE OF SURFACE SEAL: ______
I.D. OF SURFACE CASING: ______
TYPE OF SURFACE CASING: ______
RISER PIPE I.D. ______
TYPE OF RISER PIPE: ______
BOREHOLE DIAMETER: ______
TYPE OF BACKFILL: ______
ELEVATION / DEPTH TOP OF SEAL: ____/____
TYPE OF SEAL: ______
DEPTH TOP OF SAND PACK: ______
ELEVATION / DEPTH TOP OF SCREEN: ____/____
TYPE OF SCREEN: ______
SLOT SIZE x LENGTH: ______
I.D. OF SCREEN: ______
TYPE OF SAND PACK: ______
ELEVATION / DEPTH BOTTOM OF SCREEN: ____/____
ELEVATION / DEPTH BOTTOM OF SAND PACK: ____/____
TYPE OF BACKFILL BELOW OBSERVATION WELL: ______
ELEVATION / DEPTH OF HOLE: ____/____

BORING NO.: ________

MONITORING WELL SHEET

PROJECT ________ LOCATION ________
PROJECT NO. ________ BORING ________
ELEVATION ________ DATE ________
FIELD GEOLOGIST ________

DRILLER ________
DRILLING METHOD ________
DEVELOPMENT METHOD ________



ELEVATION TOP OF RISER: ________

TYPE OF SURFACE SEAL: ________

TYPE OF PROTECTIVE CASING: ________

I.D. OF PROTECTIVE CASING: ________

DIAMETER OF HOLE: ________

TYPE OF RISER PIPE: ________

RISER PIPE I.D.: ________

TYPE OF BACKFILL/SEAL: ________

____

DEPTH/ELEVATION TOP OF SAND: ____/____

DEPTH/ELEVATION TOP OF SCREEN: ____/____

TYPE OF SCREEN: ________

SLOT SIZE x LENGTH: ________

TYPE OF SAND PACK: ________

DIAMETER OF HOLE IN BEDROCK: ________

DEPTH/ELEVATION BOTTOM OF SCREEN: ____/____

DEPTH/ELEVATION BOTTOM OF SAND: ____/____

DEPTH/ELEVATION BOTTOM OF HOLE: ____/____

BACKFILL MATERIAL BELOW SAND: ________

HYDRAULIC CONDUCTIVITY TESTING DATA SHEE

PROJECT NAME: .... WELL/BORING NO.: ....

PROJECT NO.: .... GEOLOGIST: ....

WELL DIAMETER: .... SCREEN LENGTH/DEPTH: .... TEST NO.: ....

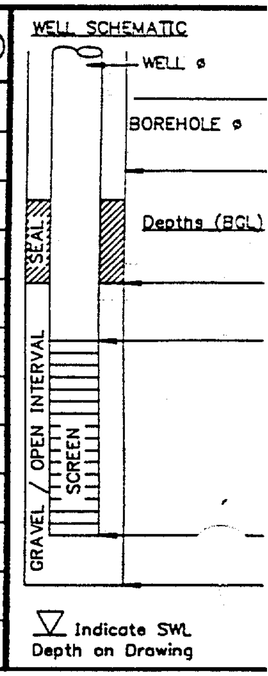
STATIC WATER LEVEL (Depth/Elevation): .... DATE: ....

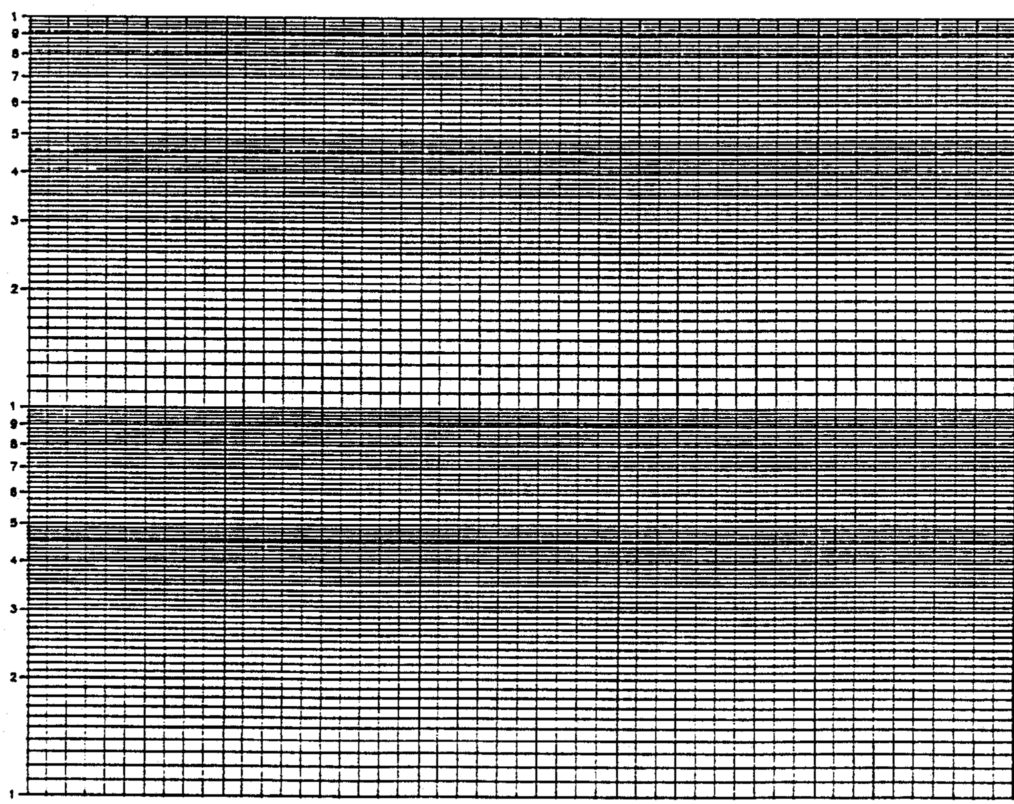
TEST TYPE (Rising/Falling/Constant Head): .... CHECKED: ....

METHOD OF INDUCING WATER LEVEL CHANGE: .... PAGE ..... OF ....

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): ....

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)





REMARKS:

....

....

....

....

....

....

....

CALCS, SKETCH MAPS, ETC.:

Brown & Root Environmental

WELL DEVELOPMENT SHEET

PROJECT NAME: ____________________
SITE/LOCATION: ____________________
PROJECT NUMBER: ____________________
MEASURING DEVICE: ____________________
PERSONNEL: ____________________
ADJUSTMENT FACTOR: ____________________
WEATHER: ____________________
DATE: ____________________
REMARKS: ____________________
WELL NO.: ____________________

☐ Domestic Well ☐ Monitoring Well
☐ Other Well ____________________

Static Water Level: ____________________
Total Depth: ____________________
One Casing Volume: ____________________

Method: ____________________
Start Time: ____________________
Complete Time: ____________________

Approx Volume	Time	pH	Temp (oC)	Turbidity	Color	Specific Conductance	Disolved Oxygen

NOTE: All measurements to nearest 0.01 foot measured from top of well riser pipe unless otherwise noted

Additional Comments: ____________________

Signature: ____________________

Page ______ of ______

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: ______________________________ WELL I.D.: ______________________________

PROJECT NUMBER: ______________________________ DATE: ______________________________

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments

SIGNATURE(S) ______________________________ PAGE __ of __

GROUNDWATER

SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: ____________________

Project No.: ____________________

- ☐ Domestic Well Data
- ☐ Monitoring Well Data
- ☐ Other Well Type: ____________________
- ☐ QA Sample Type: ____________________

Sample ID No.: ____________________

Sample Location: ____________________

Sampled By: ____________________

C.O.C. No.: ____________________

Sampling Data

	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD
Date: ______ Time: ______ Method: ______								

Purge Data

	Volume	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD
Date: ______ Method: ______	Initial							
Monitor Reading (ppm):	1							
Well Casing Dia. & Material Type:	2							
	3							
Total Well Depth (TD):	4							
Static Water Level (WL):	5							
TD-WL (ft.) =								
One Casing Volume: (gal/L)								
Start Purge (hrs.):								
End Purge (hrs.):								
Total Purge Time (min):								
Total Amount Purged (gal/L):								

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle if Applicable:

MS/MSD	Duplicate ID No:

Signature(s):

TBD: To Be Determined

SINGLE SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: ____________________

Project No.: ____________________

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Other ________
- ☐ QA Sample Type: __________

Sample ID No.: ____________________

Sample Location: ____________________

Sampled By: ____________________

C.O.C. No.: ____________________

	Composite Sample Data		
Sample Method:	Sample	Time	Color/Description
Depth Sampled:			
Sample Date and Time:			
Type of Sample ☐ Grab ☐ Composite ☐ Grab-Composite ☐ High Concentration ☐ Low Concentration			
	Grab Sample Data		
	Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)	

Analysis	Container Requirements	Collected (✓)	Map:

Observations/Notes:

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No:	

Brown & Root Environmental

MULTIPLE SAMPLE LOG SHEET

PAGE ___ OF ___

- ☐ SURFACE SOIL
- ☐ SUBSURFACE SOIL
- ☐ SEDIMENT
- ☐ LAGOON/POND
- ☐ OTHER

SAMPLER(S) SIGNATURE ____________________

PROJECT NAME: ____________________

PROJECT NUMBER: ____________________

AREA DESIGNATION ____________________

Sample No.	SAMPLE METHOD	DEPTH (FT)	DATE	TIME	SAMPLED BY	CONCENTRATION (L)LOW (H)HIGH	(G)GRAB (C)COMPOSITE	ANALYSES							No. OF CONT. TOTAL	SOIL DESCRIPTION

REMARKS:

LAB:

COC NO:

ACAD: C:\FORMS\SAMPLOG.DWG 02/17/95 ID

CHAIN OF CUSTODY RECORD

PROJECT NO.:	SITE NAME:
SAMPLERS (SIGNATURE):	

STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CON- TAINERS								REMARKS

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY(SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS:	

Order No. 70440

GROUNDWATER LEVEL MEASUREMENT SHEET

Page ___ of ___

PROJECT NAME: ______________________
PROJECT NUMBER: ______________________
PERSONNEL: ______________________
DATE: ______________________
WEATHER CONDITIONS: ______________________

LOCATION: ______________________
MEASURING DEVICE: ______________________
ADJUSTMENT FACTOR: ______________________
REMARKS: ______________________

Well or Piezometer Number	Time	Elevation of Reference Point (Feet)*	Water Level Indicator Reading (Feet)*	Groundwater Elevation (Feet)*	Comments

*Measurements to nearest 0.01 foot.

Signature(s): ______________________

Brown & Root Environmental

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME / MODEL : ____________________

JOB NAME : ________________

MANUFACTURER : ____________________

JOB NUMBER : ________________

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

DAILY ACTIVITIES RECORD

PROJECT NAME: ______________________ **PROJECT NUMBER:** ____________

CLIENT: ______________________ **LOCATION:** ____________

DATE: ______________________ **ARRIVAL TIME:** ____________

B&RE PERSONNEL: ______________________ **DEPARTURE TIME:** ____________

CONTRACTOR: ______________________ **DRILLER:** ____________

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: ______________________

APPROVED BY:

______________________ ______________________

B&RE REPRESENTATIVE DRILLER

DATE: ____________

Brown & Root Environmental

TASK MODIFICATION REQUEST FORM

Client Identification	Project Number	Task Mod. No.
To	Location	Date

Description: ______________________________

Reason For Change: ______________________________

Recommended Disposition: ______________________________

Field Operations Leader (Signature) ______________ Date ______________

Disposition: ______________________________

Project Manager (Signature) ______________ Date ______________

Distribution:
Program Manager -
Quality Assurance Officer -
Project Manager -
Field Operations Leader -

Others: ______________________________

APPENDIX B-3

ENVIRONMENTAL SAMPLE IDENTIFICATION
BROWN & ROOT ENVIRONMENTAL SOP CT-04

BROWN & ROOT ENVIRONMENTAL	STANDARD OPERATING PROCEDURES	Number: CT-04	Page: 1 of 6
		Effective Date: 03/01/96	Revision: 0
		Applicability: B&R Environmental, NE	
		Prepared: Risk Assessment Department	
Subject: SAMPLE NOMENCLATURE		Approved: D. Senovich	

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this document is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix.
- Sorting of data by depth.
- Maintenance of consistency (field, laboratory, and data base sample numbers).
- Accommodation of all project-specific requirements on a global basis.
- Accommodation of laboratory sample number length constraints (10 characters).

2.0 SCOPE

The methods described in this procedure shall be used consistently for all projects requiring electronic data handling managed by personnel located in the Northeast Region of Brown & Root Environmental (Pittsburgh, Wayne, Holt, and Wilmington) and for any large contracts managed by the Northeast Region (e.g., NORTHDIV CLEAN, SOUTHDIV CLEAN, ARCS I, ARCS III, etc.). Smaller projects (as determined by Project Manager) are outside the scope of this SOP.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Program Manager - It shall be the responsibility of the Program Manager (or designee) to inform contract-specific Project Managers of the existence and requirements of this Standard Operating Procedure.

Project Manager - It shall be the responsibility of the Project Manager to determine the applicability of this Standard Operating Procedure based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the sample nomenclature is thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and is consistent with this Standard Operating Procedure if relevant. It shall be the responsibility of the project manager to ensure that the Field Operations Leader is familiar with the sample nomenclature system.

Field Operations Leader - It shall be the responsibility of the Field Operations Leader to ensure that all field technicians or sampling personnel are thoroughly familiar with this Standard Operating Procedure and the project-specific sample nomenclature system. It shall be the responsibility of the Field Operations Leader to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

5.0 PROCEDURES

5.1 Introduction

The sample numbering system consists of 12 distinct alpha-numeric characters, only 10 of which will be provided to the laboratory on the sample labels and chain-of-custody forms. The sample number provided to the lab shall be as follows where "A" indicates "alpha," "N" indicates "numeric," and "E" indicates "either"):

E E E A A E E E N N

Once the analytical results are received from the laboratory the sample number will be revised by a subroutine such that the sample number is more user friendly (i.e., dashes will be inserted). The sample number will then appear as follows:

E E E - A A - E E E - N N

If multiple sampling events occur (or are planned) for a given matrix, a subroutine within the database will be used to append two additional characters such that the sample number will appear as follows:

E E E	-	A A	-	E E E	-	N N	-	N N
Site		Type		Location		Depth		Round

5.2 Sample Number Field Requirements

The various fields in the sample number will include the following:

- Site Identifier
- Sample Type
- Sample Location
- Sample Depth Indicator
- Sampling Round

The site identifier must be a three-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary since many facilities/sites have multiple individual sites, SWMUs, operable units, etc.

The sample type must be a two-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be a three-character field (alpha, numeric, or a mixture).

The depth field must be provided for all samples, regardless if it is strictly applicable (as discussed in Section 5.3).

The sampling round is optional, but, if provided, must be two numeric characters.

5.3 Example Sample Field Designations

Examples of each of the fields are as follows:

Site Number - Examples of site numbers/designations are as follows:

- A01 - Area of Concern Number 1
- 125 - Solid Waste Management Unit Number 125
- 000 - Base or Facility Wide Sample (e.g., upgradient well)
- BBG - Base Background

The examples cited are only suggestions. Each Project Manager (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample Type - Examples of sample types are as follows:

- AS - Air Sample
- BS - Biota Sample (See Note)
- CP - Composite Sample
- CS - Chip Sample
- DS - Drum Sample
- DU - Dust Sample
- FP - Free Product
- ID - Investigation Derived Waste Sample
- LT - Leachate Sample
- MW - Monitoring Well
- OF - Outfall Sample
- RW - Residential Well Sample
- SB - Soil Boring Sample
- SD - Sediment Sample
- SC - Scrape Sample
- SG - Soil Gas Sample
- SP - Seep Sample
- SS - Surface Soil Sample
- SU - Subsurface Soil Sample
- SW - Surface Water Sample
- TP - Test Pit Sample
- TW - Temporary Well Sample
- WC - Well Construction Material Sample
- WI - Wipe Sample
- WP - Well Point Sample
- WS - Waste/Sludge Sample

Note: The biota sample designation may be contingent upon the type of biota sampled (e.g., BL - Lobster; BF - Finfish; BC - Clam; BO - Oyster). Numerous other examples can be cited but will be site-specific.

This field will also be used to designate field Quality Control Samples, as follows:

TB - Trip Blank
FB - Field Blank
RB - Rinsate Blank (Equipment Blank)
BB - Bottle Blank
AB - Ambient Condition Blank

Field quality control samples should be numbered sequentially (e.g., RB-001; FB-010, etc.).

Filtered/unfiltered surface water or groundwater samples shall be handled in an separate manner, as subsequently discussed.

Location - Examples of the location field are as follows:

A01 - Grid node A1
001 - Monitoring Well 1

It is important that consistency be maintained with respect to the use of the characters "0" and O. Data base subroutines will not sort correctly if a mixture are used (e.g, AO1 and A02).

Depth - Formerly, depth specifications were indicated with a four digit field (e.g., 0002 - 0 to 2 feet). While this is effective for depth sorting, it is difficult to include this level of detail in a 10-character lab number (FormMaster limitations). In addition, this approach will not accommodate non-integer depths (e.g., 2.5 feet to 4.5 feet).

Based on such potential problems, the following approach shall be used: Sample depths will simply represent the horizon from which the sample was obtained: For example, if ten split-spoon samples are collected from a boring, they will be numbered 01 through 10. The sample log sheet will be used to record the specific depth of the sample, and this information will be entered in a separator field in the data base.

Similar nomenclature will be used for depth-specific surface water and sediment samples, etc. If no depth information is required (e.g., groundwater samples), the field must still be filled (e.g., Ø, Ø).

This field will also be used for the designation of filtered and unfiltered samples. An unfiltered groundwater sample shall be designated as U0, if and only if, a corresponding filtered sample is collected. Such as sample shall be designated as F0.

Sampling Round - The sampling round field is straightforward. It can range from 01 to 99.

5.4 Example Sample Numbers

Examples of complete sample numbers (field/data base versus laboratory) are as follows:

Field/Data Base ID	Lab ID	Description
101-SB-A01-01	101SBA0101	The first sample (e.g., 0 to 2 feet) from soil boring A01 (grid) at Site 101.
101-SB-A01-02	101SBA0102	The second sample from boring A01 (could be the next depth interval or a duplicate of 101-SB-A01-01).
125-MW-001-01-01	125MW00101	A groundwater sample from monitoring well MW001 (first sampling round)
125-MW-001-02-01	125MW00102	A duplicate groundwater sample from monitoring well MW001 (first sampling round)
130-MW-003-U1-01	130MW003U1	An unfiltered groundwater sample from monitoring well MW003 (first sampling round)
130-MW-003-F1-01	130MW003F1	A filtered groundwater sample from monitoring well MW003 (first sampling round)
137-RB-001-00-01	137RB00100	The first rinsate blank collected at site 137.
137-TB-004-00-02	137TB00400	The fourth trip blank collected during the second sampling event at Site 137.
155-SW-003-01-01	155SW00301	A surface water sample collected from the surface of a pond at Site 155.
155-SW-003-02-01	155SW00302	A surface water sample collected from the bottom of the water column in a pond at Site 155.

WHF-32-85

FOR

W32MW0850101

APPENDIX B-4

SITE LOGBOOK REQUIREMENTS
BROWN & ROOT ENVIRONMENTAL SOP SA-6.3

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS (Continued)

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Brown & Root Environmental field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Brown & Root Environmental field activities, as applicable. Other or additional documents may be required by specific client contracts.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all forms used in site activities (i.e., records, field reports, and upon the completion of field work, the site logbook) in the project's central file.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

5.0 PROCEDURES

5.1 Site Logbook

5.1.1 General

The site logbook is a hard-bound, paginated controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Brown & Root Environmental or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Brown & Root Environmental project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the site notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques shall be avoided, since they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Adequate logbook notation and receipts must be compiled to account for routine film processing. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

5.2 <u>Site Notebooks</u>

Key field team personnel may maintain a separate dedicated notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate site notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a site notebook.

5.3 Sample Forms

A summary of the forms illustrated in this procedure is shown as the listing of Attachments in the Table of Contents for this SOP. Forms may be altered or revised for project-specific needs contingent upon client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

5.3.1 Sample Collection, Labeling, Shipment and Request for Analysis

5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. Attachments B-1 to B-4 are examples of Sample Log Sheets. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B-5. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One part of the completed form is retained by the field crew while the other two portions are sent to the laboratory. An example of a Chain-of-Custody Record form is provided as Attachment B-6. A supply of these forms are purchased and stocked by the field department of the various Brown & Root Environmental offices. Alternately, COC forms supplied by the laboratory may be used. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Brown & Root Environmental Project Manager). The COC form is signed and one of the remaining two parts are retained by the laboratory while the last part becomes part of the samples' corresponding analytical data package. Internal laboratory chain-of-custody procedures are documented in the Laboratory Quality Assurance Plan (LQAP).

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is also an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transit to the laboratory. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.2 Geohydrological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

A groundwater level measurement sheet, shown in Attachment C-1 must be filled out for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The pumping test data sheet (Attachment C-2) facilitates this task by standardizing the data collection format, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A packer test report form shown in Attachment C-3 must be completed for each well upon which a packer test is conducted following well installation.

5.3.2.4 Summary Log of Boring

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring (Attachment C-4) is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples or cuttings from the borehole (using HNU or OVA detectors), these results must be entered on the boring log (under the "Remarks" column) at the appropriate depth. The "Remarks" column can also be used to subsequently enter the laboratory sample number and the concentration of a few key analytical results. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed for every monitoring well piezometer or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock), different forms are used (see Attachments C-5 through C-9). Similar forms are used for flush-mount well completions. The Monitoring Well Construction Details Form is not a controlled document.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log (Attachment C-10) must be filled out by the responsible field geologist or sampling technician.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log (Attachment D) which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 Weekly Status Reports

To facilitate timely review by project management, Xeroxed copies of logbook/notebook entries may be made for internal use. To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required.

5.4.2 Daily Activities Report

5.4.2.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors (Attachment E is an example of a Daily Activities Report).

5.4.2.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.2.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

6.0 ATTACHMENTS

Attachment A	TYPICAL SITE LOGBOOK ENTRY
Attachment B-1	EXAMPLE GROUNDWATER SAMPLE LOG SHEET
Attachment B-2	EXAMPLE SURFACE WATER SAMPLE LOG SHEET
Attachment B-3	EXAMPLE SOIL/SEDIMENT SAMPLE LOG SHEET
Attachment B-4	CONTAINER SAMPLE LOG SHEET FORM
Attachment B-5	SAMPLE LABEL
Attachment B-6	CHAIN-OF-CUSTODY RECORD FORM
Attachment B-7	CHAIN-OF-CUSTODY SEAL
Attachment C-1	EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET
Attachment C-2	EXAMPLE PUMPING TEST DATA SHEET
Attachment C-3	PACKER TEST REPORT FORM
Attachment C-4	EXAMPLE BORING LOG
Attachment C-5	EXAMPLE OVERBURDEN MONITORING WELL SHEET
Attachment C-5A	EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)
Attachment C-6	EXAMPLE CONFINING LAYER MONITORING WELL SHEET
Attachment C-7	EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL
Attachment C-8	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK
Attachment C-8A	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-9	EXAMPLE TEST PIT LOG
Attachment D	EXAMPLE EQUIPMENT CALIBRATION LOG
Attachment E	EXAMPLE DAILY ACTIVITIES RECORD
Attachment F	FIELD TRIP SUMMARY REPORT

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: ____________________ DATE: ____________________

SITE LEADER: ____________________

PERSONNEL:

BROWN & ROOT ENV.	DRILLER	EPA
________	________	________
________	________	________
________	________	________

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was ____________. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well ______.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _______.
4. Well ______ drilled. Rig geologist was __________________. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _________.
8. Test pit _______ dug with cuttings placed in dump truck. Rig geologist was ______________. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

____

Field Operations Leader

ATTACHMENT B-1
EXAMPLE GROUNDWATER SAMPLE LOG SHEET

GROUNDWATER

SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: ______________________ **Sample ID No.:** ______________________

Project No.: ______________________ **Sample Location:** ______________________

☐ Domestic Well Data **Sampled By:** ______________________

☐ Monitoring Well Data

☐ Other Well Type: ______________ **C.O.C. No.:** ______________________

☐ QA Sample Type: ______________

Sampling Data

Date: ________ Time: ________ Method: ________	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Purge Data

Date: ________ Method: ________	Volume	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD
	Initial							
Monitor Reading (ppm):	1							
Well Casing Dia. & Material Type:	2							
	3							
Total Well Depth (TD):	4							
Static Water Level (WL):	5							
TD-WL (ft.) =								
One Casing Volume: (gal/L)								
Start Purge (hrs.):								
End Purge (hrs.):								
Total Purge Time (min):								
Total Amount Purged (gal/L):								

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle If Applicable:		Signature(s):
MS/MSD	Duplicate ID No:	

TBD: To Be Determined

ATTACHMENT B-2
EXAMPLE SURFACE WATER SAMPLING LOG SHEET

SURFACE WATER
SAMPLING LOG SHEET

Page ___ of ___

Project Site Name: ____________ Sample ID No.: ____________

Project No.: ____________ Sample Location: ____________

☐ Spring ☐ Pond Sampled By: ____________
☐ Stream ☐ Lake
☐ Other ____________
☐ QA Sample Type: ____________ C.O.C. No.: ____________

Sample Data							
Date and Time			Method			Depth	
pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD

Analysis	Preservative	Container Requirements	Collected (✓)

Observations/Notes:

Circle if Applicable:		Signature(s):
MS/MSD	Duplicate ID No.:	

TBD: To Be Determined

ATTACHMENT B-3
EXAMPLE SOIL/SEDIMENT SINGLE SAMPLE LOG SHEET

SOIL/SEDIMENT SINGLE SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: ____________

Project No.: ____________

- ☐ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Other ________
- ☐ QA Sample Type: ________

Sample ID No.: ____________

Sample Location: ____________

Sampled By: ____________

C.O.C. No.: ____________

	Composite Sample Data		
Sample Method:	Sample	Time	Color/Description
Depth Sampled:			
Sample Date and Time:			
Type of Sample ☐ Grab ☐ Composite ☐ Grab-Composite ☐ High Concentration ☐ Low Concentration			
	GRAB Sample Data		
	Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)	

Analysis	Container Requirements	Collected (✓)

Map:

Observations/Notes:

Circle if Applicable:	
MS/MSD	Duplicate ID No:

Signature(s):

ATTACHMENT B-4
CONTAINER SAMPLE LOG SHEET FORM

Brown & Root Environmental

Page ___ of _

☐ Container Data

Case #: ______

By: ______________________

Project Site Name: ______________________ Project Site No. ______________________

Brown & Root Env. Source No. ______________ Source Location: ______________________

Container Source	Container Description
☐ Drum ☐ Bung Top ☐ Lever Lock ☐ Bolted Ring ☐ Other ______ ______ ☐ Bag/Sack ☐ Tank ☐ Other ______ ______	Color: ______ Condition: ______ Markings: ______ Vol. of Contents: ______ Other: ______
Disposition of Sample ☐ Container Sampled ☐ Container opened but not sampled. Reason: ______ ______ ☐ Container not opened. Reason: ______ ______	**Sample Description**

	Layer 1	Layer 2	Layer 3
Phase	☐Sol. ☐Liq.	☐Sol. ☐Liq.	☐Sol. ☐Liq.
Color	______	______	______
Viscosity	☐L ☐M ☐H	☐L ☐M ☐H	☐L ☐M ☐H
% of Total Volume	______	______	______
Other	______	______	______

Monitor Reading:	**Type of Sample** ☐ Low Concentration ☐ High Concentration ☐ Grab ☐ Composite ☐ Grab-composite
Sample Method:	

	Sample Identification	Organic	Inorganic
Sample Date & Time:			
Sampled by:			
Signature(s):			
	Date Shipped		
Analysis:	Time Shipped		
	Lab		
	Volume		

ATTACHMENT B-5

SAMPLE LABEL

Brown & Root Environmental PROJECT:______________________

STATION LOCATION: ______________________

DATE: ____/____/____ TIME: ________ hrs.

MEDIA: WATER ☐ SOIL ☐ SEDIMENT ☐ ________ ☐

CONCENTRATION: LOW ☐ MEDIUM ☐ HIGH ☐

TYPE: GRAB ☐ COMPOSITE ☐

ANALYSIS	PRESERVATION
VOA ☐ BNAs ☐	Cool to 4°C ☐
PCBs ☐ PESTICIDES ☐	HNO_3 to pH < 2 ☐
METALS: TOTAL ☐ DISSOLVED ☐	NaOH to pH > 12 ☐
CYANIDE ☐	________ ☐
________ ☐	

Sampled by:______________________

Remarks:

ATTACHMENT B-6

CHAIN-OF-CUSTODY RECORD FORM
(Original is 8.5 x 11")

PROJECT NO.	PROJECT NAME					NO. OF CONTAINERS							REMARKS
SAMPLERS: *(Signature)*													
STA NO.	DATE	TIME			STATION LOCATION								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks:	

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

Signature ________	**CUSTODY SEAL**
Date ________	________ Date
CUSTODY SEAL	________ Signature

ATTACHMENT C-1
EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

GROUNDWATER LEVEL MEASUREMENT SHEET

Page ___ of ___

PROJECT NAME: ____________________
PROJECT NUMBER: ____________________
PERSONNEL: ____________________
DATE: ____________________
WEATHER CONDITIONS: ____________________

LOCATION: ____________________
MEASURING DEVICE: ____________________
ADJUSTMENT FACTOR: ____________________
REMARKS: ____________________

Well or Piezometer Number	Time	Elevation of Reference Point (Feet)*	Water Level Indicator Reading (Feet)*	Groundwater Elevation (Feet)*	Comments

*Measurements to nearest 0.01 foot.

Signature(s): ____________________

ATTACHMENT C-2
EXAMPLE PUMPING TEST DATA SHEET

PUMPING TEST DATA SHEET

Page ___ of ___

PROJECT NAME: ____________________
PROJECT NUMBER: ____________________
PUMPING TEST: [ ]
TEST NUMBER: ____________________
METHOD OF MEASUREMENT: ____________
DATE(s): ____________________
STATIC H_2O LEVEL (ft) (SO) ____________
PUMPING WELL NUMBER: ____________________
MEASURED WELL NUMBER: ____________________
STEP DRAW DOWN TEST [ ]
MONITORING POINT: ____________________
DEPTH CORRECTION (ft) ____________________
PUMP SETTING (Ft. below monitoring point): ______
DISTANCE FROM PUMPING WELL (ft) (r): ________
PUMPING TEST PERFORMED BY: ____________________
REMARKS: ____________________

MILITARY TIME	ELAPSED TIME SINCE PUMP START OR STOP (Min.)	WATER LEVEL (Ft.)	CORRECTION (Ft.)	DRAW DOWN OR RECOVERY (Ft.)	FLOW METER READING (Gals.)	PUMPING RATE (GPM)	REMARKS

SIGNATURE(s): ____________________

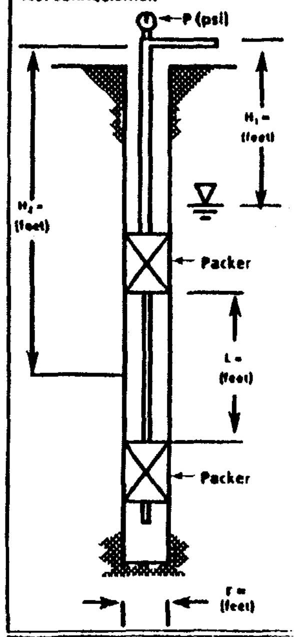
ATTACHMENT C-3

PACKER TEST REPORT FORM

PROJECT: ______________ **PROJECT NO.:** ______________ **TEST NO:** ______________ **PAGE** ____ **OF** ____
BORING NO.: ______________ **CASING DEPTH:** ______________ **CONTRACTOR:** ______________ **STATIC WATER LEVEL** ______________
TEST INTERVAL: ______________ **BY:** ______________ **CHECKED:** ______________ **PACKER PRESSURE** ______________

Flow Test					Calculated Results							
Pressure, p (psi)	Elapsed Time (min)	Flow Reading	δ Flow, ΔQ (ft^3)	δ Flow, ΔQ (gal)	Flow Rate Q (gal/min)	H_1* (ft)	Hp(ft) = 2.31 (psi)	H_2* (ft)	H = Hp + (H1 or H2)	Cp	K (ft/yr) = Cp Q/H	K (cm/sec) = 9.67 x 10⁻⁷ K (ft/yr)

TEST CONFIGURATION



Length of Test Section in feet, l	Cp			
	Casing Bit Size			
	EX (1.5")	AX (1.875")	BX (2 3/8")	NX (3")
1	31,000	28,500	25,000	23,300
2	19,000	18,300	16,000	15,500
5	9,000	9,300	8,000	8,200
8	6,000	6,500	6,100	5,900
10	5,700	5,000	5,400	4,900
15	4,100	3,900	3,700	3,600
20	3,200	3,100	3,000	2,800

CP = (1/(2 π L)) ln(L/r) (70,315.5)
7.48 Gallons = 1 Ft^3
1 psi = 2.31 ft head

* H_1 is used when the test length is below the water table.
H_2 is used when the test length is above the water table.

Remarks: ____

ATTACHMENT C-4
EXAMPLE BORING LOG

BORING LOG

Page___ of___

PROJECT NAME: ______________________
PROJECT NUMBER: ______________________
DRILLING COMPANY: ______________________
WATER LEVEL DATA: ______________________

BORING NUMBER: ______________________
DATE : ______________________
GEOLOGIST: ______________________

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION			* U S C S	Remarks	PID or FID Reading (ppm)
					Soil Density/ Consistency or Rock Hardness	Color	Material Classification			

*When rock coring enter rock brokeness.

CONVERTED TO WELL : ___ Yes ___ No;   WELL I.D.#: ______________________
REMARKS: ______________________

Signature(s): ______________________

LEGEND

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS — More Than Half of Material is LARGER Than No. 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES
GRAVELS (50%(+)>1/4"Ø	CLEAN GRAVELS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
	GRAVELS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
SANDS 50%(+)<1/4"Ø.	CLEAN SANDS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well graded sand, gravelly sands, little or no fines.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.
	SANDS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see MCL)	SM	Silty sands, poorly graded sand-silt mixtures.
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.

FINE-GRAINED SOILS — More Than Half of Material is SMALLER Than No. 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)				GROUP SYMBOL	TYPICAL NAMES
	Identification Procedures on Fraction Smaller than No. 40 Sieve Size				
	DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
SILTS AND CLAYS Liquid Limit <50	None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
	Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	Slight to Medium	Slow	Slight	OL	Organic silts and organic silt clays of low plasticity.
SILTS AND CLAYS Liquid Limit >50	Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	High to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays.
	Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other organic soils

Boundary classifications: Soils possessing characteristics of two groups are designated by combining group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.
All sieve sizes on this chart are U.S. Standard.

DENSITY OF GRANULAR SOILS

DESIGNATION	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT
Very Loose	0-4
Loose	5-10
Medium Loose	11-30
Dense	31-50
Very Dense	Over 50

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNC COMPRESSIVE STRENGTH (TONS/SQ. FT.)	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very Soft	Less than 0.25	0 to 2	Easily pentrated several inches by fist
Soft	0.25 to 0.50	2 to 4	Easily penetrated several inches by thumb.
Medium Stiff	0.50 to 1.0	4 to 8	Can be penetrated several inches by thumb.
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb.
Very Stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail.
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail.

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)			ROCK BROKENESS		
Descriptive Terms	Screwdriver or Knife Effects	Hammer Effects	Descriptive Terms	Abbreviation	Spacing
Soft	Easily Gouged	Crushes when pressed with hammer	Very Broken	(V. Br.)	0-2"
Medium Soft	Can be Gouged	Breaks (one blow); crumbly edges	Broken	(Br.)	2"-1'
Medium Hard	Can be scratched	Breaks (one blow); sharp edges	Blocky	(Bl.)	1'-3'
Hard	Cannot be scratched	Breaks conchoidally (several blows); sharp edges	Massive	(M.)	3'-10'

LEGEND:

SOIL SAMPLES - TYPES

S-2" Split-Barrel Sample
ST-3" O.D. Undisturbed Sample
O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

X-NX (Conventional) Core (-2-1/8" O.D.)
Q-NQ (Wireline) Core (-1-7/8" O.D.)
Z - Other Core Sizes, Specify in Remarks

WATER LEVELS

12/18 ▼ 12.6' Initial Level w/Date & Depth
12/18 ▼ 12.6' Stabilized Level w/Date & Depth

ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

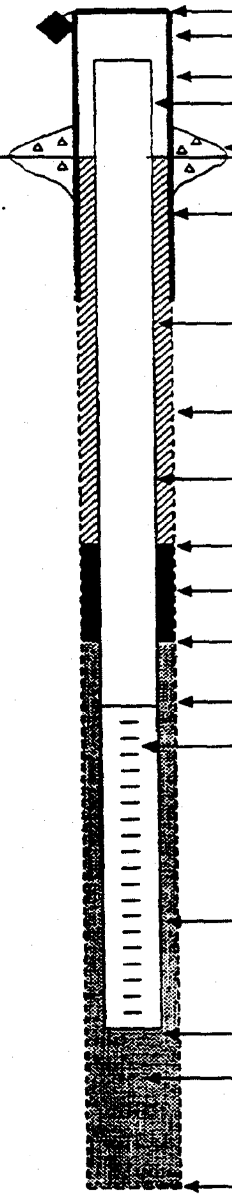
BORING NO.: ____________

OVERBURDEN
MONITORING WELL SHEET

PROJECT ____________ LOCATION ____________
PROJECT NO. ____________ BORING ____________
ELEVATION ____________ DATE ____________
FIELD GEOLOGIST ____________

DRILLER ____________
DRILLING METHOD ____________
DEVELOPMENT METHOD ____________

GROUND ELEVATION



ELEVATION OF TOP OF SURFACE CASING : ____________
ELEVATION OF TOP OF RISER PIPE: ____________
STICK - UP TOP OF SURFACE CASING: ____________
STICK - UP RISER PIPE : ____________
TYPE OF SURFACE SEAL: ____________
I.D. OF SURFACE CASING: ____________
TYPE OF SURFACE CASING: ____________
RISER PIPE I.D. ____________
TYPE OF RISER PIPE: ____________
BOREHOLE DIAMETER: ____________
TYPE OF BACKFILL: ____________
ELEVATION / DEPTH TOP OF SEAL: ______ / ______
TYPE OF SEAL: ____________
DEPTH TOP OF SAND PACK: ____________
ELEVATION / DEPTH TOP OF SCREEN: ______ / ______
TYPE OF SCREEN: ____________
SLOT SIZE x LENGTH: ____________
I.D. OF SCREEN: ____________
TYPE OF SAND PACK: ____________
ELEVATION / DEPTH BOTTOM OF SCREEN: ______ / ______
ELEVATION / DEPTH BOTTOM OF SAND PACK: ______ / ______
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____________
ELEVATION / DEPTH OF HOLE: ______ / ______

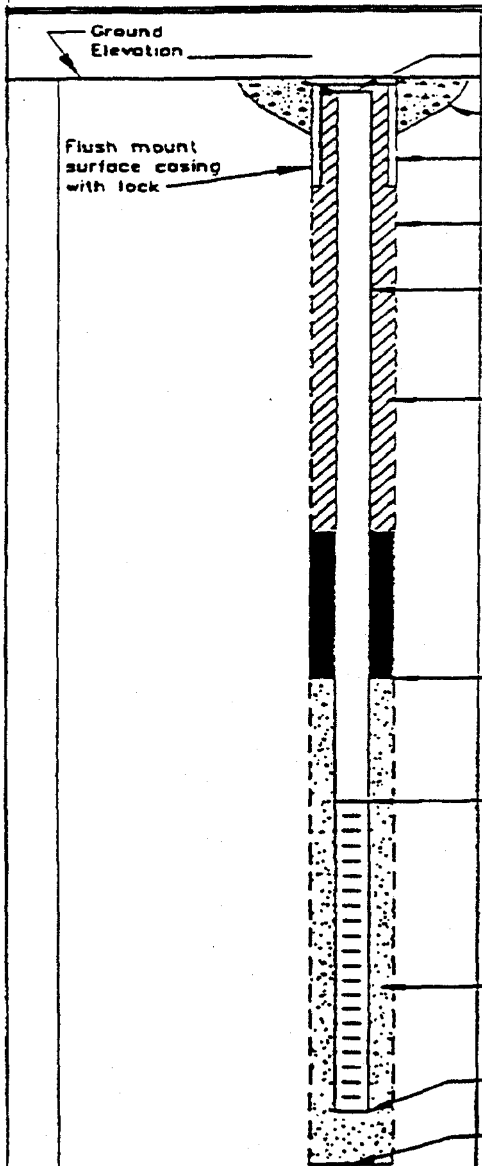
ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

BORING NO.: ______

MONITORING WELL SHEET

PROJECT ______ LOCATION ______
PROJECT NO. ______ BORING ______
ELEVATION ______ DATE ______
FIELD GEOLOGIST ______

DRILLER ______
DRILLING METHOD ______
DEVELOPMENT METHOD ______



ELEVATION TOP OF RISER: ______

TYPE OF SURFACE SEAL: ______

TYPE OF PROTECTIVE CASING: ______
I.D. OF PROTECTIVE CASING: ______

DIAMETER OF HOLE: ______

TYPE OF RISER PIPE: ______
RISER PIPE I.D.: ______

TYPE OF BACKFILL/SEAL: ______
______

DEPTH/ELEVATION TOP OF SAND: ____/____

DEPTH/ELEVATION TOP OF SCREEN: ____/____
TYPE OF SCREEN: ______
SLOT SIZE x LENGTH: ______

TYPE OF SAND PACK: ______

DIAMETER OF HOLE IN BEDROCK: ______

DEPTH/ELEVATION BOTTOM OF SCREEN: ____/____
DEPTH/ELEVATION BOTTOM OF SAND: ____/____
DEPTH/ELEVATION BOTTOM OF HOLE: ____/____
BACKFILL MATERIAL BELOW SAND: ______

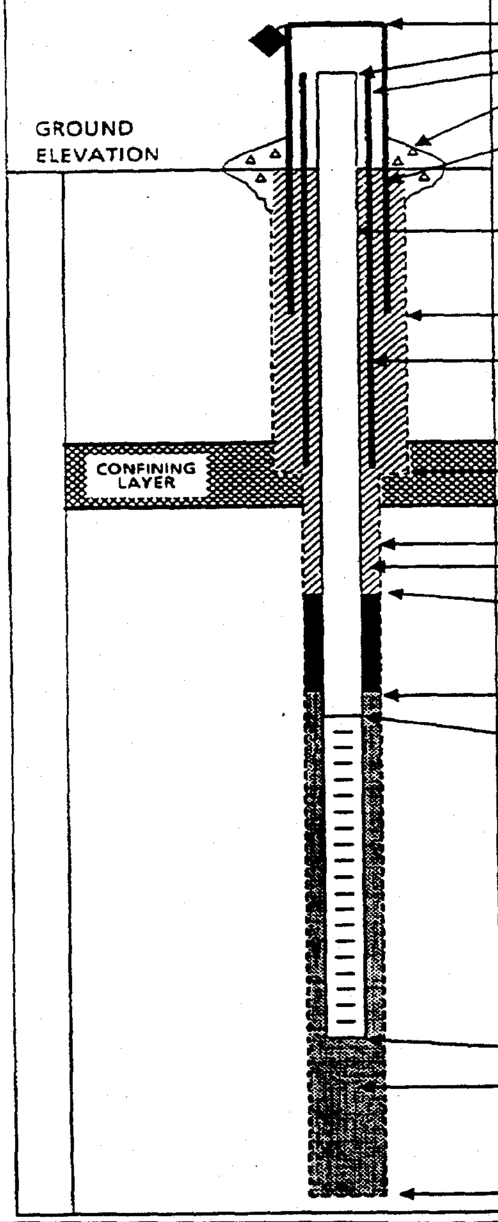
ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

BORING NO.: ____________

CONFINING LAYER
MONITORING WELL SHEET

PROJECT ____________ LOCATION ____________
PROJECT NO. ____________ BORING ____________
ELEVATION ____________ DATE ____________
FIELD GEOLOGIST ____________

DRILLER ____________
DRILLING METHOD ____________
DEVELOPMENT METHOD ____________



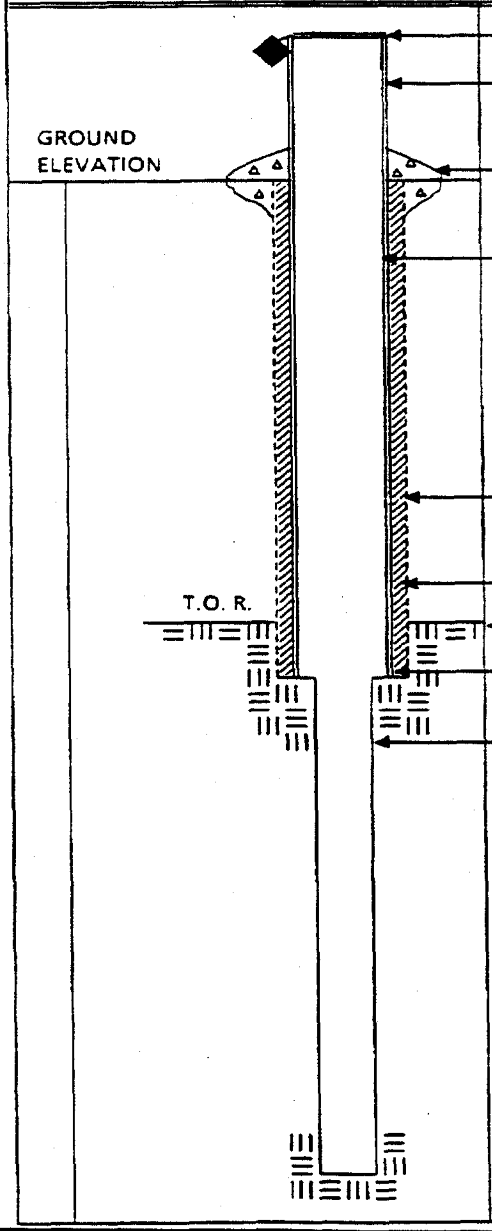
ELEVATION OF TOP OF SURFACE CASING : ____________
ELEVATION OF TOP OF RISER PIPE: ____________
ELEVATION TOP OF PERM. CASING: ____________
TYPE OF SURFACE SEAL: ____________
I.D. OF SURFACE CASING: ____________
TYPE OF SURFACE CASING: ____________
RISER PIPE I.D. ____________
TYPE OF RISER PIPE: ____________
BOREHOLE DIAMETER: ____________
PERM. CASING I.D. ____________
TYPE OF CASING & BACKFILL: ____________
ELEVATION / DEPTH TOP CONFINING LAYER: ____________
ELEVATION / DEPTH BOTTOM OF CASING: ____________
ELEVATION / DEPTH BOT. CONFINING LAYER: ____________
BOREHOLE DIA. BELOW CASING: ____________
TYPE OF BACKFILL: ____________
ELEVATION / DEPTH TOP OF SEAL: ____________
TYPE OF SEAL: ____________
DEPTH TOP OF SAND PACK: ____________
ELEVATION/DEPTH TOP OF SCREEN: ____________
TYPE OF SCREEN: ____________
TYPE OF SAND PACK: ____________
ELEVATION / DEPTH BOTTOM OF SCREEN: ____________
ELEVATION / DEPTH BOTTOM OF SAND PACK: ____________
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____________
ELEVATION / DEPTH OF HOLE: ____________

ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

BORING NO.: ____________

BEDROCK
MONITORING WELL SHEET
OPEN HOLE WELL

PROJECT ____________ LOCATION ____________ DRILLER ____________
PROJECT NO. ____________ BORING ____________ DRILLING METHOD ____________
ELEVATION ____________ DATE ____________ DEVELOPMENT METHOD ____________
FIELD GEOLOGIST ____________



ELEVATION OF TOP OF CASING: ____________

STICK UP OF CASING ABOVE GROUND SURFACE: ____________

TYPE OF SURFACE SEAL: ____________
____

I.D. OF CASING: ____________
TYPE OF CASING: ____________

TEMP. / PERM.: ____________

DIAMETER OF HOLE: ____________

TYPE OF CASING SEAL: ____________

DEPTH TO TOP OF ROCK: ____________

DEPTH TO BOTTOM CASING: ____________

DIAMETER OF HOLE IN BEDROCK: ____________

DESCRIBE IF CORE / REAMED WITH BIT:
____
____
____

DESCRIBE JOINTS IN BEDROCK AND DEPTH:
____
____
____

ELEVATION / DEPTH OF HOLE: ______ / ______

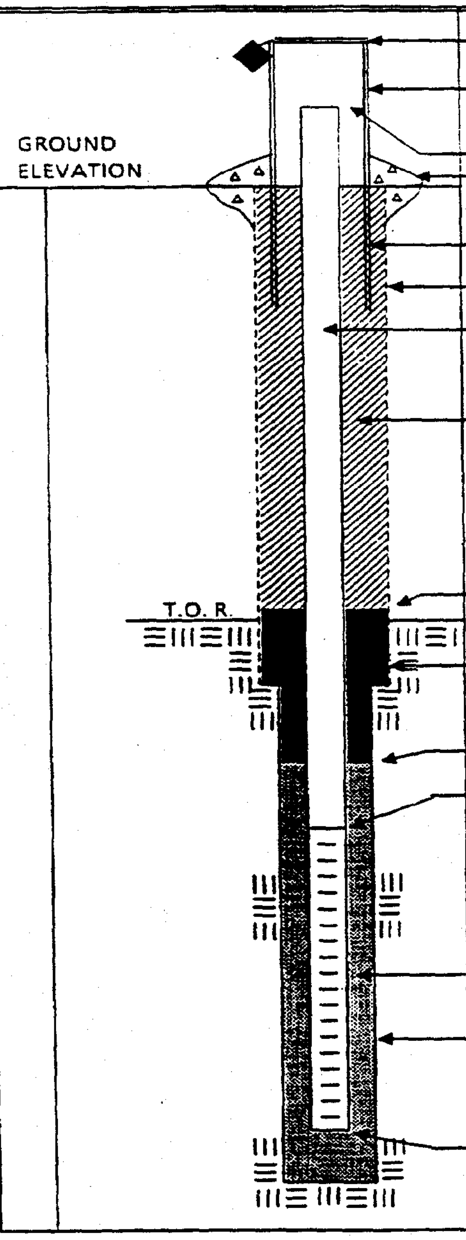
ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

BORING NO.: ________

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT ________ LOCATION ________
PROJECT NO. ________ BORING ________
ELEVATION ________ DATE ________
FIELD GEOLOGIST ________

DRILLER ________
DRILLING METHOD ________
DEVELOPMENT METHOD ________



ELEVATION OF TOP OF SURFACE CASING: ________

STICK UP OF CASING ABOVE GROUND SURFACE: ________

ELEVATION TOP OF RISER: ________

TYPE OF SURFACE SEAL: ________

I.D. OF SURFACE CASING: ________

DIAMETER OF HOLE: ________

RISER PIPE I.D.: ________

TYPE OF RISER PIPE: ________

TYPE OF BACKFILL: ________

ELEVATION / DEPTH TOP OF SEAL: ____/____

ELEVATION / DEPTH TOP OF BEDROCK: ____/____

TYPE OF SEAL: ________

ELEVATION / DEPTH TOP OF SAND: ____/____

ELEVATION / DEPTH TOP OF SCREEN: ____/____

TYPE OF SCREEN: ________

SLOT SIZE x LENGTH: ________

I.D. SCREEN: ________

TYPE OF SAND PACK: ________

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: ________

ELEVATION / DEPTH BOTTOM SCREEN: ____/____

ELEVATION / DEPTH BOTTOM OF HOLE: ____/____

ATTACHMENT C-8A
EXAMPLE BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK (FLUSHMOUNT)

BORING NO.: ____________

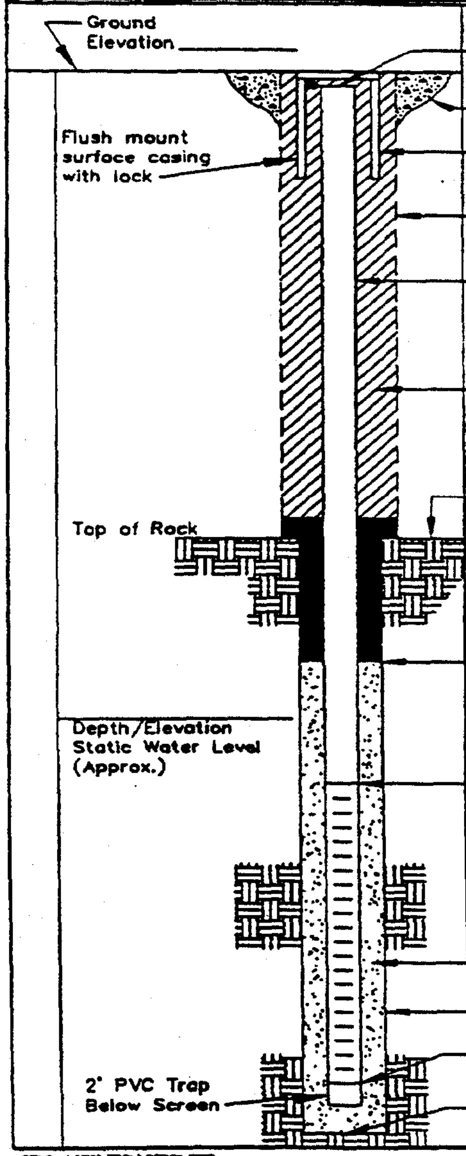
BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT: ____________ LOCATION: ____________ DRILLER: ____________

PROJECT NO.: ____________ BORING: ____________ DRILLING METHOD: ____________

ELEVATION: ____________ DATE: ____________ DEVELOPMENT METHOD: ____________

FIELD GEOLOGIST: ____________



ELEVATION TOP OF RISER: ____________

TYPE OF SURFACE SEAL: ____________

TYPE OF PROTECTIVE CASING: ____________

I.D. OF PROTECTIVE CASING: ____________

DIAMETER OF HOLE: ____________

TYPE OF RISER PIPE: ____________

RISER PIPE I.D.: ____________

TYPE OF BACKFILL/SEAL: ____________

____

DEPTH/ELEVATION TOP OF BEDROCK: ______/______

DEPTH/ELEVATION TOP OF SAND: ______/______

DEPTH/ELEVATION TOP OF SCREEN: ______/______

TYPE OF SCREEN: ____________

SLOT SIZE x LENGTH: ____________

TYPE OF SAND PACK: ____________

DIAMETER OF HOLE IN BEDROCK: ____________

DEPTH/ELEVATION BOTTOM OF SCREEN: ______/______

DEPTH/ELEVATION BOTTOM OF SAND: ______/______

DEPTH/ELEVATION BOTTOM OF HOLE: ______/______

BACKFILL MATERIAL BELOW SAND: ____________

ACFILE: L670\GEOL\BEDRW.DWG

ATTACHMENT C-9
EXAMPLE TEST PIT LOG

TEST PIT LOG

Brown & Root Environmental

PROJECT: ______________________ TEST PIT NO.:
PROJECT NO ______________ DATE: ______________
LOCATION: ______________________
FIELD GEOLOGIST: ______________________

DEPTH (ft.)	LITHOLOGY CHANGE (Depth/ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS

Test Pit Cross Section and / or Plan View

REMARKS ______________________

PHOTO LOG ______________________

TEST PIT ________

PAGE ____ OF ____

ATTACHMENT D
EXAMPLE EQUIPMENT CALIBRATION LOG

Brown & Root Environmental

EQUIPMENT CALIBRATION LOG

INSTRUMENT NAME / MODEL : ____________________

JOB NAME : ________________

MANUFACTURER : ____________________

JOB NUMBER : ________________

CALIBRATION DATE	INITIAL SETTINGS	STANDARDS USED	PROCEDURE	ADJUSTMENTS MADE	FINAL SETTINGS	SIGNATURE	COMMENTS

ATTACHMENT E
EXAMPLE DAILY ACTIVITIES RECORD

Brown & Root Environmental

DAILY ACTIVITIES RECORD

PROJECT ________ LOCATION ________
CLIENT ________ ARRIVAL TIME ________ JOB NO. ________
DATE ________ DEPARTURE TIME ________
CONTRACTOR ________ DRILLER ________
BORING NO. ________ HNUS REPRESENTATIVE ________

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: ________

APPROVED BY:

HNUS FIELD REPRESENTATIVE ________ DRILLER OR REPRESENTATIVE ________

ATTACHMENT F
FIELD TRIP SUMMARY REPORT
PAGE 1 OF 2

SUNDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________________

____

____

____

MONDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________________

____

____

____

TUESDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________________

____

____

____

WEDNESDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________________

____

____

____

ATTACHMENT F
PAGE 2 OF 2
FIELD TRIP SUMMARY REPORT

THURSDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________

____

____

____

FRIDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________

____

____

____

SATURDAY

Date: ______________________ Personnel: ____

Weather: ______________________ Onsite: ____

____

Site Activities: ______________________

____

____

____

APPENDIX C

HUMAN HEALTH RISK ASSESSMENT PARAMETERS

TABLE C-1

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION, INHALATION, AND DERMAL CONTACT
FUTURE RESIDENT (ADULT AND CHILD)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

$$INTAKE_{ing} = \frac{CSx\ IR_{soil}\ xFIxCFxEFxED}{BWxATx365days / year}$$

$$DA_{event} = CSxAFx\ ABS_{d}\ xCF$$

$$INTAKE_{dermal} = \frac{DA_{event}\ xSAxEFxED}{BWxATx365days / year}$$

$$INTAKE_{inh} = \frac{CAx\ IR_{air}\ xETxEFxED}{BWxATx365days / year}$$

Parameter	Symbol	Child Value (Age 1-6)	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific		
Soil Ingestion Rate	IR_{soil}	200	100	mg/day	[2]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor					
Inorganics	CF	1×10^{-6}	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	1×10^{-9}	kg/µg	
Exposure Frequency	EF	350	350	days/year	[2]
Exposure Duration	ED	6	24	years	[2]
Exposure Time [1]	ET	16	16	hours/day	Assumption
Averaging Time	AT				
Cancer		70	70	years	[2]
Noncancer		6	24	years	[2]
Surface Area	SA	767	5750	cm^2	[3]

See notes at end of table.

TABLE C-1

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION, INHALATION, AND DERMAL CONTACT
FUTURE RESIDENT (ADULT AND CHILD)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Parameter	Symbol	Child Value (Age 1-6)	Adult Value	Units	Source
Inhalation Rate	IR_{air}	0.625	0.833	m^3/hour	[2]
Body Weight	BW	15	70	kg	[2]
Adherence Factor	AF	1	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	Chemical Specific	unitless	[4]
Concentration in Air	CA	Chemical Specific	Chemical Specific	mg/m^3	[5]

References:

[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See [5].
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992.
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.
[5] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes:

mg = milligram.
% = percent.
kg = kilogram.
mg = microgram.
cm^2 = square centimeter.
m^3 = cubic meter.

TABLE C-2

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION AND DERMAL CONTACT
TRESPASSER (ADULT AND CHILD)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 1 OF 2

$$INTAKE_{ing} = \frac{CSx\,IR_{soil}\,xFIxCFxEFxED}{BWxATx365days\,/\,year}$$

$$DA_{event} = CSxAFx\,ABS_d\,xCF$$

$$INTAKE_{dermal} = \frac{DA_{event}\,xSAxEFxED}{BWxATx365days\,/\,year}$$

Parameter	Symbol	Child Value (Age 6-16)	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific		
Soil Ingestion Rate	IR_{soil}	100	100	mg/day	[2]
Fraction Ingested	FI	100%	100%	unitless	Assumption
Conversion Factor					
Inorganics	CF	1×10^{-6}	1×10^{-6}	kg/mg	
Organics	CF	1×10^{-9}	1×10^{-9}	kg/μg	
Exposure Frequency	EF	30	24	days/year	Assumption
Exposure Duration	ED	10	19	years	[2]
Exposure Time [1]	ET			hours/day	Assumption
Averaging Time	AT				
Cancer		70	70	years	[2]
Noncancer		10	19	years	[2]

See notes at end of table.

TABLE C-2

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION AND DERMAL CONTACT
TRESPASSER (ADULT AND CHILD)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA
PAGE 2 OF 2

Parameter	Symbol	Child Value (Age 6-16)	Adult Value	Units	Source
Surface Area	SA	1136	5750	cm^2	[3]
Inhalation Rate	IR_{air}			m^3/hour	[2]
Body Weight	BW	20.4	70	kg	[2,5]
Adherence Factor	AF	1	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	Chemical Specific	unitless	[4]
Concentration in Air	CA			mg/m^3	[6]

References:

[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See [6].
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January 1992.
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.
[5] USEPA, 1989. Exposure Factors Handbook; EPA/600/8-89/043; July 1989.
[6] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes:

mg = milligram.
% = percent.
kg = kilogram.
cm^2 = square centimeter.
m^3 = cubic meter.

TABLE C-3

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION AND DERMAL CONTACT
SITE OCCUPATIONAL WORKER (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

$$INTAKE_{ing} = \frac{CSx\ IR_{soil}\ xFIxCFxEFxED}{BWxATx365days\ /\ year}$$

$$DA_{event} = CSxAFx\ ABS_{d}\ xCF$$

$$INTAKE_{dermal} = \frac{DA_{event}\ xSAxEFxED}{BWxATx365days\ /\ year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific	
Soil Ingestion Rate	IR_{soil}	50	mg/day	[2]
Fraction Ingested	FI	100%	unitless	Assumption
Conversion Factor				
Inorganics	CF	1´10^{-6}	kg/mg	
Organics	CF	1´10^{-9}	kg/µg	
Exposure Frequency	EF	250	days/year	[2]
Exposure Duration	ED	25	years	[2]
Exposure Time [1]	ET		hours/day	Assumption
Averaging Time	AT			
Cancer		70	years	[2]
Noncancer		25	years	[2]
Surface Area	SA	2300	cm^2	[3]
Inhalation Rate	IR_{air}		m^3/hour	[2]

See notes at end of table.

TABLE C-3

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION AND DERMAL CONTACT
SITE OCCUPATIONAL WORKER (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Parameter	Symbol	Adult Value	Units	Source
Body Weight	BW	70	kg	[2]
Concentration in Air	CA		mg/m^3	[5]
Adherence Factor	AF	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	unitless	[4]

References:

[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See [5].
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."
[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992
[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.
[5] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes: mg = milligram.
% = percent.
kg = kilogram.
cm^2 = square centimeter.
m^3 = cubic meter.

TABLE C-4

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION AND DERMAL CONTACT
SITE OCCUPATIONAL WORKER-GROUNDSKEEPER (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

$$INTAKE_{ing} = \frac{CSx\ IR_{soil}\ xFIxCFxEFxED}{BWxATx365days/year}$$

$$INTAKE_{dermal} = \frac{DA_{event}\ xSAxEFxED}{BWxATx365days/year}$$

$$DA_{event} = CSxAFx\ ABS_d\ xCF$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific	
Soil Ingestion Rate	IR_{soil}	118 [2]	mg/day	[3]
Fraction Ingested	FI	100%	unitless	Assumption
Conversion Factor				
Inorganics	CF	$1'10^{-6}$	kg/mg	
Organics	CF	$1'10^{-9}$	kg/µg	
Exposure Frequency	EF	12	days/year	Assumption
Exposure Duration	ED	25	years	[3]
Exposure Time [1]	ET		hours/day	Assumption
Averaging Time	AT			
Cancer		70	years	[3]
Noncancer		25	years	[3]
Surface Area	SA	5750	cm^2	[4]
Inhalation Rate	IR_{air}		m^3/hour	[3]
Body Weight	BW	70	kg	[3]

See notes at end of table.

TABLE C-4

EXPOSURE PARAMETERS FOR SURFACE SOIL INGESTION AND DERMAL CONTACT
SITE OCCUPATIONAL WORKER-GROUNDSKEEPER (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

Parameter	Symbol	Adult Value	Units	Source
Adherence Factor	AF	1	mg/cm^2-event	[4]
Absorption Fraction	ABS_d	Chemical Specific	unitless	[5]
Concentration in Air	CA		mg/m^3	[6]

References:

[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario;See [6].

[2] Calculated based on the following assumptions from Hawley, J.K., 1985. Assessment of Health Risk From Exposure to Contaminated Soil. Risk Analysis, 5:(4):28.
- inside surface area of the hand is 14% of total surface area of the hand
  - surface area of hand (male) - 840 cm^2 (USEPA, 1992 [4])
  - inside surface area of hand (male) - 0.14 x 840 cm^2 = 118 cm^2
- adult ingests soils covering one-half of inside surface area of the hands two times per day
  - 0.5 x 118 cm^2 x 2/day = 118 cm^2;
- Use soil adherence factor of 1 mg/cm^2;
  - 118 cm^2/day x 1 mg/cm^2 = 118 mg/day

[3] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."

[4] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992

[5] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992

[6] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes:

mg = milligram.
% = percent.
kg = kilogram.
cm^2 = square centimeter.
m^3 = cubic meter.

TABLE C-5

EXPOSURE PARAMETERS FOR SURFACE AND SUBSURFACE SOIL INGESTION, INHALATION, AND DERMAL CONTACT
CONSTRUCTION WORKER (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

$$INTAKE_{ing} = \frac{CSx\ IR_{soil}\ xFIxCFxEFxED}{BWxATx365days/year}$$

$$INTAKE_{inh} = \frac{CAx\ IR_{air}\ xETxEFxED}{BWxATx365days/year}$$

$$DA_{event} = CSxAFx\ ABS_d\ xCF$$

$$INTAKE_{dermal} = \frac{DA_{event}\ xSAxEFxED}{BWxATx365days/year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Soil	CS	Chemical Specific	Chemical Specific	
Soil Ingestion Rate	IR_{soil}	480	mg/day	[2]
Fraction Ingested	FI	100%	unitless	Assumption
Conversion Factor				
Inorganics	CF	$1'10^{-6}$	kg/mg	
Organics	CF	$1'10^{-9}$	kg/µg	
Exposure Frequency	EF	30	days/year	Assumption
Exposure Duration	ED	30	days	[2]
Exposure Time [1]	ET	8	hours/day	Assumption
Averaging Time	AT			
Cancer		70	years	[2]
Noncancer		30	days	[2]
Surface Area	SA	2,000	cm^2	[3]
Inhalation Rate	IR_{air}	2.5	m^3/hour	[2]
Body Weight	BW	70	kg	[2]
Adherence Factor	AF	1	mg/cm^2-event	[3]
Absorption Fraction	ABS_d	Chemical Specific	unitless	[4]
Concentration in Air	CA	Chemical Specific	mg/m^3	[5]

TABLE C-5

EXPOSURE PARAMETERS FOR SURFACE AND SUBSURFACE SOIL INGESTION, INHALATION, AND DERMAL CONTACT
CONSTRUCTION WORKER (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

References:

[1] Exposure Time is a parameter used only in Inhalation of Particulate Dust Scenario; See [5].

[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."

[3] USEPA, 1992. Dermal Exposure Assessment: Principles and Applications; EPA/600/8-91/011B; January, 1992

[4] USEPA, 1992. USEPA Region IV Guidance Memo February 10, 1992.

[5] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes: mg = milligram.
% = percent.
kg = kilogram.
cm^2 = square centimeter.
m^3 = cubic meter.

TABLE C-6

EXPOSURE PARAMETERS FOR GROUNDWATER INGESTION INHALATION, DERMAL CONTACT
MILITARY RESIDENTS (ADULT)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

$$INTAKE_{inh} = \frac{CA_{air} xETxEFxED}{CF2xATx365days / year}$$

$$DA_{event} = PC_{event} xCWxCF1xCF2$$

$$Intake_{ing} = \frac{CWx\, IR_{groundwater} xCF1xEFxED}{BWxATx365days / year}$$

$$INTAKE_{dermal} = \frac{DA_{event} xSAxEFxED}{BWxATx365days / year}$$

Parameter	Symbol	Adult Value	Units	Source
Concentration in Groundwater	CW	Chemical Specific	mg/liter	
Water Ingestion Rate	IR_{water}	2	liters/day	[2]
Conversion Factor	CF1	0.001	mg/µg	
	CF2	24	hours/day	
Exposure Frequency	EF	350	days/year	[2]
Exposure Duration	ED	3	years	[2]
Averaging Time	AT			
Cancer		70	years	[2]
Noncancer		30	years	[2]
Body Weight	BW	70	kg	[2]
Surface Area	SA	20,000	cm^2	[5]
Event Frequency	EV	1	events/day	assumption
Permeability Constant	PC_{event}	Chemical Specific	cm/event	[5]
Concentration Shower Air	CA_{air}	[6]	mg/m^3	[3]
Exposure Time [1]	ET	0.2	hours/day	[4]

References:

[1] Exposure Time is a parameter used only in inhalation of volatiles while showering; See [6].

[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."

[3] This parameter is modeled; See [6].

[4] USEPA, 1989. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part A) EPA/540/1-89/002; December, 1989.

[5] USEPA, 1992, Dermal Exposure Assessment: Principles and Applications; EPA/600-8-91/011B; January, 1992.

[6] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes: mg = milligram.
kg = kilogram.
mg = microgram.
m^3 = cubic meter.

TABLE C-7

EXPOSURE PARAMETERS FOR GROUNDWATER INGESTION, INHALATION, AND DERMAL CONTACT
FUTURE RESIDENTS (ADULT AND CHILD)
RI/FS PHASE II-C WORK PLAN
SITES 3, 4, 30, 32, AND 33
NAS WHITING FIELD
MILTON, FLORIDA

$$INTAKE_{inh} = \frac{CA_{air} xETxEFxED}{CF2xATx365days / year}$$

$$DA_{event} = PC_{event} xCWxCF1xCF2$$

$$Intake_{ing} = \frac{CWx\,IR_{groundwater} xCF1xEFxED}{BWxATx365days / year}$$

$$INTAKE_{dermal} = \frac{DA_{event} xSAxEFxED}{BWxATx365days / year}$$

Parameter	Symbol	Child Value (age 1-6)	Adult Value	Units	Source
Concentration in Groundwater	CW	Chemical Specific	Chemical Specific	mg/liter	
Water Ingestion Rate	IR_{water}	1	2	liters/day	[2]
Conversion Factor	CF1	0.001	0.001	mg/µg	
	CF2	24	24	hours/day	
Exposure Frequency	EF	350	350	days/year	[2]
Exposure Duration	ED	6	30	years	[2]
Averaging Time	AT				
Cancer		70	70	years	[2]
Noncancer		6	30	years	[2]
Body Weight	BW	15	70	kg	[2]
Surface Area	SA	7,200	20,000	cm^2	[5]
Event Frequency	EV	1	1	events/day	assumption
Permeability Constant	PC_{event}	Chemical Specific	Chemical Specific	cm/event	[5]
Concentration Shower Air	CA_{air}	[6]	[6]	mg/m^3	[3]
Exposure Time [6]	ET	0.2	0.2	hours/day	[4]

References:

[1] Exposure Time is a parameter used only in inhalation of volatiles while showering; See [6].
[2] USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Parameters."
[3] This parameter is modeled; See [6].
[4] USEPA, 1989. Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part A) EPA/540/1-89/002; December, 1989.
[5] USEPA, 1992, Dermal Exposure Assessment: Principles and Applications; EPA/600-8-91/011B; January, 1992.
[6] ABB-ES, 1996. Baseline Risk Assessment Workplan Operable Units 3, 4, 5, and 6; Appendix A; NAS Whiting Field, Milton; Florida

Notes: mg = milligram.
kg = kilogram.
mg = microgram.
m^3 = cubic meter.

APPENDIX D

INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

DRAFT

REVISED INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

Contract No. N62467-89-D-0317

Prepared by:

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March 1996

DRAFT

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Investigation-Derived Waste Management Plan

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AOC	area of contamination
ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action, Navy
CLP	USEPA Contract Laboratory Program
CWA	Clean Water Act
DE	disposable equipment
DQO	data quality objective
EC	environmental coordinator
EIC	Engineer-in-Charge
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FID	flame ionization detector
FOL	Field Operations Leader
FR	Federal Register
HDPE	high density polyethylene
HWSF	Hazardous Waste Storage Facility
IDW	investigation-derived waste
LDR	land disposal restrictions
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
μg/ℓ	micrograms per liter
NAS	Naval Air Station
NCP	National Contingency Plan
NPL	National Priority List
OVA	organic vapor analyzer
PCB	polychlorinated biphenyl
PID	photoionization detector
POTW	publicly owned treatment works
PPE	personal protective equipment

GLOSSARY (Continued)

PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation and feasibility study
SOUTNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SSL	Soil Screening Levels
SVOC	semi-volatile organic compound
TAL	target analyte list
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TL	Technical Leader
TOM	Task Order Manager
TSD	treatment, storage, and disposal
TSCA	Toxic Substances Control Act
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
UTS	Universal Treatment Standards
VOC	volatile organic compound
WWTP	wastewater treatment plant

1.0 INTRODUCTION

ABB Environmental Services (ABB-ES), Inc., is under contract with Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) Contract No. N62467-89-D-0317 to perform an Remedial Investigation/Feasibility Study (RI/FS) at Naval Air Station (NAS) Whiting Field.

When collecting environmental samples to characterize a potential hazardous waste site, a variety of potentially contaminated investigation-derived waste (IDW) are generated (i.e., soil, groundwater, used personal protective equipment (PPE), disposable equipment (DE), and decontamination fluids). The IDW must be managed in a sufficiently responsible manner so that the site is not in a worse state than previously existed and does not pose an immediate threat to human health or the environment.

1.1 PURPOSE. The intent of this IDW plan is to implement a permanent, consistent program for managing wastes derived from the RI/FS of identified sites at NAS Whiting Field. Further, this plan will ensure that health and safety, Federal or State regulations, and Navy requirements are satisfied. This plan defines the roles and responsibilities for ABB-ES personnel, ABB-ES subcontractors, and NAS Whiting Field representatives.

1.2 PLAN GUIDANCE DOCUMENTS. This facility-specific IDW document provides the general guidelines for IDW treatment, storage, and disposal. In completing the document the following regulatory guidelines were reviewed and incorporated where appropriate:

- Management of Investigation-Derived Wastes During Site Inspections (USEPA, May 1991), and

- Management of Contaminated Media Under RCRA (Florida Department of Environmental Protection Interoffice Memo, July 1995; attached).

In addition, all IDW materials will be handled, transported, and disposed of according to Applicable or Relevant and Appropriate Requirements (ARARs) for IDW. The ARARs may include Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Toxic Substances Control Act (TSCA), and/or any other existing Federal and State of Florida regulations.

2.0 SITE-SPECIFIC INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

This section presents the RI site-specific IDW management plan for NAS Whiting Field. Section 2.1 defines and discusses types of IDW expected to be generated at NAS Whiting Field. Disposal options available for each type are also presented. Section 2.2 presents site-specific IDW management and a table depicting the expected disposal methods to be used at each site. Section 2.3 describes equipment and logistics that will be used for IDW management at NAS Whiting Field.

2.1 TYPES OF IDW. The types of IDW expected to be generated during the RI at NAS Whiting Field include: drill cuttings and mud, excavated soils, purge and development water, decontamination fluids, PPE, and DE. The following subsections describe each type of IDW and the available disposal options.

All IDW materials will be handled, transported, and disposed of according to ARARs for IDW. Non-hazardous (non-contaminated) materials will be returned to the site from which they originated and disposed onsite or in a NAS Whiting Field solid waste dumpster, as appropriate.

2.1.1 Drill Cuttings and Mud Depending on site conditions, drill cuttings and mud (earthen IDW) may be disposed of in various ways including: spread on the land surface within the Area of Contamination (AOC), buried within the AOC, or containerized in drums or roll-off boxes. The decision to return wastes to the AOC or containerize them will be determined by the field operations leader (FOL) based on his/her knowledge of the site and the waste.

Perimeter Road Sites. Earthen IDW from the Perimeter Road sites including sites 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 31 will be spread out on the ground adjacent to where they were generated to prevent a nuisance condition, physical hazard, or drainage problem. The IDW will be placed so as to minimize erosion by surface water flow or runoff. At perimeter road Site 16, earthen IDW will be segregated into separate piles of saturated and unsaturated soils. The unsaturated soils will be spread on the land surface or buried within the AOC to avoid impacting surface water quality. The saturated soils will be containerized and sampled for hazardous waste determination.

When disposing earthen IDW by burial, the USEPA guidance document Management of Investigation-Derived Wastes During Site Inspections (USEPA, May 1991) will be used. The document states that "burying RCRA hazardous soil cuttings within the AOC unit, so long as no increased hazard to human health and the environment will be created" is consistent with the National Contingency Plan (NCP) and RCRA Land Disposal Restrictions (LDRs). In addition, the IDW guidance document also states "containerization and testing are not required for onsite disposal."

For disposal into a pit, a trench will be constructed within the AOC so that the bottom does not penetrate the water table. If the FOL deems it necessary, the trench sides will be lined with plastic sheeting (16 mil thickness, minimum). Earthen IDW suitable for trench burial will be screened with a photoionization detector (PID) or a flame ionization detector (FID) at the time of excavation. The waste will be transported to the trench within 2 days. After the drilling phase is completed, the earthen IDW within the trench will be covered with a plastic liner (a minimum of 16 mil thickness), followed by a minimum 6-inch thick clean fill cover. The trench surface will be seeded with grass to prevent erosion.

Each trench or pit will contain and isolate its contents, and prevent exposure to humans and the environment. If a site associated with an IDW trench requires remediation or if leachate is encountered at a future date, samples from the trench IDW will be laboratory tested to determine if the materials within the trench require removal or remediation. If removal is warranted, then the material will be removed as part of the remediation effort at that site.

All trenches will be marked and readily identifiable by concreting in place a polyvinyl chloride (PVC) pipe stake (or other non-degradable stake) at each corner. The location of each disposal pit will be surveyed, and the trench location, physical dimensions, and IDW burial information will be recorded in a field log book.

Industrial Area Sites. For sites within the industrial or populated areas including: sites 3, 4, 5, 6, 7, 29, 30, 32, and 33 earthen IDW may be spread on the land surface within the AOC, buried within the AOC, or containerized. The decision to return wastes to the AOC or containerize them will be determined by the FOL based on his/her knowledge of the site and the waste.

If the FOL determines that earthen IDW from a particular excavation or drilling effort should be drummed, ABB-ES will collect an IDW sample from each source (or drum, if no source sample exists) at the completion of a soil boring or excavation. The samples will be analyzed for suspected contaminants that may include: volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs) from the target compound list (TCL); inorganics, and total cyanide from the target analyte list (TAL) (Level II Data Quality Objectives (DQOs)).

To determine if the containerized earthen IDW should be classified as hazardous or nonhazardous, RCRA hazardous waste criteria will be used. A RCRA solid waste is hazardous if it is listed in Subpart D of 40 CFR 261 or exhibits a hazardous characteristic defined in 40 CFR 261 as ignitability, corrosivity, reactivity or toxicity. In addition, the wastes will be screened against the Universal Treatment Standard (UTS) values specified in 40 CFR 268.40 and the Soil Screening Levels (SSLs).

Each soil sample analytical results in milligrams per kilogram (mg/kg) will be divided by 20 to yield a conservative estimate of potential leachate concentration in milligrams per liter (mg/l). The estimated concentration will then be compared with the 39 existing toxicity characteristic leaching procedure (TCLP) regulatory concentrations (40 CFR 261). If the soil analytical results indicate concentrations above any TCLP regulatory concentration, the waste will be classified as hazardous and the Installation will be responsible for appropriate disposal according to RCRA Subtitle C.

In addition, the IDW soil sample analytical results will be compared against the values provided in the UTS and SSLs (which ever has higher values will be used), if exceedances are identified the waste will be classified as hazardous and the Installation will be responsible for appropriate disposal according to RCRA Subtitle C.

If the laboratory results indicate contaminants are below the RCRA hazardous waste criteria and the UTS values, the soils will either be disposed of off facility or spread or buried at a designated area of the facility.

<u>Drummed Drill Cuttings or Mud</u>. In general earthen IDW drummed and stored at the site will become the property of NAS Whiting Field. ABB-ES will maintain a log of the drums and will clearly identify the containers using weather-resistant

labels. The labels will indicate the drum contents, site and sample location number, date filled, contact person, and corresponding log entry number. NAS Whiting Field will be responsible for the transport, disposal or treatment of the containerized IDWs.

<u>2.1.2 Purge and Development Water</u>. Purge and development water will be disposed of either by discharging on the land surface within the AOC or by containerizing into drums or a mobile storage tanker.

For liquid IDW such as purge and development water, CWA is applicable in addition to RCRA regulations. The CWA addresses site-specific pollutant discharge limitations to protect surface water quality. RCRA hazardous waste water can be disposed of at a Public Owned Treatment Works (POTW) that have a RCRA permit-by-rule and meet the offsite policy criteria for a facility receiving RCRA hazardous waste. Disposal at a POTW of nonhazardous waste waters from Comprehensive Environmental Response and Liability Act (CERCLA) sites is an option if the POTW is acceptable under USEPA's offsite policy.

The hazardous nature of liquid IDW will be determined on a well by well basis by the FOL. The FOL's decision will be based on the following factors: site location well location at site (i.e. background, hot spot, upgradient, downgradient), and knowledge of the waste (i.e., specific analytical results, results of PID/FID screening, visual inspection, and presence of odors).

If purge and development water is determined to be hazardous, the IDW will be contained in drums and stored in a designated area. ABB-ES will submit TAL/TCL analytical results to NAS Whiting Field Hazardous Waste Coordinator upon receipt. NAS Whiting Field will be responsible for the transport, disposal or treatment of the containerized IDW.

If purge and development IDW is determined to be nonhazardous, ABB-ES will discharge the IDW directly on the land surface within the AOC downgradient of the associated well and allow the liquid to percolate into the soil. Care will be taken to insure that the liquid waste percolates into the ground rather than flow into surface waterways.

Nonhazardous purge and development water from monitoring wells in the paved industrial area of NAS Whiting Field may not have an appropriate surface that could assure percolation into the subsurface. In such cases, purge and development water will be contained in drums and ultimately stored in selected compartments of a mobile tanker. NAS Whiting Field will be responsible for the appropriate disposal or treatment of the containerized IDW.

2.1.3 Decontamination Fluids. IDW in the form of decontamination fluids will be discharged either to the waste water treatment plant (WWTP) (via the equipment washrack facility) or onto the ground within the AOC.

The equipment washrack, (Building 2858), located adjacent to the northwest water tower on NAS Whiting Field, will be used to steam clean drill rigs and decontaminate selected field equipment. Rinse water from decontamination operations will be channeled directly into the sewer system which interconnects with the WWTP.

Decontamination fluids produced from decontamination of equipment at the Perimeter Road sites will be discharged onto the ground and allowed to percolate within the AOC.

2.1.4 Personal Protective Equipment (PPE) and Disposable Equipment (DE). PPE (gloves and tyvek suits) and DE (tubing, respirator cartridges, etc.) will be used only at selected sites. PPE and DE may be disposed of in one of two ways. If non-hazardous, PPE and DE will be double-bagged and disposed of in a NAS Whiting Field solid waste dumpster. Or, if contaminated, used PPE and DE will be drummed, labeled, and stored at the NAS Whiting Field hazardous waste storage facility (HWSF) and the Facility will be responsible for appropriate disposal.

The FOL will determine in the field if PPE and DE are to be drummed and sent to the HWSF or double-bagged and disposed of in a local solid waste dumpster. The FOL's decision will be based on the contamination exposure level encountered at each site.

2.2 SITE-SPECIFIC IDW MANAGEMENT

Table 2-1 presents a summary of the types of materials disposed of at each of the sites and lists the analytes of potential concern for each site. Table 2-2 presents the anticipated IDW generated from the RI field program and disposal methods associated with each site at NAS Whiting Field.

Table 2-1
Summary of Potential Disposal Sites

Investigation-Derived Waste Document
NAS Whiting Field, Milton, Florida

RI/FS Site No.	Site Name and Type	Period of Operation	Types of Material Disposed	Analytes of Potential Concern[1]
1	Northwest Disposal Area (landfill)	1943-1965	Refuse, waste paints, thinners, solvents, waste oils, and hydraulic fluids.	**Surface Soils** - dieldrin, Cd, Cr, Fe, Hg and K **Groundwater** - Al, Be, Cr, Fe, Pb, Mn and Ni
2	Northwest Open Disposal Area (landfill)	1976-1984	Construction and demolition debris, tires, and furniture.	**Soils** - NA **Groundwater** - BEHP
3	Underground Waste Solvent Storage Area (tank)	1980-1984	Waste solvents, paint stripping residue, and 120-gallon spill.	**Subsurface Soils** - acetone, 2-butanone, TCE, 10 - SVOCs, and 7 pesticides **Groundwater** - BTEX, 1,2-DCE, TCE, tetrachloroethane, BEHP, and heptachlor epoxide
4	North AVGAS Tank Sludge Disposal Area	1943-1968	Tank bottom sludge containing tetraethyl lead.	**Soils** - NA **Groundwater** - 1,2-DCE, TCE, BTEX, 4-methylphenol, BEHP, Al, Cd, Sb, Fe, Pb, and Mn
5	Battery Acid Seepage Pit (contaminated soil)	1964-1984	Waste electrolyte solution containing heavy metals and waste battery acid.	**Soils** - NA **Groundwater** - TCE, tetrachloroethane, benzene, BEHP, Al, Sb, Cd, Cr, Fe, Pb, Mn, and Hg
6	South Transformer Oil Disposal Area (contaminated soil)	1940's-1960's	PCB-contaminated dielectric fluid.	**Subsurface Soils** - 1,1-DCE, 1,2-DCE, 2-butanone, TCE, 19 SVOCs, 4,4-DDD, 4,4-DDE, endosulfan, sulfate and aroclor **Groundwater** - 1,1-DCE, TCE, BEHP, Al, Cd, Fe, Pb and Mn
7	South AVGAS Tank Sludge Disposal Area (landfill and tanks)	1943-1968	Tank bottom sludge containing tetraethyl lead.	**Soils** - NA **Groundwater** - TCE, BTEX, vinyl chloride, 1,2-DCE, Al, An, Cd, Fe, Pb, and Mn
8	AVGAS Fuel Spill Area (contaminated soil)	Summer 1972	AVGAS containing tetraethyl lead.	No Additional Investigation Planned; Received an NFRAP
9	Waste Fuel Disposal Pit (landfill)	1950's-1960's	Waste AVGAS containing tetraethyl lead.	**Soils** - NA **Groundwater** - Al and Fe
10	Southeast Open Disposal Area (A) (landfill)	1965-1975	Construction debris, solvents, paint, oils, hydraulic fluid, PCBs, pesticides, and herbicides.	**Surface Soils** - naphthalene, 2-methyl naphthalene, acenaphthalene, fluorene, phenanthrene, pyrene, aldrin, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT, An, As, Ba, Br, Cd, Ca, Cr, Cu, Fe, Pb, K, Ag, Va and Zn **Groundwater** - Al and Fe

See notes at end of table.

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Table 2-1 (Continued)
Summary of Potential Disposal Sites

Investigation-Derived Waste Document
NAS Whiting Field, Milton, Florida

RI/FS Site No.	Site Name and Type	Period of Operation	Types of Material Disposed	Analytes of Potential Concern[1]
11	Southeast Open Disposal Area (B) (landfill)	1943-1970	Construction and demolition debris, waste solvents, paint, oils, hydraulic fluid, and PCBs.	**Surface Soils** - aldrin, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT, aroclor, As, Ba, Cd, Ca, Cr, Cu, Fe, Pb, Hg, Va, Zn and Cyanide **Groundwater** - Al, Fe, Pb, and Mn
12	Tetraethyl Lead Disposal Area (waste pile)	May 1, 1968	Tank bottom sludge and fuel filters contaminated with tetraethyl lead.	**Soils** - NA **Groundwater** - Cd
13	Sanitary Landfill (landfill)	1979-1984	Refuse, waste solvents, paint, hydraulic fluids, and asbestos.	**Surface Soils** - naphthalene, Al, As, Cr, Fe, Hg, K, Va and cyanide **Groundwater** - BEHP, Al, Cd, Fe, Mn
14	Short-Term Sanitary Landfill (landfill)	1978-1979	Refuse, waste solvents, oils, paint, and hydraulic fluids.	**Surface Soils** - naphthalene, As, Cd, Cr, Fe, Hg and V **Groundwater** - BEHP, Al and Fe
15	Southwest Landfill (landfill)	1965-1979	Refuse, waste paints, oils, solvents, thinners, asbestos, and hydraulic fluid.	**Surface Soils** - naphthalene, 2-methylnaphthalene, 4,4-DDE, aroclor, Cd, Pb, Hg, K and cyanide **Groundwater** - BEHP, Al, Cd, Fe and Mn
16	Open Disposal and Burning Area (landfill)	1943-1965	Refuse, waste paints, oils, solvents, thinners, PCBs, and hydraulic fluid.	**Surface Soils** - naphthalene, 2-methyl naphthalene, acenaphthalene, fluorene, phenanthrene, fluoranthene, pyrene, BEHP, benzo fluoranthene, benzo(a)pyrene, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT, Al, As, Ba, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Ag, Na, V, Zn and cyanide **Groundwater** - 1,2-DCA, TCE, benzene, ethylbenzene, Al, Be, Cd, Cr, Fe, Pb and Mn
17	Crash Crew Training Area (contaminated soil)	1951-1991	JP-5 fuel.	**Subsurface Soils** - acetone, 2-butanone, 4-methyl-2-pentanone, diethylphthalate, di-n-butylphthalate, 4,4-DDE and 4,4-DDT **Groundwater** - BEHP, Al, Cr, Fe, Pb and Mn
18	Crash Crew Training Area (contaminated soil)	1951-1991	JP-5 fuel.	**Subsurface Soils** - acetone, 2-butanone, 4-methyl-2-pentanone and xylenes **Groundwater** - Al, Fe and Mn
29	Auto Hobby Shop	1943-present	Paint, oils, and solvents	**Subsurface Soils** - acetone, 2-butanone, butylbenzylphthalate, BEHP, dieldrin, 4,4-DDE, 4,4-DDD, 4,4-DDT and chlordane **Groundwater** - Al, An, Cd, Cr, Fe, Pb and Mn

See notes at end of table.

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Table 2-1 (Continued)
Summary of Potential Disposal Sites

Investigation-Derived Waste Document
NAS Whiting Field, Milton, Florida

RI/FS Site No.	Site Name and Type	Period of Operation	Types of Material Disposed	Analytes of Potential Concern[1]
30	South Field Maintenance Hangar	1943-present	Fuels, solvents, and oils	**Subsurface Soils** - acetone, TCE, 2-butanone, 13 SVOCs, dieldrin and 4,4-DDD **Groundwater** - 1,1-DCE, TCE, benzene, xylene, Al, Cd, Fe, Pb and Mn
31	Sludge Drying Beds and Disposal Areas	1943-1990	Wastewater Treatment Plant sludge.	**Surface Soils** - benzo(b)fluoranthene, benzo(k) fluoranthene, dieldrin 4,4-DDE, 4,4-DDT, chlordane, aroclor 1260, Ba, Br,Ca, Cd, Cr, Cu, Fe, Pb, Hg, Se, Ag, Zn and cyanide **Groundwater** - No data available
32	North Field Maintenance Hangar	1943-present	Fuels, solvents, and oils	**Subsurface Soils** - methylene chloride, acetone, 1,2-DCE, 2-butanone, TCE, tetrachloroethane, toluene, ethylbenzene, xylene, 13 SVOCs, 4,4-DDE, $,4-DDD, and aroclor **Groundwater** - 1,2-DCE, TCE, BTEX, BEHP, Al, Cd, Cr, Cu, Fe, Pb and Mn
33	Midfield Maintenance Hangar	1943-present	Fuels, solvents, and oils	***Subsurface Soils*** - *acetone*, TCE. ethylbenzene, xylenes, 7 SVOCs, heptachlor, dieldrin, 4,4-DDE, 4,4-DDT and chlordane **Groundwater** - TCE, Al, Cd, Fe, Mn and Ti

[1] See Technical Memorandum No. 3 - Soils Assessment and 5 - Groundwater Assessment for specifics relative to background concentrations.

Notes: Surface soil samples were screened against 2 times background concentrations.

Subsurface soils samples were screened in that all detected organic analytes but no inorganic analytes were reported. No screening criteria currently exists.

Groundwater were screened in that all analytes detected above Federal or Florida MCLs were reported.

RI/FS = Remedial Investigation and Feasibility Study.
NA = Data is not availabe for either surface or subsurface soils.
AVGAS = aviation gasoline.
PCB = polychlorinated biphenyl.
JP-5 = jet propellant 5.

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TABLE 2-2

Expected Investigation-Derived Waste (IDW) Disposal Methods

Site Number	Earthen IDW	Purge and Development Water	Decontamination Fluids	PPE and DE
1	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
2	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
3	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
4	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
5	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
6	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
7	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
9	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
10	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
11	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
12	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster

Site Number	Earthen IDW	Purge and Development Water	Decontamination Fluids	PPE and DE
13	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
14	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
15	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
16	bury within AOC	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
17	spread on surface within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
18	spread or bury within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
29	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
30	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
31	spread, bury within AOC	pump on ground within AOC	Whiting Field WWTP	Whiting Field dumpster
32	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster
33	spread, bury or drum	discharge or drum and tanker	Whiting Field WWTP	Whiting Field dumpster

Notes: DE - disposable sampling equipment
PPE - personal protective equipment
WWTP - wastewater treatment plant

<u>2.3 EQUIPMENT AND LOGISTICS</u>. The following sub-sections describe the type of materials and equipment that will be used at NAS Whiting Field for handling IDW. Also outlined are responsibilities, and transportation requirements.

<u>2.3.1 Containers</u>. The majority of the containers used onsite will be 55-gallon steel drums, (H or F type). The drums will be in compliance with U.S. Department of Transportation (USDOT), 49 CFR 173. Open head drums (H type) will be constructed of 16-gauge steel, top, bottom and body, as a minimum. Tops will be secured with a 12-gauge bolt ring, bolt, nut, and a sponge rubber gasket. Closed head drums (F type) will be constructed of 18-gauge steel, top, bottom, and body, as a minimum. F type drums will have two vents on the top, 2-inch and 0.75-inch, one for filling and one for venting.

Other containers that may be used onsite for monitoring well purge and development water storage include a water truck/tanker.

2.3.2.1 Labels. All drums containing IDW stored on-site will be labeled in accordance with USDOT requirements (HM-181).

Drummed material will be clearly marked with the following information: drum content, site and well (or sample) number, date containerized, and corresponding log entry number.

2.3.2.2 Transportation. NAS Whiting Field or its subcontractor will transport all liquid waste that has been drummed, stored in a tanker, or stored in a HDPE tank to the WWTP or HWSF. Transportation will be via pick-up truck, flatbed, or tanker, as required.

NAS Whiting Field or its subcontractor will transport all drummed hazardous solid IDW to the base HWSF. Transportation will be via van or flatbed pick-up truck. ABB-ES will coordinate the drum delivery with the NAS Whiting Field Hazardous Waste Coordinator. ABB-ES will provide the analytical results so that the installation can properly label or classify each drum.

2.3.2.3 Empty Drum Storage. Empty drums will be rinsed of any significant soil deposits and transported to a designated storage area identified by NAS Whiting Field Hazardous Waste Coordinator. The drums will be stored on pallets and in a manner that provides secondary containment. The storage container pallets will pallets will be arranged so as to allow access between them for container inspection. Not more than two drums will be stacked vertically together. Drum lids will be secured in place to prevent incidental collection of rainfall.

3.0 POINTS OF CONTACT

This section describes key roles in the management of IDW at NAS Whiting Field and identifies key points of contact.

3.1 ORGANIZATION.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). SOUTHNAVFACENGCOM is responsible for establishing policy and guidance for the Comprehensive Long-Term Environmental Action, Navy (CLEAN) program. SOUTHNAVFAC-ENGCOM awards contracts, approves funding, and has primary control of report release and interagency communication.

NAS Whiting Field Environmental Coordinator (EC). The NAS Whiting Field ECs, Mr. Jim Holland or Ms. Pat Durbin, will coordinate and monitor IDW activities. The ECs will provide local support and be the primary point of contact with the HWSF Manager and the local, State, and Federal regulatory agencies.

Southern Division Engineer-in-Charge (EIC). The SOUTHNAVFACENGCOM EIC, Mr. Jeff Adams, is responsible for the technical and financial management of the IDW activities at NAS Whiting Field.

Task Order Manager (TOM). The ABB-ES TOM, Mr. Terry Hansen, is responsible for evaluating the appropriateness and adequacy of the technical and engineering services provided during the handling of IDW.

RI/FS Technical Leader (TL). The ABB-ES TL, Mr. Gerry Walker, will be responsible for the quality and completeness of the IDW disposal data gathered during the field program, including overall management and coordination of field work, and supervision and scheduling of work.

Field Operations Leader (FOL). The ABB-ES FOL will vary during differing stages of field work. The FOL will be responsible for ensuring the field activities are performed consistent with the IDW plan. This will include appropriate documentation of all IDW activities at NAS Whiting Field.

3.2 IDW MANAGEMENT TEAM MEMBER LIST. The following is a list of phone numbers for members of the NAS Whiting Field IDW management team.

Navy CLEAN EIC	Jeff Adams	(803) 743-0341
NAS Whiting Field EC	Jim Holland	(904) 623-7667
NAS Whiting Field HWSF Manager	Pat Durbin	(904) 623-7667
ABB-ES Task Order Manager	Terry Hansen	(904) 656-1293
ABB-ES Technical Leader	Gerry Walker	(904) 656-1293
ABB-ES Field Trailer Phone	FOL	(904) 623-7754
USEPA Project Manager	Craig Benedikt	(404) 347-3016
FDEP Project Manager	James H. Cason	(904) 488-3935

REFERENCES:

U. S. Environmental Protection Agency (USEPA), 1991, Management of Investigation-Derived Waste During Site Inspections, EPA/540/G-91/009, May 1991.

Florida Department of Environmental Protection, 1995, Interoffice Memorandum, Management of Contaminated Waste Under RCRA, July 1995.

ATTACHMENT I

INTRODUCTION:

The following guidance was developed to be used for RCRA sites, that potentially may generate contaminated media through site investigation or corrective action/remediation activities.

This guidance does not change or supersede specific RCRA, CERCLA, or any other regulatory requirements. The outline below is to be used as interim guidance for handling contaminated media. It is anticipated that EPA will finalize a rule addressing management of contaminated media. This interim guidance will be finalized after the EPA rule is promulgated.

This guidance addresses contaminated media with contamination originating from a characteristic source or a listed source.

The objective of this guidance is to bring uniformity and consistency to the manner in which different programs in the Department handle, or require respondents/permittees to handle, contaminated media subject to RCRA requirements when contamination is above specified concentrations outlined in this memo. Approval of procedures for managing media below these concentrations will be the responsibility of the Department staff overseeing the specific project.

This guidance does not apply to contaminated media solely from petroleum cleanup sites. However it will be applicable to sites that have both petroleum and non-petroleum contamination.

INTERPRETATION:

The following criteria clarify the use of Land Disposal Universal Treatment Standards (UTSs) in determining if contaminated media (from a listed or characteristic source) are subject to RCRA Subtitle C regulation (see flowchart on Page 4):

1. Contaminated media exhibiting hazardous waste characteristics shall be managed as hazardous waste and are subject to full RCRA Subtitle C regulation.

2. (a) For Waste Water: All waste water with hazardous constituent concentrations exceeding the Universal Treatment Standards (UTSs), (40 CFR 268.40), or the Maximum Contamination Levels (MCLs), (F.A.C. Chapter 62-550), whichever is

higher, is considered hazardous waste and shall be managed in accordance with RCRA Subtitle C requirements.

(b) For Contaminated Soils: All soils with hazardous constituent concentrations exceeding the Universal Treatment Standards (UTSs), (40 CFR 268.40), or the Soil Screening Levels (SSL developed in accordance with EPA guidance), whichever is higher, are considered hazardous waste and shall be managed in accordance with RCRA Subtitle C requirements.

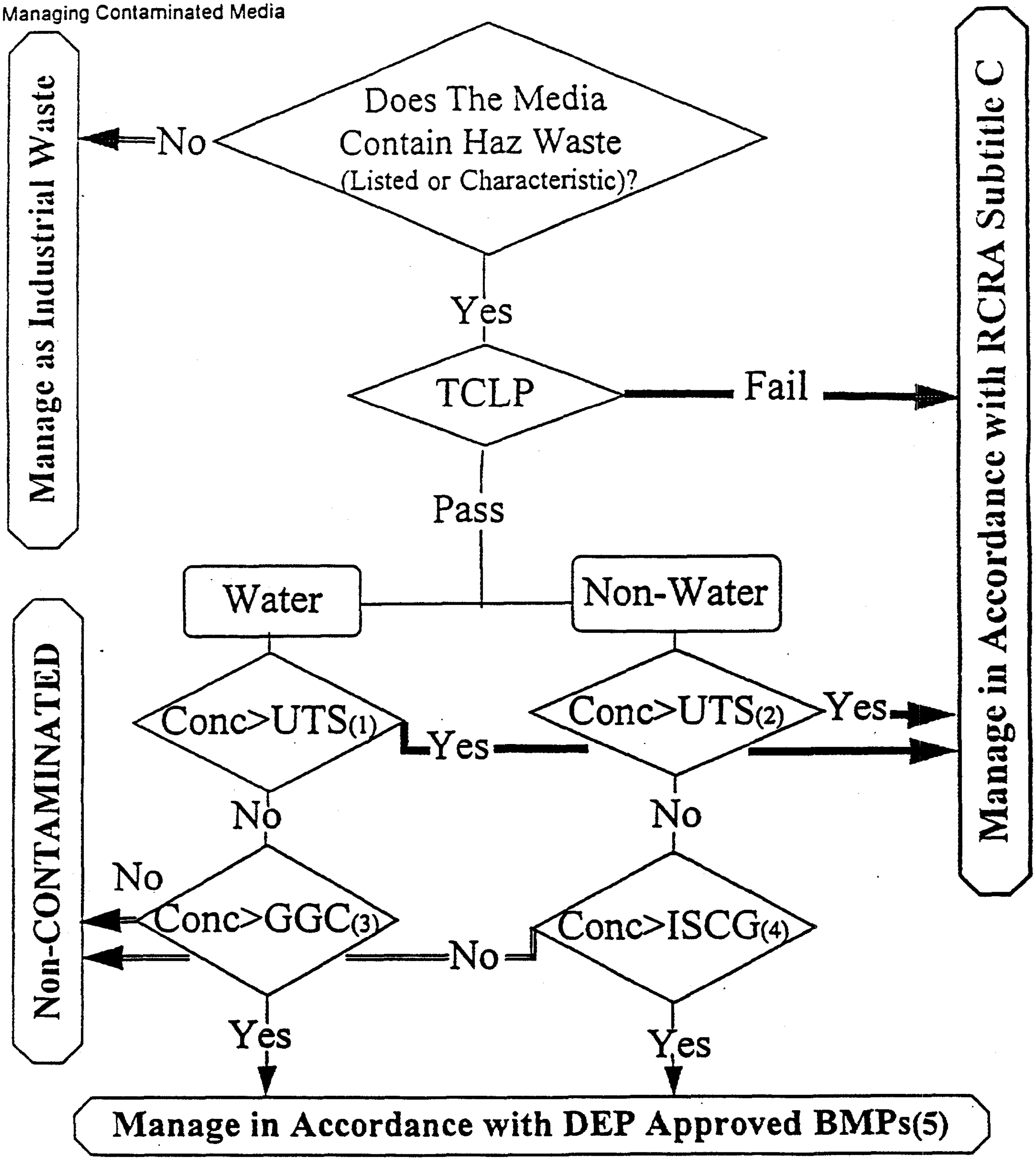
3. Contaminated media with hazardous constituent concentrations less than the UTSs (or SSLs/MCLs in cases where SSLs/MCLs are higher than UTSs) will not be subject to RCRA Subtitle C requirements, and shall be managed using Department approved best management practices (BMPs).

4. Contaminated media with hazardous constituent concentrations less than Groundwater Guidance Concentration levels (GGC) or the Interim Soil Cleanup Goal levels (ISCG developed by the Department's Bureau of Waste Cleanup), are considered decontaminated.

<u>Department approved BMPs must be applied in managing media containing hazardous waste constituents at concentrations below the standards specified above in item 3,</u> otherwise, media will be subject to full RCRA Subtitle C regulation.

BMPs will be reviewed by Department staff overseeing a specific project as a portion of the submitted assessment, interim measures, or corrective action (remediation) plans, and determine their adequacy.

ATTACHMENT II



(1) In cases where MCL > UTS, MCL is considered in this step. In cases where there is no UTS for a contaminant, media management practices will be evaluated on a case to case basis.

(2) In cases where Soil Screening Levels (As developed in accordance to EPA's Soil Screening Levels "SSL" guidance) are greater than UTS levels, SSLs will be considered.

(3) GGC = Florida Groundwater Guidance Concentrations

(4) ISCG = Interim Soil Cleanup Goals Developed by Bureau of Waste Cleanup

(5) BMPs = Best Management Plans. BMPs are to be reviewed and approved by the Bureau/District overseeing the specific project.

Florida Department of

Environmental Protection

Interoffice Memorandum

To: Waste Management Program Administrators

From: Satish Kastury, Environmental Administrator, HW Regulation

Date: July 27, 1995

Subject: Management of Contaminated Media under RCRA

Pursuant to our discussion during the WPAs meeting regarding contaminated media, provided are two attachments addressing management of contaminated media under RCRA.

The criteria listed in Attachment I under items 1, 2, 3 and 4 have already been reviewed by Bill Burns, Dan DeDomenico, Bill Martin, Jim Crane, Tom Conrardy, and Ligia Mora-Applegate of Waste Cleanup, and their comments were incorporated. Your comments from the discussion during the last WPAs Meeting were also incorporated into the text in Attachment I, and into the flowchart presented in Attachment II.

Should you have any questions, please contact me, Doug Outlaw, or Maher Budeir of my staff.

cc: John Ruddell; ....Division Director, Waste Management.
Bill Hinkley; ....Bureau Chief, Bureau of Solid and Hazardous Waste
Alan Farmer; ....EPA, Region IV
Doug Jones; ....Bureau Chief, Bureau of Waste Cleanup
Jim Crane;.....................Bureau of Waste Cleanup
Bill Burns;......................Bureau of Waste Cleanup
Dan DeDomenico; ....Bureau of Waste Cleanup
Bill Martin; ....Bureau of Waste Cleanup
Ligia Mora-Applegate;...Bureau of Waste Cleanup
Diana Coleman;............OGC
Agusta Posner; ....OGC
Doug Outlaw
Maher Budeir
Mike Redig
Merlin Russell
RCRA Permitting and Compliance Technical Committee Members

APPENDIX E

RESPONSES TO DRAFT WORK PLAN REVIEW COMMENTS

APPENDIX E
RESPONSES TO DRAFT WORK PLAN REVIEW COMMENTS
RI/FS PHASE II-C DRAFT WORK PLAN
NAVAL AIR STATION WHITING FIELD

Florida Department Of Environmental Protection Comments

Comment 1: The document has a green cover. Previous Navy documents were furnished with white (for draft) documents and green covers were furnished with corrected pages or on the final document. I would prefer to maintain this practice in the future to insure consistency; however, I am willing to accommodate this apparent change should this be your desire.

Response: **The green cover was replaced with a white cover at the June 19, 1997, Partnering Meeting. Future draft documents will be submitted with white covers, and final documents will be submitted with green covers in accordance with current Navy protocol.**

Comment 2: Figure 1-2 is adapted from an existing figure; however, the scale as it relates to the data presented is rather small. I know this is picky, but this is important in the overall work effort at each site. Figure 2-2 is more workable and is a good example.

Response: **Figure 1-2 will be replaced with a "C" size drawing to make it more readable.**

Comment 3: Section 2.6, page 2-28: proposes installation of a well to the top of the clay to identify free-phase DNAPLs, if present. I have two comments in this regard: first, it seems that knowledge of the gradient of the clay layer is mandatory if this approach is used since the DNAPL could (or may have) migrated downgradient, away from the source area; second, does the data for the aqueous phase DNAPLs indicate, stoichiometrically, that a "source" may be still (was ever) present? Since this will be an expensive well, I want to assure that such a well would yield useful data.

Response: **Knowledge of the location, thickness, gradient, etc., of the clay, silt, and sand layer(s) as well as contaminant concentrations at depth near the suspected source area is very important to remediation of the site. The important information that will be collected or derived from installation of this deep well includes vertical contaminant concentration mapping, geotechnical parameters to support groundwater modeling, vertical extent of contamination, lithologic data to support groundwater flow modeling, vertical groundwater gradient, and the presence or absence (at this location) of DNAPLs. You are correct that the DNAPLs could have migrated downgradient, crossgradient, or even upgradient from the source area due to the clay layer gradient, and the proposed deep well could miss the DNAPLs, if present. However, if DNAPLs or significant deep contamination is present and the deep well misses it, the groundwater concentration data collected from the deep well should be elevated, indicating the presence of significant contaminants. Analytical data collected to date do not indicate stoichiometrically that a "source" is present; however, no data have been collected at depth near the suspected source area.**

Comment 4: Section 2.6, page 2-29: does the possibility that workers and residents *could* be exposed to untreated ground water at NAS Whiting constitute the contaminant release scenario? I note that the base is presently under regulatory constraints which mandate GOC treatment of potable water produced at Whiting. This should be acknowledged within the context of this section and in the evaluation. A realistic scenario which could be considered would be one which examines the risk to humans using small private wells with the risk occurring from off-base migration of contaminated ground water.

Response: **The text will be revised in Section 2.6 and Section 5 to include a statement that the potable water produced by Whiting Field is GAC–treated and does not pose ~~a~~ an unacceptable risk under the current land use scenario. ~~No human health~~ However, to establish the baseline risk, military resident receptors will be evaluated for groundwater exposure under the current land use scenario in Section 5 of the Work Plan. Future residents and site occupational workers will be evaluated for groundwater exposure under the future land use scenario as shown in Table 5-2 because private wells could possibly be constructed on Base in the future.**

Comment 5: Page 2-37, Groundwater "bullet": the use of existing data and data from additional sampling of existing wells should be stated.

Response: **The text will be revised as follows: *Groundwater quality data and hydrologic information from previous investigations, sampling of existing monitoring wells, and installation of additional monitoring wells will be used to evaluate ....***

Comment 6: Table 2-3: I have problems with the use of definitives ("will, is, does not"). I am not sure that natural attenuation will prevent further migration of the aqueous plume. I know that this is a table of uncertainties, but less definitive language would be useful. Additionally, it seems to me that the biggest uncertainty is the effect of the ground water plume(s) on Clear Creek and associated habitats, which has been omitted. I recognize that we are all hoping the contamination doesn't migrate under Clear Creek; if it doesn't, where does it discharge?

Response: **Wording in the table will be revised to make it less definitive. ~~At this time, due to the distance to Clear Creek from the North Field plume it is assumed that remedial actions will prevent the North Field plume from reaching Clear Creek.~~ Table 2-3 will be revised to state that the probable condition for aqueous groundwater plume containment/treatment is as follows: "The aqueous plume migrates downgradient toward Clear Creek. Engineering controls and natural attenuation may be used to contain the plume."**

Comment 7: Table 2-5: are Level II data adequate for receptor surveys, especially in the case of Clear Creek? I'm not saying it isn't; just that we need to be sure.

Response: **The receptor survey will be qualitative in nature and will include only Sites 3, 4, 30, 32, and 33. As mentioned in Section 5.2.1.3, the survey will include a site-specific literature review and site reconnaissance. In general, this type of survey is not subject to specific quantitative data requirements.**

Comment 8: Page 3-1: Please add "and addenda" to the RAGS reference.

Response: **The text will be revised as requested.**

Comment 9: Section 3.1.3.7 (and others): what constitutes "extreme care?"

Response: **Care will be taken to limit exposure of the sample to ambient air and reduce turbidity of the sample. The reference to "extreme" will be deleted from all sections.**

Comment 10: Section 3.1.3.9 Residual Free Product Detection: Please explain how the Residual Free-Product Detection in Soils techniques will be utilized in the assessment.

Response: **Section 3.1.3.9 will be revised to state: Residual free product field detection techniques using UV light or red dye will be used for soil borings and monitoring wells installed near suspected DNAPL source areas. UV light or red dye field tests will be performed on soil samples collected from the top of significant clay layers (more than 4 feet thick) and other suspected locations based on field observations (i.e., elevated FID readings, odors, staining).**

Comment 11: Page 3-82, Investigation Scope; Page 3-99 and others: the extent of soil contamination determination should also consider Florida Soil Cleanup Goals (1995) and/or the contaminated soil criteria which may included in the revised Chapter 62-770, F.A.C., presently expected to be adopted early this summer.

Response: **The text on pages 3-82 and 3-99 will be revised as follows:**

- **Define extent of soil contamination that exceeds applicable FDEP regulations [e.g. Florida Soil Cleanup Goals (1995), Chapter 62-770 FAC, and Soil Cleanup Target Levels for Revised Chapter 62-770 FAC, if adopted]**

Comment 12: Figure 3-5: is the bi-lobed area depicted near Site 6 a plume outline, site boundary, or other differentiation of the site?

Response: **The bi-lobed area is the site boundary for Site 6. No plumes are depicted on the figure. This area will be ~~removed from the drawing~~. identified as the Site 6 boundary on Figure 3-5.**

Comment 13: Page 5-4: State of Florida Soil Cleanup Goals should be dated as 1995.

Response: **The text will be revised as requested.**

Comment 14: Section 5.1.3.2, Identification of Exposure Pathways and Receptors and Table 5-1, Proposed Human Health Receptors to be Evaluated for Current Land Use: I am unsure of the worth of conducting an assessment for military residents. How will this be achieved, considering the fact that there are no residential areas on these sites?

Response: **Approximately 100 to 300 military personnel on regular tours of duty reside at the base BQ for up to 3 years.~~; however, since groundwater is not a current land use exposure pathway (Comment No. 4) all references to Military Residents will be removed from Section 5. Table C-6 will also be deleted.~~ The military resident scenario will be evaluated to establish the potential risk to military residents if the groundwater is not treated.**

Comment 15: Page 5-6: it may be picky, but the word "contaminates" is used in a number of cases where it is obvious that the word should be "contaminants." These should be corrected.

Response: **The text will be proofread to correct spelling and grammatical errors.**

Comment 16: Page 5-12, Carcinogenic Risks: it seems to me that a statement similar to that on the following page (page 5-13) beginning with "In accordance with FDEP..." belongs in the discussion in this paragraph, especially following the EPA range statement of 10^{-6} to 10^{-4}.

Response: **We agree with the comment. A statement similar to the one on page 5-13, "In accordance with FDEP, any risks greater than 10^{-6} are worthy of further consideration and risks greater than 10^{-6} for individual chemicals in any medium will be identified" will be added following the EPA range statement of 10^{-6} to 10^{-4} on page 5-12, Carcinogenic Risks.**

Comment 17: Figure 5-1: in the "Notes" area, "Environmental" is misspelled.

Response: **The text will be proofread to correct spelling and grammatical errors.**

Comment 18: Section 5.2.1.3, page 5-19, Identification and Characterization of Ecological Receptors and Habitats: it is my understanding that NAS Whiting has a resident or part-time ecologist. She or he should be utilized in developing this study area.

Response: **If available, the base ecologist (or natural resources manager) will be contacted during the ecological risk assessment.**

Comment 19: Section 5.2.2.1, Exposure Point Concentrations: please identify the "simple" model that will be utilized for predicting dietary exposures.

Response: **The model consists of a series of linked Excel spreadsheets that calculate the contaminant doses received by representative ecological receptors and compare them to toxicity reference values (TRVs). As discussed in Section 5.2.2.1, receptor-specific exposure parameters and site-specific contaminant concentrations are used in the model. TRV derivation is discussed in Section 5.2.3.1.**

Comment 20: Table A-1: the Northwest Florida Water Management District has well permitting authority and requirements which should be acknowledged and their rules should be added to the table. This was recently learned (the hard way) by the SCAPS group during their recent visit to NAS Whiting Field.

Response: **Well permits will be obtained from the NWFWMD, if required. Reference to the NWFWMD's authority and its requirements will be added to the table.**

Comment 21: Table A-1: it would be best to reference the Florida Petroleum Contamination Rule, Chapter 62-770, F.A.C., with the existing date since the newer version of the rule has not yet been adopted. Also, change the "17-770" reference to "62-770."

Response: **The text will be revised as suggested.**

Following are comments regarding the risk assessment parameters in Appendix C. I suggest that since the field of risk assessment is in a state of flux and many values are based on professional judgment, these comments, along with those of EPA be evaluated concurrently.

Comment 22: Table C-1: Child Value/Adult Value Columns need aligning; "Chemical Specific" reference needs aligning. Check all tables in this regard.

Response: **The tables will be revised as suggested.**

Comment 23: Table C-1: There appears to be a discrepancy for the adult and child inhalation rates. I refer to the Supplemental Guidance to RAGS: Region 4 Bulletins 1 through 5, November 1995 for guidance. Based on the 15 m^3/day value in Bulletin 3, I calculate the child rate to be 0.625 m^3/hour.

Response: **We agree that the inhalation rate for the child should be 0.625 m^3/hour based on the 15 m^3/day value in Bulletin 3 of the Supplemental Guidance to RAGS: Region 4, Bulletins 1 through 5, November 1995. The inhalation rate for the child will be changed accordingly based on Region 4 guidance.**

Comment 24: Table C-2: Bulletin 3 states the child exposure duration as 10 years instead of 11. Additionally, the body weight for an adolescent is given as 45 pounds instead of 40.

Response: **Based on Region 4 guidance in Bulletin 3, Supplemental Guidance to RAGS, November 1995, the child exposure duration will be changed to 10 years and 45 pounds (20.4 kilograms) will be considered the body weight representative of an adolescent.**

Comment 25: Table C-3: Soil ingestion rate; I don't have a problem *per se* with using 50 mg/day for this value, but Bulletin 3 suggests the range of 50 mg to 480 mg per day, depending on your specific assumptions.

Response: **Table C-3 represents the office and maintenance worker. The default soil ingestion value for the "typical worker" is 50 mg/day as presented in the Standard Default Exposure Factors, OSWER Directive 9285.6-03.**

Comment 26: Table C-4: the value for inhalation rate is missing. I suggest that it is 0.833 m3/hour.

Response: **The inhalation rate for site occupational workers (groundskeepers) is not shown on Table C-4 because evaluation of this pathway was not proposed. The risk due to this pathway is usually insignificant due to the low exposure frequency. ~~Evaluation of this pathway can be included if desired.~~ The risk associated with this pathway has been found to be insignificant in previous risk assessments performed at Whiting Field, so its evaluation is not proposed.**

Comment 27: Table C-5: the value for surface area for a construction worker is given as 5750 cm^2. I suggest that this value be checked. For reference, the State of Florida value which is derived from the USEPA Dermal Exposure Assessment, 1992, is given as 2000 cm^2 in: Technical Report: Development of Soil Cleanup Target Levels (SCTLs) for Chapter 62-770, F.A.C., May 1997.

Response: **The surface area of 2,000 cm^2 referenced as a State of Florida value will be used for the construction worker as suggested.**

Comment 28: Table C-6: as previously stated, I question the use of this scenario and thus, this table.

Response: ~~**As stated in the response to Comment No. 14 all references to military residents and Table C-6 will be deleted**~~**.** **The military resident scenario will be evaluated to establish the potential risk to military residents if the groundwater is not treated.**

Comment 29: Appendix D, IDW Management Plan: the document is marked with a "draft" designation. The Whiting IDW Plan has been finalized and adopted. Please confirm that this is the final document.

Response: **The Final IDW Management Plan will be included in the Work Plan.**

Comment 30: The final document should be properly signed and sealed according to Florida Statutes.

Response: **The final Work Plan will be signed and sealed by a licensed Florida Professional Geologist.**

Environmental Protection Agency Comments

General Comment: There are numerous spelling and grammatical errors. Please proofread the document to insure that these errors are addressed.

Response: **The document will be proofread to correct spelling and grammatical errors before submittal of the final version.**

Comment 1: **Executive Summary, Page ES-1, Paragraph 2:** The paragraph as worded is confusing with regard to the purpose of the work plan and associated investigation. Suggested wording is as follows: *The purpose of the work plan is to propose an investigation to further define the nature and extent of contamination at Sites 3, 4, 30, 32 and 33. The information generated from this investigation will be utilized as a basis for recommending remedial alternatives that address identifiable risks to public health and the environment.* In the second sentence of the paragraph, the word contaminates should be contaminants. In the third sentence of the paragraph, the purpose of the Feasibility Study is to evaluate and recommend remedial alternatives. The remedy is selected in the proposed plan which is subject to public review and comment and finalized in the record of decision.

Response: **Paragraph 2 will be revised to include the suggested wording. The typographical error will be corrected.**

Comment 2: **Section 1.1, Page 1-2, Paragraph 1:** SOUTHNAVFACENGCOM is responsible for conducting PAs, SIs, RI/FSs, and selecting remedial response actions; however, it is EPA's responsibility to list federal facilities on the National Priorities List (NPL), if warranted.

Response: **The reference to "priority listing" will be deleted.**

Comment 3: **Section 2.6, Page 2-26:** This page contains philosophical rationale for streamlining the RI/FS process and contractor speculation which has no place in a technical work plan. As such, it should be deleted from the work plan. The work plan should only contain scientifically sound approaches to conducting investigations and should remain free of contractor speculation and philosophical debate.

Response: **The third and fourth paragraphs on page 2-26 will be deleted.**

Comment 4: **Section 2.7.1, Page 2-29:** The CSM should also more clearly address the various ecological receptor pathways (i.e. groundwater to surface water expression).

Response: **The CSM will be modified to add ingestion of contaminated soil as an exposure route for ecological receptors. However, groundwater to surface water migration of contaminants at Sites 3, 4, and 32 (only soils are being evaluated at Sites 30 and 33) is highly unlikely due to the absence of surface water on and near those sites and the long distance to the nearest permanent surface water.**

Comment 5: **Section 2.7.3.2, Page 2-33:** In the second paragraph, the probable exposure pathways should also include a discussion of the future resident scenario as well as the others outlined in the paragraph. Regardless of future land use, EPA advocates this receptor evaluation as a point of departure in making risk management decisions.

Response: **A brief discussion of the future resident scenario will be added to the second paragraph and the following sentence will be added to the bottom of the second paragraph: "A detailed description of the exposure pathways and receptors proposed for evaluation at Sites 3, 4, 30, 32, and 33 is included in Section 5.1.3.2."**

Comment 6: **Page 2-37, Groundwater Bullet:** The word acilitate should be facilitate.

Response: **The typographical error will be corrected.**

Comment 7: **Section 3.1, Page 3-1, Paragraph 2:** References to the partnering process should be removed from this section and elsewhere in the document. The general public is not involved in the partnering process; and therefore, any reference to the partnering process in the work plan may raise more questions than answers. It should suffice to state that the scope of work was planned in consultation with EPA, FDEP, and Navy personnel associated with NAS Whiting Field.

Response: **References to the partnering process will be deleted (throughout the Work Plan) and replaced with "in consultation with EPA, FDEP, and Navy personnel" or other similar language.**

Comment 8: **Section 3.1.1, Page 3-1, Paragraph 1:** The EPA Region IV SOP should be referenced as the USEPA, Region IV, Science and Ecosystem Support Division, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, May 1996 (EISOPQAM).

Response: **The text will be revised to state the proper name of the EPA Region 4 SOPs.**

Comment 9: **Section 3.1.3.6, Page 3-10:** Measuring DO should also be incorporated into the work plan in order to evaluate the potential for natural attenuation of chlorinated solvents.

Response: **A discussion of dissolved oxygen measurement will be added to the Work Plan and a summary table listing all the natural attenuation parameters to be analyzed will be added to Section 3. The groundwater natural attenuation parameters to be analyzed include dissolved oxygen, nitrate, iron (II), sulfate, sulfide, methane, oxidation reduction potential, pH, TOC, temperature, alkalinity, and chloride.**

Comment 10: **Section 3.1.3.8, Page 3-11:** Since the headspace analysis protocol proposed is based on FDEP Rule 62-770 as it relates to petroleum contaminated sites, the Navy should review the procedure to determine if the protocol is appropriate for chlorinated solvent sites.

Response: **The head space analysis protocol described in Section 3.1.3.8 was included in the Work Plan primarily for use at Site 4, which includes petroleum-contaminated soil.**

Comment 11: **Section 3.1.3.16, Page 3-17:** Since the use of a Global Positioning System (GPS) device is proposed in the work plan, more information specific to the use of the unit needs to be included in the work plan. For example, GPS units have a wide range of accuracy, and as such, the level of accuracy of the unit to be used should be reported in the work plan.

Response: **The text will be revised to state a GPS, if used, will have sub-meter accuracy.**

Comment 12: **Section 3.2.1.2, Page 3-31:** In the second paragraph, the RI Industrial Area Groundwater Investigation Interim Report is identified as being draft. Although the document is indeed draft now; that will not always be the case. Therefore, the document should be referenced in the work plan as neither draft nor final. Please delete the reference to the draft document at this location in the work plan and anywhere else the reference occurs in the work plan.

Response: **The reference to draft will be deleted.**

Comment 13: **Section 3.2.2.3, Page 3-51:** *Region IV RBCs* should be *Region III RBCs* at the top of the page. In addition, in the Source Areas of Concern section, "leaks from unidentified buried piping" are indicated as being a source area of concern. Is the buried piping known to exist and its exact location is called into question or is there a question of the existence of buried piping at all?

Response: **The reference to Region 4 RBCs will be changed to Region III RBCs. The *Jurisdiction Assessment Report, Underground Storage Tank Program – Sites 1466 and 1467* (ABB-ES, February 1994) states that all USTs and associated piping were removed in 1992; therefore, the "leaks from unidentified buried piping" will be deleted. However, the "tank-bottom sludge disposal areas" will be added as a source area of concern. The revised Source Areas of Concern for Site 4 will be:**

- **former USTs and associated piping and**
- **tank-bottom sludge disposal areas.**

Comment 14: **Table 5-2, Page 5-8:** Future residents should be added to the "Future Land Use Receptors" column in this table for Site Nos. 30 and 33.

Response: **Sites 30 and 33 are expected to remain industrial and, therefore, a residential scenario for soils was not proposed. Groundwater for these sites is not included in the scope of this Work Plan and, thus, was not evaluated in Table 5-2. The residential scenario for soils will be discussed qualitatively in the uncertainty section of the baseline risk assessment.**

Comment 15: **Section 5.2.1.2, Page 5-19, Paragraph 1:** While it is true that calcium, magnesium, potassium, sodium and iron are considered essential nutrients for human health risk assessment purposes, these compounds can still pose an ecotoxicity potential and should be evaluated accordingly.

Response: **The elements mentioned in the comment are rarely, if ever, toxic to ecological receptors in terrestrial environments. Literature searches have indicated that few, if any, data are available on the toxicity of these elements, primarily due to their absence of toxicity. However, if any of these elements are found in extremely high concentrations in surface soils, their potential toxicity will be investigated further.**

Document Review Comments - ABB-ES

General Document Comments

Comment 1: The document is well organized, well written, and generally accurate in the presentation of data.

Comment 2: Will the final document be sealed by a Florida Professional Geologist?

Response: **The final Work Plan will be signed and sealed by a Florida Professional Geologist.**

Comment 3: Although the former AVGAS distribution fuel pits are shown on document figures, no investigation activities are projected for them. I believe these features represent a possible source area and investigation of the soils surrounding them is warranted.

Response: **Record as-built drawings for the South Field (NAVFAC Drawing No. 5023749, Airfield Improvements, South Field AVGAS Trench Details dated 1/7/75) show that the AVGAS piping and lube oil tanks were removed from the South Field apron area in 1972–74. It is not known if the North Field and Midfield AVGAS piping and lube oil tanks were also removed during this time period. A more complete record search will be made to determine the status of the AVGAS system at North Field and Midfield. The AVGAS distribution fuel pits do represent a possible source of petroleum contamination. However, because soil contamination, if present, overlies an existing groundwater plume that requires containment or treatment and because the fuel pits are in paved areas that prevent direct soil contact, investigation of the former fuel pits should be a low priority. B&R Environmental proposes to perform additional record searches and, if necessary, limited field investigations to determine the presence or absence of the fuel pits at North Field and Midfield. Actual soils investigation adjacent to the fuel pits would be performed in the future before closure of the fuel pits (if they were found intact at the North Field or Midfield) or remediation of the underlying groundwater plumes. <u>Record drawings were found on July 24, 1997, showing that the fuel pits at the North Field had been removed.</u>**

Comment 4: Surface water and sediment contamination is not addressed in this document. Should an evaluation of this pathway and the potential receptors be included?

Response: **There are no surface water bodies or sediment in the vicinity of the sites. Surface runoff from the on-site drainage ditches is not considered surface water and is regulated by the National Pollutant Discharge Elimination System (NPDES).**

Specific Document Comments

Comment 1: **Page ES-1, paragraph 1.** The first sentence states that RI/FS studies will be completed at sites 3, 30, 32, and 33. A statement should be made in this section, similar to the second paragraph on page 1-5, that only the soils will be evaluated at sites 30 and 33.

Response: **A sentence will be inserted ~~after the second sentence~~ in paragraph ~~two~~ one stating that only the soil will be investigated at Sites 30 and 33.**

Comment 2: **Page ES-1, paragraph 2.** Please clarify the first sentence concerning the purpose of the work plan.

Response: **The sentence will be replaced with the statement proposed in EPA Comment No. 1.**

Comment 3: **Page 2-18, Table 2-1.** The table does not include all of the facility sites (i.e. Sites 35, 36, 37, 38, and 39).

Response: **Sites 35 through 39 will be added to the table.**

Comment 4: **Page 2-23, Table 2-2.** The table does not include all of the facility sites (i.e. Sites 35, 36, 37, 38, and 39).

Response: **Sites 35 through 39 will be added to the table.**

Comment 5: **Page 3-6, Table 3-1.** The table lists the SOPs for surface water sampling, however, surface water sampling is not discussed in the document text. Is it likely that surface water and possibly sediment sampling will occur or be evaluated as part of this investigation?

Response: **Because no surface water or sediment sampling is proposed for this investigation, reference to the surface water sampling SOPs will be deleted.**

Comment 6: **Page 3-7, Table 3-1.** The Investigation Derived Waste section of the table indicates that IDW will be disposed of as per FDEP SOPs (FDEP COMPQAP #870056G, March 1996), EPA region IV Environmental Investigations SOPs and QAM (May 1996), and Brown and Root Environmental Project-Specific SOPs. However, the text on page 3-15 (section 3.1.3.13), page 6-1 (section 6.0), and Appendix D all indicate that the IDW will be disposed of in accordance with the Revised Investigation-Derived Waste Management Plan for NAS Whiting Field (ABB-ES). Please indicate which document has priority if all of the documents are not the same.

Response: **A sentence will be added to Section 3.1.3 stating that project-specific SOPs have first priority, followed by the more general FDEP SOPs (FDEP COMPQAP # 870056G) and EPA Region 4 SOPs. Therefore, the project-specific Final NAS Whiting Field Investigation-Derived Waste Management Plan will be followed.**

Comment 7: **Page 3-8, last paragraph.** "This variance to the USEPA Region IV SOPs requirement for stainless steel casing and screen materials is based on previous investigation results that show that background groundwater quality (e.g., pH) and dissolved contaminants in groundwater (e.g., petroleum hydrocarbons) are not present at concentrations that are a detriment to the use of PVC". Could you provide a reference for what concentrations are significant or a detriment to the use of PVC?

Response: **This statement is intended to indicate that no problems have been identified at Whiting Field due to the use of PVC monitoring well casing and screen. A reference for specific concentrations of volatile compounds that are detrimental to PVC is not known.**

Comment 8: **Page 3-18, first paragraph.** The first sentence indicates "Site 3 is located approximately 90 ft south of building 2941 ...). However, Figure 3-1 shows the site boundary touching Building 2941. Please indicate which is correct.

Response: **Site 3 is adjacent to the south side of Building 2941. The text will be corrected in the final document.**

Comment 9: **Page 3-40, first paragraph.** The first sentence indicates "Soil samples will be collected using either nominal 2-inch diameter split spoons, or using a five-ft long continuous core barrel. Samples will be collected at a minimum of 5-ft depth intervals.". What is the length of the 2-inch diameter split spoon samplers? And does this mean that you are collecting continuous samples or will there be gaps in the lithologic data?

Response: **The text will be revised to state: In general, 5-foot continuous-core barrel samples will be collected from soil borings and monitoring wells located near source areas. Two-inch-diameter by 2-foot-long split-spoon samples may be collected from monitoring wells near the perimeter of the contaminant plume. If a standard 2 inch split spoon is used, there will be 3-foot gaps between samples.**

Comment 10: **Page 3-40, second paragraph.** Please reword the third sentence. Is the "One soil sample will be selected" for laboratory analysis? And does "one sample be selected from each 30 ft depth interval" mean that a 90 ft soil boring four samples will be collected?

Response: **The "one soil sample selected" will be for laboratory analysis. For a 90-foot boring, a total of 5 soil samples will be collected: 1 surface soil (if in vegetative area), 1 within each 30-foot interval, and 1 at the bottom of the boring. This sentence will be clarified.**

Please explain in more detail the rationale for collecting a surface soil sample at all borings in unpaved areas. Since the source areas are believed to be subsurface what is the purpose of these samples? If they are to be used in the Risk Assessment evaluation you will likely require additional surface soil samples in order to have a statistically valid data set representative of the entire site area.

Response: **Shallow contamination may be present in vegetated areas at Sites 3 and 4 due to improper waste disposal methods, surface spills, and disposal of the tank-bottom sludge at Site 4. At Site 3, contamination was previously detected in the 1- to 2-foot interval of 3SB09 (Table 3-3). No surface soil data are currently available for Site 4. The surface soil data are being collected for risk assessment purposes. At Site 4 enough data will be collected to have a statistically valid data set, and at Site 3 the risk assessment will be performed using the maximum detected concentrations because only one or two surface soil samples will be collected.**

Please indicate the methods of analysis or parameters included for VOCs, SVOCs, TPH, pesticides, PCBs and inorganics.

Response: **Analytical methods include EPA SW-846 Methods 8260 for VOCs; 8270 for SVOCs; 8015m for TPH; 8081 for pesticides/PCBs; and 6010, 7471 or 7470, 9010, and 9065 for inorganics. These methods will be added to Table 3-22 (formerly Table 3-21).**

Please clarify how the aquifer matrix samples will be collected. Will it be collected during the soil boring program or collected from a monitoring well screen interval during well installation?

Response: **The aquifer matrix samples will be collected from the monitoring well screen interval during drilling activities with thin-walled Shelby tubes as per ASTM Method D1587. Samples collected for grain size analysis only will be collected in mason jars because grain size does not require undisturbed samples.**

Please address the above questions in the relevant sections of each of the individual sites discussed in the work plan.

Response: **Each of the above comments and responses will be addressed in the respective sections for each of the individual sites.**

Comment 11: **Page 3-41, first paragraph.** Last sentence "All USTs and associated piping were removed in 1992". Does this include distribution lines up to and including the fuel pits?

Response: **The *Jurisdiction Assessment Report, Underground Storage Tank Program–Sites 1466 and 1467* (ABB-ES, February 1994) states that "all USTs and associated piping were removed in 1992." However, as stated in the response to Comment No. 3, record as-built drawings show the apron distribution fuel lines and fuel pits being removed at the South Field in 1972–74. An additional records search will be performed to try to determine if the apron fuel distribution lines and fuel pits were removed at the North Field in 1972–74. <u>A records search conducted on July 24, 1997, identified a record drawing showing removal or abandonment of the fuel distribution lines and fuel pits.</u>**

Comment 12: **Page 3-41, last paragraph.** The Site 4 history discussion does not include the "excessively contaminated soils" data gathered during the soil boring program for the CAR.

Response: **A paragraph will be added to Section 3.2.2.2 describing the head space analyses performed at Site 4 during previous investigations.**

Comment 13: **Page 3-72, second paragraph.** The work plan lacks details concerning the monitoring well installation program. Will lithologic samples be collected during monitoring well drilling operations? What is the preference in drilling methodology (hollow stem augers, mud rotary, air rotary ...) to be used in the installation of monitoring wells? Will the shallow monitoring wells be screened across the water table? What are the proposed depths of the intermediate and deep monitoring wells? Will the intermediate and deep monitoring wells be arbitrarily set or will they be located immediately above or below clay layers? Will the intermediate and deep wells include surface casing set into a clay layer to limit carry down of contamination

	from the upper groundwater zones? If at a single well nest location the intermediate depth monitoring well is not contaminated will you proceed with the installation of the deep monitoring well? If the deep monitoring well is contaminated will you install a deeper monitoring well?
Response:	**A drilling/well installation subsection will be inserted in Section 3.1, Field Investigation Methods, to address these questions. ~~This new section is included as Attachment 1.~~ The suggested revisions to Attachment 1 will be incorporated into the text of Section 3.1.3.3 of the final Work Plan.**
Comment 14:	**Page 3-74, first paragraph.** Please identify the "wells previously analyzed for partial list of contaminant of interest". Please identify the natural attenuation parameters. Please reword and clarify the last sentence of the paragraph "Groundwater from existing wells will be analyzed of contaminants of interest based on previous analytical results and natural attenuation parameters".
Response:	**A table will be added to Section 3.2.3.3 listing each well to be sampled and the parameters to be analyzed.**
Comment 15:	**Page 3-100, third paragraph.** This paragraph and those that follow detail the Quality Control samples that will be recovered. Are these samples only in relation to Site 30 and therefore the other sites discussed should have a similar QC section, or are these samples representative of all the sites discussed?
Response:	**The text will be revised/clarified to state that these sections apply to each site.**
	In addition, IDW disposal is discussed in the fourth paragraph. Are these procedures separate of the guidance documents discussed in Comment 6 above or is this a confirmation of the policy stated in the guidance documents?
Response:	**This is a confirmation of the policy stated in the guidance documents.**
Comment 16:	**Page 3-102, Table 3-21.** Please check that table for transcription errors. Site 3 has 1 surface soil sample shown, however, all of the soil borings on Figure 3-1 are shown in paved areas. The table lists 24 subsurface soil samples at Site 4, however, the text on page 3-51 indicates 10 soil borings which would indicate 20 subsurface soil samples.
Response:	**All tables will be checked for consistency**
	TCLP analysis is listed for surface and subsurface soil samples, however, it is not discussed in the text. Please indicate the rational for TCLP analysis.
Response:	**TCLP analyses will be used only for waste characterization. The TCLP samples listed on Table 3-22 (formerly Table 3-21) for surface and subsurface soils will be deleted.**
	In the groundwater table section the number of duplicate samples does not equal 10% of the environmental samples as indicated in the text on page 3-100.
Response:	**Duplicate samples will be collected at the rate of 10 percent of the environmental samples. The number of duplicate groundwater samples should be eight.**

Comment 17: **Page 5-23, first paragraph.** The text indicates "Soil sampling for analytical chemistry analysis and toxicity testing will be conducted concurrently,...". What analyses will be conducted for the analytical chemistry analysis and where will the samples be collected?

Response: **The analytical chemistry analyses referenced in this section will be performed on the surface soil samples discussed in Section 3 of the Work Plan. Soil samples will be analyzed for TCL volatiles, TCL semivolatiles, TAL inorganics, TCL pesticides/PCBs, TPH, and total organic carbon (TOC). Samples will be collected in unpaved areas near each site. No soil samples will be collected for toxicity testing at completely paved sites.**