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REMEDIAL INVESTIGATION FEASIBILITY STUDY HEALTH AND SAFETY PLAN VOLUME 2  
OF 3 NCBC GULFPORT MS  
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ABB ENVIRONMENTAL

**NAVAL CONSTRUCTION BATTALION CENTER  
GULFPORT, MISSISSIPPI**

**RI/FS SAMPLING AND ANALYSIS PLAN  
VOLUME II**

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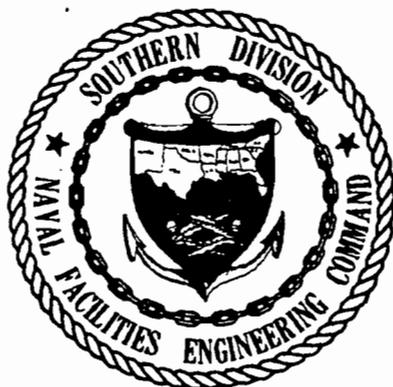
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## FOREWORD

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), the 1976 Resource Conservation and Recovery Act (RCRA), as augmented by the 1984 Hazardous and Solid Waste Amendments (HSWA), and as directed in Executive Order 12580 of January 1987, the Department of Defense (DOD) conducts an Installation Restoration (IR) Program for evaluating and remediating problems related to releases and disposal of toxic and hazardous materials at DOD facilities.

The Naval Assessment and Control of Installation Pollutants (NACIP) program was developed by the Navy to implement the IR Program for all Naval and Marine Corps facilities. The NACIP program was originally conducted in three phases: (1) Phase I, Initial Assessment Study, (2) Phase II, Confirmation Study (including a Verification Step and a Characterization Step), and (3) Phase III, Planning and Implementation of Remedial Measures. The three-phase IR Program was modified and updated to be congruent with CERCLA/SARA and RCRA/HSWA driven DOD IR program.

The updated nomenclature for the RCRA/SARA process is as follows:

- Preliminary Assessment and Site Inspection,
- Remedial Investigation,
- Feasibility Study, and
- Planning and Implementation of Remedial Design.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) has the responsibility for implementation of the Navy and Marine Corps IR Program in the southeastern and midwestern United States. Questions regarding this report should be addressed to the SOUTHNAVFACENGCOM Engineer-in-Charge, Mr. Ken Barnes (Code 1865), at (803) 743-0669.

## EXECUTIVE SUMMARY

A Remedial Investigation/Feasibility Study (RI/FS) is planned on selected sites at the Naval Construction Battalion Center (NCBC), Gulfport, Mississippi. The RI/FS will be conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA). The process will consist of:

- Preliminary Assessment and Site Inspection,
- Remedial Investigation,
- Feasibility Study, and
- Record of Decision (ROD).

ABB Environmental Services, Inc. (ABB-ES), was contracted under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) contract (Contract Number N62467-89-0-0317, Contract Task Order [CTO] Number 17) to prepare the RI/FS Workplan; Sampling and Analysis Plan (SAP), which includes the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP); Health and Safety Plan (HASP); and Community Relations Plan (CRP). Together the volumes present the scope of the RI/FS process.

The Workplan (Volume I) addresses the discussion of the sites, provides a record of site history, describes regional environmental factors, details previous investigative results, describes RI/FS tasks, and describes site-specific investigative methodology, project organization, and schedule.

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

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

The CRP describes procedures for public meetings, public comment, and methods of keeping the community informed.

The objectives of the RI are to collect sufficient data to: characterize and quantify the extent of contamination, to assess potential risks to human health and the environment posed by contaminants of concern, to support an FS at sources of contamination where remedial action is warranted, and to support an ROD at all sites.

The FS is designed to evaluate remedial alternatives, conduct treatability studies, and design remedial actions. Remedial actions are performed to mitigate threats to human health and the environment by removing, containing, or treating contaminated matrices to established target levels.

Two previous investigations were conducted at NCBC Gulfport, the Initial Assessment Study (IAS) and Verification Study. From these investigative studies, it was determined that six landfill and rubble disposal areas and one site containing two former burn pits require evaluation under the RI/FS process. The IAS provided information concerning the types and quantities of wastes reportedly disposed and methods of disposal at each site. During the Verification Study, 18 monitoring wells were installed; soil, groundwater, and surface water sampling was performed; and geophysical surveys were conducted. The data that were generated during the Verification Study are insufficient to adequately characterize the nature and extent of contamination.

The remedial investigation activities proposed within this workplan were selected to obtain three primary objectives: (1) to determine the location and orientation of the landfill and rubble disposal areas and the burn pits; (2) to determine the composition, magnitude, and extent of soil contamination; and (3) to determine the composition, magnitude, and extent of groundwater and surface water contamination. These objectives will be accomplished by analysis of aerial photographs, more extensive geophysical surveying, TerraProbe sampling, subsurface soil boring and sampling, surface soil sampling, sediment sampling, screening of existing monitoring wells, monitoring well installation and sampling, surface water sampling, and chemical analysis. For health and safety reasons, invasive sampling techniques performed within the boundaries of the disposal areas will be limited.

In addition to field screening and sampling activities, an ecological and population survey and a public health survey will be conducted. The ecological and population survey will be performed to identify potential receptors, to provide data for wetland and floodplain assessments, and to evaluate potential risk assessment exposure pathways. The public health survey will be conducted to examine on-base and off-base communities, activities, and drinking water sources. All of the information and data gathered from these activities will be evaluated for applicability and used to conduct a Baseline Risk Assessment to determine if the potential contaminants of each of the seven sites pose a risk to human and/or ecological receptors.

Final data interpretation of the remedial investigation activities will conclude with an evaluation of the degree and distribution of contamination, if present, and a recommendation for one of the following:

- take no further action or initiate long-term monitoring and prepare a Record of Decision;
- perform source removal or migration mitigation (interim or early remedial action);
- obtain additional RI data needed for adequate characterization;
- conduct a Focused Feasibility Study;
- conduct Treatability Studies; and/or
- conduct a Feasibility Study.

Should a Feasibility Study be warranted, the study will include a compilation of Applicable or Relevant and Appropriate Requirements (ARARs), development of remedial alternatives, screening of remedial alternatives, detailed analysis of remedial alternatives, an engineering description of selected remedial alternatives, RI/FS reports, proposed plans, public meetings, and an ROD.

#### ACKNOWLEDGEMENTS

In preparing this report, the personnel at ABB Environmental Services, Inc., commend the support, assistance, and cooperation provided by the personnel at NCBC Gulfport and SOUTHNAVFACENGCOM. In particular, we acknowledge the outstanding effort, dedication, and professionalism provided by the following people in the preparation of this report.

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RI/FS Sampling and Analysis Plan  
Volume II  
Naval Construction Battalion Center  
Gulfport, Mississippi

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## GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services
AOC	Area of Contamination
ARAR	Applicable or Relevant and Appropriate Requirement
ASCII	American Standard Code of International Interchange
AWPCC	Air and Water Pollution Control Commission
AWQC	Ambient Water Quality Criteria
BCF	Biodoncentration Factor
BFB	bromofluorobenzene
BLS	below land surface
BOD	biological oxygen demand
BTEX	benzene, toluene, ethylbenzene, xylenes
BW	body weight
CAS	Chemical Abstract Service
Cd	cadmium
CEC	Construction Equipment Department
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action Navy
CLP	Contract Laboratory Program
CLP-RAS	Contract Laboratory Program-Routine Analytical Services
COC	contaminant of concern or chain-of-custody
COD	Chemical Oxygen Demand
COE	Corps of Engineers
COPC	Contaminant of Potential Concern
Cr	chromium
CRP	Community Relations Plan
CRQL	Contract Required Quantitation Limit
CTO	Contract Task Order
CWA	Clean Water Act
DCE	dichloroethylene
DDT	dichlorodiphenyltrichloroethane
DNAPL	Dense Non-Aqueous Phase Level
DO	dissolved oxygen
DOD	Department of Defense
DOT	department of transportation
DQO	data quality objective
ECD	electron capture detector
EIC	Engineer-in-Charge
EP	extraction procedure
FEMA	Federal Emergency Management Agency
FFS	focused feasibility study
FICCDC	Federal Interagency Coordinating Committee for Digital Cartography
FIRMS	Floodplain Insurance Rate Maps
FOL	field operations leader
FS	feasibility study

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (Continued)

FSP	field sampling plan
ft <sup>2</sup> /day	Square Feet Per Day
g	gram(s)
GC	Gas Chromatograph
gpm	Gallons Per Minute
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Tables
HCl	Hydrochloric acid
HI	hazard indices
HLA	Harding Lawson Associates
HNO <sub>3</sub>	Nitric Acid
H <sub>2</sub> SO <sub>4</sub>	Sulfuric Acid
HSM	Health and Safety Manager
HSO	Health and Safety Officer
HSS	Health and Safety Supervisor
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
ID	inside diameter
IDW	investigation derived waste
IR	Installation Restoration
IRIS	Integrated Risk Information System
l	liter
LOEL	Lowest Observed Effect Levels
LOAEL	Lowest Observed Adverse Effect Levels
m	meter(s)
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDEQ	Mississippi Department of Environmental Quality
MEK	methyl ethyl ketone
μg/l	micrograms per liter
μm	micrometer
mg/kg	milligram per kilogram
mg/kg/bw/day	milligrams per kilogram body weight per day
mg/kg/day	milligrams per kilograms per day
mg/l	milligram per liter
ml	milliliter
mm	millimeter
MPH	miles per hour
MS	mass spectrometry
MSL	Mean Sea Level
MSLD	Mean Sea Level Depth
MDWC	Mississippi Department of Wildlife and Conservation
NACIP	Naval Assessment and Control of Installation Pollutants
NaOH	sodium hydroxide

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (Continued)

Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	sodiumthio sulfate
NBS	National Bureau of Standards
NCBC	Naval Construction Battalion Center
NCF	Naval Construction Force
NCP	National Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NGVD	National Geodetic Vertical Datum of 1929
NHP	National Heritage Program
NMCB	Naval Mobile Construction Battalions
NPDES	National Pollutant Discharge Elimination System
OD	outer diameter
O&G	oil and grease
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
POTW	public owned treatment works
PSI	pounds per square inch
%RPD	relative percent difference
%C	percent complete
%R	percent recovery
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
Pb	lead
PCE	tetrachloroethylene
PCB	polychlorinated biphenyls
PDE	potential dietary exposure
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
PVC	polyvinyl chloride
QA	Quality Assurance
QAM	quality assurance manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSAR	Quantitative Structure Activity Relationship
RAGS	Risk Assessment Guidance for Superfund
RAS	routine analytical services
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfD	reference dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPD	relative percentage difference
RSD	relative standard deviation
RTV	Reference toxicity values

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (Continued)

SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SF	slope factors
SFF	site foraging frequency
SOP	standard operating procedure
SOUTHNAVFAC	
ENGCOR	Southern Division, Naval Facilities Engineering Command
SQC	sediment quality criteria
SQL	Sample Quantitative Limit
TAL	Target Analyte List
TBC	to be considered
TBD	total body dose
TCA	tetrachloroethane
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TOC	total organic carbon
TOM	Task Order Manager
TOX	total organic halogens
TPH	total petroleum hydrocarbons
TRC	Technical Review Committee
TSCA	Toxic Substances Control Act
TSS	total suspended solids
UCL	upper confidence limit
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
VOA	volatile organic analytes
VOC	volatile organic compounds
VLF	very low frequency
WW II	World War II

## SECTION 1

## 1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION. This Sampling and Analysis Plan (SAP) consists of four sections:

- Section 1.0, Project Description
- Section 2.0, Field Sampling Plan (FSP)
- Section 3.0, Technical Approach
- Section 4.0, Quality Assurance Project Plan (QAPP)

The SAP itself is part of a three volume set of RI/FS planning documents:

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

Together the three volumes present the scope of the Remedial Investigation/Feasibility Study (RI/FS) program. The Workplan (Volume I): addresses the division of initial operable units, provides a record of site history, describes regional environmental factors, details previous investigative results, describes RI/FS tasks, and describes site-specific investigative methodology, and project organization and schedule.

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

The Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP) have been incorporated into one document (the SAP) to provide one comprehensive document that can be used by on-site field teams. This also avoids triplication of many sections that are common to the Workplan, the FSP, and the QAPP (i.e., project purpose and description; site history; sampling methods, locations, and procedures; data quality objectives [DQOs]; laboratory analytical methods; data assessment and evaluation; and project organization and schedule). These common sections are currently duplicated or summarized in both the Workplan and the SAP.

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

The Community Relations Plan (CRP), describes procedures for public meetings, public comment, and methods of keeping the community informed. The format and scope of these documents are in compliance with the 1988 RI/FS guidance under Superfund and Installation Restoration Manual of 1988.

1.2 PURPOSE AND REGULATORY SETTING. In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), and as directed

in Executive Order 12580 of January 1987, the Department of Defense (DOD) conducts an Installation Restoration (IR) Program for evaluating and remediating problems related to releases and disposal of toxic and hazardous materials at DOD facilities. The Naval Assessment and Control of Installation Pollutants (NACIP) program was developed by the Navy to implement the IR Program for all Naval and Marine Corps facilities. The NACIP program was originally conducted in three phases: (1) Phase I, Initial Assessment Study; (2) Phase II, Confirmation Study (including a Verification Step and a Characterization Step); and (3) Phase III, Planning and Implementation of Remedial Measures. The three-phase IR Program was modified in 1987-88 to be congruent with CERCLA and SARA. The updated nomenclature for the RI/FS process is as follows:

- Preliminary Assessment and Site Inspection
- Remedial Investigation
- Feasibility Study
- Planning and Implementation of Remedial Design

In addition to these programs, military installations are subject to regulations promulgated by the 1976 Resource Conservation and Recovery Act (RCRA) and the 1984 Hazardous and Solid Wastes Amendments. Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) has the responsibility for enforcement of the Installation Restoration (IR) Program in the southeastern United States.

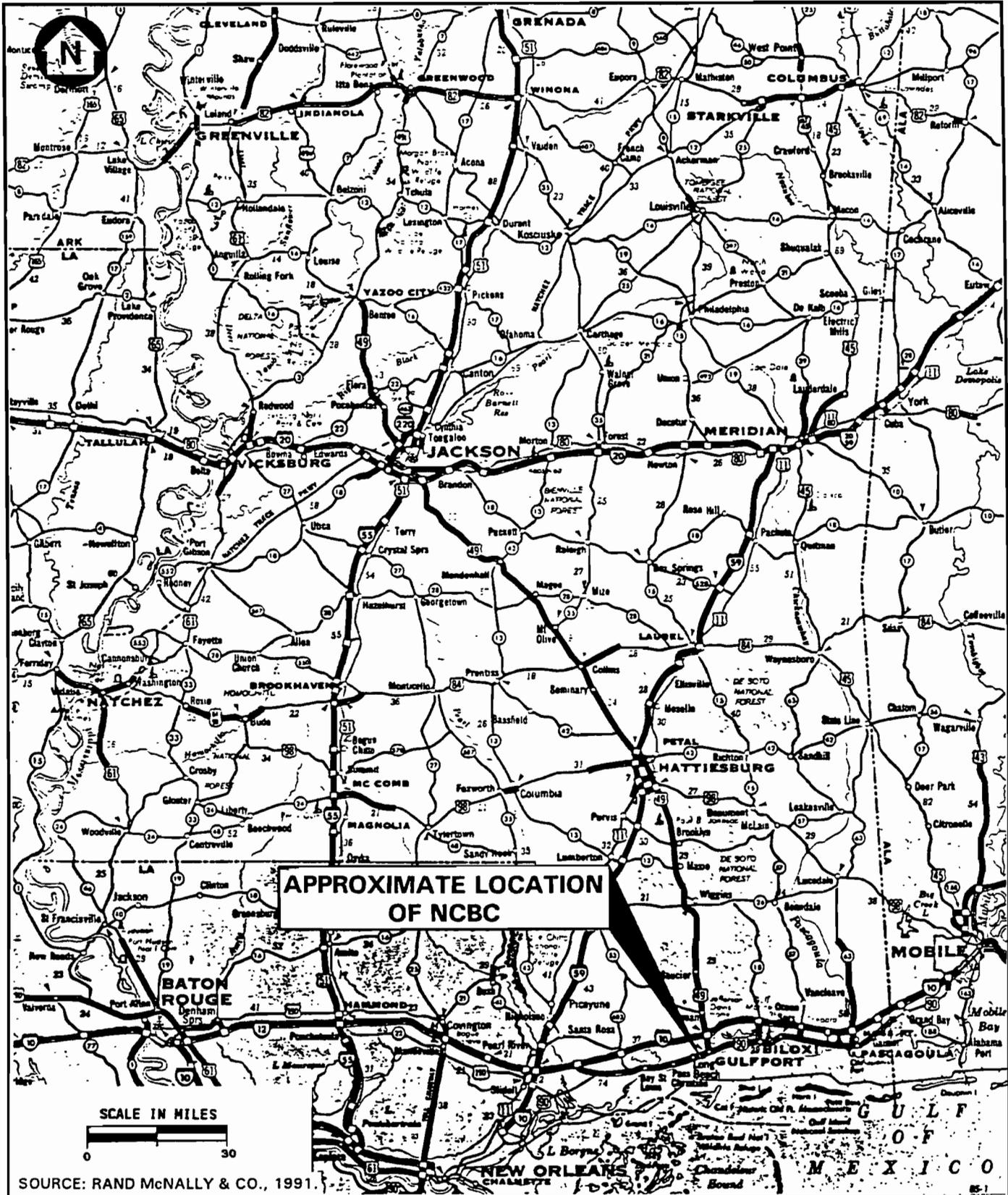
As components of the IR Program, two previous investigations were performed to assess and characterize potential sources of contamination identified at the Naval Construction Battalion Center (NCBC) Gulfport. These investigations included the 1985 Initial Assessment Study (IAS) and the 1987 Verification Study.

The conclusions of these previous investigations indicate a need for additional data collection at seven sites at NCBC Gulfport. Data were insufficient to characterize the extent of contamination, assess releases, and develop responses. As a result, ABB Environmental Services, Inc. (ABB-ES), was contracted under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) contract (Contract number N62467-89-D-0317, Contract Task Order Number 017 [CTO No. 017]) to prepare RI/FS Workplans and associated planning documents for seven RI/FS sites.

The objectives of the RI are to collect sufficient data to adequately characterize and quantify the extent of contamination for the purpose of performing a Baseline Risk Assessment, supporting an FS, and selecting a Remedial Action.

The FS is designed to evaluate remedial alternatives, conduct treatability studies, and design remedial actions. Remedial actions are performed to mitigate threats to human health and the environment by removing, containing, or treating contaminated matrices to established target levels.

**1.3 SITE DESCRIPTION.** NCBC Gulfport is located in the City of Gulfport, Harrison County, in the southeastern corner of the State of Mississippi (Figure 1-1). The base occupies an area of approximately 1,100 acres in the western part of Gulfport, situated immediately south of 28th Street. The NCBC property land-use and land-cover classifications include residential; commercial and services; transportation, communications, and utilities; industrial complexes (warehouses and associated storage areas); mixed forest land; and wetlands (forested and non-forested).



**FIGURE 1-1  
NBC GULFPORT, MS, LOCATION**



**RI/FS SAP  
NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

The land surrounding the NCBC Gulfport property is predominantly residential. Some wooded areas consisting of open pine forest and deciduous hardwoods are located northwest of the NCBC. The City of Long Beach abuts the NCBC Gulfport western property line. Low-density housing surrounds the base with a majority of the residential communities located south of the base. Mississippi Sound is approximately 1.1 miles south of the activity.

**1.4 PHYSICAL SETTING.** The following information is summarized from the Initial Assessment Study (Envirodyne, 1985). The NCBC Gulfport facility is situated within the Coastal Pine Meadows Region, which extends from the shoreline, 15 to 20 miles inland and is basically flat with a slight upward sloping to the north. Most of Harrison County is characterized by gently rolling terrain. At the NCBC, elevations range from 20 to 35 feet above mean sea level with an average elevation of approximately 23 feet above mean sea level.

The humid, moderate to subtropical climate in the vicinity of the NCBC Gulfport facility is influenced by the Gulf of Mexico, the huge land mass to the north, and its subtropical latitude. The mean annual temperature in Gulfport for the years 1951 to 1980 was 67.9 degrees fahrenheit (°F). Temperature extremes ranged from an average daily maximum of 91.2 °F in August to an average daily minimum of 42.2 °F in January. The average annual precipitation for Gulfport was 62.85 inches for the years 1951 to 1980. Average annual pan evaporation along the Mississippi coastline is approximately 48 inches, and highest evapotranspiration rates occur in the months of May through October.

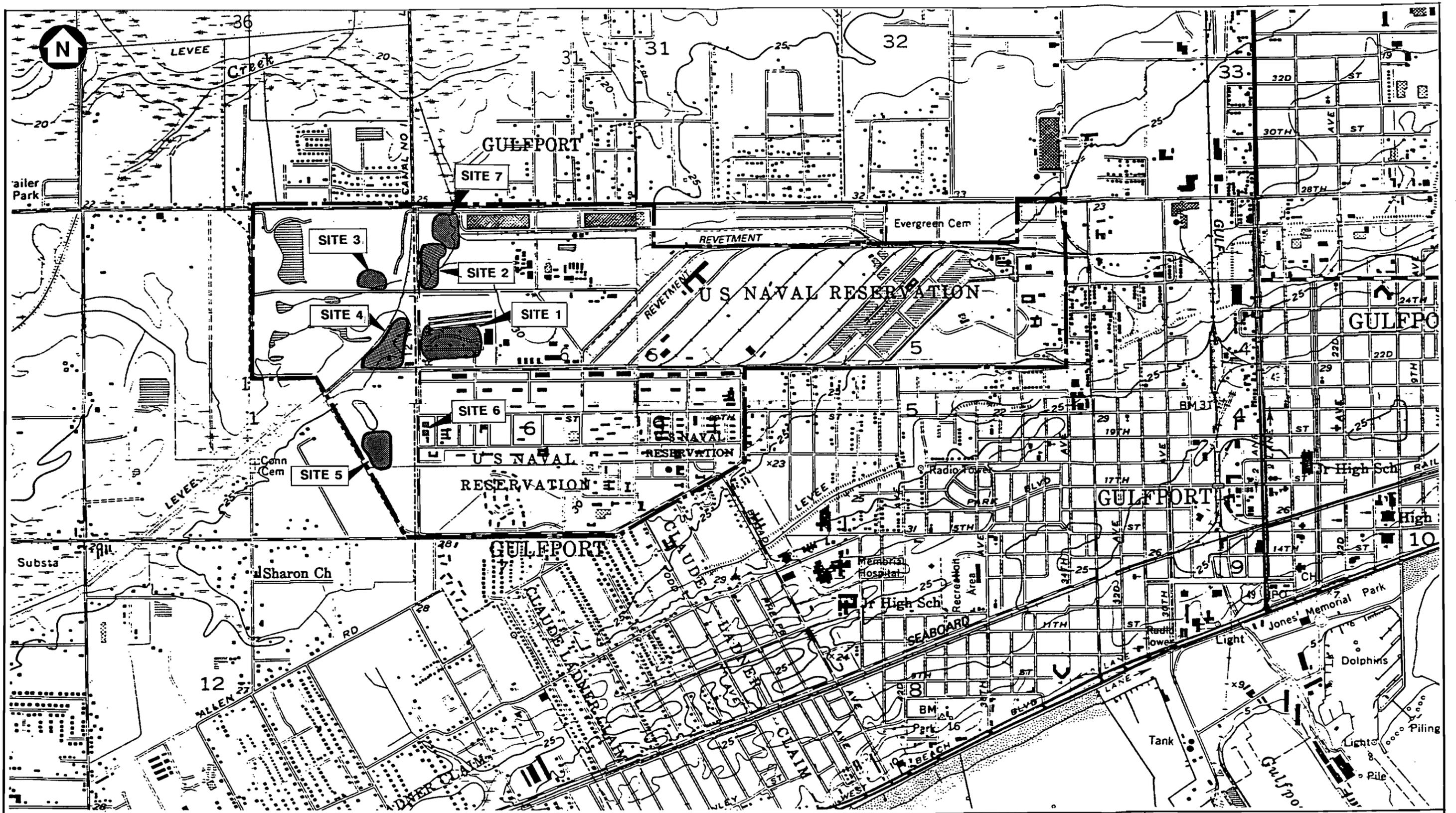
The uppermost stratigraphic units of the Coastal Pine Meadows Region are comprised of Alluvium from the Pleistocene and Recent Series, Pamlico Sand, Low and High Terrace Deposits, and Citronelle Formation from the Pleistocene series. These range from zero to 75 feet in thickness and consist of chert and quartz gravels, sands, sandy clays, and silts.

The principal water-bearing units in the vicinity of NCBC Gulfport consist of a sand and gravel aquifer overlying the Citronelle Formation and the Miocene aquifer system. Potable water is obtained from the latter two aquifer systems.

**1.5 SUMMARY OF INSTALLATION RESTORATION PROGRAM AT NCBC GULFPORT.** In September 1985, the Phase I IAS was completed by Envirodyne Engineers, Inc. (Envirodyne, 1985), under the NACIP program as described in Section 1.2. In response to the findings of the IAS report, Harding Lawson Associates (HLA) was contracted to conduct a Verification Study of six sites identified in the IAS. HLA included an additional site due to its proximity to Site 2 and ease of integration into the Verification Study. The locations of the sites are shown in Figure 1-2 and are as follows:

- Site 1, Disaster Recovery Disposal Area
- Site 2, World War II (WWII) Landfill
- Site 3, Northwest Landfill and Burn Pit
- Site 4, Golf Course Landfill
- Site 5, Heavy Equipment Training Area Landfill
- Site 6, Fire-Fighting Training Area
- Site 7, Rubble Disposal Area

In 1987, a Verification Study of Sites 1 through 7 was completed by HLA (HLA, 1987). The results of the Verification Study indicated that additional investigation was needed to evaluate the status of contamination at the seven



SCALE IN FEET  
 0 500 1000 2000  
 SOURCE: USGS QUADRANGLE  
 GULFPORT NW, MISS 1985.

 APPROXIMATE SITE AREA  
 - - - - - BASE BOUNDARY

  
 MISS.  
 QUADRANGLE LOCATION

**FIGURE 1-2**  
**NCBC LAYOUT AND**  
**SITE LOCATION**



**SAMPLING AND ANALYSIS**  
**PLAN**  
**NAVAL CONSTRUCTION**  
**BATTALION CENTER**  
**GULFPORT, MISSISSIPPI**

sites. Subsequently, ABB-ES was contracted by SOUTHNAVFACENGCOM to provide program management and technical environmental services in support of the Navy's Environmental Engineering Program. In accordance with this contract, ABB-ES has developed an RI/FS Workplan along with its supporting documents for NCBC Gulfport Sites 1 through 7.

SECTION 2



## 2.0 FIELD SAMPLING PLAN

This section of the SAP consists of two elements: Site Management and Remedial Investigation Data Collection. The Site-Specific Technical Approach is discussed separately in Section 3.0. Site management (Section 2.1) includes those activities that support data collection. These activities include mobilization, site access considerations, documentation, and field monitoring instrumentation. In addition, methods to be used for decontamination and control and disposal of investigation-derived wastes are included in this section.

Section 2.2 (Remedial Investigation Data Collection) includes descriptions of the methods employed to gather information required to meet the RI/FS objectives. Among these methods are exploratory geophysics programs; shallow and deep subsurface explorations; monitoring well installations; aquifer characterization; groundwater, soil, surface water and sediment sampling; ecological and population surveys; and location and elevation surveys.

Section 3.0 (Site-Specific Technical Approach) provides a site description, a summary of previous investigations, and RI/FS investigation rationale, and details proposed investigative methods, sampling, and analysis for each site.

### 2.1 SITE MANAGEMENT.

2.1.1 Mobilization The following activities will be performed at NCBC Gulfport as part of mobilization:

- command post setup, including office trailer/sample management trailer, communications (i.e., two-way radios), utility hookups, and portable toilets;
- staking and utility clearance (i.e., excavation permits) of all exploration locations;
- field team orientation, including acquisition of personnel badges and security clearances for work in secure areas; and
- a field team and subcontractor health and safety meeting.

2.1.2 Site Access and Control NCBC Gulfport is an active Navy base with controlled site access. Several areas on base are high-security areas requiring Controlled-Area badges. Where necessary, security police will be notified about on-base locations of ABB-ES personnel field activities by the NCBC Environmental Coordinator. A base escort may be required while conducting field explorations in the restricted areas. Badges will be obtained through the base security. All sites on base are accessible from paved or dirt roads maintained by the base.

2.1.3 Documentation Documentation and records of all procedures performed during the RI field investigation will be maintained as described below.

2.1.3.1 Operations Logbook A site logbook will be kept at the field operations office trailer. Information concerning daily operations during the field program will be recorded. Data entry into logs, forms, and notebooks will be written in ink and initialed by the author. Entry errors in the operations logbook or field logbooks, and field data sheets and logs will be crossed out with a single line

and initialed, preferably by the individual making the error. The Field Operations Leader (FOL) will be responsible for completing the site logbook.

**2.1.3.2 Field Logbooks** Field logbooks will document the details of each activity during the field investigation. Field team personnel will be responsible for data entry in field logbooks. These logbooks will document investigative and sampling activities for each site including equipment and sampling decontamination activities, sample collection, visual observations, and sample handling and shipping. These logbooks will be supported by Field Data Sheets and Logs.

**2.1.3.3 Field Data Sheets and Logs** Field data sheets and logs will be maintained by field team personnel, who will document items (e.g., sample location and information, field measurements, soils identification, boring information, and equipment calibration).

**2.1.3.4 Field Change Logbook** A separate logbook will be maintained during the field investigation program to document deviations from the RI/FS Workplan and SAP. The FOL will be responsible for completing the logbook.

**2.1.3.5 Photodocumentation** A photographic record of RI activities at NCBC Gulfport will be maintained. This effort will require coordination with NCBC Gulfport, especially when working in and around high-security areas. Two copies of each print will be produced. A photograph logbook will accompany the site camera at all times to record the date, location, time, subject matter, the orientation of the photograph (e.g., looking northeast), and photographer for each picture taken. The photograph logbook will be maintained by field team members.

**2.1.3.6 Plans** A copy of the RI/FS Workplan, the HASP, the SAP (including the FSP and QAPP), and the Community Relations Plan will be kept onsite. Copies of the HASP will be placed in the operations trailer and issued to each field team. Appropriate plans including standard operating procedures (SOPs) and the SAP (FSP and QAPP) will also be provided to each field team.

**2.1.4 Field Monitoring Instrumentation** The following monitoring instruments may be used during field activities at NCBC Gulfport:

- photoionization detector (PID)
- organic vapor analyzer (OVA)
- explosimeter
- radiation meter
- Alpha Scintillation Meter
- Draeger tubes for benzene and vinyl chloride
- pH-temperature-specific conductance meter
- gas chromatograph (GC)
- infrared spectroscopy
- oil-water interface probe
- electronic water level meter
- metal detector
- two-way radios or cellular telephones

Instruments will be calibrated (under field conditions) and inspected daily before field activities begin, as suggested by the manufacturers. Calibration information will be recorded on a calibration log, that will be kept on file at

the field office trailer. Malfunctioning instruments will be repaired or replaced. Monitoring equipment will be protected (as much as possible) from contamination during field exploration activities without hindering operation of the unit. Equipment maintenance will be performed according to manufacturer specifications before field use, or by cycling units out of the field. As appropriate, routine periodic maintenance may be performed as a function of field calibration.

2.1.5 Equipment Decontamination Procedures In order to assure that analytical results reflect the actual concentration present at sampling locations, chemical sampling and field analysis equipment must be properly decontaminated prior to the field effort, during the sampling program (i.e., between sample points), and at the conclusion of the sampling program. This will minimize the potential for cross-contamination between sample points and the transfer of contamination offsite. Field decontamination procedures conducted during a field event will be documented in the field logbook.

This section addresses the decontamination procedures for chemical sampling and field analytical equipment as well as for drilling equipment. These cleaning procedures are based on USEPA Region IV SOPs (USEPA, 1991). In order to clarify the decontamination procedures, the following definitions have been used.

Detergent will be a standard brand of phosphate-free laboratory detergent such as Alconox™ or Liquinox™.

Acid solution will be made from reagent-grade nitric acid and deionized water.

Solvent will be pesticide-grade isopropanol.

Tap or potable water will be water from the NCBC (or other) drinking water distribution system.

Deionized water will be tap water that has been treated by passing through a standard deionizing resin column.

Organic-free water will be tap water that has been treated with activated carbon and deionizing units. It will contain no pesticides, herbicides, or extractable organic compounds, and less than 50 µg/l of purgeable organic compounds as measured by a low level GC/MS scan. This organic-free water will be used for blank preparation and for final rinse in decontamination (where applicable). ABB-ES uses commercial sources of organic-free water. Each lot is documented to demonstrate reliability and purity of water resource. Field blanks provide further documentation as to the purity of the water source.

2.1.5.1 In-House Cleaning Procedures Prior to transport to the field, sampling equipment will be decontaminated using the procedures described below. To the extent feasible, enough sampling equipment will be made available to conduct a sampling episode without field decontamination. All decontamination procedures conducted in-house are documented in an equipment room logbook.

The following subsections describe cleaning procedures for sampling, pumping, and measurement equipment that will be conducted "in-house" prior to bringing the equipment to the field.

Teflon™ or Glass Sampling Equipment (Trace Organics and/or Metal Analyses) In-house decontamination procedures for Teflon™ or glass sampling equipment used to collect samples for trace organic and/or metal analysis are listed below.

1. The equipment will be washed and scrubbed thoroughly with laboratory detergent and hot water.
2. The equipment will be rinsed thoroughly with hot tap water.
3. The equipment will be rinsed with at least a 10 percent nitric acid solution.
4. The equipment will be rinsed thoroughly with tap water.
5. The equipment will be rinsed thoroughly with deionized water.
6. The equipment will be rinsed twice with solvent (pesticide-grade isopropanol).
7. The equipment will be air dried for at least 24 hours.
8. The equipment will be wrapped in aluminum foil. The edges will be rolled into a "tab" to allow easy removal. The foil-wrapped equipment will be sealed in plastic and dated.
9. After use in the field, the equipment will be rinsed thoroughly with tap water as soon as possible, if full field decontamination procedures are not used.

Stainless-Steel or Metal Sampling Equipment (Trace Organic and/or Metal Analyses) In-house decontamination procedures for stainless-steel or metal sampling equipment used to collect samples for trace organic and/or metal analysis are listed below.

1. The equipment will be washed and scrubbed thoroughly with laboratory detergent and hot water.
2. The equipment will be rinsed thoroughly with hot tap water.
3. The equipment will be rinsed with deionized water.
4. The equipment will be rinsed twice with solvent (pesticide-grade isopropanol).
5. The equipment will be air dried for at least 24 hours.
6. The equipment will be wrapped in aluminum foil. The edges will be rolled into a "tab" to allow easy removal. The equipment will then be wrapped in plastic and the date of decontamination noted on the wrap.
7. After use in the field, the equipment will be rinsed thoroughly with tap water as soon as possible, if full field decontamination procedures are not used.

Submersible Pumps and Hoses In-house decontamination procedures for submersible pumps and hoses used for purging monitoring wells are listed below.

1. Soapy water will be pumped through the hose to flush out any residual purge water.
2. The hose will be washed and scrubbed thoroughly with laboratory detergent and hot water.
3. The outside of hose will be rinsed with tap water and then deionized water; recoil hose onto spool.
4. Tap water will be pumped through the system to flush out soapy water.
5. Deionized water will be pumped through the system, then the pump will be purged in reverse mode.
6. The outside of pump housing and hose will be rinsed with deionized water.
7. The hose will be placed in polyethylene bag for storage and transport.

Sampling and/or Filtering Tubing In-house decontamination procedures for Teflon™, polyvinyl chloride (PVC), stainless-steel, and glass tubing used for groundwater sampling and/or filtering are listed below. In-line disposable filter cartridges should be rinsed with tap water and disposed.

Teflon™ Sampling Tubing Only new Teflon™ tubing will be used and it will be pre-cleaned as follows.

1. The tubing will be pre-cut to an appropriate length.
2. The outside of the tubing will be rinsed with solvent.
3. The interior of the tubing will be flushed with solvent (pesticide-grade isopropanol).
4. The tubing will be dried overnight in drying oven at 105 degrees celsius.
5. The tubing will be wrapped and ends capped with aluminum foil and sealed in plastic to prevent contamination during storage and transport.

Polyvinyl Chloride (PVC) Sampling Tubing Use only new PVC tubing and only when not sampling for organics. This tubing is not pre-cleaned, but should be stored and transported in its original container or wrapped in polyethylene to prevent contamination. Tubing should be flushed in the field with the sample before sample collection to remove any manufacturing residues.

Stainless-Steel Sampling Tubing Pre-clean tubing as follows:

1. The tubing will be washed and scrubbed thoroughly with laboratory detergent and hot water.
2. The tubing will be rinsed thoroughly with hot tap water.
3. The tubing will be rinsed with deionized water.
4. The tubing will be rinsed twice with solvent (pesticide-grade isopropanol).
5. The tubing will be air dried.
6. The equipment will be wrapped in aluminum foil. The edges will be rolled into a "tab" to allow easy removal. The equipment will then be wrapped in plastic and the date of decontamination noted on the wrap.

Glass Sampling Tubing Use only new glass tubing, pre-cleaned as follows:

1. The tubing will be rinsed with solvent (pesticide-grade isopropanol).
2. The tubing will be air dried for at least 24 hours.
3. The tubing will be wrapped and ends capped with aluminum foil and sealed in plastic (one tube/pack) to prevent contamination during storage and transport.

Well Sounders and Groundwater Measurement Tapes In-house decontamination procedures for well sounds and groundwater measurement tapes are listed below.

1. The tapes will be washed with laboratory detergent and tap water.
2. The tapes will be rinsed with tap water.
3. The tapes will be rinsed with deionized water.
4. The tapes will be allowed to air dry overnight.
5. The tapes will be wrapped in aluminum foil. The edges will be rolled into a "tab" to allow easy removal. The foil-wrapped equipment will be sealed in plastic and dated.

Ice Chests and Shipping Containers In-house decontamination procedures for ice chests and shipping containers are listed below. Noticeably contaminated containers will be thoroughly cleaned, rendered unusable, and disposed.

1. The equipment will be washed inside and out with laboratory detergent and tap water.
2. The equipment will be rinsed with tap water.

3. The equipment will be air dried.

Field Parameter Measurement Probes Field parameter measurement probes, (e.g., pH or specific ion electrodes, geophysical probes, or thermometers) that come in direct contact with the sample, will be decontaminated using the procedures listed below, unless manufacturers' instructions indicate otherwise. Probes that make no direct contact (e.g., OVA equipment) will be wiped with clean paper towels.

1. The probes will be rinsed with tap water.
2. The probes will be rinsed with deionized water.
3. The probes will be solvent rinsed, if obvious contamination remains after rinsing and if solvent will not damage probe.
4. The probes will be rinsed with deionized water.

Organic-Free Water Containers. New containers that will be used to store and transport organic-free water will be cleaned as follows.

1. The containers will be washed thoroughly with hot tap water and laboratory detergent, using a bottle brush to remove particulate matter and surface film.
2. The containers will be rinsed thoroughly with hot tap water.
3. The containers will be rinsed with at least 10 percent nitric acid.
4. The containers will be rinsed thoroughly with tap water.
5. The containers will be rinsed thoroughly with deionized water.
6. The containers will be rinsed twice with solvent and allowed to air dry for at least 24 hours.
7. The containers will be capped with aluminum foil or Teflon™ film.
8. After using, the containers will be rinsed with tap water in the field, seal with aluminum foil to keep the interior of the container wet, and returned to the laboratory.

Used containers will be capped with aluminum foil immediately after being used in the field. The exterior of the containers will be washed with laboratory detergent and rinsed with deionized water if necessary. The interior of the container will be rinsed twice with solvent. The interior of the container will be thoroughly rinsed with organic-free or Milli-Q™ water. The container will be filled with organic-free or Milli-Q™ water and capped with one layer of Teflon® paper and one layer of aluminum foil for storage.

**2.1.5.2 Field Decontamination Procedures** It is ABB-ES policy to transport to the field (when practical) sufficient equipment so that the entire study can be conducted without the need for field cleaning. When this is not possible, however, the following USEPA Region IV field decontamination procedures will be followed.

Sampling Equipment for Classic Water Quality Parameters Sampling equipment for classic water-quality parameters (e.g., dissolved oxygen [DO], biological oxygen demand [BOD], total organic carbon [TOC]) including, but not limited to, Kemmerers, buckets, dissolved oxygen [DO] dunkers and dredges, will be cleaned in the field prior to use and between sampling locations as follows.

1. The equipment will be rinsed and scrubbed with sampling water or tap water.
2. The equipment will be rinsed with deionized water.

Sampling Equipment for Organic and Metal Analysis Teflon™, stainless-steel, glass, or metal sampling equipment that is used to collect samples for organic and metal analysis will be cleaned between sample locations as listed below.

1. The equipment will be washed and scrubbed thoroughly with laboratory detergent and tap water.
2. The equipment will be rinsed thoroughly with tap water.
3. The equipment will be rinsed thoroughly with deionized water.
4. The equipment will be rinsed twice with solvent (pesticide-grade isopropanol).
5. The equipment will be rinsed with organic-free water and allow to air dry as long as possible.
6. If organic-free water is not available, the equipment will be allowed to air dry as long as possible. Do not rinse again with deionized or distilled water.

**2.1.5.3 Large Equipment Decontamination** Large equipment (e.g., drill rigs, backhoes, augers, drill pipe, casing, and screen) will be cleaned prior to use and between sample locations in accordance with USEPA Region IV SOPs as outlined below.

Cleaning Procedures Prior to Initiation of Field Work Any part of the drill rig or backhoe that will be over the borehole or sampling location (e.g., kelly bar or mast, backhoe buckets, drill platform, hoist or chain pulldowns, spindles, or cathead) will be decontaminated prior to arriving at the site as described below.

1. The equipment will be steam cleaned and wire brushed to remove soil and rust.
2. The equipment will be inspected to assure that seals and gaskets are intact and that there are no residual oils, grease or hydraulic fluids that could drip into the sample location.
3. If necessary, a Teflon™ string will be used to tighten drill stem. No oils or grease will be used to lubricate drill stem threads.
4. The drill rig will be steam cleaned prior to drilling each borehole.

Cleaning Procedures for Downhole Equipment Drilling, sampling, and associated equipment that will come in contact with the downhole sampling medium will be cleaned as outlined below.

1. The equipment will be washed and scrubbed with tap water and laboratory-grade detergent.
2. The equipment will be steam cleaned and/or high-pressure washed, if necessary to remove soils. The steam cleaner or high-pressure washer will be capable of generating a pressure of at least 2500 pounds per square inch (PSI) and producing hot water and/or steam (200°F and above).
3. The equipment will be rinsed thoroughly with tap water.
4. The equipment will be rinsed thoroughly with deionized water.
5. The equipment will be rinsed twice with solvent (pesticide-grade isopropanol). Note: do not rinse PVC materials with solvent.
6. The equipment will be rinsed thoroughly with organic-free water and allowed to air dry. Do not rinse again with deionized or distilled water.
7. If organic-free water is not available, the equipment will be allowed to air dry. Do not rinse again with deionized or distilled water.
8. Where appropriate, the equipment will be wrapped with aluminum foil to prevent contamination during storage. Augers, drill stems, casings and other large items can be wrapped in clean plastic if necessary.
9. If caked mud, rust, and/or paint is present that can not be removed by steam or high pressure wash, the downhole equipment will be sandblasted prior to step number 1 above, and prior to arrival onsite.
10. Printing and/or writing on well casing, screens, tremie tubing, etc., will be removed with emery cloth or sand paper prior to arrival onsite. Where possible, materials without printing or writing will be ordered.

**2.1.5.4 Decontamination Staging Area** Cleaning and decontamination of all equipment will occur at a designated area onsite that is downgradient and downwind (prevailing wind direction) of the clean equipment drying and storage area. The cleaning and decontamination area will contain an excavated pit, lined with heavy duty plastic sheeting, for containment of washwater and waste. The pit will be designed such that washwater will drain into the pit. Solvent rinseates will be collected in separate containers and allowed to evaporate. Large portable equipment (e.g., drill rods, auger flights, well casings, and screens) will be cleaned on saw horses or other supports constructed above the plastic sheeting. At the completion of field activities the pit will be backfilled with originally excavated material.

2.1.6 Control and Disposal of Investigation-Derived Waste This waste management plan has been prepared in accordance with USEPA Region IV SOPs to address the disposal of contaminated and uncontaminated investigation-derived wastes (IDW) (i.e., soil cuttings and other soil or sediment wastes, purging and development water, wastewater and waste solvents from decontamination activities, personal protective clothing, and other disposable items [including disposable equipment and/or parts]). Investigation-derived purge and development water, decontamination water, and soil cuttings may be disposed on-site within the area of contamination (AOC), if exposure to discharged waste or vapors will not present a known health risk and if the wastes will not be discharged in a manner that would affect surface water bodies.

Decontamination water that results from washing of drilling equipment in the central decontamination area will be placed in new, 55-gallon, steel drums and staged in an area that is designated by the Base Environmental Coordinator. The drums will be labeled to indicate the site and borings from which they are derived, dated and the contents will be indicated. Following receipt of laboratory analytical data for environmental samples, the contents of each drum will be evaluated to determine whether the associated environmental samples suggest that a drum may contain a RCRA- or CERCLA-listed or characteristic hazardous waste. If environmental data do suggest that a drum may contain a hazardous waste, a sample will be collected from the drum contents and submitted for Toxicity Characteristic Leaching Procedure (TCLP) analysis. The TCLP analysis will be limited to constituents suspected of being present at levels that may cause the waste to be regulated as a RCRA hazardous waste. If the environmental data do not suggest that CERCLA- or RCRA-listed wastes are present in a drum at levels that would cause it to be regulated as a RCRA hazardous waste, permission to discharge the drum contents to the local Public-Owned Treatment Works (POTW) will be sought.

Other IDW associated with the RI includes decontamination water produced from washing groundwater and Terraprobe sampling equipment, monitoring well purge water, and soil cuttings from drilling operations. This material will be screened with an OVA or PID. If concentrations above background readings are detected, or if visual evidence of contamination is noted, the material will be placed in 55-gallon drums, labeled and dated, and stored on the site from which it is derived. If concentrations are at or below background readings, these items will be double-bagged in plastic garbage bags and disposed in an NCBC dumpster. If screening concentrations are above background concentrations, contaminated personal protective equipment or other disposable items will be placed in 55-gallon drums and stored on the site from which it is derived until receipt of laboratory analysis of the associated site matrix. If no contaminants are detected in the associated soil or water samples, the personal protective equipment or other items will be disposed in an NCBC dumpster. If contaminants are detected, these items will be properly disposed as hazardous waste or cleaned and the associated wastewater will be treated as other contaminated wastewaters described above.

Personal protective equipment and other disposable items will also be screened with an OVA or PID. If OVA or PID screening concentrations are at or below background, these items will be disposed in an NCBC dumpster. If screening concentrations are above background concentrations, contaminated personal protective equipment or other disposable items will be placed in 55-gallon drums until receipt of laboratory analysis of the associated site matrix. If no contaminants are detected in the associated soil or water samples, the personal

protective equipment or other items will be disposed in an NCBC dumpster. If contaminants are detected, these items will be properly disposed as hazardous waste or cleaned and the associated wastewater will be treated as other contaminated wastewaters described above.

Materials that are contained in drums will be staged by field personnel at the respective site and will become the property of NCBC Gulfport. At each site, and at the decontamination area, drums will be staged on pallets and covered with plastic sheeting secured with ropes. Signs will be prominently displayed on the staged material indicating the drums are not to be moved and provide the name and telephone number of the Base Environmental Coordinator. ABB-ES will maintain a log of the drums and their contents and will clearly label the containers, on weather-resistant labels, with the drum contents, site and sample location number, date filled, and corresponding log entry number. ABB-ES personnel or their subcontractor will prepare the staging area and move drums to the staging area located on the site. The staging area location will be coordinated with the Base Environmental Coordinator.

The materials will be handled, transported, and treated/disposed according to Applicable or Relevant and Appropriate Requirements (ARARs) for IDW. The ARARs may include Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), the Toxic Substances Control Act (TSCA), and/or existing State regulations. Upon receipt of RI analytical data, ABB-ES will evaluate the data and recommend disposal alternatives. If off-site disposal at a permitted hazardous waste disposal facility is a selected alternative, ABB-ES personnel will collect samples to send to each facility for waste approval (as required by each disposal facility). ABB-ES will prepare manifest document(s) for the wastes. NCBC Gulfport will be responsible for bidding, subcontracting, signing or manifests, and scheduling transportation and disposal. USEPA guidance and SOPs indicate that the standard 90-day hazardous-waste-storage period applies to CERCLA site investigations. Furthermore, if this timeframe cannot be met, no special permits are required. ABB-ES personnel will work closely with SOUTHNAVFACENGCOM and NCBC Gulfport personnel in an effort to have the hazardous waste, if any, appropriately disposed before the 90-day period expires. The 90-day storage period begins when it is determined that a waste is hazardous. On-site disposal within the AOC will be evaluated as a potential disposal alternative in consideration of site-specific information during the RI. Non-hazardous (noncontaminated) materials will be returned to the site where they originated and disposed on-site or in a dumpster, as appropriate.

**2.2 REMEDIAL INVESTIGATION DATA COLLECTION.** This section provides a description of each investigative technique to be used during the NCBC Gulfport RI of Sites 1 through 7.

**2.2.1 Exploratory Geophysics Program** Geophysical investigations at NCBC Gulfport will include magnetometer, terrain conductivity, and ground-penetrating radar (GPR) surveys. In addition, a metal detector will be used before drilling at selected sites to screen for possible underground utility lines, fuel distribution lines, or other obstructions that could interfere with the completion of subsurface explorations and to prevent damage to underground equipment.

Magnetometers measure small variations in the earth's magnetic field caused by changes in soil composition and stratigraphy. A magnetometer survey can be used to screen for the presence of buried ferrous materials (such as 55-gallon

containers and abandoned tanks) and to define the edge of landfills where there is sufficient ferrous debris to show a contrast with natural terrain. Metal detectors can be used for smaller-scale surveys to locate buried metal or utilities.

Terrain conductivity refers to the relative ability of the earth to conduct electricity. Terrain conductivity can be measured using electromagnetic ground conductivity meters. As some types of leachate can alter the electrical properties of soil-pore waters and groundwater, this technique can be useful in tracing ionic fractions of leachate plumes. In addition (by measuring the in-phase response) the instruments can detect buried metallic objects and can profile some changes in soil composition. These features can provide data for determining the limits of waste disposal areas or landfills. Both the magnetometry and terrain conductivity instruments are sensitive to metal objects; therefore, on-site fences, pipes, and power lines may cause interferences. For areas where interferences may occur, GPR may be used to define potential waste disposal areas and buried objects.

Typical applications for GPR include delineating the boundaries of buried hazardous waste materials (including unexploded ordnance) and the perimeters of abandoned landfills; finding steel reinforcement bars and voids in concrete structures; recording the depth of geological interfaces, bedrock, and coal seams; locating and mapping buried utilities; bottom and shallow subsurface profiling on lakes; and determining glacial ice stratification and thickness. Applications at NCBC Gulfport will be mainly delineation of trench and landfill perimeters.

The GPR technique uses high frequency radio waves to determine the presence of subsurface objects and structures. Energy is radiated downward into the subsurface from an antenna that is pulled slowly across the ground at speeds varying from about 0.25 to 5 miles per hour (mph), depending upon the amount of detail desired and the nature of the target. The radio wave energy is reflected from surfaces where there is a contrast in the electrical properties of subsurface materials. These surfaces may also be naturally-occurring geologic horizons (soil layers, changes in moisture content, or voids and fractures in bedrock) or manmade (e.g., buried utilities, tanks, or drums). The reflected energy is processed and displayed as a continuous strip chart recording of distance versus time (where time can be thought of as proportional to depth). The depth of penetration of a GPR system is highly site-specific, and depends, among other factors, on (1) the soil types at the site (clean sands are best), (2) moisture conditions (dry is best), and (3) the frequency of the antenna (the lower the frequency, the deeper the penetration, and the less the resolution capability).

The radar system consists of a control unit, an antenna assembly (transmitter/receiver), and a recording device for analog field recordings. A tape recording unit may also be present for further data processing after field activities are completed. The antenna transmits electromagnetic pulses of short duration into the ground. The pulses are reflected from geologic or man-made surfaces and are picked up by the receiver, which transmits the signals to the control unit for processing and analog display. Shallow objects appear near the top of the strip chart recording (less time elapsed between the outgoing pulse and the return of reflected energy), whereas deeper objects appear further down the recording (more time elapsed).

2.2.2 TerraProbe Soil Sampling The TerraProbe system, comprising a self-contained, hydraulically operated earth probe capable of collecting discrete vapor, soil, and water samples from the subsurface, is a unique and cost-effective method for site investigations. The TerraProbe quickly obtains soil, water, and vapor samples that can be analyzed for a wide variety of contaminants on-site, yielding real-time analytical data for immediate interpretation. The TerraProbe system will be used at Site 6, Fire-Fighting Training Area, for the collection of shallow subsurface soil samples.

The TerraProbe system's hydraulic probe has the capability to push and/or hammer 0.75-inch-diameter rods and specialized probe tips into the subsurface for the collection of environmental samples. The entire system is easily mobilized to any site where a standard cargo van has access. The hydraulic probe system can be unfolded quickly from the rear van doors and adapted to a wide variety of terrain conditions. Special probe tips allow the system to core or drill through pavement or concrete for access to the subsurface without the need for additional equipment or personnel. The probe can be used for the collection of discrete soil or water samples as described below, similar to split spoon or water samples from a drill rig.

The sample tube is initially driven to the desired depth by the hydraulic pushing and hammer action. The soil probe is closed and does not allow soil to enter the tube until the sample depth is reached. Then a set of extension rods is placed into the probe rods and connected to the piston stop. The piston stop is removed, thereby allowing the soil probe tip to move upward when the rods are driven farther into the soil.

The probe is pushed or hammered into the soil, the tip remaining stationary and the soil probe filling with soil. The sample tube collects approximately 8 inches of soil when the probe tip is fully retracted into the probe. The rods are then removed from the hole and the soil core is extruded using the hydraulic extruder powered by the system.

It is not unusual to collect and analyze 10 to 15 samples per day from 5 to 6 different locations with the TerraProbe system. This procedure provides immediate data for interpretation, whereas conventional site investigation techniques might allow for 5 to 10 samples collected from 2 to 3 sites with a minimum 2- to 3-day turn around from laboratory analysis. The overall costs that are associated with subcontracted drilling or test-pitting and the cost of collecting, packaging, shipping, and laboratory analysis gives a clear advantage to the on-site collection and analysis offered by the TerraProbe system.

The groundwater probe is operated in a manner similar to the soil probe. A closed tip is hammered and pushed to the desired depth within the saturated zone, and a slight upward motion on the rods allows the tip to remain stationary and a small cavity is produced in the saturated soil. A mechanism is pulled to expose a slotted screen that allows the groundwater to flow into a collection chamber.

The TerraProbe system also includes a mobile field laboratory within a cargo van. This allows for rapid screening of soil and groundwater samples for volatile organic compounds and other selected analytes. This rapid collection and analytical screening technique will be used to provide data that can be used to optimize soil boring and monitoring well installation locations, thereby minimizing laboratory analytical costs and potential re-mobilization costs.

**2.2.3 Soil Borings** Soil borings will be drilled using hollow-stem auger and split-spoon sampling techniques in areas where confirmatory soil sampling is needed and where exploration depths exceed 5 feet. If conditions are encountered where the hollow-stem auger method cannot be used (i.e., hard bedrock or slumping sands), other investigative techniques, such as solid-stem auger or water and air rotary may be used. If water rotary methods are used, potable water that has been analyzed for contaminants of concern will be used. The borings will be sampled continuously to the water table, then at 5-foot intervals. Air quality in the breathing zone will be monitored using a PID or OVA during borehole advancement.

Samples will be collected and logged by ABB-ES field personnel using the Unified Soil Classification System (USCS). Soil borings will be used to obtain characterization and confirmation samples for laboratory analysis, and for installation of monitoring wells. Soil samples will be collected in accordance with Level IV DQOs. In general, samples that are collected for laboratory analysis will be selected based on previous field screening results, field monitoring results (i.e., elevated PID), visual examination, and/or at pre-designated depth intervals. Most soil boring locations will correspond with monitoring well installations. Soil borings that are not used for monitoring well installation will be grouted to ground surface.

The data that are collected during the RI need to characterize and delineate areas of contaminated soils. Delineation, by nature, requires that samples be collected from both contaminated and uncontaminated intervals of soil borings. During the process of selecting soil samples from soil borings, OVA headspace readings were taken. The responsible party selecting the samples for laboratory analysis must give thought to selecting some samples for characterization of contaminated soils and selecting other samples from intervals immediately below contaminated areas for purposes of obtaining laboratory analytical data that confirms the vertical extent of contamination. The field team performing the OVA headspace analyses and selecting subsurface soil samples for laboratory analysis must also consider that the OVA has a detection limit that is one order of magnitude higher than the laboratory analysis and that the OVA will not detect all volatile organic compounds and is not sensitive to semivolatile compounds, pesticides, PCBs, or metals. The OVA detects organic vapors that are present at concentrations on the order of 1 mg/kg, whereas laboratory analysis of volatile organic compounds is capable of detecting concentrations as low as 1  $\mu$ g/kg. Delineation of the vertical extent of contamination does not necessarily require samples that are nondetectable for all COPCs, but should provide an approximation, at minimum, of the depth at which contamination is no longer present. Identification of the types and concentrations of COPCs (characterization) in soil and the horizontal and vertical extent of the presence of COPCs (delineation) are both used to support the development of human and ecological risk assessments and remedial alternatives. Risk analysis and selection of remedial measures are the end results of the entire investigation process.

**2.2.4 Field Screening Methods** Field screening methods at NCBC Gulfport will include field GC and infrared spectroscopy analysis of shallow subsurface soils that are collected with the TerraProbe (Site 6) and groundwater samples that are collected from monitoring wells (all sites). The following subsections summarize the GC and IR analytical and QA/QC procedures.

**2.2.4.1 Field Gas Chromatograph Screening** The following describes the purge-and-trap field-screening methodology, sample preparation, and calibration. During the RI/FS at NCBC, field GC screening will include TerraProbe soil samples and groundwater samples that are collected from monitoring wells.

Purge-and-Trap Method This methodology involves purging samples at ambient temperature with helium and concentrating the volatile organic analytes on a polymer trap. Volatile organic compounds are then desorbed onto the gas chromatograph for compound separation and identification. Retention time windows that are based on calibration runs generated at the field site will be compared to sample-retention times for identification. Compounds will be quantified using a three-point calibration curve with one point at or near the detection limit (approximately 1 part per billion).

Purge-and-Trap Sample Preparation A 5-milliliter (ml) aqueous sample aliquot is transferred to the sparger using a gas-tight syringe. The sample is purged with helium for 11 minutes, desorbed for 4 minutes, and the trap baked for 5 minutes. For low-level soil samples, a 5-gram (g) aliquot is transferred to the sparger, 5 ml of organic-free water is added, and the sample is purged as described.

Medium-level samples (including product) may be run via a methanol extraction. A 4-g aliquot of soil is transferred to a wide-mouth test tube. Ten ml of purge-and-trap-grade methanol is added, and the soil methanol slurry is shaken. One hundred microliters of the methanol extract is added to a syringe containing 5 ml of organic-free water, and this is transferred to the sparger for purging.

Total solids analysis will be performed in accordance with USEPA method SW 846 so that dry-weight calculations can be performed for soil samples.

Surrogates and Matrix Spikes To evaluate recovery, a surrogate such as bromofluorobenzene (BFB) may be added to selected samples. Matrix spikes may be prepared and analyzed in duplicate to assess precision and accuracy.

Gas Chromatography, Column, and Target Compounds One HNU™ Gas Chromatograph (or equivalent) will be set up at NCBC Gulfport for the analysis of selected volatile organic analytes. This analysis will be conducted using either single- or multi-position purge-and-trap devices. A chemical electrolytic conductivity cell will be used for detection of volatile halocarbons, while a PID will be used for detection of aromatic compounds. A DB624, 30-meter (m) megabore column (0.53 millimeter [mm] inside diameter [ID]) (or equivalent) will be used for the separation of target volatile organics. Compounds that are selected as standards for analysis include previously detected compounds and selected related compounds: benzene, toluene, ethyl benzene, total xylenes, and methyl ethyl ketone. Additional compounds may be added based upon site-specific needs or previous screening results.

Method Blanks Before analyzing any samples or standards, the chemist will ensure that the system is free from organic interferences. A method-blank run is analyzed as the first run of the day, after the calibration check standard, and after any high-level sample to ensure that carry-over is not occurring.

Calibration The system is calibrated using the external standard technique. For each analyte of interest, calibration standards are prepared at a minimum of three concentrations. These calibration standards are analyzed in the same manner as the samples. Continuing calibration check standards are run at the

beginning of the day, after every 10 samples, and at the end of the day. The continuing calibration check standard contains each analyte of concern at mid-level concentrations. The relative standard deviation (RSD) of the continuing calibration check standard must be within 30 percent of the calibration. If the RSD exceeds 30 percent, a new calibration curve will be prepared. Samples with results that exceed the calibration range may be diluted and re-run or reported as estimated, as determined by the field chemist.

**2.2.4.2 Field Infrared Spectroscopy** The following describes the field-screening methodology for total petroleum hydrocarbons (TPH), sample preparation, and calibration. During the RI/FS at NCBC Gulfport, field screening will include TerraProbe soil samples and groundwater samples collected from monitoring wells.

Freon 113 Extraction Method This methodology involves extracting soil and water samples with Freon 113, passing a beam of light through each extract, and determining the frequency at which the extract absorbs light. This frequency and intensity of absorption is measured using a Miran™ fixed-filter detection unit. The frequency at which petroleum hydrocarbons absorb light will be determined during initial instrument calibration at the field site and will be compared to sample absorption frequencies for identification. Total petroleum hydrocarbons will be quantified using a five-point calibration curve with one point at or near the detection limit (approximately 20 parts per million).

Sample Preparation A measured volume of aqueous sample is extracted in a test tube with Freon 113. The extract is transferred into a test tube containing silica gel, thoroughly mixed, and allowed to settle. This same procedure is used for soil samples except samples are mixed with sodium sulfate prior to Freon 113 extraction.

Method Blanks A method blank must be run before analyzing samples. The method blank should be prepared as a sample and analyzed after the instrument is zeroed.

Calibration The system is calibrated using the external standard technique. Calibration standards are prepared at a minimum of five concentrations. These calibration standards are analyzed in the same manner as the samples. The continuing calibration is a mid-level standard that must be run at the beginning of the day, after every 10 samples, and at the end of the day. If at any time the continuing calibration deviates more than 30 percent from the original calibration, the initial calibration standards must be reanalyzed. Samples with results that exceed the calibration range may be diluted and re-run or reported as estimated, as determined by the field chemist.

**2.2.5 Surface Soil Sampling** Hand augers (for sample depths from 0 to 5 feet) and/or stainless-steel tulip bulb planters (for sample depths from 0 to 6 inches) will be used to collect shallow soil samples for laboratory analysis. Augers will be decontaminated prior to use and between each sampling location. Bulb planters will be decontaminated before sampling and discarded after use. The soil samples will be logged by field personnel using the USCS. Detailed sampling procedures are included in Section 4.3 (QAPP).

**2.2.6 Monitoring Well Installation** Groundwater monitoring wells will be installed to provide groundwater samples in accordance with Level IV DQOs for CLP laboratory analysis, to monitor groundwater elevations, and to perform in-situ aquifer hydraulic conductivity tests. The monitoring well depths and screened intervals will depend on site-specific data objectives. In general, wells will

be installed for confirmation sampling in the surficial aquifer. Well screens will be placed at depths that are designed to intercept suspected site-specific contaminants.

Monitoring wells will be constructed of 2-inch, inside-diameter (ID), Schedule 40, flush-threaded, PVC riser pipe and well screen (Figures 2-1 and 2-2). Ten-foot well screens with slotting appropriate for the representative formation will be used to construct all wells. In some instances it may be necessary to use 5-foot well screens to avoid overlap of well screens in a monitoring well pairs. Monitoring wells will be constructed and installed in accordance with SOUTNAVFACENCOM Guidelines For Groundwater Monitoring Well Installation (Workplan, Appendix D).

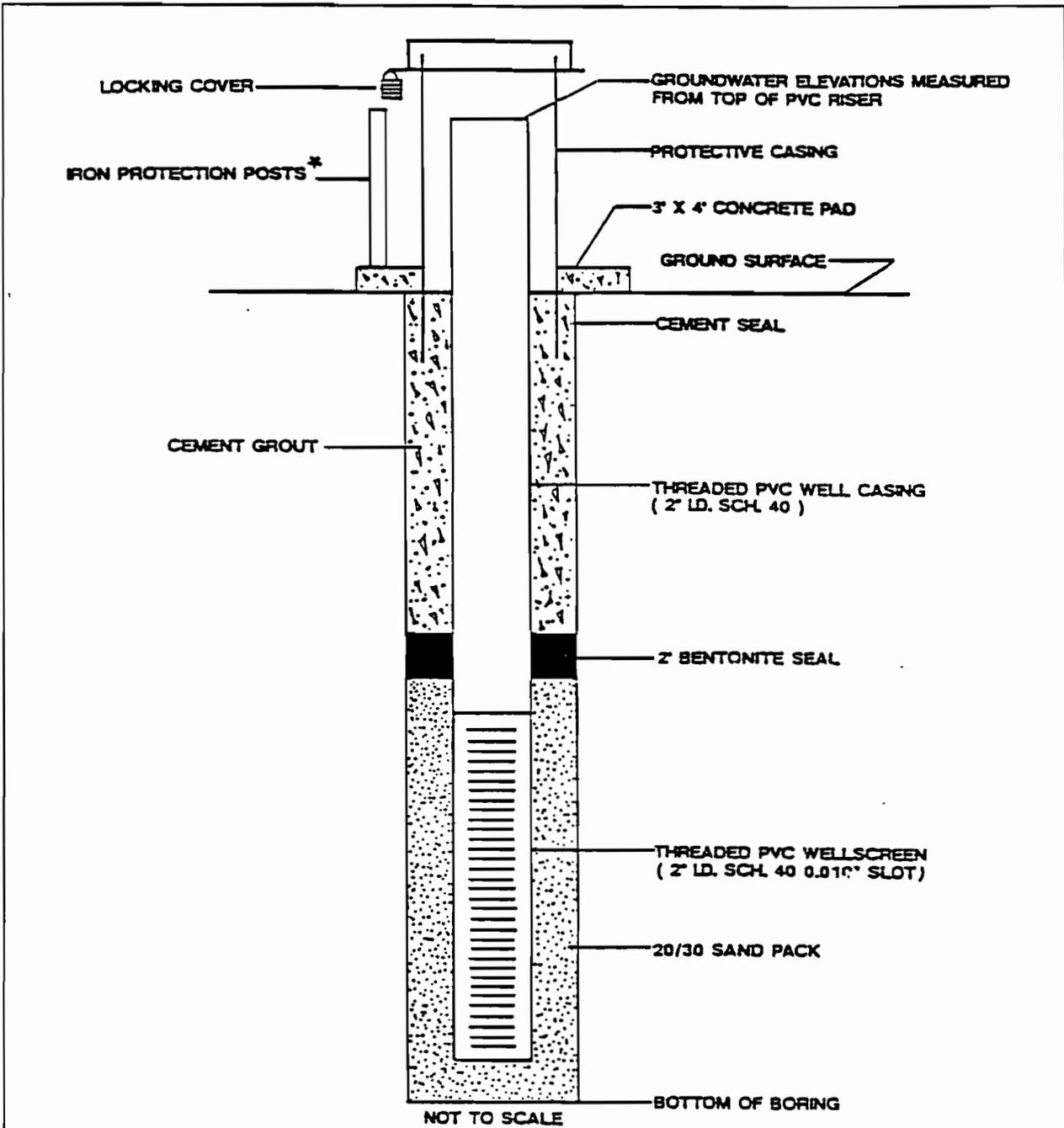
The annulus or annular space around all well screens will be backfilled with a clean silica sand, compatible with the screen slot size, from a minimum of 6 inches below the bottom of the well screen to 2 feet (if possible) above the top of the screen per EPA SOP (USEPA, 1991a). A minimum 2-foot (if possible; thickness depending on depth below ground) bentonite pellet seal will be installed above the sandpack. A cement-bentonite grout will be tremie grouted from the bentonite seal to within 2 feet of the ground surface. All materials placed in boreholes greater than 25 feet in depth will be installed using a tremie method. The well will be developed prior to sampling (after a minimum of 24 hours grout set time) to remove fines, improve the hydraulic connection with natural soils, and to obtain a representative sample.

Monitoring wells will be developed using an air-activated (pneumatic) surge pump, gasoline-powered diaphragm pump, or both. No air or water will be injected into the wells during development. Wells will generally be purged of at least three well volumes, until the water is clear and free of silts, and/or until field measurements of pH, temperature, and conductivity have stabilized.

Monitoring wells will either be flush mounted with protective steel casing at ground surface or will have aboveground protective casings to protect the well riser. Aboveground wells in high traffic areas will be surrounded by four protective steel posts. Protective steel casings will be equipped with locking covers. A cement seal and cement pad will be placed from the top of the grout to the ground surface around each protective casing to secure the casing, prevent surface runoff from entering the borehole, and to direct runoff away from the casing. The aboveground parts of both the well riser and protective casing will be vented. The protective casing will have two weep holes near ground level to allow water to drain from inside the casing. Wells will be permanently and properly identified as specified in SOUTNAVFACENCOM guidance (Workplan, Appendix D).

2.2.7 Groundwater Sampling This section briefly describes groundwater sampling from permanent monitoring wells and active potable wells. Where possible, sampling of monitoring wells will proceed from the upgradient (background) wells to the downgradient (or potentially contaminated) wells. Wells with free product will not be sampled for trace chemical analyses unless necessitated by special circumstances or client request. The sampling locations will be recorded in the field logbook and indicated on a site map.

Monitoring wells will be purged prior to sampling, and field measurements of pH, temperature, and conductivity will be recorded. Groundwater samples will be



\* INSTALLED ONLY AT BORING LOCATIONS WHERE THERE IS A RISK OF DAMAGE TO THE MONITORING WELL FROM EQUIPMENT OPERATIONS OR VEHICULAR TRAFFIC.

**FIGURE 2-1**  
**TYPICAL MONITORING WELL CONSTRUCTION DIAGRAM**



**RI/FS SAMPLING AND ANALYSIS PLAN**  
**NAVAL CONSTRUCTION BATTALION CENTER**  
**GULFPORT, MISSISSIPPI**

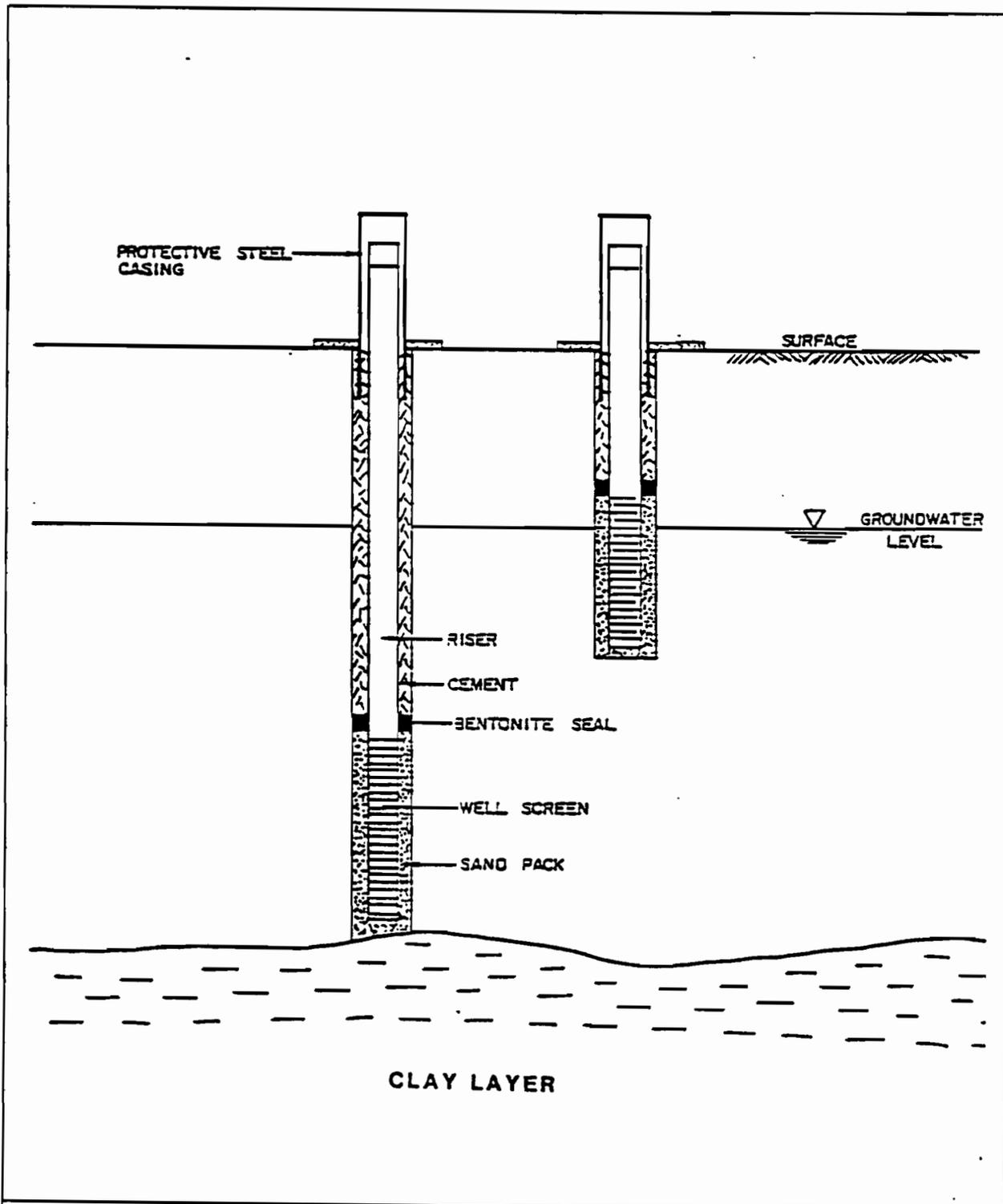


FIGURE 2-2

MONITORING WELL PAIR  
CONSTRUCTION DIAGRAM



RI/FS SAMPLING AND  
ANALYSIS PLAN

NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI

collected for laboratory analysis using stainless-steel or Teflon™ bailers and clean nylon or monofilament line. A 3- to 4-foot Teflon™ coated stainless steel wire or other inert material will be attached to closed top Teflon™ bailers to prevent the nylon or monofilament line from coming into contact with the well water. Samples from deep monitoring wells may require the use of a sampling pump. Wells screened at the confining layer are to be sampled using a bottom filling bailer, or other appropriate device, suitable for collection of groundwater samples from the bottom of the water column. Detailed sampling procedures are included in Section 4.5.3 (QAPP).

**2.2.8 Surface Water and Sediment Sampling** Surface water and sediment samples will be collected to assess potential contaminant migration through groundwater-surface water interaction, surface runoff, or soil erosion. Both upgradient and downgradient samples will be collected from each site to distinguish potential source areas.

Based on observed flows and shallow depths of water at the designated sampling locations, water samples will be collected by direct immersion of sample bottles. If water depths of 2 feet or more are encountered, the samples will be collected using a discrete, stainless-steel water sampler at approximately mid-depth levels in the water column. At shallow locations, samples will be collected by direct immersion of sample bottles. Care will be taken to avoid stirring up sediments that would contaminate the water sample. Field measurements of surface water pH, temperature, and conductivity will be recorded for each sampling location. Sediment samples will be collected using either a gravity corer or stainless-steel trowel, depending on the bottom type and overlying water depth. Detailed sampling procedures are included in Section 4.3 (QAPP).

**2.2.9 Aquifer Characterization** Hydraulic conductivity testing (slug tests) will be performed on selected monitoring wells that are representative of each sampling interval. Hydraulic conductivity measurements can be useful for calculating estimated groundwater flow parameters, for evaluating the heterogeneity of the aquifer, for identifying high permeability zones, and for determining the viability of various remedial options.

Slug tests will be performed in accordance with USEPA Method 9100, Section 3.0, Field Methods. In general, the test consists of the introduction and withdrawal of either a slug of water or of a weight (such as a tube filled with sand), and the measurement of the change in water level, or fluid pressure, in the well over time. The data will be analyzed using a method developed by Bouwer and Rice (1976) for calculating the hydraulic conductivity of an aquifer from partially penetrating wells in an unconfined aquifer.

Slug tests can be categorized into falling-head and rising-head tests. Falling-head tests are typically performed either by introducing a solid slug below the water level and measuring the rate of water level decrease per time until equilibrium conditions are reached (i.e., the rate of recovery). Rising-head tests are performed by withdrawing a solid slug and measuring the rate of recovery. The change in water level with time is measured with an electronic transducer and data logger over specified time intervals. Rising- and falling-head tests will be performed on wells that are screened below the water table. Rising-head tests will be performed on wells that are screened across the water table.

Based on previous site investigations, contamination of the aquifer is not expected. More extensive tests (e.g., pumping tests or step drawdown tests), are therefore, not warranted to evaluate the hydrologic properties of the aquifer.

2.2.10 Ecological and Population Surveys An ecological and a population survey will be conducted to identify potential receptors, to provide data for wetland and floodplain assessments, and to evaluate potential risk assessment exposure pathways.

2.2.10.1 Ecological Survey The ecological survey will consist of an informal visual identification of terrestrial vegetation cover types (e.g., herbaceous plants, emergents, shrubs, and trees) and terrestrial wildlife (e.g., mammals, reptiles, amphibians, and birds). Local wildlife officials may also be contacted to determine terrestrial species that are reported to be in the area or reported to inhabit the types of vegetative cover identified. Additional information may be collected for use in wetlands and floodplains assessments, including identification of soil types and wetland vegetation.

Wetland and Floodplain Evaluation According to the preamble of the National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR], Part 300), CERCLA actions will consider Federal environmental standards such as the Floodplains Management Executive Order 11990 the Clean Water Act (CWA) Section 404(b)(1) Guidelines, and the Office of Emergency and Remedial Response Policy on *Floodplains and Wetlands Assessments for Superfund Sites* (USEPA, 1985a). To evaluate the impact of remedial alternatives on wetlands and floodplains, it is necessary to first identify the location of floodplains and wetlands and then determine wetland functional attributes. Wetlands at the NCBC have been identified and mapped (see RI Workplan, Figure 2-10).

If necessary, wetlands and floodplains off base may be identified using information collected during the ecological survey and a review of available wetland and floodplain mapping of the area. Floodplain Insurance Rate Maps (FIRMs) that were prepared by the Federal Emergency Management Agency (FEMA) will be used to evaluate the 100-year floodplain boundaries. If available, wetlands will be identified using U.S. Fish and Wildlife Survey wetland inventory maps and on-site inspection. Wetland functional attributes may be identified based on a qualitative evaluation of the ecological survey information and hydrogeology of the area.

2.2.10.2 Public Health Survey A public health survey consisting of an area reconnaissance, interviews, and records search will be conducted by an ABB-ES Public Health Risk Assessment specialist. The survey will be conducted to examine on-base and off-base communities, activities, and drinking water source. Information gathered will be used to develop potential exposure pathways to be evaluated in the Baseline Risk Assessment.

2.2.11 Topographic and Water Elevation Survey The existing topographic map of the NCBC Gulfport will be used as a base map for additional survey data collection. This base map is available in digitized and hard-copy formats.

An elevation and location survey will be performed by a Mississippi-licensed surveyor under contract to ABB-ES to locate all sampling locations including monitoring wells, soil borings, surface soil samples, surface water and sediment samples, and any other necessary control points. The inner casing (riser) for

the monitoring wells will be surveyed for both horizontal and vertical control to a minimum degree of accuracy of 0.1 and 0.01 foot, respectively. Other exploration locations will be marked in the field and will be surveyed for horizontal and vertical control to a minimum degree of accuracy of 0.1 foot.

Sampling locations and other control points will be plotted on site-specific base maps and will be available in both digitized and hard copy formats. In addition, the survey data will be organized and reported in accordance with USEPA *Locational Data Policy and Region IV Environmental Monitoring and Data Reporting Requirements* (Workplan, Appendix E). These documents require the identification of sampling locations in terms of latitude/longitude coordinates in accordance with the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC) recommendations.

**SECTION 3**

### 3.0 TECHNICAL APPROACH

The RI technical approach developed for each site is based on several considerations including: (1) the physical characteristics and geographic location of the site, (2) the history and previous use of the site, (3) results and conclusions of previous investigations, and (4) site reconnaissance. Two previous investigations have been conducted: (1) an IAS by Envirodyne Engineers, Inc., completed in July, 1985 and (2) a Verification Study by HLA, completed in November, 1987. Previous investigative results are detailed in Section 2.0 of the RI Workplan and previous analytical results are summarized in Tables 3-3 through 3-8 of this section.

This section provides a summary of the proposed technical approach for RI activities for each of the seven sites (and areas on the base selected for background/base-wide information) that will be investigated. Each subsection provides: background information and a description of each location; a summary of previous investigative results, if applicable; a rationale for proposed remedial investigative activities; and a description of proposed RI survey and sampling activities for each of the seven sites. The final subsections describe activities that are common to all sites and a summary of the number of survey and sampling points for all sites.

The general approach for investigating the seven sites includes three basic steps: (1) survey techniques to define the lateral and vertical extent of the disposal areas and to select subsequent sampling locations; (2) screening techniques with on-site analyses to direct and refine confirmation sampling locations; and (3) CLP sampling and analyses in conformance with Level IV DQOs to provide defensible confirmation of the presence or absence, magnitude, and quantification limits of contaminants. Level III DQOs will be used for analyses not included in the CLP SOW.

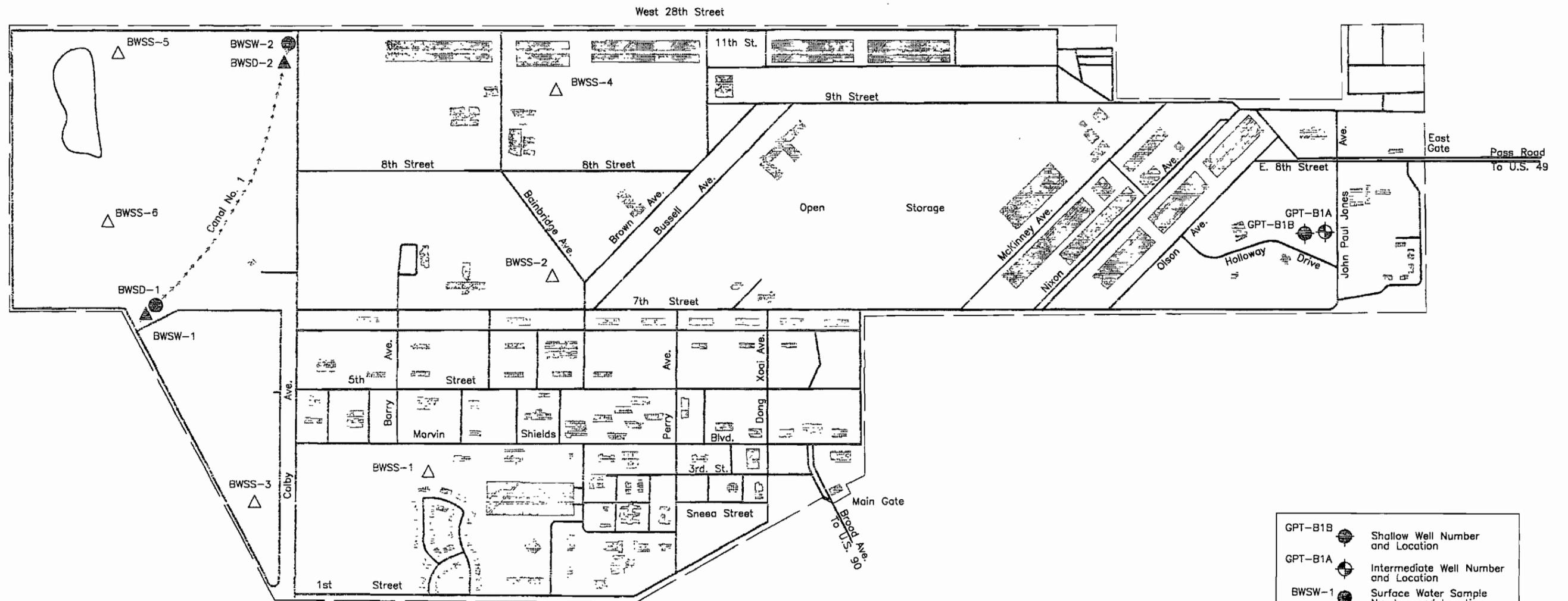
For health and safety reasons, invasive sampling techniques (e.g., drilling or TerraProbe) performed within the boundaries of the landfill areas are not proposed. Sampling locations adjacent to and beyond the boundary of the disposal areas can generally provide sufficient characterization and delineation data.

All existing monitoring wells at NCBC Gulfport are constructed of standard Schedule 40 PVC casing and well screens (Workplan, Appendix B). This material (PVC) is not expected to significantly interact with contaminants that have been detected or are suspected at NCBC Gulfport. For these reasons, and to avoid excessive cost, proposed monitoring wells will be constructed of standard Schedule 40 PVC casing and well screens. Appendix B of the RI Workplan contains information supporting the use of PVC in well construction. All monitoring well sampling for laboratory analysis will be conducted in conformance with Level III and Level IV DQOs to minimize and trace potential sampling interferences.

#### 3.1 BACKGROUND/BASE-WIDE SAMPLING.

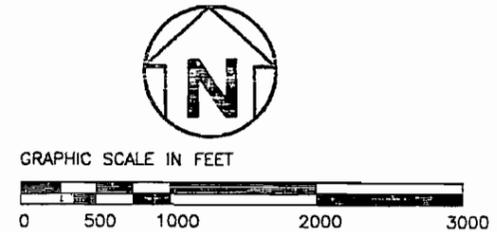
3.1.1 Description and Background Background sampling of groundwater, surface soils, and subsurface soils will be performed in the Housing/Recreation Area in the eastern section of the Activity (See Figure 3-1). This location was selected because it is away from the sites that will be investigated and industrial areas at the Activity. It is primarily a residential area with recreational facilities (e.g., swimming pool, picnic pavilion, and ball field) and has no history of





- GPT-B1B  Shallow Well Number and Location
- GPT-B1A  Intermediate Well Number and Location
- BWSW-1  Surface Water Sample Number and Location
- BWSD-1  Sediment Sample Number and Location
- BWSS-6  Surface Soil Sample and Location

Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.



 Canal Location and Flow Direction

**FIGURE 3-1  
BACKGROUND/BASE-WIDE  
SAMPLING AND MONITORING  
LOCATIONS**



**SAMPLING AND ANALYSIS  
PLAN  
NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

industrial operations. Active potable wells will be sampled. Six additional surface soil samples will be collected in the vicinity of the sites as shown in Figure 3-1.

Surface water and sediment sampling will be performed on NCBC Gulfport property at the locations where Canal No. 1 enters and exits the Activity (see Figure 3-1). Canal No. 1 enters the NCBC Gulfport along the western boundary of the Activity and exits along the northern boundary of the Activity.

3.1.2 Rationale and Technical Approach The data generated from Base-wide sampling activities will be used to evaluate the following:

- background levels of naturally-occurring TAL inorganics in the subsurface soils;
- background levels of naturally-occurring TAL inorganics in the surface soils and the potential impact on surface soils from widespread use of pesticides and vehicular traffic; and
- background levels of naturally-occurring TAL inorganics in groundwater.

The objectives of sampling the surface water and sediments in Canal No. 1 are to determine if potential contaminants are entering the Activity from areas outside the Base and if potential site-related contaminants are leaving the Base through surface water and/or bedload transport.

3.1.3 Proposed Investigation The following provides brief descriptions of proposed Base-wide investigative methods and sampling and analysis plans.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of background data and evaluate the history of Canal No. 1.

Surface Soil Sampling Six surface soil samples will be collected from areas in the western part of NCBC Gulfport. The proposed locations are shown in Figure 3-1. The locations were selected to represent four soil types reported to be present at NCBC Gulfport (see Section 2.3.3.2 of the Workplan). These samples will be submitted to the laboratory for analysis of TCL semivolatiles, TCL pesticides and PCBs, TPH, and TAL inorganics. Analytical data will be used to evaluate background surface soils for compounds associated with wide-spread use of pesticides and vehicular traffic, and to provide data regarding natural levels of TAL inorganics at the NCBC Gulfport.

Actual sample locations will be chosen in the field based on reconnaissance of the proposed locations. Samples will be collected in areas that are free of visible contamination and away from local industrial-type activities. Surface soil samples will be collected from 0- to 1-foot using a hand auger or similar device.

Soil Borings Two borings will be conducted in the eastern part of the Activity off John Paul Jones Avenue (Figure 3-1). These borings correlate with completion of a monitoring well pair (GPT-B1A and GPT-B1B). One of the borings will extend into the clay layer and will be the location of an intermediate depth monitoring

well. The other boring will extend approximately 9 feet below the water table and will be the location of a shallow monitoring well. The borings are located away from the seven sites and in an area used for housing and recreation that does not have a history of industrial activity.

Split-spoon sampling will be conducted continuously to the water table and every 5 feet thereafter in the two borings. The purpose of split-spoon sampling is to characterize subsurface soils, confirm the presence of the clay layer, and obtain background data for soil to use in evaluating the status of contamination at the seven sites. Three soil samples will be collected from each boring for laboratory analysis; one surface soil (0 to 2 feet), one sample above the water table, and one from the bottom of the boring. The surface soil samples will be submitted for analysis of TCL pesticides and PCBs, TCL semivolatile compounds, TAL inorganics, and TPHs. These data will be used to evaluate background surface soils for compounds associated with wide-spread use of pesticides and vehicular traffic, and to provide data regarding natural levels of TAL inorganics at NCBC Gulfport. The other four subsurface soil samples collected from the borings will be submitted to the laboratory for analysis of TAL inorganics. The TAL data from all background soil samples will be compared to TAL data for soil samples that are collected from the sites to aid in identification of potential inorganic contaminants at the sites. Soil samples will be collected and analyzed in conformance with Level IV DQOs, except that non-CLP analyses will conform to Level III DQOs.

Monitoring Wells Installation Two monitoring wells will be installed in the eastern part of the activity off John Paul Jones Avenue (Figure 3-1). The well pair will be installed in an area used for housing and recreation that does not have a history of industrial activity. The purpose of the well pair is to obtain groundwater samples for analysis of TAL inorganics. Sampling and analysis will be in conformance with Level IV DQOs for CLP analyses and Level III DQOs for analyses not included in the CLP SOW. The data will be used to provide background levels of inorganics in groundwater.

Analysis of groundwater samples that are collected from the sites during the Verification Study indicated concentrations of chromium and lead in groundwater ranging from 21 to 392  $\mu\text{g}/\text{l}$  and from 5.4 to 124  $\mu\text{g}/\text{l}$ , respectively. These compounds were present at apparent elevated levels in monitoring wells upgradient and downgradient of the individual sites and are not presently considered to be site related. The concentrations of chromium and lead that are detected in groundwater samples may be indicative of groundwater quality in the surficial aquifer or may be a consequence of analyzing turbid groundwater samples. The TAL inorganic data from the two monitoring wells that will be installed in the eastern part of the activity will provide information regarding chromium and lead levels at a location away from the sites. Laboratory analysis of background groundwater samples will include TAL inorganics, TDS, and TSS. Both filtered and unfiltered samples will be submitted for TAL inorganic analyses.

The well pair will be comprised of a shallow well and an intermediate-depth well, which is consistent with monitoring well installations that were proposed for the sites. The shallow well will be constructed to intercept the water table in the screened interval. The intermediate well will be constructed with the screened interval situated above the clay layer. The wells will be constructed using 2-inch ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC in well construction is included in Appendix B of the RI Workplan. Wells will have screens with 0.01-inch machined slots and filter packs comprised of

20/30 mesh sand, based on the anticipated occurrence of silty sands. The wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) and SOUTHNAVFACENGCOCM guidelines.

Sediment and Surface Water Sampling Two sediment and two surface water samples (two "sets") will be collected from Canal No. 1 at locations shown on Figure 3-1. One sample set will be collected from a location near the NCBC property line where Canal No. 1 enters the property. The second sample set will be collected from a location near the NCBC property line where Canal No. 1 exits the property.

The purpose of this sampling is to evaluate sediment and surface water in Canal No. 1 for contaminants from sources outside the limits of NCBC Gulfport and for the presence of contaminants being transported off NCBC Gulfport property.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPH, and TAL inorganics. Surface water samples will be analyzed for TAL inorganics, TDSs, and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses.

### 3.2 CHARACTERIZATION OF FIRST CONFINED AQUIFER.

3.2.1 Description and Background The groundwater in southern Mississippi consists of a sand and gravel surficial aquifer overlying the Citronelle Formation and the Miocene aquifer system. In Gulfport, the surficial aquifer and the Citronelle Formation are separated by a layer of clay, with varying amounts of sand, ranging in thickness from 28 to 197 feet. The Citronelle Formation, which is confined by this clay layer, is composed mostly of quartz sand, chert gravel, and lenses and layers of clay ranging from zero to 300 feet thick. More detailed information regarding regional hydrogeology is presented in Section 2.3.5 of the RI Workplan.

3.2.2 Rationale for Technical Approach The top 2 feet of the clay layer will be sampled and analyzed for potential site-related contaminants during the installation of intermediate wells. Shallow and intermediate-depth monitoring wells at the sites will provide additional data regarding potential site contamination. The analytical data from clay samples and groundwater samples will be evaluated to determine the need for the installation of as many as four deep wells around the periphery of the potential source area(s). These deep wells will be installed such that the wells monitor the source areas that are suspected of contributing contaminants collectively. Locations of these wells will be approved by the USEPA, MDEQ, and SOUTHNAVFACENGCOCM prior to installation.

3.2.3 Proposed Investigation The decision to install deep groundwater monitoring wells into the first confined aquifer (Citronelle Formation) will be based on TCL/TAL analytical results of groundwater samples collected from monitoring wells completed in the surficial aquifer and subsurface soil samples collected from the top of the clay layer. Participants in the decision-making process include SOUTHNAVFACENGCOCM, USEPA Region IV, MDEQ, and ABB-ES. The purpose of completing deep monitoring wells would be to evaluate groundwater in the Citronelle Formation for contaminants that are suspected of migrating through the confining clay layer. The confining clay layer is estimated to be 28 feet to 197 feet thick (Envirodyne, 1985) in the area of NCBC. The locations of the

wells would be chosen based on the sites that are suspected of contributing contaminants.

Double-cased well construction would be used for the deep wells to avoid interconnection of the surficial aquifer and confined aquifer by well construction. Interconnection of the two aquifers could result in cross contamination. The installation of double-cased wells involves setting an outer steel casing that extends from the surface into the confining unit. After the outer casing is grouted in place (and grout has set) the borehole is advanced by drilling inside the outer casing. Should deep wells be installed, it is anticipated that both hollow-stem auger and air/water rotary drilling will be used.

Deep wells will be constructed of 4-inch ID, Schedule 40 PVC pipe with 10 feet of machine-slotted standard PVC well screen. Slot size may vary dependent upon stratigraphic characterization. Deep wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENCOM guidelines (RI Workplan, Appendix D).

If deep wells are installed, groundwater samples would be collected and analyzed in conformance with Level IV DQOs for CLP analyses and Level III DQOs for analyses not included in the CLP SOW. Laboratory analyses would probably be limited to include compounds suspected of being present based on results of analysis of surficial groundwater samples and subsurface soil samples collected during the initial phase of the RI/FS field program.

### 3.3 SITE 1, DISASTER RECOVERY DISPOSAL AREA.

3.3.1 Description and Background The Disaster Recovery Disposal Area is located on the northeastern corner of Seventh Street and Colby Avenue. The site consists of an inactive landfill measuring approximately 400 by 1,000 feet. The site is bordered on the north by three parallel abandoned catfish ponds, on the west by Colby Avenue, and on the south by Seventh Street. One third of each of the three catfish ponds had been filled along their eastern ends as of October 31, 1991. Prior to fill operations, three soil samples were collected from each of the ponds on 16 August 1990 and were tested for extraction procedure toxicity characteristic metals (EP toxicity metals). Analytical results indicated that none of the samples exhibited characteristics of EP toxicity for metals (Table 3-1).

An unknown quantity of chemical wastes that were generated mainly by the public works shops or the Supply Department and containerized in 55-gallon drums were disposed by trench-and-fill operations at this location between 1942 to 1948. The chemical wastes disposed reportedly included paints (which may contain cadmium, chromium, and lead), oils, solvents (Stoddard, xylene, toluene, MEK, and trichloroethylene), paint strippers, and cleaning compounds. The site was subsequently covered and is now characterized by planted pine trees and grassed areas that surround roads and buildings associated with the Disaster Recovery Training.

Verification Study During the Verification Study three soil borings were completed and a monitoring well was installed in each of these borings. Also, four surface water samples and four sediment samples were collected and analyzed for pH, specific conductance (conductance), total organic carbon (TOC), total organic halogen (TOX), chemical oxygen demand (COD), oil and grease (O&G),

Table 3-1 Results of Extraction Procedure Toxicity Tests of Catfish Pond Soil Samples

	South Pond			Center Pond			North Pond		
	#1	#2	#3	#1	#2	#3	#1	#2	#3
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.14	0.18	0.33	0.25	0.03	0.12	0.19	0.20	0.20
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Selenium	<0.01	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Note: Concentrations are in milligrams per liter.

cadmium (Cd), chromium (Cr), and lead (Pb) (Table 3-2). Analytical results are presented in Table 3-3.

One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organics, and semivolatile organics (Table 3-2). Compounds detected in groundwater samples by these analyses are presented in Table 3-3 and include Cr and Pb as follows:

GPT-1-1	Cr, 136 µg/l; Pb, 52 µg/l
GPT-1-2	Cr, 392 µg/l; Pb, 79 µg/l
GPT-1-3	Cr, 81 µg/l; Pb, 66 µg/l.

A geophysical survey using a Scintrex-IGS™ was conducted at these sites. A 50-foot by 5-foot grid was used for the survey of Site 1. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-10 in the RI Workplan.

3.3.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 1 are to define the location and orientation of the landfill burial trenches; to determine the composition, magnitude, and extent of potential soil and sediment contamination; to determine the composition and magnitude of potential groundwater and surface water contamination; and to determine whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be a consequence of analyzing turbid samples. This will be evaluated by obtaining background samples, by analyzing filtered and unfiltered samples, and by analyzing total dissolved solids (TDSs) and total suspended solids (TSSs). Results of the Verification Study indicate that except for the concentrations of chromium and lead, there does not appear to be contamination of the shallow groundwater. However, two of the monitoring wells were installed upgradient of the landfill and only one was installed downgradient of the landfill. Additionally, monitoring well screens range from 23 to 27 feet long and may result in dilution of groundwater samples. Therefore, additional monitoring wells are needed to evaluate the status of contamination in the surficial aquifer at Site 1.

The following investigative objectives and methods are proposed to characterize Site 1:

Objective 1: to determine the location and orientation of the landfill burial trenches.

Methods: aerial photography analysis, and geophysical surveys (magnetometer, terrain conductivity, and GPR).

Objective 2: to determine the composition, magnitude, and extent of potential soil contamination.

Methods: soil boring and subsurface soil sampling, surface soil sampling, and sediment sampling.

Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Table 3-2 Chemical and Physical Parameters Identified for Analysis of Sediment, Soil, and Water Samples, RI/FS Sampling and Analysis Plan NCBC Gulfport, Gulfport, Mississippi

Parameter	Surface and Groundwater Samples		Sediment and Soil Samples	
	Analytical Method Number	Method Detection Limit	Analytical Method Number	Method Detection Limit
pH	1150.1	0.1 su	23-51	0.01 su
Specific conductance	1120.1	1 $\mu$ mhos/cm	Not applicable	
Total organic carbon (TOC)	1415.2	1 mg/l	3DC-80	100 mg/kg
Total organic halogen (TOX)	49020	5 $\mu$ g/l	5DX-20	200 mg/kg
Chemical oxygen demand (COD)	6Hach	5 mg/l	23-393	50 mg/kg
Oil and grease (O and G)	1413.2	1.0 mg/l	23-284	100 mg/kg
Cadmium (Cd)	1213.2	5 $\mu$ g/l	1213.2	3 mg/kg
Chromium (Cr)	1218.2	10 $\mu$ g/l	1218.2	5 mg/kg
Lead (Pb)	1239.2	5 $\mu$ g/l	1239.2	3 mg/kg
<b>Volatile organics<sup>8</sup></b>	7624		Not applicable	
Acrolein		20		
Acrylonitrile		10		
Benzene		5		
Bromoform		5		
Bromomethane		10		
Carbon tetrachloride		5		
Chlorobenzene		5		
Chlorodibromomethane		5		
Chloroethane		10		
Chloromethane		10		
1,1-Dichloroethane		5		
1,2-Dichloroethane		5		
1,1-Dichloroethylene		5		
1,2-Dichloropropane		5		
trans-1,3-Dichloropropene		5		
Ethyl Benzene		5		
Methylene Chloride		5		
1,1,2,2-Tetrachloroethane		5		
Tetrachloroethylene		5		

See notes at end of table.

Table 3-2 (Continued) Chemical and Physical Parameters Identified for Analysis of Sediment, Soil, and Water Samples, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Parameter	Surface and Groundwater Samples		Sediment and Soil Samples	
	Analytical Method Number	Method Detection Limit	Analytical Method Number	Method Detection Limit
Toluene		5		
1,2-trans-Dichloroethylene		5		
1,1,1-Trichloroethane		5		
1,1,2-Trichloroethane		5		
Trichloroethylene		5		
Trichlorofluoromethane		10		
Vinyl chloride		10		
cis-1,3-Dichloropropene		10		
Semivolatile organics <sup>8</sup>	7625		Not applicable	
2-Chlorophenol		10		
2,4-Dichlorophenol		10		
2,4-Dimethylphenol		10		
4,6-Dinitro-o-cresol		50		
2,4-Dinitrophenol		50		
2-Nitrophenol		10		
4-Nitrophenol		50		
P-chloro-m-cresol		10		
Pentachlorophenol		50		
Phenol		10		
2,4,5-Trichlorophenol		50		
2,4,6-Trichlorophenol		10		
Acenaphthene		10		
Acenaphthylene		10		
Anthracene		10		
Benzidine		50		
Benzo(a)anthracene		10		
Benzo(a)pyrene		10		
Benzo(b)fluoranthene		10		
Benzo(ghi)perylene		10		

See notes at end of table.

Table 3-2 (Continued) Chemical and Physical Parameters Identified for Analysis of Sediment, Soil, and Water Samples, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Parameter	Surface and Groundwater Samples		Sediment and Soil Samples	
	Analytical Method Number	Method Detection Limit	Analytical Method Number	Method Detection Limit
Benzo(k)fluoranthene		10		
bis(2-Chloroethoxy)methane		10		
bis(2-Chloroethyl)ether		10		
bis(2-Chloroisopropyl)ether		10		
bis(2-Ethylhexyl)phthalate		10		
4-Bromophenylphenyl ether		10		
Butyl benzyl phthalate		10		
2-Chloronaphthalene		10		
4-Chlorophenyl phenyl ether		10		
Chrysene		10		
Dibenzo(a,h)anthracene		10		
1,2-Dichlorobenzene		10		
1,3-Dichlorobenzene		10		
1,4-Dichlorobenzene		10		
3,3'-Dichlorobenzidine		20		
Diethylphthalate		10		
Dimethyl phthalate		10		
Di-n-butylphthalate		10		
1,2-Diphenylhydrazine		10		
2,4-Dinitrotoluene		10		
2,6-Dinitrotoluene		10		
Di-n-octyl phthalate		10		
Fluoranthene		10		
Fluorene		10		
Hexachlorobenzene		10		
Hexachlorobutadiene		10		
Hexachlorocyclopentadiene		10		
Hexachloroethane		10		
Ideno(1,2,3-cd)pyrene		10		

See notes at end of table.

Table 3-2 (Continued) Chemical and Physical Parameters Identified for Analysis of Sediment, Soil, and Water Samples, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Parameter	Surface and Groundwater Samples		Sediment and Soil Samples	
	Analytical Method Number	Method Detection Limit	Analytical Method Number	Method Detection Limit
Isophorone		10		
Naphthalene		10		
Nitrobenzene		10		
N-nitrosodi-n-propylamine		10		
N-nitrosodiphenylamine		10		
Phenanthrene		10		
Pyrene		10		
1,2,4-Trichlorobenzene		10		
Pesticides and PCBs <sup>B</sup>	7608		Not applicable	
Aldrin		0.1		
alpha-BHC		0.1		
beta-BHC		0.1		
gamma-BHC		0.1		
delta-BHC		0.1		
alpha Chlorodane		0.5		
gamma Chlorodane		0.5		
4,4'-DDT		0.1		
4,4'-DDE		0.1		
4,4'-DDD		0.1		
Dieldrin		0.1		
alpha-Endosulfan		0.1		
beta-Endosulfan		0.1		
Endosulfan sulfate		0.1		
Endrin		0.1		
Endrin ketone		0.1		
Heptachlor		0.1		
Heptachlor epoxide		0.1		
Methoxychlor		0.5		
PCB-1242		1.0		

See notes at end of table.

Table 3-2 (Continued) Chemical and Physical Parameters Identified for Analysis of Sediment, Soil, and Water Samples, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Parameter	Surface and Groundwater Samples		Sediment and Soil Samples	
	Analytical Method Number	Method Detection Limit	Analytical Method Number	Method Detection Limit
PCB-1254		1.0		
PCB-1221		1.0		
PCB-1232		1.0		
PCB-1248		1.0		
PCB-1260		1.0		
PCB-1016		1.0		
Toxaphene		1.0		

Notes:

- <sup>1</sup>Methods for Chemical Analysis of Water and Wastes, USEPA-600/4-79-020, March 1979 (USEPA, 1979).
- <sup>2</sup>Plumb, R.H., Jr., 1981, Procedures for Handling Sediment and Water Samples, Technical Report USEPA/CE-81-1 (Plumb, 1981).
- <sup>3</sup>Dohrmann DC-80 Analysis Specifications.
- <sup>4</sup>USEPA Test Methods for Evaluating Solid Waste-Physical/Chemical Methods, SW-846, 2nd Edition (USEPA, 1985).
- <sup>5</sup>Dohrmann DX-20 Analysis Specification.
- <sup>6</sup>HACH COD Specifications.
- <sup>7</sup>USEPA Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, USEPA-600/4-82-057, July 1982 (USEPA, 1982).
- <sup>8</sup>All method detection limits for volatile and semi-volatile organics and pesticides/PCB's are in  $\mu\text{g/l}$ .

Notes:

- SU = standard units
- $\mu\text{mhos/cm}$  = micromhos per centimeter
- $\mu\text{g/l}$  = micrograms per liter
- PCBs = polychlorinated biphenyl compounds
- $\text{mg/kg}$  = milligrams per kilogram
- $\text{mg/l}$  = milligrams per liter

Source: HLA, 1987.

Table 3-3 Summary of Chemical Analysis Results, Site 1, RI/FS Sampling and, Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Location	Location						
	GPT-1-1	GPT-1-2	GPT-1-3	SW1-1	SW1-2	SW1-3	SW1-4
Sampling Date	3/29/87	3/28/87	3/28/87	3/28/87	3/28/87	3/28/87	3/28/87
Temperature	17	17	15	20	17	20	24
pH (field)	5.03	4.59	5.34	6.00	7.34	7.01	7.64
Specific conductance (field)	150	130	200	160	620	100	100
pH (laboratory)	5.61	5.25	5.73	6.46	7.18	9.41	7.10
Specific conductance (laboratory)	100	90	120	110	390	62	48
total organic carbon (TOC)	-	-	-	6	10	6	6
total organic halogens (TOX)	-	-	-	42	228	33	73(73)
chemical oxygen demand (COD)	-	-	-	22	37	47	17
oil and grease (O and G)	-	-	-	1.4	<1.0	1.0	1.2
cadmium (Cd)	<4.7 (<4.7)	<4.7(<4.7)	<4.7	<4.7	<4.7	<4.7	<4.7
chromium (Cr)	136 (165)	392 (415)	81	<7.8	<7.8	<7.8	<7.8
lead (Pb)	52 (61)	79 (70)	66	<5.0	<5.0	<5.0	<5.0
Volatile organics <sup>1</sup>				-	-	-	-
Semivolatile organics <sup>1</sup>				-	-	-	-
Pesticides and PCBs <sup>1</sup>				-	-	-	-

See notes at end of table.

Table 3-3 (continued) Summary of Chemical Analysis Results, Site 1 RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Location	SD1-1	SD1-2	SD2-3	SD1-4
Sampling Date	3/28/87	3/28/87	3/28/87	3/28/87
Temperature	-	-	-	-
pH (field)	-	-	-	-
Specific conductance (field)	-	-	-	-
pH (laboratory)	6.15	5.44 (5.49)	5.79	5.84
Specific conductance (laboratory)	-	-	-	-
total organic carbon (TOC)	6,400	4,200	1,900	1,000
total organic halogens (TOX)	280	150 (160)	210	260
chemical oxygen demand (COD)	5,480	3,530 (3,180)	2,190	2,670
oil and grease (O and G)	366	<122	<134	<131 (<131)
cadmium (Cd)	<3.2	<2.9	<3.2	<3.1 (<3.1)
chromium (Cr)	<5.3	7.3	<5.2	7.2 (6.6)
lead (Pb)	<3.4	<3.0	<3.4	<3.3 (<3.3)
Volatile organics	-	-	-	-
Semivolatile organics	-	-	-	-
Pesticides and PCBs	-	-	-	-

<sup>1</sup>All chemical parameters not specifically reported were below their analytical detection limit (Table 3-2).

Source: HLA, 1987.

Notes:

All analyses results for water samples are reported in  $\mu\text{g/l}$  except TOC, COD, and O and G which are reported in mg/l. Analyses results for sediment and soil samples are reported in mg/kg. Temperature, pH, and specific conductance are reported in  $^{\circ}\text{C}$ , standard units, and  $\mu\text{mhos/cm}$  at  $25^{\circ}\text{C}$ , respectively.

Temperature, pH (field), and specific conductance (field) data for groundwater samples are an average of three separate measurements.

Results presented in parentheses are for duplicate analyses.

- sample not analyzed or measured for these parameters.

PCBs = polychlorinated biphenyl compounds

Methods: sampling of existing monitoring wells, monitoring well installation and sampling, and surface water sampling.

3.3.3 Proposed Investigation The following provides descriptions of proposed investigative methods and sampling and analysis plans for Site 1, Disaster Recovery Disposal Area.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former landfill operations and the historical development of the site.

Geophysical Survey A geophysical survey consisting of magnetometer, GPR, and/or terrain conductivity will be completed. The magnetometer survey will be comprised of survey lines spaced 100 feet apart, with readings taken every 20 feet along a survey line. Figure 3-2 shows the area to be included in the magnetometer survey. Each survey line will extend beyond the anticipated limits of the site. Terrain conductivity and GPR surveys will be located to confirm magnetic anomalies that are suspected of indicating areas of buried metal such as drums. Geophysical results will be presented on scaled site maps. Cumulative evaluation and interpretation of data from the three geophysical methods will be used to interpret the extent, location, and orientation of the landfill.

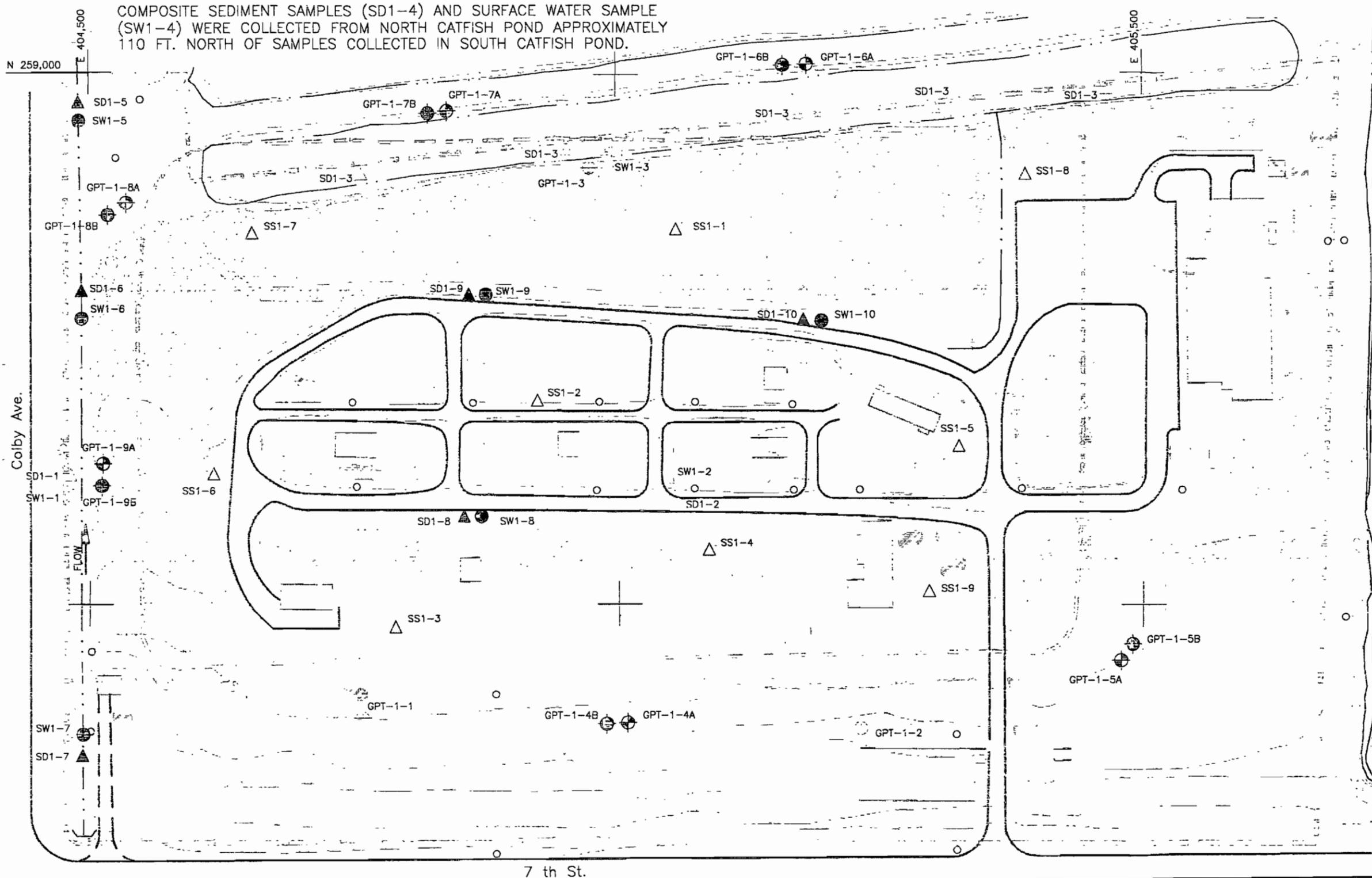
Because Site 1 is near the location of a communications radio antenna, the geophysical survey crew should contact the activity responsible for using the antenna to schedule site work such that potential interaction between geophysical instruments and the antenna do not create problems.

Surface Soil Sampling Nine surface soil samples will be collected from locations within the boundaries of the disposal area at Site 1. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-2; however, actual locations will be chosen in the field based on results of the geophysical survey. Some locations will be at or near areas interpreted as disposal trenches based on geophysical data. Other locations will be selected so that sampling generally covers all areas of the site, as necessary to support the Baseline Risk Assessment. Surface soil samples will be collected from 0 to 1 foot using a hand auger or similar device. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganics.

Subsurface Soil Sampling. At Site 1, subsurface soil samples will be collected from soil borings conducted in association with monitoring well installation at the periphery of the site. Figure 3-2 shows proposed locations for soil borings and monitoring well installations. Because of the nature of the site (a landfill), no soil borings will be conducted within the limits of the site.

Split-spoon sampling will be conducted continuously (every 2 feet) to the water table then every 5 feet (or at facies boundaries) in intermediate-depth borings associated with monitoring well pairs. Headspace analysis using an OVA will be performed in the field on all samples from the intermediate borings. Four soil samples will be selected from each intermediate boring for laboratory analysis, including the sample from the interval above the water table and the top 2-foot



Source: HLA, 1987

GPT-2-2	Existing Well and Location	SW4-2	Surface Water Sample and Location
GPT-7-2B	Shallow Monitoring Well and Location		Topographic Elevation Contour
GPT-1-4A	Intermediate Monitoring Well and Location		Verification Study Sample and Location
SS2-5	Surface Soil Sample and Location		Heavily Vegetated Area
SD4-2	Sediment Sample and Location		Site Boundary
			General Location Of Geophysical Activities



Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.

**FIGURE 3-2  
PROPOSED LOCATIONS OF REMEDIAL  
INVESTIGATION ACTIVITIES**

**SITE-1**



**SAMPLING AND ANALYSIS  
PLAN  
NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

interval of the clay layer. Two additional samples will be selected for laboratory analysis based on results of OVA headspace analysis. Rationale for selecting subsurface soil samples for laboratory analysis based on OVA analysis is discussed in Section 2.2.3 of this document. A total of 24 subsurface soil samples from 6 borings will be submitted for analysis of TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganics. Sampling and analysis will conform with Level IV DQOs, however, Level III DQOs will be used for total petroleum hydrocarbon analyses because it is not included in the CLP SOW.

Split-spoon sampling will be conducted every 5 feet and/or at facies boundaries in shallow soil borings associated with monitoring well pairs. These samples will be used for soil classification and visual inspection only.

As many as 12 subsurface soil samples from Site 1 will be submitted for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The 12 samples will represent four different facies expected of being present at the site. These four facies are sand, silty sand, clayey sand, and clay. To evaluate spatial variation in organic carbon content, the samples will be collected from three boring locations. If all four facies are not represented at three locations, the number of samples submitted for organic carbon content determination will decrease accordingly. The data will be used to evaluate spatial and depth variation of organic carbon, as well as variation among facies.

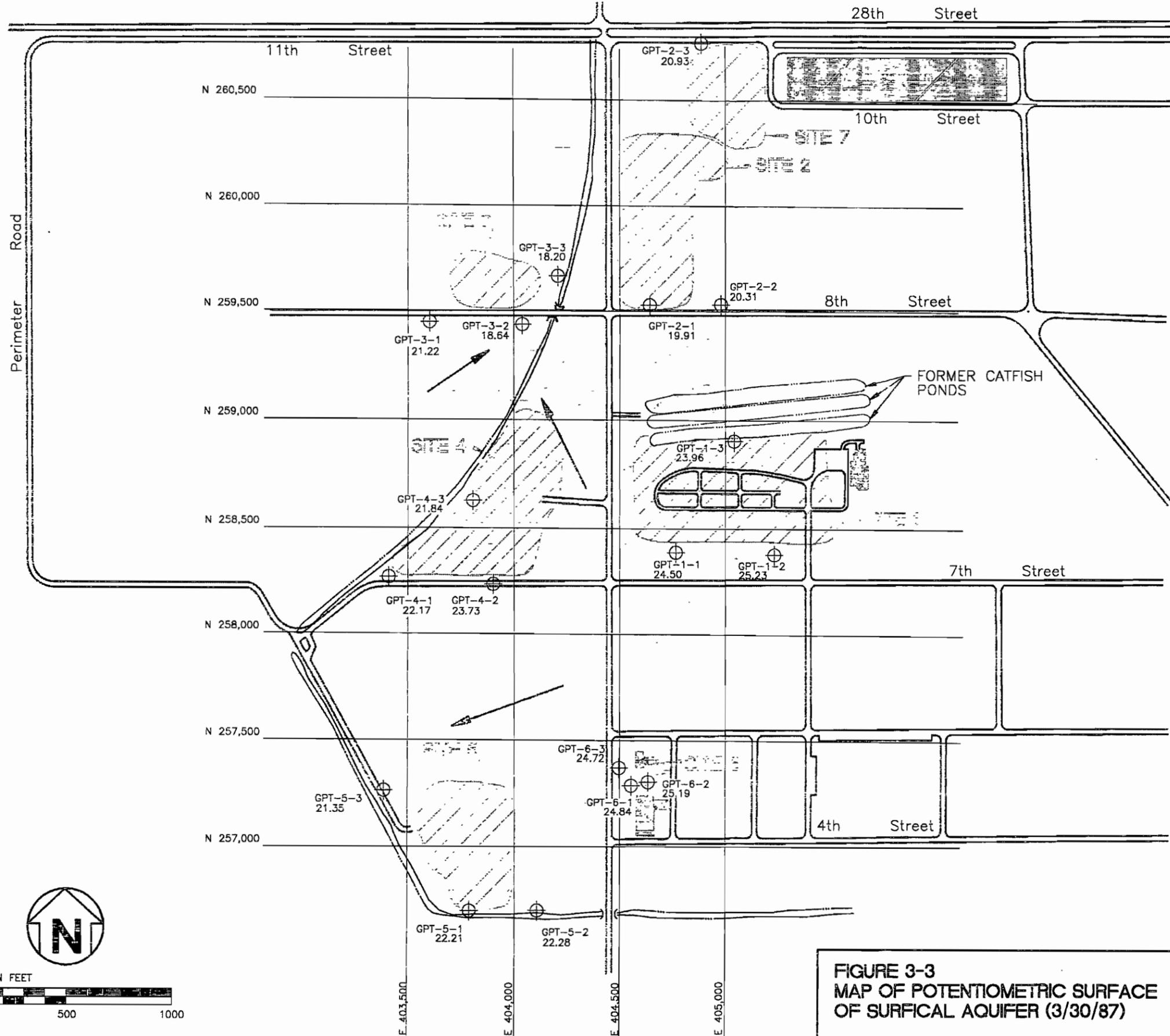
Three samples of the clay layer will be collected from three intermediate borings using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in the COE Engineering Manual 1110-2-1906 (USCOE, 1970). The laboratory permeability data will be used in conjunction with slug-test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on groundwater flow direction determined by two sets of water-level measurements that were obtained from three existing monitoring wells at Site 1. Figures 3-3 and 3-4 are potentiometric surface maps developed from water level measurements collected 30 March 1987 and 31 October 1991. Groundwater flow direction at Site 1 is northwest during periods of high water table (Figure 3-3) and north-northwest during periods of low water table (Figure 3-4).

Available data indicate groundwater flow in the eastern part of the site may be more northerly than in the western part of the site.

Six monitoring well pairs are proposed at Site 1. Figure 3-2 shows the proposed location of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells will be used to monitor groundwater for free-phased floating product and detection of shallow groundwater contaminants. Intermediate-depth wells will be constructed to monitor groundwater on top of the clay layer. Intermediate-depth monitoring wells will be used to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

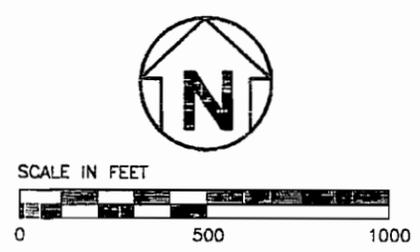




Source: HLA, 1987

GPT-3-1	⊕	Groundwater Monitoring Well Number and Location
22.17		Groundwater Elevation (NGVD)
	—	Groundwater Elevation Contour
	▨	Probable Waste Disposal Sites
	→	Groundwater Flow Direction
		MISSISSIPPI STATE PLANE COORDINATES (See Appendix C for exact monitoring well locations)

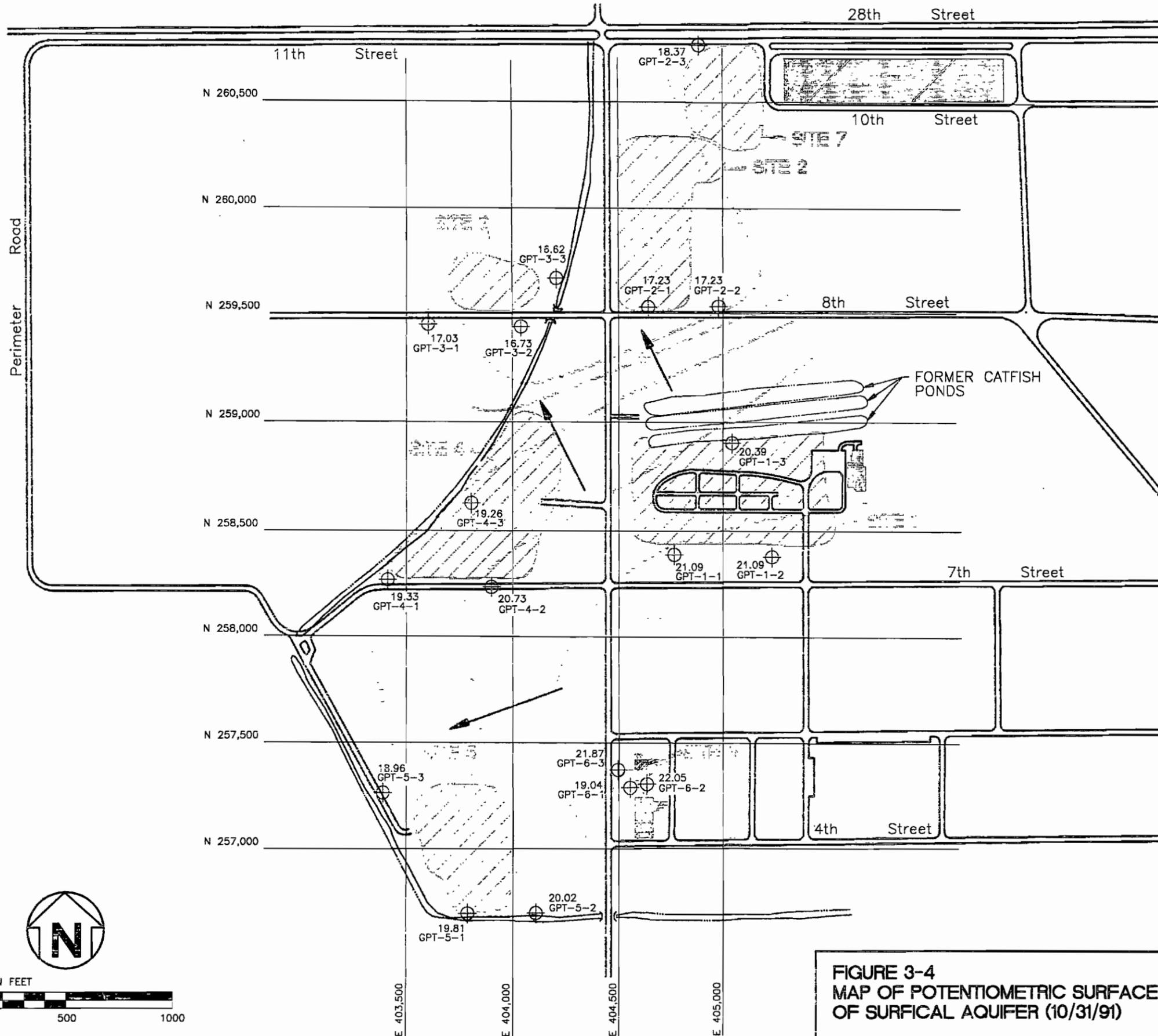
NOTE: Groundwater elevations measured on March 30, 1987.



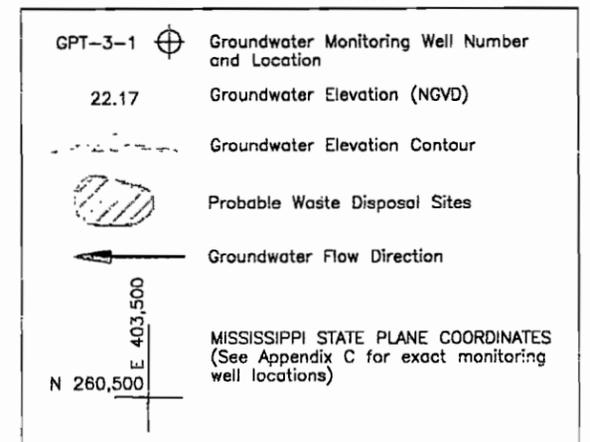
**FIGURE 3-3**  
**MAP OF POTENTIOMETRIC SURFACE**  
**OF SURFICIAL AQUIFER (3/30/87)**



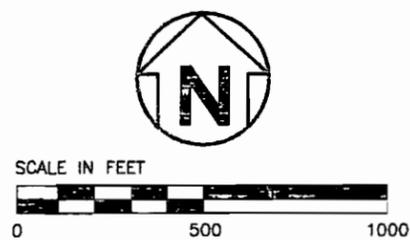
**SAMPLING AND ANALYSIS**  
**PLAN**  
**NAVAL CONSTRUCTION**  
**BATTALION CENTER**  
**GULFPORT, MISSISSIPPI**



Source: HLA, 1987



NOTE: Groundwater elevations measured on October 31, 1991



**FIGURE 3-4**  
**MAP OF POTENTIOMETRIC SURFACE**  
**OF SURFICIAL AQUIFER (10/31/91)**



**SAMPLING AND ANALYSIS**  
**PLAN**  
**NAVAL CONSTRUCTION**  
**BATTALION CENTER**  
**GULFPORT, MISSISSIPPI**

Two well pairs will be located south and southeast of the site to provide information regarding upgradient groundwater conditions. Two upgradient well pairs are proposed because of the large size of the site and the variation in groundwater flow directions over time. Four downgradient well pairs will be located along the western and northern boundaries of the site. The locations of downgradient monitoring wells were selected based on the variation in groundwater flow direction over time and the need to detect potential small plumes of groundwater contamination originating from one or more burial trenches.

During the 1987 Verification Study conducted by HLA, soil borings were conducted for installation of three monitoring wells. Boring logs that were provided in the Verification Report (HLA, 1987) indicate that the depth of the clay layer ranges from 26 to 29 feet BLS at Site 1. Therefore, intermediate depth wells installed during the RI/FS are expected to range from 26 to 29 feet BLS. Groundwater levels at Site 1 range from less than 1 foot to 6 feet BLS. Depths of shallow wells to be installed during the RI/FS are expected to range from 10.5 to 15 feet BLS. Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment. Because the proposed well locations are based on knowledge of groundwater flow directions, actual well locations should be as close as possible to proposed locations.

All wells will be constructed of flush-threaded, 2-inch ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mesh filter sand have been chosen based on the presence of silty sand and clayey sand in the subsurface at Site 1, as indicated by boring logs associated with the Verification Study. Well screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in intermediate-depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENGCOCM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs. Level III DQOs will be used for analyses not included in the CLP SOW. Groundwater samples will be analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganics, TDS, and TSS. Both filtered and unfiltered samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Level IV DQOs will be used for second round groundwater analyses using CLP methods. Level III DQOs will be used for non-CLP analyses. If the analytical results of the first round of groundwater samples from Site 1 do not reveal detectable levels of site

related organics and all inorganics are within background ranges, no further groundwater sampling will be conducted at Site 1.

Surface Water and Sediment Sampling Six surface water samples and six sediment samples (six "sets") will be collected in and adjacent to Site 1. Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations in the area of interest will be chosen. The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Three sets of samples will be collected from the drainage ditch west of the site and east of Colby Avenue (Figure 3-2). One set will be collected from a location hydraulically upgradient of Site 1. Two sets of samples will be collected from locations adjacent to and downgradient of Site 1. The remaining three sets of samples will be collected from drainage ditches within the boundaries of Site 1 (Figure 3-2).

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses and Level III DQOs for non-CLP analyses. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganic compounds, TDS, and TSS. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

### 3.4 SITE 2, WW II LANDFILL.

3.4.1 Description and Background The WW II Landfill is located on the northeastern corner of Eighth Street and Colby Avenue. The site consists of an inactive landfill measuring approximately 600 by 800 feet, bordered on the west by Colby Avenue and on the south by Seventh Street. Site 7 is located just northeast of Site 2.

The WW II Landfill was active from 1942 to 1948, during the same time period as Site 1. Site 2 was used primarily for the disposal of an unknown quantity of general refuse and inert material such as paper, cardboard, wood, and garbage generated at the installation. Additionally, liquid wastes were disposed at the site that reportedly included paints (which may contain cadmium, chromium, and lead), paint thinners, solvents, oils, and fuels. A former structure located at the northern end of the site was used for burning of combustible materials. The ash and noncombustible materials were then disposed using trench-and-fill operations. The site was subsequently covered and planted with pine trees, which now occupy the site. The site is presently densely vegetated with pines and underbrush.

Verification Study. Sites 2 and 7 were investigated as one site for the purposes of groundwater monitoring and surface water and sediment sampling during the Verification Study. Three soil borings were completed and a monitoring well was installed in each of these borings to monitor Sites 2 and 7. One surface water sample and one sediment sample were collected and analyzed for pH, conductance,

TOC, TOX, COD, O&G, Cd, Cr, and Pb (Table 3-2). The sediment sample contained lead at a concentration of 4.9 mg/kg and chromium at a concentration of 4.7 mg/kg. One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organic compounds, and semivolatile organic compounds (Table 3-2). Compounds detected in groundwater samples by these analyses include Cr and Pb as follows:

GPT-2-1	Cr, 26 µg/l;	Pb, 20 µg/l
GPT-2-2	Cr, 73 µg/l;	Pb, 41 µg/l
GPT-2-3	Cr, 21 µg/l;	Pb, 13 µg/l.

Additionally, concentrations of 1,2-trans-dichloroethylene (37 µg/l), trichloroethylene (5 µg/l), and bis(2-ethylhexyl)phthalate (21 µg/l) were detected in samples from GPT-2-3. This well is north of Site 7. Table 3-4 summarizes analytical results from the Verification Study at Site 2.

A geophysical survey using a Scintrex-IGS<sup>TM</sup> was conducted at the site. A 50-foot by 50-foot grid was used for the survey of Site 2. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-11 in the RI Workplan.

3.4.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 2 are to define the location and orientation of the landfill burial trenches; to determine the composition, magnitude, and extent of potential soil and sediment contamination; to determine the composition and magnitude of potential groundwater and surface water contamination; and to determine whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be a consequence of analyzing turbid samples. This will be evaluated by obtaining background groundwater samples, by analyzing filtered and unfiltered samples, and by analyzing TDSs and TSSs. The status of contamination of the surficial aquifer, based on the concentrations of 1,2-trans-dichloroethene, trichloroethylene, and bis(2-ethylhexyl)phthalate in samples from GPT-2-3 cannot be evaluated based on results of the Verification Study alone. The concentrations of the organic compounds were only detected in one of the wells (GPT-2-3) and only one of the three monitoring wells is suspected of being downgradient of the landfill. The three wells are insufficient for determining groundwater flow direction in the area of Site 2 and Site 7. Therefore, there currently are not a sufficient number of monitoring wells at the site to evaluate the status of contamination of the surficial aquifer.

During this remedial investigation program, Sites 2 and 7 will be investigated as two separate entities. The following investigative objectives and methods are proposed to characterize Site 2:

Objective 1: to determine the location and orientation of the landfill burial trenches.

Methods: aerial photography analysis, and geophysical surveys (magnetometer, terrain conductivity and ground-penetrating radar)

Table 3-4 Summary of Chemical Analysis Results, Sites 2 and 7<sup>1</sup>, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Location	GPT-2-1	GPT-2-2	GPT-2-3	SW2-1	SD2-1
Temperature	20	18	17	20	-
pH (field)	5.99	5.49	5.19	7.41	-
Specific conductance (field)	230	210	660	270	-
pH (laboratory)	6.42	5.66	5.61	7.52(7.48)	5.80
Specific conductance (laboratory)	160	120	440	200(200)	-
total organic carbon (TOC)	-	-	-	10	2,800
total organic halogen (TOX)	-	-	-	73	300
chemical oxygen demand (COD)	-	-	-	40(35)	8,240
oil and grease (O and G)	-	-	-	1.5	<123
cadmium (Cd)	<4.7	<4.7	<4.7	<4.7(<4.7)	<2.9(<2.9)
chromium (Cr)	26	73	21	<7.8(<7.8)	4.9(<4.8)
lead (Pb)	20	41	13	<5.0(<5.0)	4.7(3.7)
Volatile organics	(1)	(1)	(1)	-	-
1,2-trans-Dichloroethylene			37		
Trichloroethylene			5		
Toluene			1 <sup>2</sup>		
Semivolatile Organics	(4)	(4)	(4)	-	-
bis(2-Ethylhexyl) Phthalate			21		
Pesticides/PCBs	(4)	(4)	(4)		

<sup>1</sup>All chemical parameters not specifically reported were below their analytical detection limit (Table 3-2).  
 - Sample not analyzed or measured for these parameters.

<sup>2</sup> Found below detection limit for analytical method.

Source: HLA, 1987.

Notes:

All analyses results for water samples are reported µg/l except TOC, COD, and O and G which are reported in mg/l. Analyses results for sediment and soil samples are reported in mg/kg. Temperature, pH, and specific conductance are reported in °C, standard units, and µmhos/cm at 25°C, respectively.

Temperature, pH (field), and specific conductance (field) data for groundwater samples are an average of three separate measurements.

Results presented in parentheses are for duplicate analyses.

PCBs = polychlorinated biphenyl compounds

Objective 2: to determine the composition, magnitude, and extent of potential soil contamination.

Methods: soil boring and subsurface soil sampling, surface soil sampling, and sediment sampling.

Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Methods: sampling of existing monitoring wells, monitoring well installation and sampling, and surface water sampling.

3.4.3 Proposed Investigation The following narrative provides descriptions of proposed investigative methods and sampling and analysis plans for Site 2, WW II Landfill.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former landfill operations and the historical development of the site.

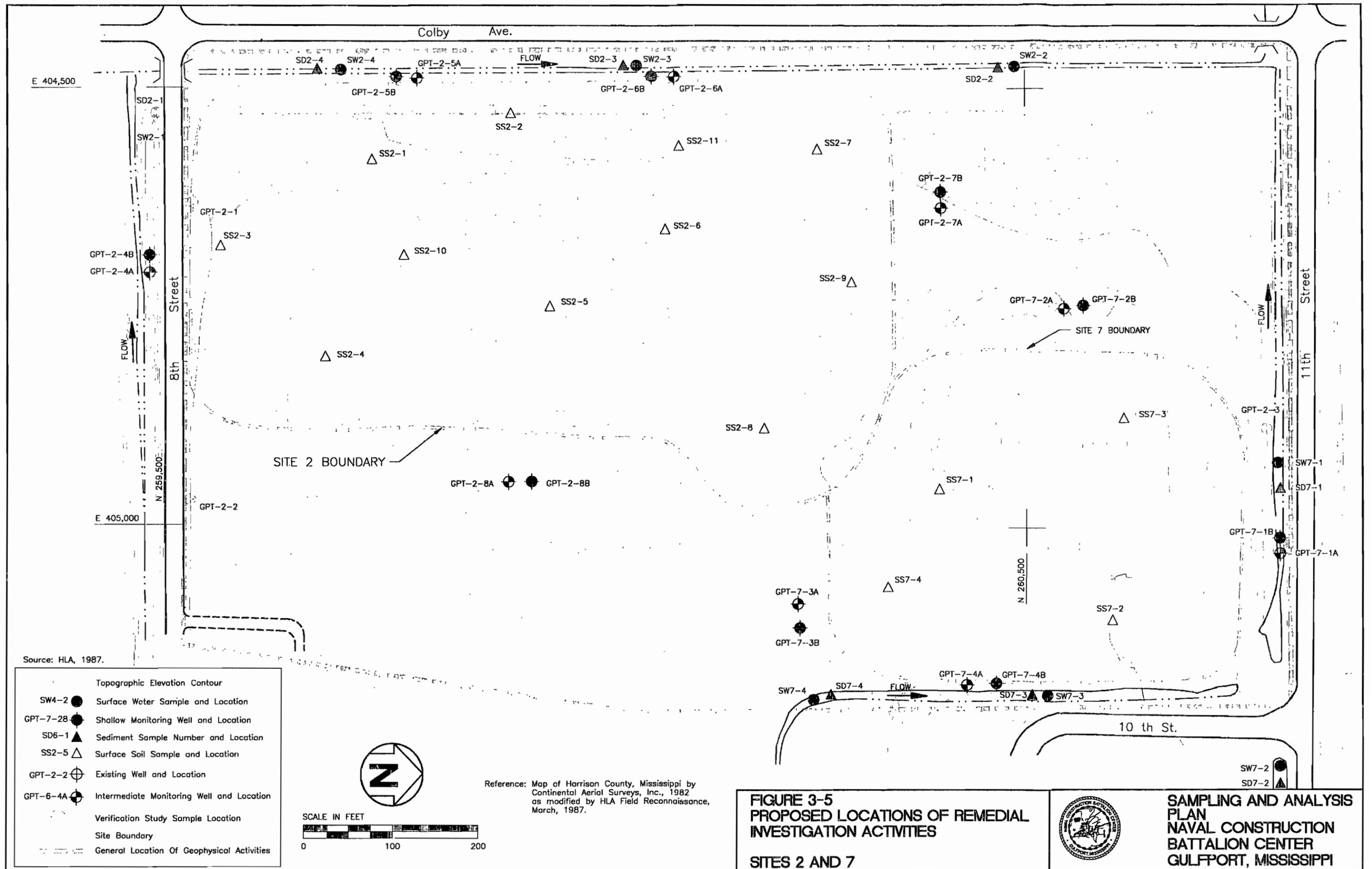
Geophysical Survey A geophysical survey consisting of magnetometer, GPR, and/or terrain conductivity transects will be completed. The magnetometer survey will be comprised of survey lines spaced 100 feet apart, with readings taken every 20 feet along a survey line. Figure 3-5 shows the area to be included in the magnetometer survey. Each survey line will extend beyond the anticipated limits of the site. Terrain conductivity and GPR surveys will be located to confirm magnetic anomalies suspected of indicating areas of buried metal such as drums. Geophysical results will be presented on scaled site maps. Cumulative evaluation and interpretation of data from the three geophysical methods will be used to interpret the extent, location, and orientation of the landfill.

Surface Soil Sampling Eleven surface soil samples will be collected from locations within the boundaries of the disposal area at Site 2. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-5. Actual locations will be chosen in the field based on results of the geophysical survey. Some locations will be at or near areas interpreted as disposal trenches based on geophysical data. Other locations will be selected so that sampling generally covers all areas of the site, as necessary to support the Baseline Risk Assessment. Surface soil samples will be collected from the surface to 1 foot depth using a hand auger or similar device. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds.

Subsurface Soil Sampling At Site 2, subsurface soil samples will be collected from soil borings conducted in association with monitoring well installation at the periphery of the site. Figure 3-5 shows proposed locations for soil borings and monitoring well installations. The purpose of this sampling is to determine whether subsurface soils at the periphery of the site have been impacted by past waste disposal. Because of the nature of the site (a landfill) borings will not be conducted within the limits of the site.





Split-spoon sampling will be conducted continuously (every 2 feet) to the water table then every 5 feet (or at facies boundaries) in intermediate depth borings that are associated with monitoring well pairs. Headspace analysis using an OVA will be performed in the field on all samples from the intermediate borings. Four soil samples will be selected from each intermediate boring for laboratory analysis, including the sample from the interval above the water table and the top 2-foot interval of the clay layer. Two additional samples will be selected for laboratory analysis based on results of OVA headspace analysis. Rationale for selecting subsurface soil samples for laboratory analysis based on OVA headspace analyses is discussed in Section 2.2.3 of this document. Twenty subsurface soil samples from 5 borings will be submitted for analysis of TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Sampling and analysis will conform with Level IV DQOs, except that Level III DQOs will be used for TPH because this analyte is not included in the CLP SOW.

Split-spoon sampling will be conducted every 5 feet and/or at facies boundaries in shallow soil borings that are associated with monitoring well pairs. These samples will be used for soil classification and visual inspection only.

As many as 12 subsurface soil samples from Site 2 will be submitted for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The 12 samples will represent four different facies expected of being present at the site. These four facies are sand, silty sand, silt, and clay. To evaluate spatial variation in organic carbon content, the samples will be collected from three boring locations. If all four facies are not represented at three locations, the number of samples submitted for organic carbon content determination will decrease accordingly. The data will be used to evaluate spatial and depth variations of organic carbon, as well as variation among facies.

Three samples of the clay layer will be collected from three intermediate borings using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in the COE Engineering Manual 1110-2-1906 (USCOE, 1970). The laboratory permeability data will be used in conjunction with slug test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on groundwater flow direction determined by two sets of water-level measurements obtained from two existing monitoring wells at Site 2 and a third existing monitoring well at Site 7. Figures 3-3 and 3-4 are potentiometric surface maps developed from water-level measurements collected 30 March 1987 and 31 October 1991. Groundwater flow direction at Site 2 is not well defined. The three wells at Sites 2 and 7 are insufficient for determining groundwater flow directions with certainty. Therefore, the need to define groundwater flow direction at Site 2 was considered in selection of proposed locations for monitoring well installation during the RI/FS.

Five monitoring well pairs are proposed at Site 2. Figure 3-5 shows the proposed locations of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells will be used to monitor groundwater for free-phase floating product and detection of shallow groundwater

contaminants. Intermediate-depth wells will be constructed to monitor groundwater on top of the clay layer. Intermediate-depth monitoring wells will be used to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

Two well pairs will be installed along the western periphery of the site and are expected to be downgradient monitoring wells. One well pair will be installed along each of the remaining three sides of the site. The locations for the five well pairs were selected in consideration of the proximity of Site 2 to Site 7; the potential for contaminated groundwater from Site 1 to migrate towards Site 2; the need to better define groundwater flow directions in the area of Site 2; and the presence of chlorinated solvents in groundwater from existing well GPT-2-3, which was sampled during the Verification Study (March 1987). Additionally, monitoring well locations were selected based on the potential for small plumes of contaminated groundwater due to releases from one or more disposal trenches.

During the 1987 Verification Study conducted by HLA, soil borings were conducted for installation of three monitoring wells. Boring logs that were provided in the Verification Study report (HLA, 1987) indicate that depth of the clay layer ranges from 13 to 30 feet BLS at Site 2. Intermediate-depth wells installed in areas where the clay layer is relatively close to the surface of the water table may not require a corresponding shallow well to monitor for shallow or floating contaminants. Monitoring well installations at locations where the clay is relatively shallow may result in completion of only one well; or require the use of 5-foot-long well screens in the intermediate depth well; or completing the intermediate well with a part of the screen in the clay. These determinations will be made in the field on a case-by-case basis.

Groundwater levels at Site 2 range from 1.2 to 5.6 feet BLS. Depths of shallow wells installed at Site 2 during the RI/FS are expected to range from 10.5 to 14.5 feet BLS.

Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment.

All wells will be constructed of flush-threaded, 2-inch ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mesh filter sand have been chosen based on the presence of silt and sand in the subsurface at Site 2, as indicated by boring logs associated with the Verification Study. Well screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in intermediate depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENGCOM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses and Level III DQOs for non-CLP analyses. Groundwater

samples will be analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganic compounds, TDS, and TSS. Both filtered and unfiltered samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Level IV DQOs will be used for second round groundwater analyses using CLP methods and Level III DQOs for non-CLP analyses. If the analytical results of the first round of groundwater samples from Site 2 do not reveal detectable levels of site-related organics and all inorganics are within background ranges, no further groundwater sampling will be conducted at Site 2.

Surface Water and Sediment Sampling Three surface water samples and three sediment samples (three "sets") will be collected from the drainage ditch west of Site 2 (Figure 3-5). Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations within the area of interest will be chosen. The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Three sets of samples will be collected from the drainage ditch west of the site and east of Colby Avenue. One set will be collected from a location hydraulically upgradient of Site 2. Two sets of samples will be collected from locations adjacent to Site 2.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs except that Level III DQOs will be used for parameters not included in the CLP SOW. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganics, TDSs, and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

### 3.5 SITE 3, NORTHWEST LANDFILL AND BURN PIT.

3.5.1 Description and Background The Northwest Landfill and Burn Pit are located on the northwestern corner of the intersection of Eighth Street and Canal No. 1. The site consists of an inactive landfill measuring approximately 650 by 240 feet. The site is bordered on the south by Eighth Street, on the east by Canal No. 1, and wooded areas to the north and west. Additionally, a burn pit was located on the northwest side of Site 3.

An estimated 30,000 tons of solid waste and an unknown quantity of other liquid wastes such as fuels, oils, solvents (Stoddard, xylene, toluene, and MEK), paints, and paint strippers were disposed in the landfill. The disposal operations consisted of transporting wastes to the burn pit on the site, igniting them with diesel fuel, then pushing the ash and remaining materials into the trenches and covering them with soil. The landfill itself was in operation from 1948 to the mid 1960s. The pit was used from the mid-1950s to 1965 for fire-fighting training. Throughout the life of the burn pit, an estimated 130,000 gallons of flammable liquids such as waste fuels, oils, solvents, paints, and paint thinners were burned at the site.

The burn pit was filled in with soil upon closure of the landfill in 1965. The location of the pit is no longer apparent at the site. Although bordered by trees and vegetation, the site itself has little vegetation because of on-going training activities such as dismantling of tents, towers, and other structures.

Verification Study Three soil borings were completed and a monitoring well was installed in each of these borings. One surface water sample and one sediment sample were collected and analyzed for pH, conductance, TOC, TOX, COD, O&G, Cd, Cr, and Pb. Analytical results are presented in Table 3-5. The sediment sample contained lead at a concentration of 6.8 mg/kg and chromium at a concentration 5.0 mg/kg. One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organic compounds, and semivolatile organic compounds. Analytical results are presented in Table 3-5. Compounds detected in groundwater include Cr and Pb as follows:

GPT-3-1	Cr, 40 $\mu\text{g/l}$ ; Pb, 26 $\mu\text{g/l}$
GPT-3-2	Cr, 71 $\mu\text{g/l}$ ; Pb, 35 $\mu\text{g/l}$
GPT-1-3	Cr, 45 $\mu\text{g/l}$ ; Pb, 17 $\mu\text{g/l}$ .

A geophysical survey using a Scintrex-IGS™ was conducted at the site. A 50-foot by 50-foot grid was used for the survey of Site 3. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-12 in the RI Workplan.

3.5.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 3 are to define the location and orientation of the landfill burial trenches and burn pit; to determine the composition, magnitude, and extent of potential soil and sediment contamination; to determine the composition and magnitude of potential groundwater and surface water contamination; and to determine whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be consequence of analyzing turbid samples. This will be evaluated by obtaining background samples, by analyzing filtered and unfiltered samples, and by analyzing TDSs and TSSs. The Verification Study indicates that except for the concentrations of chromium and lead, there does not appear to be contamination of the shallow groundwater. However, two of the monitoring wells were installed upgradient of the landfill and only one was installed downgradient of the landfill. Additionally, the monitoring well screens range from 23 to 26 feet long and may cause dilution of groundwater samples. Therefore, additional wells are needed to evaluate the status of contamination of groundwater in the surficial aquifer at Site 3.

Table 3-5 Summary of Chemical Analysis Results, Site 3<sup>1</sup>, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Location	GPT-3-1	GPT-3-2	GPT-3-3	SW3-1	SD3-1
Sampling Date	3/28/87	3/28/81	3/28/87	4/7/87	5/4/87
Temperature	17	15	19	16	-
pH (field)	5.24	4.96	4.88	6.12	-
Specific conductance (field)	180	100	120	95	-
pH (laboratory)	5.75	4.66	5.41	6.06(7.48)	4.76(4.78)
Specific conductance (laboratory)	140	140	80	92	-
total organic carbon (TOC)	-	-	-	8	4,800
total organic halogen (TOX)	-	-	-	29	<200
chemical oxygen demand (COD)	-	-	-	28	1450(1280)
oil and grease (O and G)	-	-	-	2.1(2.2)	<123(123)
cadmium (Cd)	<4.7	<4.7	<4.7	<4.7(<4.7)	<2.9
chromium (Cr)	40	71	45	<7.8(<7.8)	5.0
lead (Pb)	26	35	17	<5.0(<5.0)	6.8
Volatile organics	(1)	(1)	(1)	-	-
Semivolatile organics	(1)	(1)	(1)	-	-
Pesticides/PCBs	(4)	(4)	(4)	-	-

<sup>1</sup>All chemical parameters not specifically reported were below their analytical detection limit (Table 3-2).

Source: HLA, 1987.

Notes:

All analyses results for water samples are reported  $\mu\text{g/l}$  except TOC, COD, and O and G which are reported in mg/l. Analyses results for sediment and soil samples are reported in mg/kg. Temperature, pH, and specific conductance are reported in  $^{\circ}\text{C}$ , units, and  $\mu\text{mhos/cm}$  at  $25^{\circ}\text{C}$ , respectively.

Temperature, pH (field), and Specific Conductance (field) data for groundwater samples are an average of three separate measurements.

Results presented in parentheses are for duplicate analyses.

- Sample not analyzed or measured for these parameters.

PCBs = polychlorinated biphenyl compounds

The following investigative objectives and methods are proposed to characterize Site 3:

Objective 1: to determine the location and orientation of the landfill burial trenches and burn pit.

Methods: aerial photography analysis, and geophysical surveys (magnetometer, terrain conductivity, and ground-penetrating radar).

Objective 2: to determine the composition, magnitude, and extent of potential soil and sediment contamination.

Methods: soil boring and subsurface soil sampling, surface soil sampling, and sediment sampling.

Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Methods: sampling of existing monitoring wells, monitoring well installation and sampling, and surface water sampling.

3.5.3 Proposed Investigation The following provides descriptions of proposed investigative methods and sampling and analysis plans for Site 3, Northwest Landfill and Burn Pit.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former landfill operations and the historical development of the site.

Geophysical Survey A geophysical survey consisting of magnetometer, GPR, and/or terrain conductivity transects will be completed. The magnetometer survey will be comprised of survey lines spaced 100 feet apart, with readings taken every 20 feet along a survey line. Figure 3-6 shows the area to be included in the magnetometer survey. Each survey line will extend beyond the anticipated limits of the site. Terrain conductivity and GPR surveys will be located to confirm magnetic anomalies suspected of indicating areas of buried metal such as drums.

Geophysical results will be presented on scaled site maps. Cumulative evaluation and interpretation of data from the three geophysical methods will be used to interpret the extent, location, and orientation of the landfill.

Surface Soil Sampling Five surface soil samples will be collected from locations within the boundaries of the disposal area at Site 3. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-6. Actual locations will be chosen in the field based on results of the geophysical survey. Some locations will be at or near areas interpreted as disposal trenches based on geophysical data. Other locations will be selected so that sampling generally covers all areas of the site, as necessary to support the Baseline Risk Assessment. Surface soil samples will be collected from the surface to 1-foot depth using a hand auger or similar device. Laboratory analyses will include TCL

N 260,000

E 408,500

N 259,500

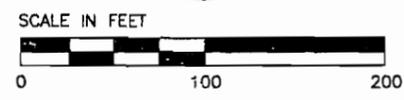
E 404,000

Calby Ave.

8th Street

APPROX. LOCATION OF BURN PIT

- Source: HLA, 1987.
- Topographic Elevation Contour
  - SW4-2 Surface Water Sample and Location
  - GPT-7-28 Shallow Monitoring Well and Location
  - SD6-1 Sediment Sample Number and Location
  - SS2-5 Surface Soil Sample and Location
  - GPT-2-2 Existing Well and Location
  - GPT-6-4A Intermediate Monitoring Well and Location
  - Verification Study Sample Location
  - Site Boundary
  - General Location Of Geophysical Activities



Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.

**FIGURE 3-6**  
**PROPOSED LOCATIONS OF REMEDIAL INVESTIGATION ACTIVITIES**  
**SITE-3**



**SAMPLING AND ANALYSIS PLAN**  
**NAVAL CONSTRUCTION BATTALION CENTER**  
**GULFPORT, MISSISSIPPI**

volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds.

Subsurface Soil Sampling At Site 3, subsurface soil samples will be collected from soil borings conducted in association with monitoring well installation at the periphery of the site. Figure 3-6 shows proposed locations for soil borings and monitoring well installations. The purpose of this sampling is to determine whether subsurface soils at the periphery of the site have been impacted by past waste disposal. Because of the nature of the site (a landfill) borings will not be conducted within the limits of the site.

Split-spoon sampling will be conducted continuously (every 2 feet) to the water table then every 5 feet (or at facies boundaries) in intermediate-depth borings associated with monitoring well pairs. Headspace analysis using an OVA will be performed in the field on all samples from the intermediate borings. Four soil samples will be selected from each intermediate boring for laboratory analysis, including the sample from the interval above the water table and the top 2-foot interval of the clay layer. Two additional samples will be selected for laboratory analysis based on results of OVA headspace analysis. Rationale for selection of subsurface soil samples for laboratory analysis based on OVA headspace analysis is discussed in Section 2.2.3 of this document. Twelve subsurface soil samples from three borings will be submitted for analysis of TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Sampling and analysis will conform with Level IV DQOs, however, Level III DQOs will be used for analyses not included in the CLP SOW.

Split-spoon sampling will be conducted every 5 feet and/or at facies boundaries in shallow soil borings associated with monitoring well clusters. These samples will be used for soil classification and visual inspection only.

As many as nine subsurface soil samples from Site 3 will be submitted for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The nine samples will represent three different facies expected of being present at the site. These three facies are sand, silty sand, and clay. To evaluate spatial variation in organic carbon content, the samples will be collected from three boring locations. If all three facies are not represented at three locations, the number of samples submitted for organic carbon content determination will decrease accordingly. The data will be used to evaluate spatial and depth variations of organic carbon, as well as variation among facies.

Three samples of the clay layer will be collected from three intermediate borings using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in COE Engineering Manual 1110-2-1906 (USCOE, 1970). The laboratory permeability data will be used in conjunction with slug-test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on groundwater flow direction determined by two sets of water-level measurements obtained from three existing monitoring wells at Site 3. Figures 3-3 and 3-4 are potentiometric surface maps developed from water level measurements collected 30 March 1987 and 31 October 1991.

Four monitoring well pairs are proposed at Site 3. Figure 3-6 shows the proposed locations of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells will be used to monitor groundwater for free-phase floating product and detection of shallow groundwater contaminants. Intermediate-depth wells will be constructed to monitor groundwater on top of the clay layer. Intermediate-depth monitoring wells will be used to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

Two well pairs will be installed along the northeastern and eastern periphery of the site to monitor groundwater downgradient of the site. One well pair will be installed at the southwestern corner of the site. One well pair will be installed on the north to northwest side of the burn area. The locations for the four wells pairs were selected in consideration of the proximity of Site 3 to Site 2; the potential for contaminated groundwater from Site 2 to migrate towards Site 3; and the groundwater flow direction in the area of Site 3. Additionally, monitoring well locations were selected based on the potential for small plumes of contaminated groundwater because of releases from one or more disposal trenches.

During the 1987 Verification Study conducted by HLA, soil borings were conducted for installation of three monitoring wells. Boring logs that were provided in the Verification Study report (HLA, 1987) indicate that depth of the clay layer ranges from 15.4 to 27.5 feet BLS at Site 3. Intermediate-depth wells to be installed in areas where the clay layer is relatively close to the surface of the water table may not require a corresponding shallow well to monitor for shallow or floating contaminants. Monitoring well installations at locations where the clay is relatively shallow may result in completion of only one well; or require the use of 5-foot-long well screens in the intermediate-depth well; or completing the intermediate well with a part of the screen in the clay. These determinations will be made in the field on a case-by-case basis.

Groundwater levels at Site 3 range from 2 to 6 feet BLS. Depths of shallow wells installed at Site 3 during the RI/FS are expected to range from 11 to 15 feet BLS.

Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment.

All wells will be constructed of flush-threaded, 2-inch ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mesh filter sand have been chosen based on the presence of silty sand and sand in the subsurface at Site 3, as indicated by boring logs that were associated with the Verification Study. Well screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in intermediate-depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENCOM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs, with the exception of non-CLP analyses, which will be done using Level III DQOs. Groundwater samples will be analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganic compounds, TDSs, and TSSs. Both filtered and unfiltered groundwater samples will be submitted for TAL inorganic analyses. TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Level IV DQOs will be used for second round groundwater analyses included in the CLP SOW. Non-CLP analyses will be done using Level III DQOs. If the analytical results of the first round of groundwater samples from Site 3 do not reveal detectable levels of site-related organics and all inorganics are within background ranges, no further groundwater sampling will be conducted at Site 3.

Surface Water and Sediment Sampling Four surface water samples and four sediment samples (four "sets") will be collected from Canal No. 1 east of Site 3 and a tributary entering Canal No. 1 from the east. Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations within the area of interest will be chosen.

The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Three sets of samples will be collected from Canal No. 1 east of the site and west of Colby Avenue. One set will be collected from a location hydraulically upgradient of Site 3 (Figure 3-6). Two sets of samples will be collected from Canal No. 1 at locations adjacent to and downgradient of Site 3. One set of samples will be collected from a tributary to Canal No. 1, entering the canal from the east. These samples will provide information regarding contribution of potential contaminants from other areas.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs for CLP parameters and Level III DQOs for non-CLP parameters. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganics, TDSs, and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

### 3.6 SITE 4, GOLF COURSE LANDFILL.

3.6.1 Description and Background The Golf Course Landfill is located northeast of the intersection of Seventh Street and Canal No. 1. The site consists of an inactive landfill encompassing a trapezoidal area of approximately 4 acres. The site is bordered on the south by Seventh Street and on the west by Canal No. 1. A practice putting green, the No. 9 green, and the No. 1 tee are now located at this site.

An estimated 16,000 tons of solid waste and an unknown quantity of other liquid wastes such as fuels, oils, solvents (Stoddard, xylene, toluene, and MEK), paints, and paint strippers were disposed in the landfill. The majority of the liquid wastes were burned during fire-fighting training. The disposal operations of the solid wastes consisted of transporting wastes to the site, igniting them with diesel fuel, then pushing the ash and remaining materials into trenches and covering them with soil. The landfill was in operation from 1966 to 1972. Ten feet of fill was reportedly placed over the site upon closure of the landfill. There is no indication of the landfill at the site.

Verification Study Three soil borings were completed and a monitoring well was installed in each of these borings. One surface water sample and one sediment sample were collected and analyzed for pH, conductance, TOC, TOX, COD, O&G, Cd, Cr, and Pb. Analytical results are presented in Table 3-6. The sediment sample showed elevated concentrations of chromium (19 mg/kg) and lead (39 mg/kg). One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organic compounds, and semivolatile organic compounds. Compounds detected in groundwater are presented in Table 3-6 and include Cr and Pb as follows:

GPT-4-1	Cr, 72 $\mu\text{g/l}$ ;	Pb, 50 $\mu\text{g/l}$
GPT-4-2	Cr, 22 $\mu\text{g/l}$ ;	Pb, 5.4 $\mu\text{g/l}$
GPT-4-3	Cr, 155 $\mu\text{g/l}$ ;	Pb, 124 $\mu\text{g/l}$ .

A geophysical survey using a Scintrex-IGS™ was conducted at the site. A 50-foot by 50-foot grid was used for the survey of Site 4. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-13 of the RI Workplan.

3.6.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 4 are to define the location and orientation of the landfill burial trenches; to determine the composition, magnitude, and extent of potential soil and sediment contamination; to determine the composition and magnitude of potential groundwater and surface water contamination; and to determine whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be a result of analyzing turbid samples. This will be evaluated by obtaining background samples, by analyzing both filtered and unfiltered samples, and by analyzing TDSs and TSSs. The Verification Study indicates that except for the concentrations of chromium and lead, there does not appear to be contamination of the shallow groundwater.

However, two of the monitoring wells were installed upgradient of the landfill and only one was installed downgradient of the landfill. Well-screens in the three monitoring wells range from 16 to 23 feet long and may cause dilution of

Table 3-6 Summary of Chemical Analysis Results, Site 4<sup>1</sup>, RI/FS Sampling and Analysis Plan ,NCBC Gulfport, Gulfport, Mississippi

Location	GPT-4-1	GPT-4-2	GPT-4-3	SW4-1	SD4-1
Sampling Date	3/29/87	3/29/81	4/7/87	4/7/87	4/7/87
Temperature	16	16	20	20	-
pH (field)	5.18	6.36	6.86	7.21	-
Specific conductance (field)	470	330	1600	140	-
pH (laboratory)	5.58	6.75	7.05	6.60	6.31
Specific Conductance (laboratory)	370(370) <sup>1</sup>	210	1600	120	-
TOC (TOC)	-	-	-	7	30,000
total organic halogen (TOX)	-	-	-	60(60)	340
chemical oxygen demand (COD)	-	-	-	20	5,140
oil and grease (O and G)	-	-	-	3.0	442(442)
cadmium (Cd)	<4.7	<4.7	<4.7	<4.7	<4.6
chromium (Cr)	72	22	155	<7.8	19
lead (Pb)	50	5.4	124	<5.0(<5.0)	39
Volatile organics	(1)	(1)	(1)	-	-
Semivolatile organics	(1)	(1)	(1)	-	-
Pesticides and PCBs	(1)	(1)	(1)	-	-

<sup>1</sup>All chemical parameters not specifically reported were below their analytical detection limit (Table 3-2).

Source: HLA, 1987.

Notes:

All analyses results for water samples are reported  $\mu\text{g/l}$  except TOC, COD, and O and G which are reported in mg/l. Analyses results for sediment and soil samples are reported in mg/kg. Temperature, pH, and specific conductance are reported in  $^{\circ}\text{C}$ , standard units, and  $\mu\text{mhos/cm}$  at  $25^{\circ}\text{C}$ , respectively.

Temperature, pH (field), and specific conductance (field) data for groundwater samples are an average of three separate measurements.

Results presented in parentheses are for duplicate analyses.

- Sample not analyzed or measured for these parameters.

PCBs = polychlorinated biphenyl compounds

groundwater samples. Therefore, additional monitoring wells are needed at the site to evaluate the status of contamination in the surficial aquifer at Site 4. The following investigative objectives and methods are proposed to characterize Site 4:

Objective 1: to determine the location and orientation of the landfill burial trenches.

Methods: aerial photography analysis, and geophysical surveys (magnetometer, terrain conductivity, and ground-penetrating radar).

Objective 2: to determine the composition, magnitude, and extent of potential soil and sediment contamination.

Methods: soil borings and subsurface soil sampling, surface soil sampling, and sediment sampling.

Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Methods: sampling of existing monitoring wells, monitoring well installation and sampling, and surface water sampling.

3.6.3 Proposed Investigation The following provides descriptions of proposed investigative methods and sampling and analysis plans for Site 4, Golf Course Landfill.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former landfill operations and the historical development of the site.

Geophysical Survey A geophysical survey consisting of magnetometer, GPR, and/or terrain conductivity transects will be completed. The magnetometer survey will be comprised of survey lines spaced 100 feet apart, with readings taken every 20 feet along a survey line. Figure 3-7 shows the area to be included in the magnetometer survey. Each survey line will extend beyond the anticipated limits of the site. Terrain conductivity and/or GPR surveys will be located to confirm magnetic anomalies suspected of indicating areas of buried metal such as drums.

Geophysical results will be presented on scaled site maps. Cumulative evaluation and interpretation of data from the three geophysical methods will be used to interpret the extent, location, and orientation of the landfill.

Surface Soil Sampling Five surface soil samples will be collected from locations within the boundaries of the disposal area at Site 4. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-7. Actual locations will be chosen in the field based on results of the geophysical survey. Some locations will be at or near areas interpreted as disposal trenches based on geophysical data. Other locations will be selected so that sampling generally

N 259,000

GOLF GREEN

SD4-5  
SW4-5

GPT-4-7A  
GPT-4-7B

SD4-4  
SW4-4

SS4-1

E 403,500

GPT-4-3

GPT-4-6A  
GPT-4-6B

PUTTING GREEN

GOLF GREEN

E 404,000

N 258,500

SW4-1  
SD4-1

GPT-4-5B  
GPT-4-5A

SS4-3

GOLF GREEN

GPT-4-4A  
GPT-4-4B

SS4-5

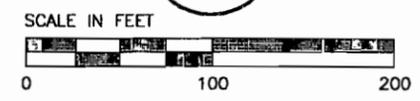
SS4-4

Source: HLA, 1987.

- Topographic Elevation Contour
- SW4-2 ● Surface Water Sample and Location
- GPT-7-2B ● Shallow Monitoring Well and Location
- SD6-1 ▲ Sediment Sample Number and Location
- SS2-5 △ Surface Soil Sample and Location
- GPT-2-2 ⊕ Existing Well and Location
- GPT-6-4A ⊕ Intermediate Monitoring Well and Location
- Verification Study Sample Location
- Site Boundary
- General Location Of Geophysical Activities

SW4-2  
SD4-2

GPT-4-1



Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.

FIGURE 3-7  
PROPOSED LOCATIONS OF REMEDIAL INVESTIGATION ACTIVITIES  
SITE-4



SAMPLING AND ANALYSIS PLAN  
NAVAL CONSTRUCTION BATTALION CENTER  
GULFPORT, MISSISSIPPI

covers all areas of the Site, as necessary to support the Baseline Risk Assessment. Surface soil samples will be collected from the surface to 1-foot depth using a hand auger or similar device. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds.

Subsurface Soil Sampling At Site 4, subsurface soil samples will be collected from soil borings that are conducted in association with monitoring well installation at the periphery of the site. Figure 3-7 shows proposed locations for soil borings and monitoring well installations. The purpose of this sampling is to determine whether subsurface soils at the periphery of the site have been impacted by past waste disposal. Because of the nature of the site (a landfill) borings will not be conducted within the limits of the site.

Split-spoon sampling will be conducted continuously (every 2 feet) to the water table then every 5 feet (or at facies boundaries) in intermediate-depth borings associated with monitoring well pairs. Headspace analysis using an OVA will be performed in the field on all samples from the intermediate borings. Four soil samples will be selected from each intermediate boring for laboratory analysis, including the sample from the interval above the water table and the top 2-foot interval of the clay layer. Two additional samples will be selected for laboratory analysis based on results of OVA headspace analysis. The rationale for selecting subsurface soil samples for laboratory analysis based on OVA headspace is discussed in Section 2.2.3 of this document. Sixteen subsurface soil samples from four borings will be submitted for analysis of TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Sampling and analysis will conform with Level IV DQOs, except for those analyses not included in the CLP SOW which will be performed in accordance with Level III DQOs.

Split-spoon sampling will be conducted every 5 feet and/or at facies boundaries in shallow soil borings associated with monitoring well pairs. These samples will be used for soil classification and visual inspection, only.

As many as nine subsurface soil samples from Site 4 will be submitted for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The nine samples will represent three different facies expected of being present at the site. These three facies are sand, silty sand, and clay. To evaluate spacial variation in organic carbon content, the samples will be collected from three boring locations. If all three facies are not represented at three boring locations, the number of samples submitted for organic carbon content determination will decrease accordingly. The data will be used to evaluate spatial and depth variations of organic carbon, as well as variation among facies.

Three samples of the clay layer will be collected from three intermediate borings using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in COE Engineering Manual 1110-2-1906 (USCOE, 1970). The laboratory permeability data will be used in conjunction with slug test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on groundwater flow direction determined by two sets of

water-level measurements obtained from three existing monitoring wells at Site 4. Figures 3-3 and 3-4 are potentiometric surface maps developed from water level measurements collected 30 March 1987 and 31 October 1991. Groundwater flow direction at Site 4 is to the northwest towards Canal No. 1.

Five monitoring well pairs are proposed at Site 4. Figure 3-7 shows the proposed locations of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells will be used to monitor groundwater for free-phase floating product and detection of shallow groundwater contaminants. Intermediate-depth wells will be constructed to monitor groundwater on top of the clay layer. Intermediate-depth monitoring wells will be used to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

Three well pairs will be installed along the western periphery of the site to monitor groundwater downgradient of the site. One well pair will be installed to the southeast of the site to monitor upgradient groundwater for potential contaminants from off-site. The locations for the four well pairs were selected in consideration of the direction of groundwater flow and size of the site, and based on the potential for small plumes of contaminated groundwater due to releases from one or more disposal trenches.

During the 1987 Verification Study conducted by HLA soil borings were conducted for installation of three monitoring wells. Boring logs that were provided in the Verification Study report (HLA, 1987) indicate that depth of the clay layer ranges from 19 to 26 feet BLS at Site 4. Intermediate-depth wells to be installed in areas where the clay layer is relatively close to the surface of the water table may not require a corresponding shallow well to monitor for shallow or floating contaminants. Monitoring well installations at locations where the clay is relatively shallow may result in completion of only one well; or require the use of 5-foot-long well screens in the intermediate-depth well; or require completing the intermediate well with a part of the screen in the clay. These determinations will be made in the field on a case-by-case basis.

Groundwater levels at Site 4 range from less than 1 foot to 9.5 feet BLS. Depths of shallow wells installed at Site 4 during the RI/FS are expected to range from 10 to 18.5 feet BLS. Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment.

All wells will be constructed of flush-threaded, 2-inch ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mash filter sand have been chosen based on the presence of silty sand and sand in the subsurface at Site 4, as indicated by boring logs associated with the Verification Study. Well-screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in intermediate-depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENGCOM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses and Level III DQOs for analyses not included in the CLP SOW. Groundwater samples will be analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganic compounds, TDSs, and TSSs. Both filtered and unfiltered samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Level IV DQOs will be used for second round groundwater sampling and analyses included in the CLP SOW. Level III DQOs will be used for non-CLP analyses. If the analytical results of the first round of groundwater samples from Site 4 do not reveal detectable levels of any TCL chemical and all TAL inorganics are within background ranges, no further groundwater sampling will be conducted at Site 4.

Surface Water and Sediment Sampling Four surface water samples and four sediment samples (four "sets") will be collected from Canal No. 1 west of Site 4. Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations within the area of interest will be chosen.

The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Four sets of samples will be collected from Canal No. 1 west of the site (Figure 3-7). One set will be collected from a location hydraulically upgradient of Site 4. Three sets of samples will be collected from locations adjacent to and downgradient of Site 4.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs, except that Level III DQOs will be used for analyses not included in the CLP SOW. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganics, TDSs and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

### 3.7 SITE 5, HEAVY EQUIPMENT TRAINING AREA LANDFILL.

3.7.1 Description and Background The Heavy Equipment Training Area is located approximately 450 feet west of the intersection of Fourth Street and Colby

Avenue. The site consists of an inactive landfill that encompasses an area of approximately 5.5 acres. The site is bordered on the south and west by a drainage ditch. The Navy property line parallels the site approximately 250 feet west of the presumed landfill boundary.

An estimated 6,000 cubic yards of solid waste consisting of mainly trash, refuse from the reserve barracks, and tree cuttings were disposed in the landfill. An unknown quantity of other liquid wastes such as fuels, oils, solvents (Stoddard, xylene, toluene, and MEK), paints, and paint strippers were also disposed in the landfill. The majority of the liquid wastes were burned during fire-fighting training activities. Reportedly, 50 to 100 drums of liquid DDT and boxes of powder containing DDT were disposed in the southern part of the site. The disposal operations of the solid wastes consisted of transporting wastes to the site and disposing them directly in trenches. The landfill was in operation from 1972 to the 1976. The site is currently being used as a heavy equipment training area. The site was eventually covered with a 4- to 6-foot layer of fill dirt because wastes were continually uncovered during training activities. There is no vegetation on the site because of extensive use of heavy equipment at the site.

Verification Study Three soil borings were completed and a monitoring well was installed in each of these borings. One surface water sample and one sediment sample were collected and analyzed for pH, conductance, TOC, TOX, COD, O&G, Cd, Cr, and Pb. Analytical results are summarized in Table 3-7. The surface water sample, collected from the drainage ditch south of the site, had a concentration of cadmium of 21 mg/kg. One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organics, and semivolatile organics. Compounds detected in groundwater are summarized in Table 3-7 and include Cr and Pb as follows:

GPT-5-1	Cr, 79 µg/l;	Pb, 39 µg/l
GPT-5-2	Cr, 104 µg/l;	Pb, 48 µg/l
GPT-5-3	Cr, 91 µg/l;	Pb, 35 µg/l.

A geophysical survey using a Scintrex-IGS™ was conducted at the site. A 50-foot by 50-foot grid was used for the survey of Site 5. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-14 of the RI Workplan.

3.7.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 5 are to define the location and orientation of the landfill burial trenches; to determine the composition, magnitude, and extent of potential soil and sediment contamination; to determine the composition and magnitude of potential groundwater and surface water contamination; and to determine whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be a consequence of analyzing turbid samples. This will be evaluated by obtaining background samples, by analyzing both filtered and unfiltered samples, and by analyzing TDSs and TSSs. Results of the Verification Study indicate that, except for the concentrations of chromium and lead, there does not appear to be contamination of the shallow groundwater. However, two of the monitoring wells were installed upgradient of the landfill and only one was installed downgradient of the landfill. Wells screens in the three monitoring wells range from 15.5 to 18 feet long and may cause dilution of

Table 3-7 Summary of Chemical Analysis Results, Site 5<sup>1</sup>, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Location	GPT-5-1	GPT-5-2	GPT-5-3	SW5-1	SD5-1
Sampling Date	3/29/87	3/29/87	3/29/87	4/7/87	3/27/87
Temperature	18	18	16	22	-
pH (field)	5.70	5.16	5.22	6.72	-
Specific conductance (field)	110	800	1200	900	-
pH (laboratory)	6.19	5.66	5.42	6.50	5.12(5.09)
Specific conductance (laboratory)	72	80	100	140	-
TOC (TOC)	-	-	-	6	1,800
total organic halogen (TOX)	-	-	-	327	280(250)
chemical oxygen demand (COD)	-	-	-	<5(<5)	1530(1650)
oil and grease (O and G)	-	-	-	1.3	301(442)
cadmium (Cd)	<4.7	<4.7	<4.7	21	<3.0
chromium (Cr)	79	104	91	<7.8	<5.0
lead (Pb)	39	48	35	<5.0	<3.2
Volatile organics	(1)	(1)	(1)	-	-
Semivolatile organics	(1)	(1)	(1)	-	-
Pesticides and PCBs	(1)	(1)	(1)	-	-

<sup>1</sup>All chemical parameters not specifically reported were below their analytical detection limit (Table 3-2).

Source: HLA, 1987.

Notes:

All analyses results for water samples are reported  $\mu\text{g/l}$  except TOC, COD, and O and G which are reported in  $\text{mg/l}$ . Analyses results for sediment and soil samples are reported in  $\text{mg/kg}$ . Temperature, pH, and specific conductance are reported in  $^{\circ}\text{C}$ , standard units, and  $\mu\text{mhos/cm}$  at  $25^{\circ}\text{C}$ , respectively.

Results presented in parentheses are for duplicate analyses.

Temperature, pH (field), and specific conductance (field) data for groundwater samples are an average of three separate measurements.

- Sample not analyzed or measured for these parameters.

PCBs = polychlorinated biphenyl compounds

groundwater samples. Therefore, additional monitoring wells are needed at the site to evaluate the status of groundwater contamination in the surficial aquifer at Site 5.

The following investigative objectives and methods are proposed to characterize Site 5:

Objective 1: to determine the location and orientation of the landfill burial trenches.

Methods: aerial photography analysis, and geophysical surveys (magnetometer, terrain conductivity, and ground-penetrating radar).

Objective 2: to determine the composition, magnitude, and extent of potential soil and sediment contamination.

Methods: soil boring and subsurface soil sampling, surface soil sampling, and sediment sampling.

Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Methods: sampling of existing monitoring wells, monitoring well installation and sampling, and surface water sampling.

3.7.3 Proposed Investigation The following provides descriptions of proposed investigative methods and sampling and analysis plans for Site 5, Heavy Equipment Training Area Landfill.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former landfill operations and the historical development of the site.

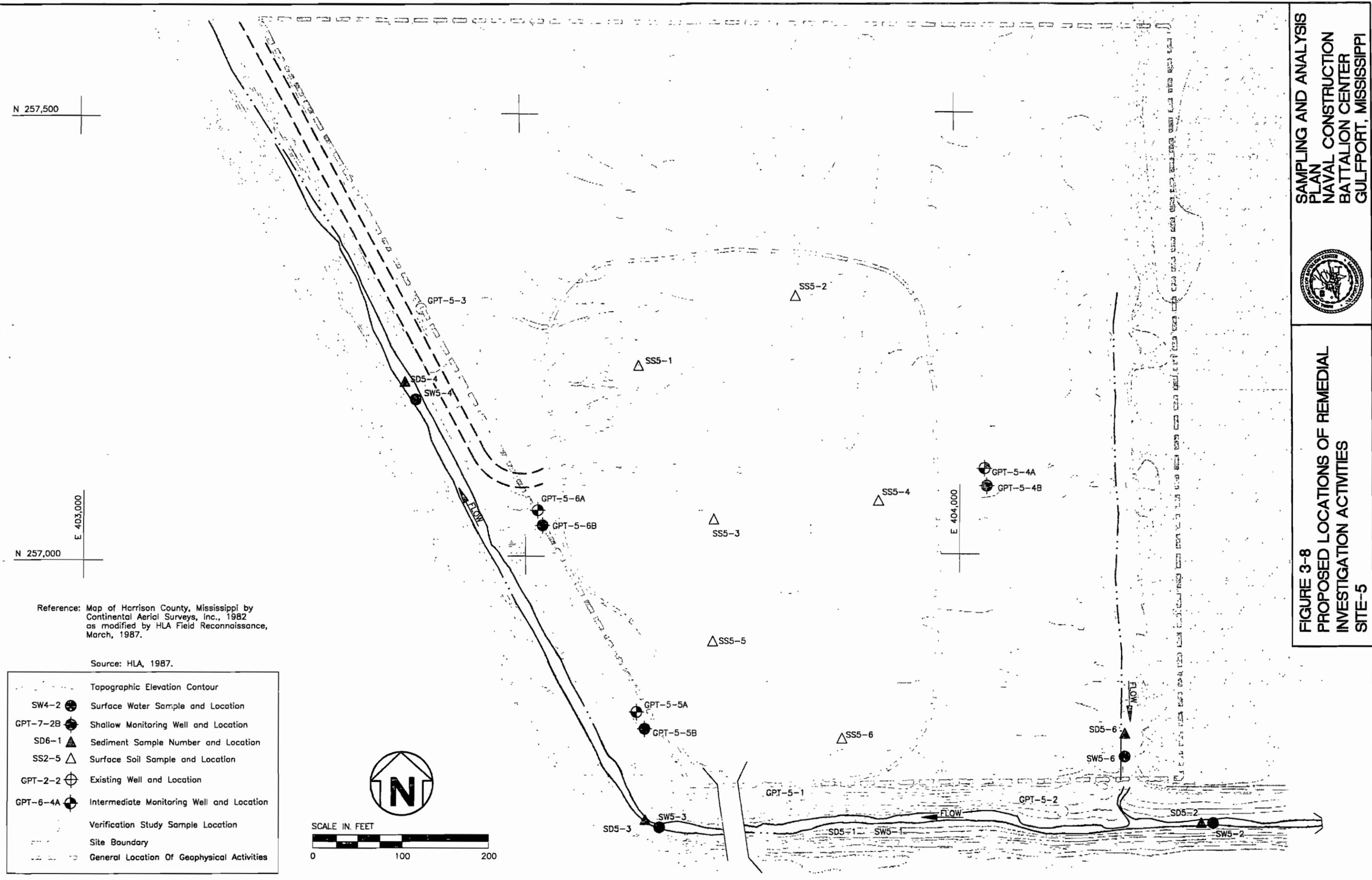
Geophysical Survey A geophysical survey consisting of magnetometer, GPR, and/or terrain conductivity transects will be completed. The magnetometer survey will be comprised of survey lines spaced 100 feet apart, with readings taken every 20 feet along a survey line. Figure 3-8 shows the area to be included in the magnetometer survey. Each survey line will extend beyond the anticipated limits of the site. Terrain conductivity and GPR surveys will be located to confirm magnetic anomalies suspected of indicating areas of buried metal, such as drums. Geophysical results will be presented on scaled site maps. Cumulative evaluation and interpretation of data from the three geophysical methods will be used to interpret the extent, location, and orientation of the landfill.

Surface Soil Sampling Six surface soil samples will be collected from locations within the boundaries of the disposal area at Site 5. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-8. Actual locations will be chosen in the field based on results of the geophysical survey. Some locations will be at or near areas interpreted as disposal trenches based on geophysical data. Other locations will be selected so that sampling generally



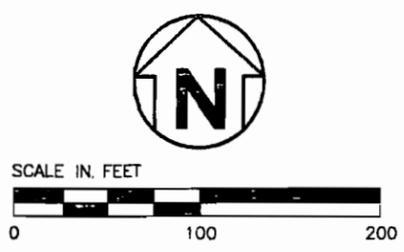
FIGURE 3-8  
 PROPOSED LOCATIONS OF REMEDIAL  
 INVESTIGATION ACTIVITIES  
 SITE-5



Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.

Source: HLA, 1987.

- Topographic Elevation Contour
- SW4-2 Surface Water Sample and Location
- GPT-7-2B Shallow Monitoring Well and Location
- SD6-1 Sediment Sample Number and Location
- SS2-5 Surface Soil Sample and Location
- GPT-2-2 Existing Well and Location
- GPT-6-4A Intermediate Monitoring Well and Location
- Verification Study Sample Location
- Site Boundary
- General Location Of Geophysical Activities



covers all areas of the site, as necessary, to support the Baseline Risk Assessment. Surface soil samples will be collected from the surface to 1-foot depth using a hand auger or similar device. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds.

Subsurface Soil Sampling At Site 5 subsurface soil samples will be collected from soil borings conducted in association with monitoring well installation at the periphery of the site. Figure 3-8 shows proposed locations for soil borings and monitoring well installations. The purpose of this sampling is to determine whether subsurface soils at the periphery of the site have been impacted by past waste disposal. Because of the nature of the site (a landfill) borings will not be conducted within the limits of the site.

Split-spoon sampling will be conducted continuously (every 2 feet) to the water table then every 5 feet (or at facies boundaries) in intermediate-depth borings that are associated with monitoring well pairs. Headspace analysis using an OVA will be performed in the field on all samples from the intermediate borings. Four soil samples will be selected from each intermediate boring for laboratory analysis, including the sample from the interval above the water table and the top 2-foot interval of the clay layer. Two additional samples will be selected for laboratory analysis based on results of OVA headspace analysis. Rationale for selecting subsurface soil samples for laboratory analysis based on OVA headspace analysis is discussed in Section 2.2.3 of this document. Twelve subsurface soil samples from three borings will be submitted for analysis of TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds.

Split-spoon sampling will be conducted every 5 feet and/or at facies boundaries in shallow soil borings associated with monitoring well clusters. These samples will be used for soil classification and visual inspection only.

As many as 12 subsurface soil samples from Site 5 will be submitted for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The 12 samples will represent four different facies expected of being present at the site. These four facies are sand, silty sand, clayey sand, and clay. To evaluate spatial variation in organic carbon content, the samples will be collected from three boring locations. If all four facies are not represented at three locations, the number of samples submitted for organic carbon content determination will decrease accordingly. The data will be used to evaluate spatial and depth variations of organic carbon, as well as variation among facies.

Three samples of the clay layer will be collected from three intermediate borings using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in the COE Engineering Manual 1110-2-1906 (USCOE, 1070). The laboratory permeability data will be used in conjunction with slug-test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on groundwater flow direction determined by two sets of water-level measurements obtained from three existing monitoring wells at Site 5. Figures 3-3 and 3-4 are potentiometric surface maps developed from water-

level measurements collected 30 March 1987 and 31 October 1991. Groundwater flow direction at Site 5 is to the west-southwest during periods of high water table (Figure 3-3) and west during periods of low water table (Figure 3-4) towards Canal No. 1, which borders the site on the west and south sides.

Three monitoring well pairs are proposed at Site 5. Figure 3-8 shows the proposed locations of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells will be used to monitor groundwater for free-phase floating product and detection of shallow groundwater contaminants. Intermediate-depth wells will be constructed to monitor groundwater on top of the clay layer. Intermediate-depth monitoring wells will be used to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

Two well pairs will be installed along the western periphery of the site to monitor groundwater downgradient of the site. One well pair will be installed to the east of the site to monitor upgradient groundwater for potential contaminants from off-site. The locations for the three well pairs were selected in consideration of the direction of groundwater flow and size of the site, and based on the potential for small plumes of contaminated groundwater as a result of releases from one or more disposal trenches.

During the 1987 Verification Study conducted by HLA soil borings were conducted for installation of three monitoring wells. Boring logs that were provided in the Verification Study report (HLA, 1987) indicate that depth of the clay layer ranges from 19 to 26 feet BLS at Site 5. Intermediate-depth wells to be installed in areas where the clay layer is relatively close to the surface of the water table may not require a corresponding shallow well to monitor for shallow or floating contaminants. Monitoring well installations at locations where the clay is relatively shallow may result in completion of only one well; or require completing the use of 5-foot-long well screens in the intermediate-depth well; or require completing the intermediate well with a part of the screen in the clay. These determinations will be made in the field on a case-by-case basis.

Groundwater levels at Site 5 range from 2.8 to 9.4 feet BLS. Depths of shallow wells installed at Site 5 during the RI/FS are expected to range from 12 to 18.5 feet BLS. Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment.

All wells will be constructed of flush-threaded, 2-inch-ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mesh filters have been chosen based on the presence of silty sand, clayey sand, and sand in the subsurface at Site 5, as indicated by boring logs associated with the Verification Study. Well-screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in the intermediate-depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENCOM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses and Level III DQOs for analyses not included in the CLP SOW. Groundwater samples will be analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganic compounds, TDSs, and TSSs. Both filtered and unfiltered samples will be submitted for TAL inorganics analyses. TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Level IV DQOs will be used for second round groundwater sampling and analyses included in the CLP SOW. Level III DQOs will be used for non-CLP analyses. If the analytical results of the first round of groundwater samples from Site 5 do not reveal detectable levels of any TCL chemical and all TAL inorganics are within background ranges, no further groundwater sampling will be conducted at Site 5.

Surface Water and Sediment Sampling Four surface water samples and four sediment samples (four "sets") will be collected from the drainage ditch west of Site 5 and the drainage ditch east of Site 5. Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations within in the area of interest will be chosen.

The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Three sets of samples will be collected from the drainage ditch west of the site (Figure 3-8). One set will be collected from a location hydraulically upgradient of Site 5. Three sets of samples will be collected from locations adjacent to Site 5. One set of samples will be collected from the drainage ditch east of Site 5.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses. Level III DQOs will be used for analyses not included in the CLP SOW. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganics, TDSs and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

### 3.8 SITE 6, FIRE-FIGHTING TRAINING AREA.

3.8.1 Description and Background The former Fire-Fighting Training Area consisted of two unlined pits located southeast of the Fifth Street and Colby Avenue intersection. One pit was approximately 50 feet long, 35 feet wide, and 4 to 5 feet deep. The other pit was approximately 40 feet long, 25 feet wide, and 6 feet deep. The larger site is now partially covered by Building No. 383 and the smaller site is located just east of Building No. 390.

The two pits were used for fire-fighting training activities from 1966 to 1975. Waste liquids from the CED, NCTC, 20th NCR, and public works shops, as well as flammable liquids from Keesler Air Force Base, the Air National Guard, and Pascagoula Shipyard were drained into the pits and ignited. Approximately 500,000 gallons of liquids such as waste fuels, oils, solvents (Stoddard, xylene, toluene, MEK), paints, paint thinners and cleaning compounds were burned at the site. Upon closure of the site, the pits were filled in with soil and are no longer distinguishable. The site is currently used to train personnel how to construct and dismantle power lines and transformers on electric utility poles.

Verification Study Three soil borings were completed and a monitoring well was installed in each of these borings. One sediment sample and two soil samples were collected and analyzed for pH, conductance, TOC, TOX, COD, O&G, Cd, Cr, and Pb. Analytical results are summarized in Table 3-8. Concentration of lead detected in the sediment sample was 4.1 mg/kg and chromium was below detection. Chromium was detected in both soil samples at levels of 5.4 and 7.7 mg/kg. Lead was detected in one soil sample at a level of 6.9 mg/kg. One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organic compounds, and semivolatile organic compounds. Compounds detected in groundwater are summarized in Table 3-8 and include Cr and Pb as follows:

GPT-6-1	Cr: 72 µg/l	Pb: 70 µg/l
GPT-6-2	Cr: 38 µg/l	Pb: 21 µg/l
GPT-6-3	Cr: 30 µg/l	Pb: 26 µg/l.

A geophysical survey using a Scintrex-IGS™ was conducted at the site. A 50-foot by 50-foot grid was used for the survey of Site 6. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-15 of the RI Workplan.

On 31 October 1991 ABB-ES personnel conducted a site visit to NCBC Gulfport. During the site visit water-level measurements were collected from three existing monitoring wells at Site 6. Monitoring well GPT-6-1 was found to contain a significant amount of free-phase floating product. Upon retrieval from the well, the probe and line of the water-level indicator were coated with a brown, oily, viscous liquid having an odor and appearance of diesel fuel. Additionally, the water table is depressed 2 to 3 feet in the area of well GPT-6-1 (Figure 3-4). The source of the product is unknown. There was no report of confirmed or suspected free product in the 1987 Verification Study report. The presence, extent, and source of free product at Site 6 will be evaluated during the RI/FS.

3.8.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 6 are to assess the location and orientation of the two unlined pits; to evaluate the composition, magnitude, and extent of potential soil contamination; to evaluate the composition and magnitude of potential groundwater and surface

Table 3-8 Summary of Chemical Analysis Results, Site 6<sup>1</sup>, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Location	GPT-6-1	GPT-6-2	GPT-6-3	SD6-1	SL6-1	SL6-2
Sampling Date	4/7/87	3/29/87	3/29/87	3/26/87	3/26/87	3/26/87
Temperature	21	18	19	-	-	-
pH (field)	4.91	4.94	4.85	-	-	-
Specific conductance (field)	95	120	1400	-	-	-
pH (laboratory)	5.23(5.21) <sup>3</sup>	5.44	5.10	5.26	6.95	5.75(5.70)
Specific conductance (laboratory)	80	90	110	-	-	-
TOC (TOC)	-	-	-	5500	11,800	5,100
total organic halogen (TOX)	-	-	-	<200	210	380(370)
chemical oxygen demand (COD)	-	-	-	3,800	9,450	3770(3750)
oil and grease (O and G)	-	-	-	<132	7,248	135
cadmium (Cd)	<4.7	<4.7	<4.7	<3.1	<2.6	<2.6
chromium (Cr)	72	38	30	<5.9	5.4	7.7
lead (Pb)	70	21	26	4.1	<3.3	6.9
Volatile Organics	(2)	(2)	(2)	-	-	-
1,1-Dichloroethane			2 <sup>1</sup>			
1,2-Dichloroethane			5			
Semivolatile organics	(2)	(2)	(2)	-	-	-
Pesticides and PCBs	(2)	(2)	(2)	-	-	-

<sup>1</sup>All chemical parameters not specifically reported were below their analytical detection limit (Table 3-2).

Source: HLA, 1987.

Notes:

All analyses results for water samples are reported µg/l except TOC, COD, and O and G which are reported in mg/l. Analyses results for sediment and soil samples are reported in mg/kg. Temperature, pH, and specific conductance are reported in °C, standard units, and µmhos/cm at 25°C, respectively.

Results presented in parentheses are for duplicate analyses.

Temperature, pH (field), and specific conductance (field) data for groundwater samples are an average of three separate measurements.

- Sample not analyzed or measured for these parameters.

PCBs = polychlorinated biphenyl compounds

water contamination; assess the presence, extent, and source of free phase floating product on the water table; and to assess whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be a consequence of analyzing turbid samples. This will be evaluated by obtaining background soil and groundwater samples, by analyzing both filtered and unfiltered samples and by analyzing TDSs and TSSs. Results of the Verification Study indicate that except for the concentrations of chromium and lead, there does not appear to be contamination of the shallow groundwater. However, two of the monitoring wells were installed upgradient of the burn pits and only one was installed downgradient of the burn pits. Well screens in the monitoring wells range from 19 to 24.5 feet long and may cause dilution of groundwater samples. Therefore, additional monitoring wells are needed at the site to evaluate the status of potential groundwater contamination.

The following investigative objectives and methods are proposed to characterize Site 6:

Objective 1: to determine the location and orientation of the two unlined pits.

Methods: aerial photography analysis, and geophysical surveys (terrain conductivity and ground-penetrating radar).

Objective 2: to determine the composition, magnitude, and extent of potential soil and sediment contamination.

Methods: soil boring and subsurface soil sampling, surface soil sampling, TerraProbe sampling, and sediment sampling.

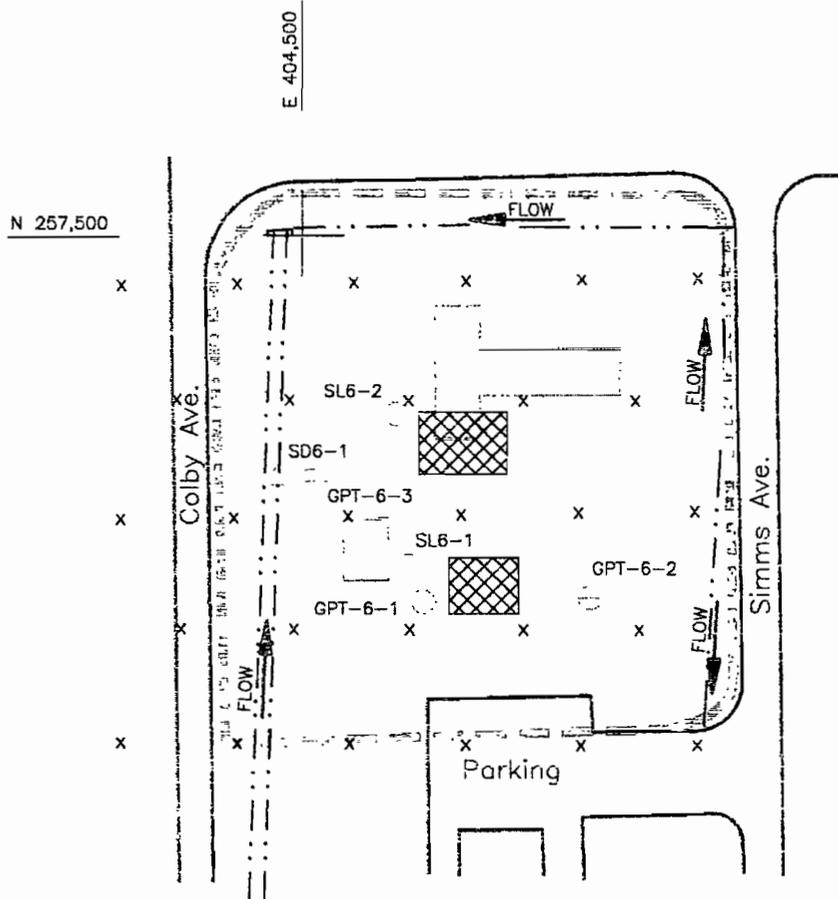
Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Methods: sampling of existing monitoring wells, monitoring well installation and sampling, and surface water sampling.

3.8.3 Proposed Investigation The following provides descriptions of proposed investigative methods and sampling and analysis plans for Site 6, Fire-Fighting Training Area.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former training operations and the historical development of the site.

Geophysical Survey A geophysical survey consisting of terrain-conductivity and GPR will be completed. The terrain conductivity survey will be comprised of readings collected on a 25-foot grid. The area to be included in the conductivity survey is shown in Figure 3-9. The purpose of the conductivity survey is to assist in delineation of the pits and/or groundwater containing relatively high levels of organic compounds or free product. A GPR survey will be used to confirm terrain-conductivity anomalies suspected of being the location of the former pits. Geophysical results will be presented on scaled site maps.

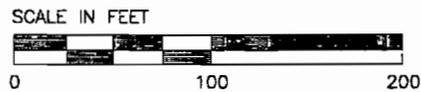


Source: HLA, 1987.

SL6-1	Soil Sample Number and Location
SD6-1	Sediment Sample Number and Location
GPT-2-2	Existing Well and Location
x	Terraprobe Soil Sample Location
	Former Burn Pit
- - - - -	General Location Of geophysical Activities



Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.



**FIGURE 3-9  
PROPOSED TERRAPROBE SAMPLE  
LOCATIONS AND AREA OF  
GEOPHYSICAL SURVEY -  
SITE-6**



**SAMPLING AND ANALYSIS  
PLAN  
NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

Cumulative evaluation and interpretation of data from the two geophysical methods will be used to interpret the location and orientation of the former pits.

TerraProbe Sampling Twenty-eight shallow subsurface soil samples will be collected using a TerraProbe. The samples will be screened for fuel-related volatile organic compounds (benzene, toluene, ethylbenzene, and xylenes), methylene chloride, and TPHs in an on-site mobile laboratory using Level II DQOs. The Level II screening data will be used to select locations for six soil borings (discussed separately below).

The TerraProbe soil samples will be collected from an interval above the water table. The samples will be visually inspected for the presence of free product. If free product is apparent (i.e., soils are saturated with an oily material) field analyses will not be conducted because high levels of organics in samples will contaminate the instruments and delay work progress and/or interfere with analysis of other samples. The presence and location of saturated samples will be recorded in the field log book.

Figure 3-9 shows proposed locations for 28 TerraProbe sample points. The proposed sample points are spaced 60 feet apart along offset grid lines. Grid lines are 60 feet apart. Results of field analyses (and observations) may warrant relocating certain points or shifting the grid to concentrate on areas of concern (positive results) and limit sampling in areas consistently lacking detection of analytes.

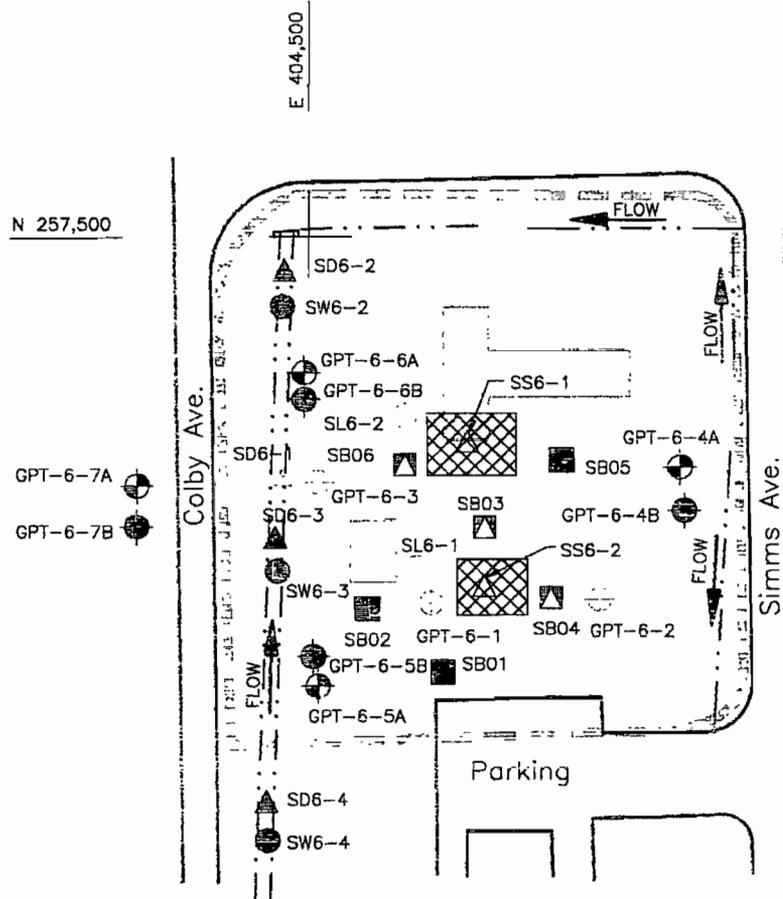
Surface Soil Sampling Five surface soil samples will be collected from Site 6. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-10. Actual locations will be chosen in the field based on results of the geophysical survey and field analysis of samples collected with the TerraProbe. Two surface soil sample locations will be in the areas interpreted as being within the limits of the former pits. These samples will be collected from the zero to 1-foot depth using a hand auger or similar device. The three remaining samples will be collected from the uppermost interval of on-site soil borings (discussed below) and will be collected using either a split-spoon or hand auger (or similar device). Sample collection and analysis will conform to Level IV DQOs. Level III DQOs will be utilized for parameters not included in the CLP SOW. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganic compounds and polychlorinated dibenzodioxins.

Subsurface Soil Sampling Six on-site soil borings will be conducted for purposes of obtaining subsurface soil samples. Subsurface soil samples will also be collected from four soil borings conducted in association with monitoring well installation at the periphery of the site. Subsurface soil samples will provide information regarding the status of contamination in on-site subsurface soils.

Proposed soil boring locations are shown in Figure 3-10. Actual locations will be selected based on results of the geophysical survey and field analyses conducted on samples collected with the TerraProbe. At each boring location split-spoon sampling will be conducted continuously (every 2 feet) to the water table, then every 5 feet or at facies boundaries. Split-spoon sampling will extend 2 feet into the clay layer. All split-spoon samples will be evaluated for





Source: HLA, 1987.

SL6-1 ○	Soil Sample Number and Location
SW4-2 ●	Surface Water Sample and Location
GPT-7-2B ●	Shallow Monitoring Well and Location
SD6-1 ▲	Sediment Sample Number and Location
SS2-5 ▲	Surface Soil Sample and Location
SB06 ▽	Soil Boring/ Surface Soil
SB01 ▽	Soil Boring
GPT-2-2 ⊕	Existing Well and Location
GPT-6-4A ●	Intermediate Monitoring Well and Location
▨	Former Burn Pit
⊙	Verification Study Sample Location
---	General Location Of Geophysical Activities



Reference: Map of Harrison County, Mississippi by Continental Aerial Surveys, Inc., 1982 as modified by HLA Field Reconnaissance, March, 1987.

SCALE IN FEET



**FIGURE 3-10  
PROPOSED LOCATIONS OF  
REMEDIAL INVESTIGATION  
ACTIVITIES  
SITE-6**



**SAMPLING AND ANALYSIS  
PLAN  
NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

volatile organic contamination by headspace analysis using an OVA. Four soil samples will be selected from each boring for laboratory analysis, always including the interval above the water table and top 2-foot interval of the clay layer. Additionally, three surface soil samples from three of six on-site borings will be submitted for laboratory analysis. One or two (as appropriate) additional subsurface soil samples will be selected for laboratory analysis based on results of headspace analysis. Rationale for selection of subsurface soil samples for laboratory analysis based on OVA headspace analysis is discussed in Section 2.2.3 of this document. Completed on-site borings will be plugged with a cement/bentonite grout placed by tremie method.

Forty soil samples from 10 borings will be submitted for laboratory analysis. This total includes samples collected from six on-site borings and four monitoring well borings. Collection and analysis of soil samples from soil borings will be in conformance with Level IV DQOs for CLP analyses. Level III DQOs will be used for analyses not included in the CLP SOW. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface soil samples collected from soil borings will also be analyzed for polychlorinated dibenzodioxins.

As many as 12 subsurface soil samples will be selected from one of the six on-site borings and two of the four intermediate-depth monitoring well borings for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The 12 samples will represent four facies expected of being present at the site. The four facies are sand, silty sand, clayey sand, and clay. If all four facies are not represented at the three boring locations, the number of samples collected for analysis of organic carbon content will decrease accordingly.

Three samples of the clay layer will be collected from three borings (one on-site boring and two intermediate monitoring well borings) using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in the COE Engineering Manual 1110-2-1906 (USCOE, 1970). The laboratory permeability data will be used in conjunction with slug-test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on groundwater flow direction determined by two sets of water-level measurements obtained from three existing monitoring wells at Site 6. Figures 3-3 and 3-4 are potentiometric surface maps developed from water-level measurements collected 30 March 1987 and 31 October 1991. Groundwater flow at Site 6 is to the west-southwest.

Four monitoring well pairs are proposed at Site 6. Figure 3-10 shows the proposed locations of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells will be used to monitor groundwater for free-phase floating product and detection of shallow groundwater contaminants. Intermediate-depth wells will be constructed to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

Three well pairs will be installed along the western periphery of the site to monitor groundwater downgradient of the site. One well pair will be installed to the east of the site to monitor groundwater for potential contaminants from off-site sources. The locations for the four well pairs were selected in consideration of the free product observed in well GPT 6-1 during the 31 October 1991 site visit and the groundwater flow direction in the area of the Site 6.

During the 1987 Verification Study conducted by HLA, soil borings were conducted for installation of three monitoring wells. Boring logs that were provided in the Verification Study report (HLA, 1987) indicate that depth of the clay layer ranges from 22 to 27.5 feet BLS at Site 6. Intermediate-depth wells installed in areas where the clay layer is relatively close to the surface of the water table may not require a corresponding shallow well to monitor for shallow or floating contaminants. Monitoring well installations at locations where the clay is relatively shallow may result in completion of only one well; or require the use of the 5-foot-long well-screens in the intermediate-depth well; or require completing the intermediate well with a part of the screen in the clay. These determinations will be made in the field on a case-by-case basis.

Groundwater levels at Site 6 range from 1.5 to 7.4 feet (10.2 feet in GPT-6-1, due to product on water table) BLS. Depths of shallow wells installed at Site 6 during the RI/FS are expected to range from 10.5 to 16.5 feet BLS. Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment.

All wells will be constructed of flush-threaded, 2-inch ID, Schedule 40 PVC riser pipe and well screens. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mesh filter sand have been chosen based on the presence of clayey sand, silty sand, and sand in the subsurface at Site 6, as indicated by boring logs associated with the Verification Study. Well-screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in intermediate-depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENCOM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will not be collected from wells containing free product, if any. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses. Level III DQOs will be used for non-CLP analyses. Groundwater samples will be analyzed for TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, TAL inorganic compounds, TDSs, and TSSs. Both filtered and unfiltered samples will be submitted for TAL inorganic analyses. TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Second round sampling and analyses will conform with Level IV DQOs for CLP analyses. Level III DQOs will be used for non-CLP analyses. If the analytical results of the first round of groundwater samples from Site 6 do not reveal detectable levels of site-related organics and all inorganics are within background ranges, no further groundwater sampling will be conducted at Site 6.

Surface Water and Sediment Sampling Three surface water samples and three sediment samples (three "sets") will be collected from the drainage ditch west of Site 6. Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations within the area of interest will be chosen.

The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Three sets of samples will be collected from the drainage ditch west of the site and east of Colby Avenue (Figure 3-10). One set will be collected from a location hydraulically upgradient of Site 6. Two sets of samples will be collected from locations adjacent to and downgradient of Site 6.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses. Level III DQOs will be used for non-CLP analyses. Laboratory analyses will include TCL volatile organics, TCL semivolatile organics, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganics, TDSs, and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

### 3.9 SITE 7, RUBBLE DISPOSAL AREA.

3.9.1 Description and Background Site 7 is located northeast of Site 2; is bordered on the north by Eleventh Street; and is located approximately 200 feet east of Building 225, an operational storage area. Site 7 consists of an inactive disposal area measuring approximately 375 by 350 feet.

Site 7 was used for the disposal of construction and demolition debris such as concrete, lumber, scrap metal, and similar inert materials. The site was reportedly used from 1978 to 1984. There is no report of hazardous waste disposal at this site. The area is now characterized by an open grassed area.

Verification Study Sites 2 and 7 were investigated as one site for the purposes of groundwater monitoring and surface water and sediment sampling during the Verification Study. Three soil borings were completed and a monitoring well was installed in each of these borings to monitor Sites 2 and 7. One monitoring well (GPT-2-3) is located along the northern boundary of Site 7. The other two wells

(GPT-2-1 and GPT-2-2) are located along the southern boundary of Site 2. One groundwater sample from each well was collected and analyzed for pH, conductance, Cd, Cr, Pb, volatile organics, and semivolatile organics. Compounds detected in groundwater by these analyses include Cr and Pb as follows:

GPT-2-1	Cr, 26 $\mu\text{g}/\text{l}$ ;	Pb, 20 $\mu\text{g}/\text{l}$
GPT-2-2	Cr, 73 $\mu\text{g}/\text{l}$ ;	Pb, 41 $\mu\text{g}/\text{l}$
GPT-2-3	Cr, 21 $\mu\text{g}/\text{l}$ ;	Pb, 13 $\mu\text{g}/\text{l}$ .

Additionally, concentrations of 1,2-trans-dichloroethene (37  $\mu\text{g}/\text{l}$ ), trichloroethylene (5  $\mu\text{g}/\text{l}$ ), and bis(2-ethylhexyl)phthalate (21  $\mu\text{g}/\text{l}$ ) were detected in GPT-2-3. This well is nearest Site 7.

A geophysical survey using a Scintrex-IGS<sup>TM</sup> was conducted at Site 7. A 100-foot by 100-foot survey was used for the survey of Site 7. Areas of magnetic anomalies and VLF values detected above background are shown on Figure 2-11 of the RI Workplan.

**3.9.2 Rationale for Technical Approach** The objectives of the RI/FS program at Site 7 are to assess the location and orientation of the landfill; to evaluate the composition, magnitude, and extent of potential soil contamination; to evaluate the composition and magnitude of potential groundwater and surface water contamination; and to assess whether an imminent hazard to human health or the environment exists.

The concentrations of chromium and lead may be inherent to the groundwater in the region or may be a consequence of analyzing turbid samples. This will be evaluated by obtaining background samples and by analyzing both filtered and unfiltered samples, and by analyzing TDSs and TSSs. Potential contamination of the surficial aquifer based on the concentrations of 1,2-trans-dichloroethene and bis(2-ethylhexyl)phthalate in GPT-2-3 cannot be determined based on results of the Verification Study alone. The concentrations of organic compounds were only detected in one of the wells (GPT-2-3), the only monitoring well installed at Site 7. The well-screen in the monitoring well is 19 feet long and may cause dilution of groundwater samples. Therefore, there currently are not a sufficient number of monitoring wells at the site to determine groundwater flow direction or to confirm whether contamination of the surficial aquifer exists.

During this remedial investigation program, Sites 2 and 7 will be investigated as two separate entities. The following investigative objectives and methods are proposed to characterize Site 7:

Objective 1: to determine the location and orientation of the landfill.

Methods: aerial photography analysis and geophysical surveys (magnetometer, terrain-conductivity and ground-penetrating radar).

Objective 2: to determine the composition, magnitude, and extent of potential soil and sediment contamination.

Methods: soil boring and subsurface soil sampling, surface soil sampling, and sediment sampling.

Objective 3: to determine the composition and magnitude of potential groundwater and surface water contamination.

Methods: sampling of the existing monitoring well, monitoring well installation and sampling, and surface water sampling.

3.9.3 Proposed Investigation The following provides descriptions of proposed investigative methods and sampling and analysis plans for Site 7, Rubble Disposal Area.

Aerial Photography Survey An aerial photography survey will be conducted, consisting of procuring, evaluating, analyzing, and interpreting available historical and recent aerial photographs to aid in the assessment of former landfill operations and the historical development of the site.

Geophysical Survey A geophysical survey consisting of magnetometer, GPR, and/or terrain conductivity transects will be completed. The magnetometer survey will be comprised of survey lines spaced 100 feet apart, with readings taken every 20 feet along a survey line. Figure 3-5 shows the area to be included in the magnetometer survey. Each survey line will extend beyond the anticipated limits of the site. Terrain conductivity and GPR surveys will be located to confirm magnetic anomalies suspected of indicating areas of buried metal. Geophysical results will be presented on scaled site maps. Cumulative evaluation and interpretation of data from the three geophysical methods will be used to interpret the extent, locations, and orientation of the landfill.

Surface Soil Sampling Four surface soil samples will be collected from locations within the boundaries of the disposal area at Site 7. Surface soil samples will provide information concerning potential human and ecological exposure and possible off-site transport of contaminants through soil erosion.

Proposed surface soil sample locations are shown in Figure 3-5. Actual locations will be chosen in the field based on results of the geophysical survey. Locations will be selected so that sampling generally covers all areas of the site, as necessary to support the Baseline Risk Assessment. Surface soil samples will be collected from the surface to 1-foot depth using a hand auger or similar device. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds.

Subsurface Soil Sampling At Site 7, subsurface soil samples will be collected from soil borings conducted in association with monitoring well installation at the periphery of the site. Figure 3-5 shows proposed locations for soil borings and monitoring well installations. The purpose of this sampling is to determine whether subsurface soils at the periphery of the site have been impacted by past waste disposal. Because of the nature of the site (a landfill) borings will not be conducted within the limits of the site.

Split-spoon sampling will be conducted continuously (every 2 feet) to the water table than every 5 feet (or at facies boundaries) in intermediate-depth borings that are associated with monitoring well pairs. Headspace analysis using an OVA will be performed in the field on all samples from the intermediate borings. Four soil samples will be selected from each intermediate boring for laboratory analysis, including the sample from the interval above the water table and the top 2-foot interval of the clay layer. Two additional samples will be selected

for laboratory analysis based on results of OVA headspace analysis. Rationale for selecting subsurface soil samples for laboratory analysis based on OVA headspace analysis is discussed in Section 2.2.3 of this document. Sixteen subsurface soil samples from four borings will be submitted for analysis of TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Sampling and analysis will conform with Level IV DQOs for CLP analyses. Level III DQOs will be used for analyses not included in the CLP SOW.

Split-spoon sampling will be conducted every 5 feet and/or at facies boundaries in shallow soil borings associated with monitoring well clusters. These samples will be used for soil classification and visual inspection only.

As many as nine subsurface soil samples from Site 7 will be submitted for analysis of TOC for purposes of estimating soil-water partitioning coefficients. The nine samples will represent three different facies expected of being present at the site. These three facies are sand, silty sand, and clay. To evaluate spatial variation in organic carbon content, the samples will be collected from three boring locations. If all three facies are not represented at three locations, the number of samples submitted for organic carbon content determination will decrease accordingly. The data will be used to evaluate spatial and depth variations of organic carbon, as well as variation among facies.

Three samples of the clay layer will be collected from three intermediate borings using Shelby tubes. The Shelby tubes will be sealed on each end with wax, capped, labeled, and submitted to a geotechnical laboratory for constant-head flexible-wall permeability tests using the method found in COE Engineering Manual 1110-2-1906 (USCOE, 1970). The laboratory permeability data will be used in conjunction with slug-test data (discussed in Section 3.10.1) and TOC data to evaluate fate and transport of potential contaminants at the site.

Monitoring Well Installation Proposed locations for groundwater monitoring wells were selected based on the need to evaluate groundwater flow direction at Site 7 and monitor groundwater quality in the surficial aquifer. Figures 3-3 and 3-4 are potentiometric surface maps developed from water level measurements collected 30 March 1987 and 31 October 1991. Groundwater flow direction at Site 7 is not well defined.

Four monitoring well pairs are proposed at Site 7. Figure 3-5 shows the proposed locations of the monitoring well pairs. Each pair is comprised of a shallow well and an intermediate-depth well. Shallow wells will be constructed to intercept the water table in the screened interval. Shallow wells would be used to monitor groundwater for free-phase floating product and detection of shallow groundwater contaminants. Intermediate-depth wells will be constructed to monitor groundwater on top of the clay layer. Intermediate-depth monitoring wells will be used to monitor groundwater for free-phase product that is denser than water and to provide information regarding vertical distribution of potential contaminants in groundwater.

One well pair will be installed along each of the four sides of the site. The locations for the four well pairs were selected in consideration of the proximity of Site 7 to Site 2; the potential for contaminated groundwater from Site 2 to migrate towards Site 7; and the presence of chlorinated solvents in groundwater

from existing well GPT-2-3 which was sampled during the Verification Study (March 1987).

During the 1987 Verification Study conducted by HLA soil borings were conducted for installation of three monitoring wells at Site 2 and Site 7. Boring logs that were provided in the Verification Study report (HLA, 1987) indicate that depth of the clay layer ranges from 13 to 30 feet BLS at in the area of Site 7. Intermediate-depth wells to be installed in areas where the clay layer is relatively close to the surface of the water table may not require a corresponding shallow well to monitor for shallow or floating contaminants. Monitoring well installations at locations where the clay is relatively shallow may result in completion of only one well; or require the use of 5-foot-long well screens in the intermediate-depth well; or completing the intermediate well with a part of the screen in the clay. These determinations will be made in the field on a case-by-case basis.

Groundwater levels in the area of Site 7 range from less than 1.2 to 5.6 feet BLS. Depths of shallow wells installed at Site 7 during the RI/FS are expected to range from 10.5 to 14.5 feet BLS. Actual depths of both shallow and intermediate wells will depend on site conditions at the boring locations. Actual locations of monitoring wells will depend on obtaining clearance for drilling activities and accessibility of the area to drilling equipment.

All wells will be constructed of flush-threaded, 2-inch-ID, Schedule 40 PVC riser pipe and well-screen. Justification for the use of PVC well construction material is presented in Appendix B of the RI Workplan. A well-screen slot size of 0.01 inch and 20/30 mesh filter sand have been chosen based on the expected presence of silty sand and sand in the subsurface at Site 7, as indicated by boring logs that were provided with the Verification Study. Well-screens in associated well pairs should be positioned such that there is no overlap of the screened intervals. Ten-foot-long well screens will be used; however, 5-foot-long screens may be used in intermediate-depth wells as necessary to avoid overlap of screened intervals in associated wells of a well pair. Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991a) (RI Workplan, Appendix C) and SOUTHNAVFACENGCOM guidelines (RI Workplan, Appendix D).

Groundwater samples will be collected from all new and existing monitoring wells. Groundwater samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses and Level III DQOs for analyses not included in the CLP SOW. Groundwater samples will be analyzed for TCL volatile organics, TCL semivolatile organics, TCL pesticides and PCBs, TPHs, TAL inorganic compounds, TDSs, and TSSs. Both filtered and unfiltered samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of groundwater samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

If the sample results of the first round of groundwater sampling indicate the presence of site-related contaminants, a second round of groundwater samples will be collected for confirmation. The analyses performed on the second round of groundwater samples will be limited to include previously detected contaminants and will not necessarily include the entire TCL/TAL analyses. Level IV DQOs will be used for second round groundwater sampling and analyses using CLP methods. Level III DQOs will be used for analyses that are not included in the CLP SOW.

If the analytical results of the first round of groundwater samples from Site 7 do not reveal detectable levels of site-related organics and all inorganics are within background ranges, no further groundwater sampling will be conducted at Site 7.

Surface Water and Sediment Sampling Four surface water samples and four sediment samples (four "sets") will be collected from the drainage ditch north of Site 7 and the stream east of Site 7 (Figure 3-5). Collection of surface water and sediment samples will be dependent upon the presence of sufficient material to sample. If sample material is not present at a proposed location, alternate sample locations within in the area of interest will be chosen.

The purpose of sediment and surface water sampling is to provide data for evaluation of possible ecological and human exposure pathways and to assess the potential for contaminant transport.

Two sets of samples will be collected from the drainage ditch north of the site and south of 11th Street. One set from this ditch will be collected from a location hydraulically upgradient of Site 7. Two sets of samples will be collected from the stream east of the site at locations adjacent to and downgradient of Site 7.

Surface water and sediment samples will be collected and analyzed in conformance with Level IV DQOs for CLP analyses. Level III DQOs will be used for analyses not included in the CLP SOW. Laboratory analyses will include TCL volatile organic compounds, TCL semivolatile organic compounds, TCL pesticides and PCBs, TPHs, and TAL inorganic compounds. Surface water samples will be analyzed for TAL inorganics, TDSs and TSSs. Both filtered and unfiltered surface water samples will be submitted for TAL inorganic analyses. The TCL volatile organic analysis of surface water samples will use a low-concentration method included in the CLP SOW that has lower detection limits than the usual CLP CRQLs. The lower detection limits are similar to ARARs that are associated with some volatile organic compounds.

3.10 INVESTIGATION ACTIVITIES COMMON TO ALL SITES. Investigation activities common to all seven sites include: aquifer characterization, screening of groundwater samples, ecological survey, public health survey, sample location survey, and decontamination and disposal of investigation waste.

3.10.1 Aquifer Characterization Six slug tests will be conducted at each site to obtain an estimate of the horizontal hydraulic conductivity of the surficial aquifer. This testing can provide estimates for calculating groundwater transport parameters, can potentially identify high hydraulic conductivity zones, and can provide preliminary data for evaluating the feasibility of selected remedial actions.

The slug tests will include three shallow and three intermediate-depth wells belonging to three well pairs. Only rising-head slug tests will be performed on shallow wells screened across the water table. Both rising- and falling-head slug tests will be performed on intermediate-depth wells that are screened below the water table.

More extensive aquifer tests are not proposed for the RI because long-term pumping tests in contaminated aquifers are problematic and expensive. Typical problems that are associated with conducting pumping tests include disposal of

contaminated water that must be handled as hazardous wastes, and concentration of contaminants at pumping wells. Because preliminary data indicate little, if any, groundwater contamination exists at the sites, more detailed information regarding hydraulic conductivities is not needed at this time. If significant contamination is detected during the RI, more extensive tests can be designed based on slug-test data and in consideration of contaminants present.

**3.10.2 Screening of Groundwater Samples** New and existing monitoring wells will be screened for volatile organic contamination using a field GC. Level II DQOs will be used to collect and analyze groundwater samples for field screening. The purpose of this sampling is to assess the need for additional monitoring wells at the sites. For planning purposes, three additional monitoring well pairs are included in the RI field effort for use as needed based on results of screening of groundwater samples. Up to three monitoring well pairs will be installed downgradient of monitoring wells where field screening indicates volatile organic contamination exist. The purpose of additional wells is to evaluate the horizontal and vertical extent of contamination as necessary to support the Baseline Risk Assessment, Feasibility Study, and selection/evaluation of remedial alternatives.

**3.10.3 Ecological Survey** An ecological survey consisting of an area reconnaissance, interviews, and records search will be conducted by an Ecological Risk Assessment specialist. The survey will be conducted to note potentially sensitive ecosystems and species that may be impacted by contaminants from the sites and to develop potential exposure pathways to be evaluated in the Baseline Risk Assessment.

The survey will consist of an informal visual identification of terrestrial vegetation cover types and terrestrial wildlife. Local wildlife officials may also be contacted to determine terrestrial species reported to be in the area or reported to inhabit the types of vegetative cover identified. Additional information may be collected for use in wetlands and floodplains assessments, including identification of soil types and wetland vegetation.

**3.10.4 Public Health Survey** A public health survey consisting of an area reconnaissance, interviews, and records search will be conducted by an ABB-ES Public Health Risk Assessment specialist. The survey will be conducted to examine on-base and off-base communities and activities and to develop potential exposure pathways to be evaluated in the Baseline Risk Assessment.

**3.10.5 Survey of Sampling Locations** An elevation and location survey will be performed by a Mississippi-licensed surveyor under contract to ABB-ES to locate all sampling locations including monitoring wells (existing and new), soil borings, surface soil samples, surface water and sediment samples, and any other necessary control points. Sampling locations will be marked upon collection with a wooden stake and flagging tape.

The inner casing (riser) for the monitoring wells will be surveyed for both horizontal and vertical control to a degree of accuracy of 0.1 and 0.01 foot, respectively. Other exploration locations will be marked in the field and will be surveyed for horizontal and vertical control to a degree of accuracy of 0.1 foot.

Sampling locations and other control points will be plotted on site-specific base maps and will be available in both digitized and hard copy formats. In addition,

the survey data will be organized and reported in accordance with USEPA Locational Data Policy and Region IV Environmental Monitoring and Data Reporting Requirements (RI Workplan, Appendix E [ABB-ES, 1993]). These documents require the identification of sampling locations in terms of latitude/longitude coordinates in accordance with the FICCDC recommendations.

3.10.6 Decontamination In-house cleaning procedures, field-cleaning procedures, and containment and disposal of wastewater and solvents will be performed in accordance with USEPA Region IV SOPs (USEPA 1991a) and are detailed in Section 2.1.5 of this document. This section includes cleaning procedures for: sampling sounders and measurement tapes, ice chests and shipping containers, field parameter measurement probes, organic-free water containers, and large equipment. In addition, Section 2.1.6 of this document includes a detailed description of decontamination staging area and fluid disposal practices.

3.11 SUMMARY OF SURVEY AND SAMPLING INVESTIGATIONS. The survey and sampling investigative activities can be divided into two categories: screening samples and samples collected for laboratory analysis. The estimated number of sampling points can be divided into two location categories: upgradient and background locations, and downgradient and source locations. Finally, the types of samples to be collected can be divided into investigation samples and QA/QC samples. The number and types of samples proposed for screening and for laboratory analysis at each of the seven sites and Base-wide are summarized in Tables 3-9 through 3-17.

Table 3-9 Summary of Sample Screening Program, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Screening VOAs							
	Base-Wide	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Groundwater	2	15	12	11	11	9	11	9
Duplicate	1	2	2	2	2	1	2	1
Matrix spike	1	1	1	1	1	1	1	1
Matrix spike duplicate	1	1	1	1	1	1	1	1
Soil (Terraprobe)	NA	NA	NA	NA	NA	NA	28	NA
Duplicate							3	
Matrix spike							2	
Matrix spike duplicate							2	

Notes:

Includes screening for TPHs and volatile organic compounds.

All samples to be analyzed in conformance with Level II data quality objectives (DQOs).

VOAs = volatile organic analytes.

NA = not applicable.

Table 3-10 Summary of Laboratory Analytical Program, Base-Wide, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>						
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TDS	TSS
<b>Subsurface Soil</b>							
Source/downgradient	0	0	0	0	0	0	0
Background/upgradient	0	0	0	4	0	0	0
QC samples (number estimated)							
Trip Blank <sup>2</sup>	0	0	0	QA/QC samples are included under surface soil (same boring)	0	0	0
Rinsate Blank <sup>3</sup>	0	0	0		0	0	0
Duplicate <sup>4</sup>	0	0	0		0	0	0
Matrix spike <sup>5</sup>	0	0	0		0	0	0
Matrix spike duplicate <sup>6</sup>	0	0	0		0	0	0
<b>Groundwater<sup>7</sup></b>							
Source/downgradient	0	0	0	0	0	0	0
Background/upgradient	2	2	2	4	2	2	2
QC samples (number estimated)							
Trip blank	1	0	0	0	0	0	0
Rinsate Blank	1	1	1	1	1	1	1
Duplicate	1	1	1	1	1	1	1
Matrix spike	1	1	1	1	1	0	0
Matrix spike duplicate	1	1	1	1	1	0	0
<b>Surface Water</b>							
Source/downgradient	1	1	1	2	1	1	1
Background/upgradient	1	1	1	2	1	1	1
QC samples (number estimated)							
Trip blank	1	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	1	1
Duplicate	1	1	1	1	1	1	1

See notes at end of table.

Table 3-10 (Continued) Summary of Laboratory Analytical Program, Base-Wide RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>						
	TCL-CLP	TCL-CLP	TCL-CLP	TAL-CLP	TPH	TDS	TSS
	VOAs	SVOAs	Pest/PCBs	Inorganics			
Matrix spike	1	1	1	1	1	0	0
Matrix spike duplicate	1	1	1	1	1	0	0
Sediment							
Source/downgradient	1	1	1	1	1	0	0
Background/upgradient	1	1	1	1	1	0	0
QC samples (number estimated)							
Trip blank	1	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0
Duplicate	1	1	1	1	1	0	0
Matrix spike	1	1	1	1	1	0	0
Matrix spike duplicate	1	1	1	1	1	0	0
Surface Soil							
Source/downgradient	0	0	0	0	0	0	0
Background/upgradient	0	8	8	8	8	0	0
QC samples (number estimated)							
Trip blank	0	0	0	0	0	0	0
Rinsate blank	0	3	3	3	3	0	0
Duplicate	0	2	2	2	2	0	0

Table 3-10 (Continued) Summary of Laboratory Analytical Program, Base-Wide RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>						
	TCL-CLP	TCL-CLP	TCL-CLP	TAL-CLP	TPH	TDS	TSS
	VOAs	SVOAs	Pest/PCBs	Inorganics			
Matrix spike	0	1	1	1	1	0	0
Matrix spike duplicate	0	1	1	1	1	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Two new wells.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and  
Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticides and polychlorinated biphenyls.

NR = not requested.

QC = quality control.

QA = quality assurance.

Table 3-11 Summary of Laboratory Analytical Program, Site 1, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOCs	TDSs	TSSs
Subsurface Soil								
Source/downgradient	16	16	16	16	16	12	0	0
Background/upgradient	8	8	8	8	8	0	0	0
QC samples (number estimated)								
Trip Blank <sup>2</sup>	6	0	0	0	0	0	0	0
Rinsate Blank <sup>3</sup>	6	6	6	6	6	6	0	0
Duplicate <sup>4</sup>	3	3	3	3	3	3	0	0
Matrix spike <sup>5</sup>	2	2	2	2	2	0	0	0
Matrix spike duplicate <sup>6</sup>	2	2	2	2	2	0	0	0
Groundwater <sup>7</sup>								
Source/downgradient	9	9	9	18	9	0	9	9
Background/upgradient	6	6	6	12	6	0	6	6
QC samples (number estimated)								
Trip blank	3	0	0	0	0	0	0	0
Rinsate Blank	3	3	3	3	3	0	3	3
Duplicate	2	2	2	2	2	0	2	2
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Water								
Source/downgradient	5	5	5	10	5	0	5	5
Background/upgradient	1	1	1	2	1	0	1	1

See notes at end of table.

Table 3-11 (Continued) Summary of Laboratory Analytical Program, Site-1, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOCs	TDSs	TSSs
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1
Duplicate	1	1	1	1	1	0	1	1
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/Downgradient	5	5	5	5	5	0	0	0
Background/Upgradient	1	1	1	1	1	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil								
Source/Downgradient	9	9	9	9	9	0	0	0
Background/Upgradient	0	0	0	0	0	0	0	0

See notes at end of table.

Table 3-11 (Continued) Summary of Laboratory Analytical Program, Site-1, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOCs	TDSs	TSSs
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Three existing wells and twelve new wells.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

Table 3-12 Summary of Laboratory Analytical Program, Site 2, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
<b>Subsurface Soil</b>								
Source/downgradient	16	16	16	16	16	12	0	0
Background/upgradient	4	4	4	4	4	0	0	0
QC samples (number estimated)								
Trip blank <sup>2</sup>	4	0	0	0	0	0	0	0
Rinsate blank <sup>3</sup>	4	4	4	4	4	4	0	0
Duplicate <sup>4</sup>	2	2	2	2	2	2	0	0
Matrix spike <sup>5</sup>	1	1	1	1	1	0	0	0
Matrix spike duplicate <sup>6</sup>	1	1	1	1	1	0	0	0
<b>Groundwater<sup>7</sup></b>								
Source/downgradient	8	8	8	16	8	0	8	8
Background/upgradient	4	4	4	8	4	0	4	4
QC samples (number estimated)								
Trip blank	3	0	0	0	0	0	0	0
Rinsate blank	3	3	3	3	3	0	3	3
Duplicate	2	2	2	2	2	0	2	2
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
<b>Surface Water</b>								
Source/downgradient	2	2	2	4	2	0	2	2
Background/upgradient	1	1	1	2	1	0	1	1
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1
Duplicate	1	1	1	1	1	0	1	1

See notes at end of table.

Table 3-12 (Continued) Summary of Laboratory Analytical Program, Site 2, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/downgradient	2	2	2	2	2	0	0	0
Background/upgradient	1	1	1	1	1	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil								
Source/downgradient	11	11	11	11	11	0	0	0
Background/upgradient	0	0	0	0	0	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	2	2	2	2	2	0	0	0

See notes at end of table.

Table 3-12 (Continued) Summary of Laboratory Analytical Program, Site 2, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP	TCL-CLP	TCL-CLP	TAL-CLP	TPH	TOC	TDSs	TSSs
	VOAs	SVOAs	Pest/PCBs	Inorganics				
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Two existing wells and ten new wells.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and  
Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

Table 3-13 Summary of Laboratory Analytical Program, Site 3, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Subsurface Soil								
Source/downgradient	8	8	8	8	8	9	0	0
Background/upgradient	4	4	4	4	4	0	0	0
QC samples (number estimated)								
Trip blank <sup>2</sup>	3	0	0	0	0	0	0	0
Rinsate blank <sup>3</sup>	3	3	3	3	3	3	0	0
Duplicate <sup>4</sup>	2	2	2	2	2	2	0	0
Matrix spike <sup>5</sup>	1	1	1	1	1	0	0	0
Matrix spike duplicate <sup>6</sup>	1	1	1	1	1	0	0	0
Groundwater <sup>7</sup>								
Source/downgradient	7	7	7	14	7	0	7	7
Background/upgradient	4	4	4	8	4	0	4	4
QC samples (number estimated)								
Trip blank	3	0	0	0	0	0	0	0
Rinsate blank	2	2	2	2	2	0	2	2
Duplicate	2	2	2	3	2	0	2	2
Matrix spike	1	1	1	2	1	0	0	0
Matrix spike duplicate	1	1	1	2	1	0	0	0
Surface Water								
Source/downgradient	2	2	2	4	2	0	2	2
Background/upgradient	2	2	2	4	2	0	2	2
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1

See notes at end of table.

Table 3-13 (Continued) Summary of Laboratory Analytical Program, Site 3, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Duplicate	1	1	1	1	1	0	1	1
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/downgradient	2	2	2	2	2	0	0	0
Background/upgradient	2	2	2	2	2	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil								
Source/downgradient	5	5	5	5	5	0	0	0
Background/upgradient	0	0	0	0	0	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0

See notes at end of table.

Table 3-13 (Continued) Summary of Laboratory Analytical Program, Site 3, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Three existing wells and six new wells.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and  
Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

Table 3-14 Summary of Laboratory Analytical Program, Site 4, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
<b>Subsurface Soil</b>								
Source/downgradient	12	12	12	12	12	9	0	0
Background/upgradient	4	4	4	4	4	0	0	0
QC samples (number estimated)								
Trip blank <sup>2</sup>	3	0	0	0	0	0	0	0
Rinsate blank <sup>3</sup>	3	3	3	3	3	3	0	0
Duplicate <sup>4</sup>	2	2	2	2	2	2	0	0
Matrix spike <sup>5</sup>	1	1	1	1	1	0	0	0
Matrix spike duplicate <sup>6</sup>	1	1	1	1	1	0	0	0
<b>Groundwater<sup>7</sup></b>								
Source/downgradient	7	7	7	14	7	0	7	7
Background/upgradient	4	4	4	8	4	0	4	4
QC samples (number estimated)								
Trip blank	2	0	0	0	0	0	0	0
Rinsate blank	2	2	2	2	2	0	2	2
Duplicate	2	2	2	2	2	0	2	2
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
<b>Surface Water</b>								
Source/downgradient	3	3	3	6	3	0	3	3
Background/upgradient	1	1	1	2	1	0	1	1
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1

See notes at end of table.

Table 3-14 (Continued) Summary of Laboratory Analytical Program, Site 4, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Duplicate	1	1	1	1	1	0	1	1
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/downgradient	3	3	3	3	3	0	0	0
Background/upgradient	1	1	1	1	1	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil								
Source/downgradient	5	5	5	5	5	0	0	0
Background/upgradient	0	0	0	0	0	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0

See notes at end of table.

Table 3-14 (Continued) Summary of Laboratory Analytical Program, Site 4, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP	TCL-CLP	TCL-CLP	TAL-CLP	TPH	TOC	TDSs	TSSs
	VOAs	SVOAs	Pest/PCBs	Inorganics				
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Three existing wells and eight new wells.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and  
Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

Table 3-15 Summary of Laboratory Analytical Program, Site 5, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Subsurface Soil								
Source/downgradient	8	8	8	8	8	12	0	0
Background/upgradient	4	4	4	4	4	0	0	0
QC samples (number estimated)								
Trip blank <sup>2</sup>	3	0	0	0	0	0	0	0
Rinsate blank <sup>3</sup>	3	3	3	3	3	3	0	0
Duplicate <sup>4</sup>	2	2	2	2	2	2	0	0
Matrix spike <sup>5</sup>	1	1	1	1	1	0	0	0
Matrix spike duplicate <sup>6</sup>	1	1	1	1	1	0	0	0
Groundwater <sup>7</sup>								
Source/downgradient	6	6	6	12	6	0	6	6
Background/upgradient	3	3	3	6	3	0	3	3
QC samples (number estimated)								
Trip blank	2	0	0	0	0	0	0	0
Rinsate blank	2	2	2	2	2	0	2	2
Duplicate	1	1	1	1	1	0	1	1
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Water								
Source/downgradient	2	2	2	4	2	0	2	2
Background/upgradient	2	2	2	4	2	0	2	2
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1
Duplicate	1	1	1	1	1	0	1	1

See notes at end of table.

Table 3-15 (Continued) Summary of Laboratory Analytical Program, Site 5, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/downgradient	2	2	2	2	2	0	0	0
Background/upgradient	2	2	2	2	2	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil								
Source/downgradient	6	6	6	6	6	0	0	0
Background/upgradient	0	0	0	0	0	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0

See notes at end of table.

Table 3-15 (Continued) Summary of Laboratory Analytical Program, Site 5, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Three existing wells and six new wells.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and

Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

Table 3-16 Summary of Laboratory Analytical Program, Site 6, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorgani cs	TPH	TOC	TDSs	TSSs
Subsurface Soil								
Source/downgradient	36	36	36	36	36	12	0	0
Background/upgradient	4	4	4	4	4	0	0	0
QC samples (number estimated)								
Trip blank <sup>2</sup>	7	0	0	0	0	0	0	0
Rinsate blank <sup>3</sup>	7	7	7	7	7	7	0	0
Duplicate <sup>4</sup>	4	4	4	4	4	4	0	0
Matrix spike <sup>5</sup>	2	2	2	2	2	0	0	0
Matrix spike duplicate <sup>6</sup>	2	2	2	2	2	0	0	0
Groundwater <sup>7</sup>								
Source/downgradient	8	8	8	16	8	0	8	8
Background/upgradient	3	3	3	6	3	0	3	3
QC samples (number estimated)								
Trip blank	2	0	0	0	0	0	0	0
Rinsate blank	2	2	2	2	2	0	2	2
Duplicate	2	2	2	2	2	0	2	2
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Water								
Source/downgradient	2	2	2	4	2	0	2	2
Background/upgradient	1	1	1	2	1	0	1	1
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1

See notes at end of table.

Table 3-16 (Continued) Summary of Laboratory Analytical Program, Site 6, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorgani cs	TPH	TOC	TDSs	TSSs
Duplicate	1	1	1	1	1	0	1	1
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/downgradient	2	2	2	2	2	0	0	0
Background/upgradient	1	1	1	1	1	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil <sup>8</sup>								
Source/downgradient	5	5	5	5	5	0	0	0
Background/upgradient	0	0	0	0	0	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0

See notes at end of table.

Table 3-16 (Continued) Summary of Laboratory Analytical Program, Site 6, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorgani cs	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>Three existing wells and eight new wells.

<sup>8</sup>Surface soil samples will also be analyzed for polychlorinated dibenzodioxins.

Notes: Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and  
Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

Table 3-17 Summary of Laboratory Analytical Program, Site 7, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Subsurface Soil								
Source/downgradient	8	8	8	8	8	9	0	0
Background/upgradient	8	8	8	8	8	0	0	0
QC samples (number estimated)								
Trip blank <sup>2</sup>	3	0	0	0	0	0	0	0
Rinsate blank <sup>3</sup>	3	3	3	3	3	3	0	0
Duplicate <sup>4</sup>	2	2	2	2	2	2	0	0
Matrix spike <sup>5</sup>	1	1	1	1	1	0	0	0
Matrix spike duplicate <sup>6</sup>	1	1	1	1	1	0	0	0
Groundwater <sup>7</sup>								
Source/downgradient	6	6	6	12	6	0	6	6
Background/upgradient	3	3	3	6	3	0	3	3
QC samples (number estimated)								
Trip blank	2	0	0	0	0	0	0	0
Rinsate blank	2	2	2	2	2	0	2	2
Duplicate	1	1	1	2	1	0	1	1
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Water								
Source/downgradient	2	2	2	4	2	0	2	2
Background/upgradient	2	2	2	4	2	0	2	2
QC samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	1	1
Duplicate	1	1	1	2	1	0	1	1

See notes at end of table.

Table 3-17 (Continued) Summary of Laboratory Analytical Program, Site 7, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Sediment								
Source/downgradient	2	2	2	2	2	0	0	0
Background/upgradient	2	2	2	2	2	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0
Surface Soil								
Source/downgradient	4	4	4	4	4	0	0	0
Background/upgradient	0	0	0	0	0	0	0	0
QC Samples (number estimated)								
Trip blank	1	0	0	0	0	0	0	0
Rinsate blank	1	1	1	1	1	0	0	0
Duplicate	1	1	1	1	1	0	0	0

See notes at end of table.

Table 3-17 (Continued) Summary of Laboratory Analytical Program, Site 7, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Gulfport, Mississippi

Sample Type	Number of Samples for Laboratory Analysis <sup>1</sup>							
	TCL-CLP VOAs	TCL-CLP SVOAs	TCL-CLP Pest/PCBs	TAL-CLP Inorganics	TPH	TOC	TDSs	TSSs
Matrix spike	1	1	1	1	1	0	0	0
Matrix spike duplicate	1	1	1	1	1	0	0	0

<sup>1</sup>To be analyzed in conformance with Level IV data quality objectives (DQOs).

<sup>2</sup>Trip blank frequency, one per cooler.

<sup>3</sup>Rinsate blank frequency, one per day.

<sup>4</sup>Duplicate frequency, 1 per 10 samples of each matrix.

<sup>5</sup>Matrix spike, 1 per 20 samples (or less) of each matrix shipped per day.

<sup>6</sup>Matrix spike duplicate, one duplicate of each matrix spike collected each day.

<sup>7</sup>One existing well and eight new wells.

Notes: Upgradient and downgradient directions are assumed at this time.

Additional program - specific QC samples include:

Preservative blanks, one set collected at the beginning and end of the program, and

Field blanks, one collected from each water source used during the program.

TCL-CLP = target compound list-contract laboratory program.

VOAs = volatile organic analytes.

SVOAs = semivolatile organic analytes.

Pest/PCBs = pesticide/polychlorinated biphenyls.

NR = not requested.

QC = quality control.

**SECTION 4**

#### 4.0 QUALITY ASSURANCE PROJECT PLAN

The Quality Assurance Project Plan (QAPP) provides procedures to be followed so that data acquired during the RI/FS will be of known quality and reliability. This QAPP contains policies, organization, objectives, functional activities, and specific QA/QC procedures that will be used by ABB-ES and its subcontractors to conduct the investigation.

4.1 FACILITY BACKGROUND. Two previous studies were conducted at NCBC Gulfport to assess potential sources of contamination. An Initial Assessment Study (IAS) was conducted in 1985 and a Verification Study in 1987. Based on these studies, seven sites were identified for remedial investigation. These sites are:

- Site 1, Disaster Recovery Disposal Area
- Site 2, WWII Landfill
- Site 3, Northwest Landfill and Burn Pit
- Site 4, Golf Course Landfill
- Site 5, Heavy Equipment Training Area Landfill
- Site 6, Fire-Fighting Training Area
- Site 7, Rubble Disposal Area

The RI/FS process will be conducted on these seven sites to determine the nature and extent of contamination, assess the potential threat to human health and environment, and develop remedial action alternatives on sites where a threat, if any, is identified.

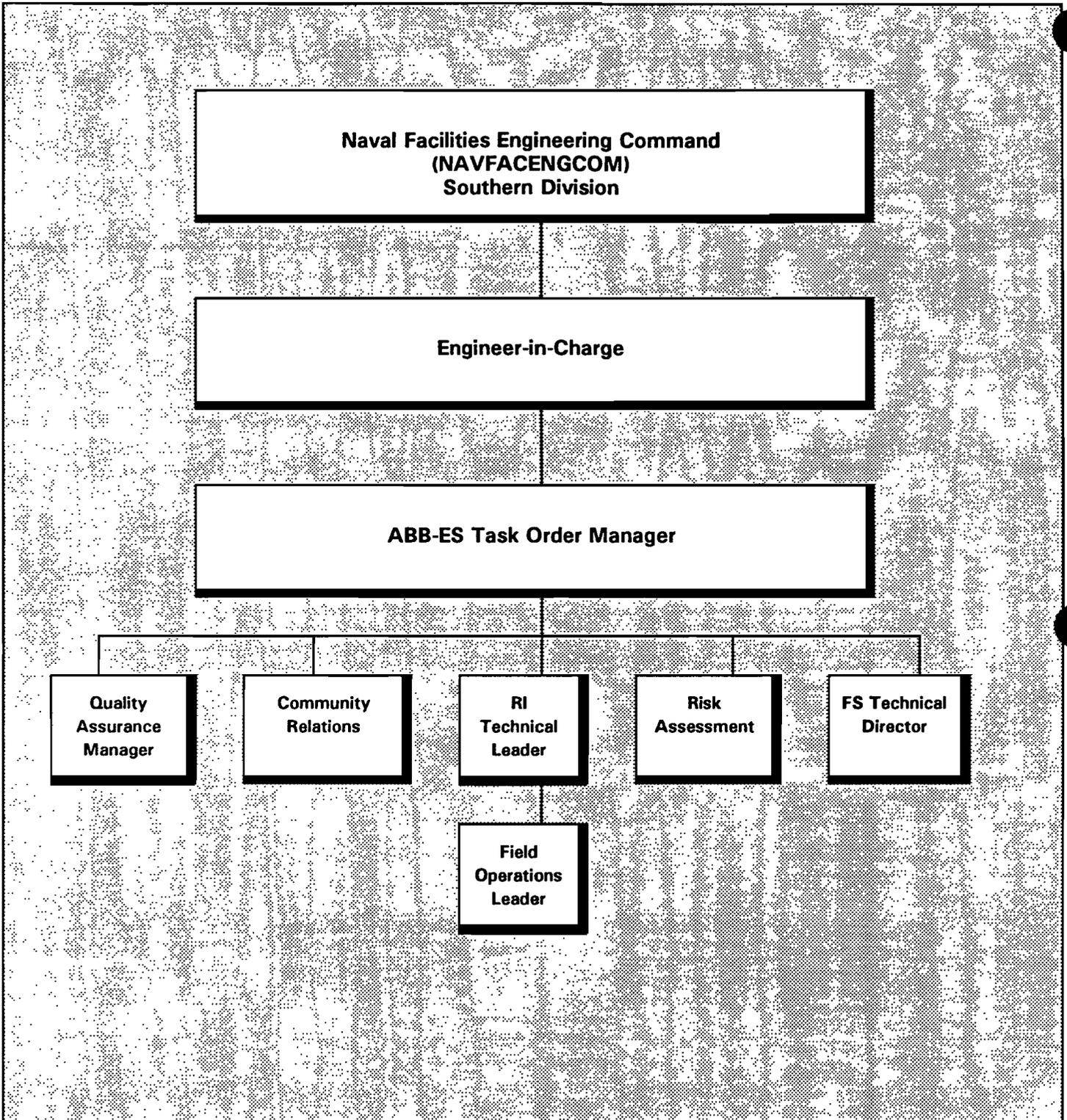
4.2 PROJECT ORGANIZATION. The RI/FS planning documents have been prepared under the CLEAN contract with SOUTHNAVFACENGCOM. Key positions in the project structure are highlighted below and the project organization is depicted in Figure 4-1.

SOUTHNAVFACENGCOM SOUTHNAVFACENGCOM is responsible for establishing policy and guidance for the CLEAN program. SOUTHNAVFACENGCOM awards contracts, approves funding, and has primary control of report release and interagency communication.

NCBC Gulfport Environmental Coordinator The environmental coordinator will coordinate and monitor RI/FS activities at the NCBC Gulfport. The coordinator maintains a working relationship with local, State, and Federal regulatory agencies.

SOUTHNAVFACENGCOM Engineer-in-Charge (EIC) The SOUTHNAVFACENGCOM EIC is responsible for the technical and financial management of the RI/FS and design activities at NCBC Gulfport. The EIC is the primary project contact. He prepares the project statement of work; develops the project Site Management Plan; manages project scope, schedule, and budget; and provides technical review and approval of all deliverables. The EIC will be responsible for changes in the scope of work determined during Project Managers' Meetings.

Task Order Manager The ABB-ES Task Order Manager (TOM) for the NCBC Gulfport RI/FS is responsible for evaluating the appropriateness and adequacy of the technical and engineering services that are provided.



**FIGURE 4-1  
PROJECT ORGANIZATION**



**RI/FS SAMPLING AND  
ANALYSIS PLAN**  
  
**NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

The TOM is responsible for ABB-ES resource management and for ensuring that the project fulfills the requirements of the Contract Task Order. The TOM is responsible for the daily conduct of work, including integration of input from supporting disciplines and subcontractors

Remedial Investigation (RI) Technical Leader The RI is responsible for the quality and completeness of data gathered during the RI field program, including overall management and coordination of field work, and supervision and scheduling of work.

Field Operations Leader (FOL) The FOL will be responsible for ensuring that field activities are performed consistent with the project workplan and supporting documents. This will include appropriate logging and documentation of standard and approved drilling and monitoring well installation methods to ensure that pertinent drilling and testing information is obtained during the exploration program. Other responsibilities include oversight of sampling activities and site characterization studies.

Risk Assessment The risk assessment leader will be responsible for the public health and the ecological assessment, and he will plan and perform the risk assessment supported by RI data. The risk assessment leader will identify potential exposure pathways, evaluate available data, and propose compound target levels within acceptable risk ranges.

Quality Assurance Manager (QAM) The QAM will be responsible for ensuring that field and laboratory activities support DQOs and conform with the project workplan. The QAM will perform periodic field and laboratory audits to monitor conformance with requirements.

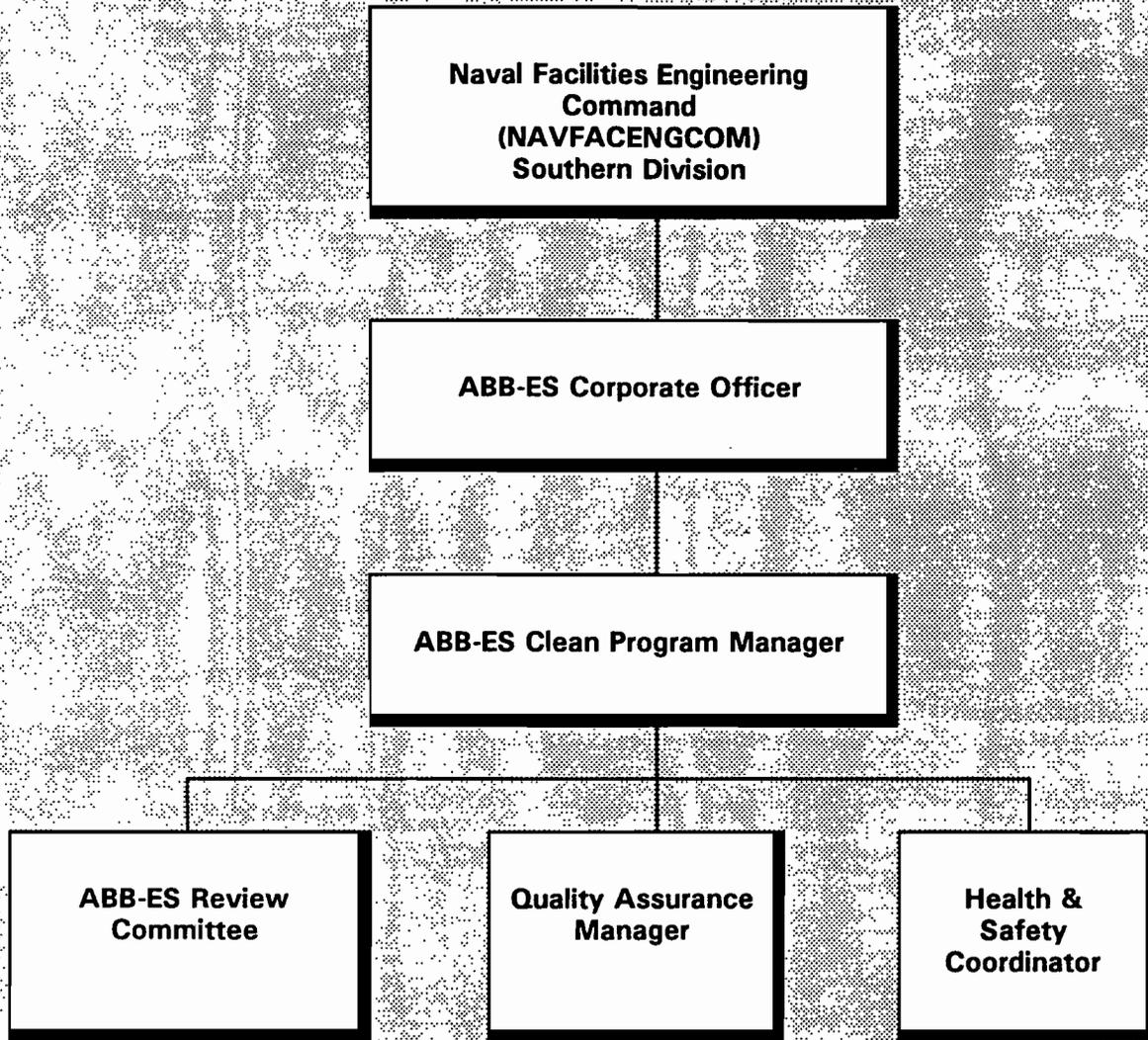
Feasibility Study (FS) Technical Director The FS technical director will be responsible for coordinating FS activities and for ensuring that the FS progresses in accordance with project plans and supporting documents. The FS technical director will oversee development of remedial alternatives and records of decision.

Community Relations Director The community relations director will be responsible for providing community relation support activities, if so requested by NCBC Gulfport. Support may include activities such as the development of fact sheets and press releases, or community interviews.

4.3 PROGRAM ORGANIZATION. The following narrative highlights key individuals in the ABB-ES CLEAN program and the program organization is depicted in Figure 4-2.

SOUTHNAVFACENGCOM SOUTHNAVFACENGCOM is responsible for establishing policy and guidance for the CLEAN program. SOUTHNAVFACENGCOM awards contracts, approves funding, and has primary control of report release and interagency communication.

Corporate Officer The Corporate Officer and Vice-President of Southeastern Regional Operations is responsible for committing the corporate resources necessary to conduct the program work activities, supplying corporate-level input for problem resolution, and assisting the TOM as needed in project implementation.



**FIGURE 4-2  
PROGRAM ORGANIZATION**



**RI/FS SAMPLING AND  
ANALYSIS PLAN**  
  
**NAVAL CONSTRUCTION  
BATTALION CENTER  
GULFPORT, MISSISSIPPI**

Program Manager The program manager is the ABB-ES CLEAN Program Manager and is responsible for administration and management of the ABB-ES SOUTHNAVFACENCOM CLEAN contract. In this position, the program manager is able to perceive program needs, promote technology and other information transfers between various CLEAN projects, and direct resources as appropriate for effective and timely completion of program activities.

Internal Review Committee A Board of Technical Directors, consisting of senior technical staff from the ABB-ES team, supports the TOM by reviewing technical aspects of the project so that services (1) reflect the accumulated experience of the firm, (2) are produced according to corporate policy, and (3) meet the intended needs of the project. The primary function of the committee is to support the application of technically-sound methodologies and the development of defensible data, interpretations, and conclusions. The committee will consist of QAM and others as appointed.

Quality Assurance (QA) Coordinator The Task Order Manager is supported by a QA Coordinator who will report to the Program Manager. The QA Coordinator, to be appointed, will oversee the implementation of appropriate NEESA and USEPA protocols. The QA Coordinator will also work with the Task Order Manager to establish QC procedures.

Health and Safety Coordinator The Health and Safety Coordinator is responsible for project team compliance with ABB-ES corporate requirements and the CLEAN Program HASP. Conformance with safety protocols will be assessed through periodic site visits and daily supervision by the site leaders.

4.4 DATA QUALITY OBJECTIVES (DQOs). The intended use of data and the required DQOs are best defined during the planning stages to ensure that collection, decontamination, containerization, shipping, and analytical methods are consistent with the degree of confidence required of the resultant data. The following sections provide a brief description of U.S. Environmental Protection Agency (USEPA) DQO levels and identifies the levels that are associated with each RI/FS field task.

4.4.1 DQOs, General Description DQOs refer to standards for analytical precision, accuracy, representativeness, completeness, and comparability (PARCC). Five DQO levels have been defined by the USEPA: Level I, Field Screening; Level II, Field Analysis; Level III, Laboratory Analysis; Level IV, Contract Laboratory Program-Routine Analytical Services (CLP-RAS); and Level V, Nonconventional Parameter Analysis (USEPA, 1987).

The Naval Energy and Environmental Support Activity (NEESA) has adopted three of these levels as QA requirements; Levels C, D, and E, that correspond with USEPA Levels III, IV, and V (NEESA, 1988). For the purposes of this document, the USEPA nomenclature (Levels I through V) will be used.

The DQO level needed for a specific task is generally based on the intended use of the data and on the limitations of the analytical instrumentation. Many field screening and field-analytical techniques are intended to provide a rapid turn-around time and qualitative data for decision making in the field. Field techniques necessarily involve rugged instrumentation with less sample preparation and rapid analysis. More precise and accurate analytical methods are used when both qualitative and quantitative data are needed, such as to support site characterization, confirmation, enforcement, treatability, and/or remedial

action. The five broad categories of data quality used in the RI/FS process are described below.

Level I, Field Screening Field screening provides rapid real-time results that can be used to determine optimal placement of sampling locations and for health and safety support. Data that are generated will provide information concerning the presence or absence of certain constituents or groups of constituents. The data are generally qualitative rather than quantitative.

Level I sampling requirements include the use of equipment and sampling containers that are clean (soap and tap water), visibly free of contamination, and free of analytes detectable by the screening method employed (USEPA, 1987).

Level II, Field Analysis Field analysis includes the use of more sophisticated analytical instruments in the field, including on-site gas chromatographs (GCs) and mobile laboratories. The data that are generated may be both qualitative and quantitative, but the degree of QA/QC achievable may be more variable than with laboratory analysis.

Level II sampling and equipment requirements include the use of sampling equipment that is constructed of material that is compatible with the parameters being analyzed (e.g., PVC for inorganic parameter analyses, or chrome-plated material for organic parameter analyses) and field-cleaning procedures that include a potable water and soap scrub followed by a potable water rinse (or steam cleaning or high pressure washing).

The use of potable water is limited only by the parameters being analyzed for and the minimum quantitation limits of the analytical method; water containing up to one half the minimum quantitation limit of the parameters of concern may be used. A minimum of 5 percent of samples collected for DQO Level II analysis should be split for DQO Level IV analysis. Level IV DQOs may not be attainable for analyses other than those performed using USEPA Contract Laboratory Program (CLP) methods. These samples must be representative of all samples that are analyzed in the field (USEPA, 1991a).

Level III, Laboratory Analysis Laboratory analytical data are generated using USEPA-approved methods to achieve a level of confidence set by specified QA/QC protocols. Level III DQOs are appropriate for data collected for most activities including site characterization (i.e., qualitative and quantitative identification of contaminants and contaminant source(s) and extent of migration) and treatability studies. This level corresponds to NEESA Level C.

Level III field methods, decontamination procedures, and sampling equipment construction materials are as specified in the *USEPA Standard Operating Procedures and Quality Assurance Manual* (USEPA Standard Operating Procedures [SOPs] [USEPA, 1991a]). Cleaning of down-hole drilling or excavation equipment must be performed as with Level IV requirements with the exclusion of the deionized water rinse, the double rinse with pesticide-grade isopropanol, and the rinse with organic-free water. All other cleaning and decontamination guidance must be followed.

When wells are constructed using materials that are not inert with respect to the contaminants being analyzed, data that are collected from those wells are DQO Level III or lower for those incompatible analytes, even if DQO Level IV analytical procedures are used.

Level III QA/QC sampling blank requirements include:

- a minimum of one equipment rinsate blank per week for each week sampling equipment is field cleaned;
- if samples are preserved, a preservative blank must be collected and analyzed at the beginning and end of the study; and
- a blank of the rinse water must be collected and analyzed prior to beginning the study and at the end of each week that sampling equipment is field cleaned.

A minimum of 5 percent of samples that are collected for DQO Level III analysis using CLP methods should be split for DQO Level IV analysis. These samples must be representative of all samples submitted for Level III analysis (USEPA, 1991a). Level IV DQOs may not be achievable for analyses that are other than CLP.

Level IV, Contract Laboratory Program (CLP) Level IV DQOs are the most stringent and are defined as data that are collected in accordance with USEPA SOPs (USEPA, 1991a) and analyzed in accordance with the USEPA Contract Laboratory Program (CLP) (USEPA, 1991b; 1991c). Data that are collected for characterization and confirmation during an RI/FS, during remedial action, for compliance monitoring, or for enforcement often require Level IV for DQOs. This level corresponds to NEESA Level D.

Level V, Nonconventional Parameter Analysis Individual site or remedial design characteristics may require the analysis of contaminants or conditions for which USEPA-approved methods do not exist; these fall into the category of nonconventional parameter analyses. The Level V DQOs that are associated with these types of analyses must, by definition, be defined on an individual basis. The DQOs that are identified will be dependent on the specific collection method, decontamination procedures, and analyses to be used. This level corresponds with NEESA Level E.

4.4.2 Task Specific DQOs Tasks for the RI/FS at NCBC Gulfport will involve data collection with DQOs ranging from Level I through Level IV. The following narrative discusses the primary RI/FS tasks for NCBC Gulfport and the associated DQO level.

- **Geophysical Survey, Level I:** Magnetometer, terrain conductivity, and ground-penetrating-radar (GPR) surveys will be used to define the perimeter of disposal areas. Data that are generated as a result of the surveys will indicate the presence or absence of subsurface objects (e.g., drums or refuse) and structures. Terrain conductivity data can also provide qualitative information regarding high concentrations of conductive or nonconductive constituents in shallow groundwater. Data requirements are primarily qualitative.
- **Soil Sample Screening, Level I:** Split-spoon samples from discrete depths in soil borings will be screened in the field with an organic vapor analyzer (OVA), providing Level I data concerning the presence or absence of volatile compounds.
- **Soil and Groundwater Sample Screening, Level II:** TerraProbe soil sampling will be conducted at Site 6 and field gas chromatography

(GC) and infrared spectroscopy analyses will be performed. Field gas chromatography (GC) analyses will also be performed on groundwater samples collected from new and existing monitoring wells. The Level II data for soil samples will be used to assist in placement of soil borings. The Level II groundwater data will be used to screen samples for volatile organic contamination to allow field decisions regarding the need for additional monitoring wells at any of the seven sites.

- **Air-Quality Monitoring, Level I:** For health and safety purposes, air quality will be monitored in the breathing zone by OVA and/or by photoionization detector (PID), providing Level I data concerning the presence or absence of volatile compounds.
- **Field Parameter Analysis, Levels I and II:** Field measurements of surface water and groundwater temperature, pH, and specific conductance will be performed to screen samples for laboratory analysis and to determine aquifer stabilization during well purging. These measurements are both quantitative and qualitative, and the data that are generated can conform with both Level I and II DQOs.
- **Characterization and Confirmation Sampling, Level IV:** Groundwater and soil samples that are collected from monitoring wells and split-spoon soil sampling, respectively, and all surface water and sediment samples that are collected during the RI field program will be collected and analyzed in conformance with Level IV DQOs and CLP methods.
- **Treatability Studies, Level III:** Samples that are collected to evaluate the effectiveness and feasibility of selected remedial alternatives will be analyzed in conformance with Level III DQOs. A minimum of 5 percent of these samples will be split for Level IV DQO analysis.
- **Remedial Monitoring and Confirmation Sampling, Level IV:** Samples that are collected to confirm the input and output of treatment methods and samples that are collected to confirm the effectiveness of remedial actions will be analyzed in conformance with Level IV DQOs.

These RI/FS data will be used, as applicable, for health and safety monitoring, site characterization, public health and ecological risk assessment, evaluating remedial alternatives, treatability studies, remedial action, and monitoring.

**4.4.3 Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) Definition** Parameters that are used within the data-validation process to evaluate data quality include measurement of PARCC. The achievable limits for these parameters vary with the DQO level of the data. The limits used for CLP analytical data in this RI program will be those set by the CLP for Level IV DQOs. These parameters are defined here and methods of calculation are discussed in Section 3.6.2.

**Precision and Accuracy** Precision, the ability to replicate a value, and accuracy, the ability to obtain a true value, are addressed for all generated data. Precision and accuracy requirements vary depending on intended data uses

and are selected in accordance with project requirements. The DQOs for precision and accuracy are established for each major parameter to be measured at the site based on knowledge of the capabilities of available measurement systems and the detection limits that are required.

Representativeness Representativeness expresses the degree to which sample data depict an existing environmental condition. Representativeness is accomplished through proper selection of sampling locations and sampling techniques and collection of a sufficient number of samples.

The sampling locations in this RI will be chosen in a biased approach based on previous analytical data, screening data that are collected in the field, and apparent and measured flow directions. Sampling and analytical protocols will be chosen so that measurements of samples will be as representative of the media and conditions being measured as possible.

Sample collection, handling, and documentation will be performed in accordance with USEPA Region IV SOPs (USEPA, 1991a) to ensure that collection and handling techniques do not alter the sample and to provide an adequate tracking mechanism from the time of collection through laboratory analysis.

Completeness The characteristic of completeness is a measure of the amount of valid data that is obtained compared to the amount of data originally intended to be obtained. The completeness goal for DQO Levels III and IV has been chosen as 80 percent, which is consistent with CLP requirements of 80 to 85 percent.

Field activities that are performed at DQO Levels I and II are on-site measurement techniques that provide information in real-time or after minimal delay. The completeness achieved for these methods may be more variable than those for standard analytical methods. A higher degree of completeness may be achieved because measurements can be readily repeated; however, site conditions may constrain the use of some techniques, resulting in fewer valid analyses than anticipated.

The sampling objectives described in these planning documents allow for a sufficient number of samples to accomplish the project objectives; however, the number of samples presented are estimates that may be revised based on screening data that are collected in the field. Examples of circumstances that may cause variations might include increasing or decreasing the number of samples that are needed for adequate delineation or characterization, increasing or decreasing the number of samples that are required for characterization of investigation-derived waste, and/or decreasing the number of screening samples if site conditions constrain the use of a particular method.

Comparability The characteristic of comparability reflects the confidence with which one data set can be compared with other measurements and the expression of results that are consistent with other organizations reporting similar data. This will be accomplished through the use of standard techniques for sample collection and analysis and the reporting of results in appropriate units. Comparability of analytical procedures also implies using analytical methodologies that produce results that are comparable in terms of precision, accuracy, and effective range of calibration.

**4.5 SAMPLING PROCEDURES.** Details of investigation and sampling plans (including the rationale, types, location and number of samples) for each site are included in Section 3 of this document. Methodology and collection techniques for screening samples are also presented in the SAP. This section focuses on samples that will be collected for laboratory analysis in conformance with Level IV DQOs, including collection methods, collection devices, requirements for containers, preservation and holding times, sample identification, sample handling, packaging and shipping, sample records, and a definition of QC samples to be collected.

**4.5.1 Soil Boring Samples.** A split-spoon sampler will be used to collect subsurface soil samples below a depth of 5 feet. This sampler consists of a split-steel tube or sample barrel threaded at both ends. A sharpened drive shoe secures the bottom of the barrel and an adaptor secures the top. The adaptor contains a check valve and is threaded to connect directly to the drill rods. The split-spoon is driven into undisturbed soil below the casing or hollow-stem auger. After the sampler has been driven, it is withdrawn from the borehole and the sampler is opened by removing both drive shoe and adaptor.

Equipment that is required to collect split-spoon samples from soil borings includes the items listed below:

- field logbook
- sample tags and labels and appropriate forms and documentation
- glass or stainless-steel mixing bowls
- stainless-steel spoons and spatulas
- appropriate sampling containers
- split-spoons
- decontamination equipment and supplies
- personnel protective equipment, as necessary
- appropriate equipment (OVA or PID) for downhole, breathing zone, and sample screening

**Sample Collection** Sample collection and documentation procedures include the following steps.

1. The soil will be scanned with an OVA or PID and the results will be recorded in the field logbook.
2. The sample will be visually examined and its physical characteristics will be recorded using the Unified Soil Classification System (USCS) (e.g., texture, color, consistency, moisture content, layering, and other pertinent data).
3. The portion(s) of the sample that is (are) selected for chemical analysis will be removed and placed into appropriate containers using a clean spatula. Soil that is intended for volatile organic analysis will be placed in 40-ml containers and capped as quickly as possible. Soil that is intended for other types of analyses will be placed in a glass or stainless-steel mixing bowl and thoroughly mixed using a stainless-steel spoon. Once the sample has been thoroughly mixed, sample material will then be placed in the appropriate sample containers.

4. Any excessively disturbed or loose material found in the top portion of the sampler that may not be representative of the interval sampled will be discarded. This material will be discarded with other boring spoils at each boring location.
5. All containers will be properly labeled and chain-of-custody documents will be prepared. Sample location, description, sample numbers, and other pertinent information will be recorded in the field logbook.
6. The sampling device(s) will be decontaminated in accordance with specified procedures.

The sampler will exercise considerable care while collecting samples for analysis. Methods to assure that high quality samples are collected are described below.

1. The sample will be obtained from undisturbed soil below the casing or auger. This will be accomplished by monitoring or checking the drill crew's measurements, observing the sampling process, and examining the sample once it is retrieved.
2. Any portions of the sample that may have become contaminated by contacting the casing, auger, or drilling fluids (e.g., bentonite, drilling mud, or native intervals mixed with potable water) will be carefully removed and discarded.
3. Conserve sample volume, because under certain soil conditions it may be difficult or impossible to achieve good sample recovery with split-spoons.

Procedures that will be employed to prevent cross contamination during test-boring sampling operations include the following.

- Samples will be collected immediately after the boring is advanced to the desired sampling elevation.
- The down-hole sampling tools will be decontaminated prior to the collection of each sample.
- The drilling techniques and procedures to be used, particularly the use of drilling fluids, will be carefully evaluated for each site. If wet-rotary drilling is required, such as for drilling hard rock or in the event of unstable boreholes, only potable water will be used (no drilling mud).

4.5.2 Surface Soil and Sediment Samples Equipment and materials that will be involved in the collection of surface soil samples include:

- field logbook
- sample tags and labels and the appropriate forms and documentation
- appropriate sample containers
- plastic zip-top bags and sealing tape
- decontamination equipment and supplies
- protective clothing and gear

- appropriate equipment (OVA or PID) for breathing zone and sample screening
- stainless-steel and/or Teflon™-lined pans, trays, or bowls
- stainless-steel and/or Teflon™-lined scoops, shovels, trowels, spoons, or spatulas
- an Eckman or Ponar dredge for deep water sediment sampling

The following describes steps for sample collection.

1. Personal protective clothing and equipment will be worn, as necessary.
2. Plastic sheeting will be placed on a flat, level surface near the sampling area, if possible. Decontamination equipment and supplies, sampling equipment, sampling containers, and insulated cooler will be placed on separate plastic sheeting.
3. Sample locations, soil descriptions, sample numbers, and other pertinent information will be documented.
4. Surface soil to a depth of 1 to 2 cm will be removed before sample collection (not necessary for sediment samples).
5. A clean stainless-steel or Teflon™-lined scoop, trowel, or shovel will be used to obtain a minimum of three sample volumes or the volume needed to fill the specified sample container.
6. Volatile organic compound vials will be filled and capped as quickly as possible and the remainder of sample will be mixed directly in a clean stainless-steel or Teflon™-lined tray or bowl. Each of the remaining sample containers will be filled and capped.
7. Each sample container will be labeled with the appropriate information. Chain-of-custody forms will be filled out and samples will be properly packaged.

4.5.3 Groundwater Sample Collection Procedures Groundwater samples for laboratory analyses will be collected from existing and new monitoring wells. The purging and sampling techniques that are outlined below will help ensure the collection of a representative sample.

Purging Technique Wells will be purged before groundwater sampling to remove stagnant water so that a representative sample may be obtained. Wells will be sampled within 24 hours after purging. Purging equipment includes:

- pump (centrifugal or submersible), pump tubing, Teflon™ or stainless-steel bailer, and line with a Teflon™ leader
- power source (e.g., generator), if required
- water-level indicator or weighted surveyor tape
- temperature, conductivity, pH meter
- personal protective equipment as specified in the site-specific health and safety plan
- decontamination supplies
- waste disposal drums, if required.

Two common procedures that may be used to purge a monitoring well are presented below. These procedures include the indicator-parameter method of well purging and the volumetric method of well purging. The actual method to be used in the field will be specific to the site or investigation. However, the purging of standing well water is considered complete when one of the following is achieved:

- (1) at least three well volumes have been purged and in-situ parameters are determined to have been stabilized by taking two consecutive measurements at 5-minute intervals, that differ by no more than 10 percent.
- (2) five well volumes have been purged; or
- (3) the well has been pumped dry.

#### Volumetric Method of Well Purging

1. Personal protective clothing and equipment will be worn as specified in the site-specific HASP.
2. The well cover will be opened and the condition of the wellhead will be checked.
3. The volume of water in the well will be determined by measuring distance from the bottom of the well to the static water level (height of standing water), then measuring the inside diameter of well or casing. Water-level measurements will be measured from the same point each time it is measured with minimum measurements made in 0.1 foot. Note: more stringent measurements may be required for specific project programs (i.e., 0.01 foot).
4. Calculate well volume by using the follow formula (or its equivalent):

$$v = 0.041d^2h$$

where:

h = height of standing water column in feet,

d = inside diameter of well in inches, and

v = volume of water in gallons.

5. The pump and tubing, or bailer will be prepared and lowered into casing.
6. The number of well volumes specified in project plans will be removed, the length of time taken to purge a measured amount of water will be measured, the flow rate will be calculated, and the well will be allowed to purge for the necessary length of time.
7. If the well goes dry during pumping or bailing, one is assured of removing all water that had prolonged contact with the well casing or air.
8. All pertinent data will be recorded in field logbook.

9. The pump assembly or bailer will be removed from the well and decontaminated, as required.
10. The produced water will be disposed of as required by project workplan.

#### Indicator-Parameter Method of Well Purging

1. Personal protective clothing and equipment will be worn as specified in the HASP.
2. The well cover will be opened and the condition of the wellhead will be checked.
3. The depth to static water level and depth to bottom of well will be determined.
4. Probes of indicator meter(s) (temperature, conductivity, and pH) in a clean beaker will be set up. Probes will be allowed to equilibrate according to manufacturer's specifications.
5. All readings will be recorded in field logbook (include the time of day that the measurement was made).
6. The pump and tubing, or bailer, will be assembled and lowered into casing.
7. Pumping or bailing will then be started.
8. Indicator parameter readings at predetermined intervals will be recorded.
9. A record of appropriate volumes of water produced will be maintained.
10. The pumping or bailing will be continued until indicator-parameter readings remain stable within ~10 percent for two consecutive recording intervals (5 minutes apart) and at least three well volumes have been purged.
11. Purging will continue until the discharge stream is clear.
12. The pump assembly or bailer will be removed from the well and decontaminated as required.
13. The well cover will be locked before leaving.
14. Produced water will be disposed as required by the project workplan or proposed by the NCBC Gulfport personnel.
15. Note: All fuel-powered units will be placed away from and downwind of any site activity (purging, sampling, etc.).

In order to prevent backflow of purged water into wells, submersible pumps must be equipped with a check valve, and centrifugal pumps must have a foot valve.

When sampling for organics or metals, certain precautions must be taken to minimize the risk of contaminating the groundwater sample with the pump. In general, any parts of the pump and tubing that contact the groundwater must be constructed of Teflon™ and/or stainless steel.

Sampling Procedures for Monitoring Wells Where possible, sampling of monitoring wells will proceed from the upgradient (background) wells to the downgradient (or potentially contaminated) wells. Wells with free product will not be sampled for trace chemical analyses unless necessitated by special circumstances or client request. The sampling locations will be recorded in the field logbook and indicated on a site map.

Groundwater sampling equipment includes:

- bailers that are constructed of appropriate material (Teflon™, stainless-steel, or polypropylene),
- Teflon™ leaders (to attach lines to bailers),
- clean (nylon twine or monofilament) line of sufficient length to lower bailer (new lanyard must be used for each well),
- a pump (type dictated by physical conditions),
- silicone tubing,
- 45-micrometer ( $\mu\text{m}$ ) in-line filters,
- appropriate sample containers with labels and preservatives, as required,
- coolers with wet ice,
- water-level meter and/or other water-level measuring device,
- temperature, conductivity, pH, dissolved oxygen, and organic vapor meters, if required,
- plastic sheeting,
- decontamination supplies, as required, and
- personal protective clothing and equipment, if required by the HASP.

Groundwater sampling procedures include the following steps.

1. Protective clothing and equipment will be worn, as necessary.
2. The site will be prepared for sample collection by covering the ground surface around the well head with plastic sheeting.
3. The well will be opened and the condition of casing and cap will be noted. The well will be checked for vapors using vapor analyzing equipment.
4. The static water level and depth to well bottom will be determined using water-level meter/tape. Wells screened at the confining layer will be checked for Dense Non-Aqueous Phase Levels (DNAPLs) using an oil/water interface probe. This information will be recorded in field logbook.
5. The purge volume will be determined and the well will then be purged. Wells containing DNAPLs, if any, will not be purged or sampled unless requested by the client or regulatory agency.

7. The bailer or pump intake will be lowered (as appropriate for parameters of concern) into well. The bailer must enter the water slowly to prevent aeration, particularly when samples for volatile organic and semivolatile organic analysis are being collected. The filled bailer will be retrieved to the surface.
8. The samples will be collected, as follows.
  - Volatile organic sample vials will be directly filled from Teflon™ or stainless-steel bailer with as little agitation as possible. The vials will be filled until the sample forms a convex meniscus above the top edge of the vial and then carefully capped. Sample bottles will then be inverted and tapped to check for air bubbles.
  - Other samples will be placed directly in the appropriate container from the discharge tubing of the pump or Teflon™ or stainless-steel bailer. Filtration of groundwater samples for inorganic analyses will be achieved by using a peristaltic pump, silicone (or other suitable material) tubing, and 0.45- $\mu\text{m}$  in-line filters. Both filtered and unfiltered samples will be collected.
9. Preservatives will be added (if needed) and samples containers will then be capped, sealed, and properly labeled. Filled containers will be placed into the cooler(s) immediately.
10. Sample types and amounts collected, and time and date of collection will be recorded in the field logbook. The chain-of-custody will be prepared and coolers will be prepared for shipment to the laboratory.
11. Sampling equipment (as required) will be decontaminated and garbage will be disposed of.

Groundwater sampling (or purging) with a bailer for metals and organic compounds will only be done with a stainless-steel or Teflon™ bailer.

Sampling Procedures for Active Potable Wells The techniques used to sample potable wells depends on the construction of the wells. Pumps and plumbing often cannot be bypassed for conventional sampling without first dismantling the equipment. Where possible, active potable wells will be sampled in accordance with Section 4.10 of the USEPA Region IV SOP (USEPA, 1991a).

Potable water sampling procedures include the following steps.

1. Protective clothing and equipment will be worn, as necessary.
2. Tap will be selected that is connected directly to a water main and is not too close to the sink bottom or to the ground. Leaking taps should be avoided.
3. Purge well for 15 minutes or until one volume of water in the well casing and the storage tank is evacuated.

3. Purge well for 15 minutes or until one volume of water in the well casing and the storage tank is evacuated.
4. Measure pH, conductivity, and temperature until constant values are obtained.
5. Cold water tap should be opened for 2 to 3 minutes to clear the service line. A smooth flowing water stream is desired.
6. Samples will be collected, handled, and recorded as described in Steps 8 through 11 under the Groundwater Sampling Procedure.

**4.5.4 Surface Water Sample Collection Procedures** Surface water is defined as water that flows over or rests on the land and is open to the atmosphere. This includes ditches, streams, rivers, lakes, ponds, pools, basins, or any other impoundments that fit this definition. Selection of a surface water sample location is based on many factors including: study objectives, water use, physical characteristics of the water body, flow rate, characteristics of anticipated analytical procedures, and accessibility.

Surface water sampling equipment may include:

- personal protective equipment as required
- decontamination equipment and supplies
- stainless-steel or Teflon™ spoons, spatulas, scoops, or dippers
- pond sampler with 1-liter beaker, clamp, and telescoping heavy-duty pole
- dissolved oxygen dunker
- Van Dorn bottle/Kemmerer Sampler
- grab sampler

Pre-preserved sample containers will not be used as surface water collection containers. If samples must be preserved, then the preservative must be added to the container after the sample is collected, or an intermediate collection container must be used to collect the sample, which can then be transferred to the pre-preserved sample container. All surface water samples must be collected by submerging the inverted collection container to desired depth, and then turning it upright while pointing the opening upstream. The sampler should always be positioned downstream of the sampling location.

The sampling procedures for shallow surface water sample collection and deep surface water sample collection are presented below.

**Method of Collecting Samples of Near-Shore Surface Water for Volatile Organic Analysis**

1. Protective clothing and equipment will be worn, as necessary.
2. Unpreserved volatile organic analysis vials will be inverted and slowly but completely submerged into the water and then slowly turned upright to fill. Bottom sediments must not be disturbed. Open end of the vial will be pointed upstream in undisturbed gently flowing water. For inorganic compound analyses, both filtered and unfiltered samples will be collected. Filtration will be done by

using a peristaltic pump, silicone (or other suitable material) tubing, and 0.45- $\mu\text{m}$ , in-line filters.

3. The vial will be capped under water. Air bubbles from the cap will be dislodged before sealing the vial. The vial will be turned upside down and checked for air bubbles. The bottom of the vials will be tapped to dislodge any bubbles that may have formed around the cap or sides. The samples will be discarded and resampled if bubbles are present.
4. The caps will be sealed, the outside of sample vials will be rinsed with deionized water, wiped dry, and labeled. The sample container(s) will be placed in zip-top or other plastic bags and immediately placed in sample cooler.

#### Method for Shallow Surface Water Sample Collection for Nonvolatile and Inorganic Compounds

1. The appropriate flask, dipper, pail, or pond sampler will be used to collect samples. If wading is required, the sample site will be approached from downstream and the actual sample area will not be entered. Extension handles will be used to reach into the sample site.
2. The sample collector will be inverted and immersed into the water and reinverted to fill. Underlying sediments must not be disturbed. A sufficient volume of water to fill all sample containers will be collected. For inorganic analyses, both filtered and unfiltered samples will be collected. Filtration will be done using a peristaltic pump, silicone (or other suitable material) tubing, and 0.4- $\mu\text{m}$ , in-line filters.
3. Sample containers will be sealed, wiped dry, and labeled. Sample information will be documented in the field logbook.

4.6 SAMPLING EQUIPMENT CONSTRUCTION MATERIALS. Table 4-1 details the appropriate construction materials that will be used for selected types of sampling equipment when sampling for specific parameters. Sampling equipment will be constructed of materials that are appropriate for the matrix to be sampled and parameters to be analyzed for. This should prevent or minimize the chance for contamination of the sample by the equipment itself.

4.7 SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES. For the majority of sampling episodes, ABB-ES obtains sample containers from a NEESA-approved subcontract laboratory. ABB-ES and NEESA require all subcontract laboratories to have a current and comprehensive QA program and sample-container requirements that meet USEPA-CLP QA requirements. Sample containers for screening samples may, however, be obtained in a precleaned condition from a commercial source. The origin of sample containers is noted in equipment room files. ABB-ES obtains sample containers from suppliers which meet USEPA-CLP QA requirements; ABB-ES currently contracts with I-CHEM Research, Inc. Records of I-CHEM bottles and their certification paperwork for each bottle lot are maintained by the ABB-ES equipment manager.

Table 4-1 Sampling Equipment, Restrictions, Materials, and Appropriate Uses, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Equipment Type	Use	Permissible Parameter Group	Restrictions and Precautions
<u>Water Sampling</u> <u>Ground Water</u>			
Pumps(')			
1. Positive displacement pumps			
a. Submersible (turbine, helical rotor)	Purging	All parameter groups	1,2,3,4,5,
	Sampling	Demands, nutrients Metals Extractable organics	None 1,2,3,4,6 1,2,3,4,6
b. Submersible (gear drive)	Purging	All parameter groups	1,2,3,4,5,6
	Sampling	Demands, nutrients Metals Extractable organics	None 1,2,3,4,6 1,2,3,4,6
c. Bladder pump (no gas contact)	Purging	All parameter groups	3,4,6
	Sampling	Demands, nutrients Metals VOCs and extractable organics	None 4,7 3,4,6
2. Suction lift pumps			
a. Centrifugal	Purging	All parameter groups	4,5,6,8
b. Peristaltic	Purging	All parameter groups	5,8
	Sampling	Demands, nutrients Metals Extractable organics	None 23 9
3. Bailer			
	Purging	All parameter groups	10, 26
	Sampling	Demands, nutrients Metals VOCs and extractable organics	None 11 10

See notes at end of table.

Table 4-1 (continued) Sampling Equipment, Restrictions, Materials, and Appropriate Uses, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Equipment Type	Use	Permissible Parameter Group	Restrictions and Precautions
<u>Surface Water</u>			
1. Automatic sampler	Sampling	Demands, nutrients, metals	23
2. DO dunker	Composited samples of water column	Demands, nutrients Metals VOC and extractable organics	None 11 13
3. Kemmerer or Van Dorn	Grab samples at specified depth	Demands, nutrients Metals VOCs and extractable organics	None 11 13
4. Peristaltic pump	Sampling	See 2. above	
<u>Field Filtration Units</u>			
	Filtration for dissolved components	Demands, nutrients Tract Metals	15 16
<u>SOLID SAMPLING</u>			
<u>Sediments and Soils</u>			
1. Core Barrel	Sampling	Demands, nutrients Metals VOCs Extractable organics	None 17 18, 24 24
2. Trowel, scoop, spoon or spatula	Sampling and compositing	Demands, nutrients Trace metals Extractable organics	None 11 12, 19
3. Mixing tray	Compositing or homogenizing	Demands, nutrients Trace metals Extractable organics	None 11 25
4. Shovel	Sampling	Demands, nutrients Trace metals, VOCs and Extractable organics	None 20
5. Hand auger, bucket auger	Sampling	Demands, nutrients Trace metals, VOCs and Extractable organics	None 20
6. Split spoon	Sampling	Demands, nutrients Tract meats, VOCs	None 18, 21
7. Shelby tube	Sampling	Demands, nutrients Metals VOCs Extractable organics	None 22 18 None

See notes at end of table.

Table 4-1 (continued) Sampling Equipment, Restrictions, Materials, and Appropriate Uses, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Equipment Type	Use	Permissible Parameter Group	Restrictions and Precautions
<u>Container Sampling</u>			
8. Dredges	Sampling	All parameter groups Extractable Organics	19, 20 18
1. Glass tubing	Sampling	All parameter groups	14
2. Coliwassa tube	Sampling	All parameter groups	13

Key to Restrictions and Precautions

1. Pump must be equipped with a check valve to prevent backflow of purged water into the well.
2. If purging or sampling for organics or metals, this device may be used when no other pumping device is available, because lines cannot be practically constructed of inert materials.
3. If purging or sampling for organics or metals, pump housing should be of stainless-steel and Teflon™ construction.
4. If used as a nondedicated system, pump must be cleaned between wells. Delivery tubing should be precleaned and precut at the base of operations or laboratory. If the same tubing is used during the sampling event, it must be cleaned and decontaminated between use.
5. When purging for organics or metals, the entire length of tubing (or pipe) or the portion that comes in contact with the formation water should be constructed of Teflon™ or stainless steel. If other materials (i.e., rigid PVC, polyethylene, or polypropylene) are used, the following protocols must be followed: (1) contact with formation waters will be minimized by slowly withdrawing the pump from the water column during the last phase of purging, thus removing from the well any water which has contacted the exterior of the pump and/or tubing; and (2) a single well volume will be removed with the sampling device before sampling begins. Tygon™ will never be used for purging when organics are of interest.
6. If sampling for organics or metals, the entire length of tubing (or pipe) or the portion that will come in contact with the formation water must be constructed of Teflon™ or stainless steel.
7. Pump and delivery tubing must be constructed of stainless steel or suitable nonmetallic materials.
8. Must be equipped with foot valve to prevent backflow of purged water into the well.

See notes at end of table.

Table 4-1 (continued) Sampling Equipment, Restrictions, Materials, and Appropriate Uses, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

9. All components of the sample collection system contacting the sample water must be constructed of Teflon™, stainless steel, or glass. The system must be configured such that the sample is collected before the pump head.
10. If purging or sampling for organics or metals, construction must be of stainless steel or Teflon™.
11. Equipment must be constructed of stainless steel or suitable nonmetallic materials.
12. Must be constructed of stainless steel or coated with Teflon™.
13. Must be constructed of stainless steel or glass.
14. If sampling for volatile organic compounds (VOCs), no vacuum can be used to draw up sample.
15. Units must use filters with a pore size of 0.45 micron.
16. When sampling groundwater, units must use high-capacity filters with a pore size of 0.45 micron and be constructed of materials that will not contaminate the sample with trace metals.
17. Liners must be constructed of stainless steel or a suitable nonmetallic material. If a carbon-steel liner is used with the core barrel, the samples for metals shall be taken from the interior part of the core sample.
18. If samples are sealed in the liner for transport to the laboratory, the sample for VOCs organic analysis must be taken from the interior part of the core.
19. Samples for VOCs should not be taken from a composite (mixed) sample.
20. Cannot be constructed of any metal other than stainless steel.
21. If constructed of materials other than stainless steel, then a Teflon™ insert must be used.
22. If constructed of materials other than stainless steel, the sample for metals analysis must be taken from the interior part of the core sample.
23. The flexible tubing used for the peristaltic pump should be medical grade silicone tubing.
24. Liners may be constructed of stainless steel, Teflon™, glass, aluminum, or other suitable liner of metallic construction.
25. Must be constructed of stainless steel, Teflon™, glass, or aluminum.

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Source: ABB-ES Comprehensive Quality Assurance Program Plan.

Notes: VOCs = volatile organic compounds

DO Dunker = Dissolved oxygen dunker

<sup>1</sup>Pumps may not be used in sampling for volatile organic components except when pumps are permanently installed as part of a drinking water system, or if positive displacement stainless steel and Teflon™ bladder pumps are used. If installed as part of a drinking water system, the material construction of the pump and holding tank must be noted in the field documentation.

Preservatives, controlled holding times, and selected container materials may be required to avoid sample degradation or alteration prior to laboratory analysis. Common preservation techniques include pH control, chemical complexation, and refrigeration, or freezing. Holding times are controlled to minimize the time between sample collection and analysis, which in turn minimizes the reaction time for potential mechanisms of analyte loss or alteration. Selected container materials may be required to minimize sorption, leaching, or other interactions between the sample and the container. Amber containers may be required to block the sunlight and reduce photolytic degradation in selected analytes. In general, preservatives, holding times, and container materials are selected to inhibit biological activity; retard degradation or other alteration processes; reduce volatility; and/or reduce sorption, leaching, and complexation. Sufficient sample volumes must be collected to accommodate specified analytical methods and to allow for the analysis of laboratory QA/QC samples, where required.

Sample Containers In general, samples for organic analysis should be stored in glass containers and samples for inorganic analysis should be stored in plastic containers. Because the container specifications depend on the analyte and sample matrix types (as indicated in Table 4-2), separate samples should be taken when both organic and inorganic analyses are required. Containers should be kept in the dark (to minimize biological or photo-oxidation/photolysis breakdown of constituents) until they reach the analytical laboratory. The sample container should generally allow approximately 5 to 10 percent air space ("ullage") to allow for expansion/vaporization if the sample is heated during transport (1 liter of water at 4°C expands by 15 ml if heated to 130°F 55°C). Important exceptions include VOA, COD, and BOD, all of which should not have headspace in containers. The containers should be kept sealed and as far as possible from solvents also being stored. Ideally, solvents should be kept in separate facilities from clean containers and organic-free water.

Preservation Techniques Preservation techniques for selected analytes are presented in Table 4-2. Reagents required for sample preservation will generally be added to the sample containers by the subcontract laboratory prior to shipment. In some instances, preservatives may be added in the field by ABB-ES personnel. Samples will be preserved immediately upon collection in the field. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C with ice. Low-concentration aqueous samples for metals are preserved with nitric acid, whereas low- or medium-concentration soil samples for metals are cooled to 4°C. Samples that should not be immediately preserved in the field include the following:

- Samples that are collected within a hazardous waste site that are known or thought to be highly contaminated with toxic materials should not be preserved. Barrel, drum, closed container, spillage, or other source samples from hazardous waste sites are not to be preserved with any chemical. These samples may be preserved with ice, if necessary.
- Samples that have extremely low or high pH or samples that may generate potentially dangerous gases should not be preserved.
- Water samples that contain considerable amounts of solids may require filtering prior to preservation with nitric acid. These samples can be preserved with ice and returned to the laboratory for filtering and preservation.

Table 4-2 Sample Container and Preservation Requirements, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Parameter	Matrix	Holding time (from time of collection)	Container	Preservative	Minimum <sup>1</sup> sample size
Volatile organic aromatics	Water	14 days	Two 40 ml vials with Teflon™-lined caps	4 drops concentrated HCl, 4°C	40 ml
	Soil	14 days	Glass with Teflon™-lined septum	4°C	10 g
Volatile organic halogenated compounds	Water	14 days	Two 40 ml vials with Teflon™-lined caps	4 drops concentrated HCl, 4°C	40 ml
	Soil	14 days	Glass with Teflon™-lined septum	4°C	10 g
Extractable organics	Water	7-days extraction 40-days analytical	1 l amber glass with Teflon™ liner,	4°C	1,000 ml
	Soil	14 days extraction 40-days analytical	Amber glass jar with Teflon™ liner or core tube	4°C	50 g
Acrolein	Water	14 days	Glass with Teflon™-lined septum	0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>4</sup> adjust pH to 4 to 5, 4°C	40 ml
	Soil	14 days	Glass with Teflon™-lined septum	4°C	Enough to fill 2 40-ml vials
Organophosphorus pesticides	Water	7-days extraction 40-days analysis	1 l borosilicate glass	Adjust pH to 6.0 to 8.0 with H <sub>2</sub> SO <sub>4</sub> or 10 N NaOH, 4°C	1,000 ml
	Soil	14-days extraction 40-days analysis	1 l borosilicate glass	4°C	100 g
Chlorinated herbicides	Water	7-days extraction 40-days analysis	1 l borosilicate glass	4°C	1,000 ml
	Soil	14-days extraction 40-days analysis	1 l borosilicate glass	4°C	100 g

See notes at end of table.

Table 4-2 (continued) Sample Container and Preservation Requirements, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Parameter	Matrix	Holding time (from time of collection)	Container	Preservative	Minimum <sup>1</sup> sample size
Organochlorine pesticides and PCB	Water	7-days extraction 40-days analysis	1 l borosilicate glass	4°C	1,000 ml
	Soil	14-days extraction 40-days analysis	1 l borosilicate glass	Adjust pH to 6.0-8.0 with 1:1 H <sub>2</sub> SO <sub>4</sub> or NaOH, 4°C	100 g
Metals (other than chromium IV and mercury)	Water	180 days	Polyethylene or glass	HNO <sub>3</sub> to pH <2 <sup>2</sup>	100 ml
	Soil	180 days	Polyethylene or glass	4°C	10 g
Chromium IV	Water	24 hours	Polyethylene or glass	4°C	100 ml
	Soil	24 hours	Polyethylene or glass	4°C	10 g
Mercury	Water	28 days	Polyethylene or glass	HNO <sub>3</sub> to pH <2 <sup>2</sup>	100 ml
	Soil	28 days	Polyethylene or glass	4°C	10 g
Cyanide	Water	14 days	Polyethylene or glass	0.6 g ascorbic <sup>2</sup> acid, NaOH to pH >12, 4°C	100 ml
	Soil	14 days glass	Polyethylene or glass	4°C	10 g
Dioxins/ furans	Water	7-days extraction 40-days analytical	1 l glass	4°C	1,000 ml
	Soil/waste	14-days extraction 40-days analytical	Core tube	4°C	50 g
Petroleum hydrocarbons as gasoline	Water	14 days	Two 40 ml vials with Teflon™ liners	4°C, HCl to pH <2	40 ml
	Soil/waste	14 days	Core tube	4°C	50 g

See notes at end of table.

Table 4-2 (continued) Sample Container and Preservation Requirements, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Parameter	Matrix	Holding time (from time of collection)	Container	Preservative	Minimum <sup>1</sup> sample size
Petroleum hydrocarbons as diesel	Water	14-days extraction 40-days analytical	1 l glass	4°C	500 ml
	Soil/waste	14-days extraction	Core tube	4°C	50 g
Total petroleum hydrocarbons (TPH)	Water	28 days	1 l glass	4°C, HCl to pH <2	1,000 ml
	Soil	28 days	Glass jar with Teflon™ liner or core tube	4°C	50 g
Oil and grease	Water	28 days	Glass bottle	Adjust pH to <2.0 with H <sub>2</sub> SO <sub>4</sub> , 4°C	1,000 ml
	Soil	28 days	Glass jar with Teflon™ liner	4°C	50 g
Residue, settleable	Water	48 hours	Polyethylene or glass bottle	4°C	1,000 ml
Residue, all others (TSS, TDS)	Water	7 days	Polyethylene or glass bottle	4°C	500 ml
Biochemical oxygen demand	Water	48 hours	Polyethylene or glass bottle	4°C	1,000 ml
Chemical oxygen demand	Water	28 days	Polyethylene or glass bottle	Adjust pH to <2.0 with H <sub>2</sub> SO <sub>4</sub> , 4°C	1,000 ml
Metals (ICP)	Water	6 months	Polyethylene	HNO <sub>3</sub> to pH <2	100 ml
	Soil/waste	6 months	Core tube or glass jar	4°C	10 g
Arsenic (GFAA)	Water	6 months	Polyethylene	HNO <sub>3</sub> to pH <2	100 ml
	Soil/waste	6 months	Core tube or glass jar	4°C	10 g
Mercury (CVAA)	Water	28 days	Polyethylene	HNO <sub>3</sub> to pH <2	100 ml
	Soil/waste	28 days	Core tube or glass jar	4°C	10 g
Selenium (GFAA)	Water	6 months	Polyethylene	HNO <sub>3</sub> to pH <2	100 ml
	Soil/waste	6 months	Core tube or glass jar	4°C	10 g

See notes at end of table.

Table 4-2 (continued) Sample Container and Preservation Requirements, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Parameter	Matrix	Holding time (from time of collection)	Container	Preservative	Minimum <sup>1</sup> sample size
Thallium (GFAA)	Water	6 months	Polyethylene	HNO <sub>3</sub> to pH <2	100 ml
	Soil/waste	6 months	Core tube or glass jar	4°C	10 g
Lead (GFAA)	Water	6 months	Polyethylene	HNO <sub>3</sub> to pH <2	100 ml
	Soil/waste	6 months	Core tube or glass jar	4°C	10 g
Chromium (VI)	Water	24 hours	Polyethylene	4°C	100 ml
	Soil/waste	24 hours	Core tube or glass jar	4°C	10 g
Cyanide	Water	14 days	Polyethylene or glass	0.6 g ascorbic	100 ml
Fecal streptococci	Water	6 hours	Polyethylene or glass bottle	0.08 % Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>4</sup> 4°C	500 ml
Nitrogen, organic and Kjeldahl	Water	28 days	Polyethylene or glass bottle	Adjust pH to <2.0 with H <sub>2</sub> SO <sub>4</sub> , 4°C	500 ml
Nitrate	Water	48 hours	Polyethylene or glass bottle	4°C	125 ml
Nitrate-nitrite	Water	28 days	Polyethylene or glass bottle	Adjust pH to <2.0 with H <sub>2</sub> SO <sub>4</sub>	125 ml
Phosphorus, total	Water	28 days	Polyethylene or glass bottle	Adjust pH to <2.0 with H <sub>2</sub> SO <sub>4</sub> acid, NaOH to pH ≥12, 4°C	125 ml
	Soil/waste	14 days	Polyethylene or glass bottle	4°C	10 g
Coliform, fecal and total	Water	6 hours	Polyethylene or glass bottle	0.08 % Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> <sup>4</sup> 4°C	500 ml
Sulfate	Water	28 days	Polyethylene or glass bottle	4°C	125 ml
Sulfide	Water	7 days	Polyethylene or glass bottle	Adjust pH to >9.0 with zinc acetate plus NaOH, 4°C	500 ml

See notes at end of table.

Table 4-2 (continued) Sample Container and Preservation Requirements, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Parameter	Matrix	Holding time (from time of collection)	Container	Preservative	Minimum <sup>1</sup> sample size
Surfactants	Water	48 hours	Polyethylene or glass bottle	4°C	1,000 ml
Radiological tests: alpha, beta, radium	Water	6 months	Polyethylene or glass bottle	Adjust pH to <2.0	
Total organic halogens	Water	28 days	Glass with Teflon™-lined cap	Adjust pH to <2.0 4°C	40 ml

<sup>1</sup>Additional sample must be collected for matrix spike or matrix spike duplicate samples.

<sup>2</sup>Dissolved metals require filtration before pH adjustment.

<sup>3</sup>Only used in the presence of residual chlorine.

Notes: ml = milliliter  
HCl = hydrochloric acid  
°C = degrees centigrade  
g = gram  
l = liter  
HNO<sub>3</sub> = nitric acid  
Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> = sodium thiosulfate  
NaOH = sodium hydroxide  
H<sub>2</sub>SO<sub>4</sub> = sulfuric acid  
PCB = polychlorinated biphenyls  
TSS = total suspended solids  
TDS = total dissolved solids

- All samples that are preserved with chemicals will be clearly labelled.
- If containers are preserved by subcontract laboratory, additional preservatives will be from same source.

The following subsections describe the procedures for preparing and adding chemical preservatives. Table 4-2 indicates specific analytes for which these preservatives are recommended.

Addition of Acid (H<sub>2</sub>SO<sub>4</sub>, HCl, or HNO<sub>3</sub>) or Base (NaOH) Addition of the following acids or bases may be specified for sample preservation:

Acid or base	Concentration	Normality	Amount for acidification <sup>1</sup>
HCl	1:1 dilution of concentrated HCl	6N	5-10 ml
H <sub>2</sub> SO <sub>4</sub>	1:1 dilution of concentrated H <sub>2</sub> SO <sub>4</sub>	18N	2-5 ml
HNO <sub>3</sub>	Undiluted concentrated HNO <sub>3</sub>	16N	2-5 ml
NaOH	400 grams solid NaOH in 870 ml water	10N	2 ml <sup>2</sup>

<sup>1</sup>Amount of acid to add (at the specified strength) per liter of water to reduce the sample pH to less than 2, assuming that the water is initially at pH 7, and is poorly buffered and does not contain particulate matter.  
<sup>2</sup>To raise pH of 1 liter of water to 12.

HCl, H<sub>2</sub>SO<sub>4</sub>, and NaOH should be analytical reagent (AR) grade and should be diluted to the required concentration with double-distilled, deionized water in the laboratory performing the analyses or by field personnel. This procedure should be followed prior to conducting field sampling. Nitric acid (HNO<sub>3</sub>) for metals preservation must be ultra-purified metals-grade HNO<sub>3</sub>.

The approximate volumes that are needed to acidify one liter of neutral water to a pH of less than 2 (or raise the pH to 12) are shown in the last column of the above table. These volumes are only approximate; if the water is more alkaline, contains inorganic or organic buffers, or contains suspended particles, more acid or base may be required. The final pH must be checked using narrow-range pH paper. Never dip pH paper into the sample; apply a drop of sample to the pH paper using the stirring rod.

Sample acidification or base addition should proceed as follows:

1. The initial pH of sample will be checked with wide-range (0 to 14) pH paper.
2. Sample bottles will be filled to within 5 to 10 ml of final desired volume and about one-half of the estimated acid or base required will be added to the bottle. The sample will be stirred gently and the pH checked with medium-range pH paper (pH 0 to 6 or pH 7.5 to 14, respectively).
3. Acid or base will be added, a few drops at a time, while stirring gently. The final pH will be checked using narrow-range (0 to 2.5 or 11 to 13, respectively) pH paper. When the desired pH is reached, the sample bottle will be capped and sealed.

Cyanide Preservation Presample preservation will be required to prevent oxidizing agents such as chlorine from decomposing cyanide compounds. To test for oxidizing agents, a drop of the sample will be placed on potassium-iodide starch-test paper (KI-starch paper); a blue color will indicate the need for treatment. Ascorbic acid will be added to the sample, a few crystals at a time, until a drop of sample produces no color on the KI-starch paper. An additional 0.6 gram of ascorbic acid for each liter of sample volume will then be added. NaOH solution will be added to raise pH to greater than 12 as described above.

Sulfides can also adversely affect cyanide analyses. To test for sulfide, a drop of the sample will be placed on lead-acetate test paper that was previously moistened with acetic acid buffer solution (pH 4). Darkening of the paper indicates the presence of sulfide. If sulfide is present, cadmium nitrate powder will be added (to form a yellow cadmium sulfide precipitate) until the lead-acetate test yields negative results. The sample will be filtered to remove precipitate and NaOH solution added to the filtrate (to raise pH above 12). Avoid a large excess of cadmium and a long contact time in order to minimize a loss by complexation or occlusion of cyanide on the precipitated materials.

Sulfide Preservation Samples for sulfide analysis will be preserved by the addition of 4 drops (0.2 ml) of 2N zinc acetate solution per 100 ml sample. The sample pH will then be raised to 9 using NaOH solution (1 to 2 drops). The 2N zinc acetate solution will be made by dissolving 220 grams of zinc acetate in 870 ml of distilled water to make 1 liter of solution.

Preservation of Organic Samples Containing Residual Chlorine Organic samples that contain residual chlorine will be treated upon collection to remove this chlorine. The samples will be tested for residual chlorine using EPA Method 330.4 or 330.5 (field test kits are available for this purpose). If residual chlorine is present, 0.008 percent sodium thiosulfate (80 mg per liter of sample) will be added to an empty sample vial. The vial will be filled to at least one-half volume with sample. Acid will be added and then the remainder of the vial will be filled with sample as per the stated procedure.

**4.8 SAMPLE HANDLING, PACKAGING, AND SHIPPING.** Sample packaging and shipping procedures will protect the integrity of the samples and prevent detrimental effects from leakage or breakage. Regulations for packaging, marking, labeling, and shipping hazardous materials and wastes are promulgated by the U.S. Department of Transportation (DOT) and described in the Code of Federal Regulations (49 CFR 171 through 177; in particular 172.402h, Packages Containing Samples). In general, these regulations were not intended to hamper shipment of samples collected at controlled or uncontrolled hazardous waste sites or samples collected during emergency responses; however, the USEPA has agreed through a memorandum of agreement to package, mark, label, and ship samples observing DOT procedures. The information presented here is for general guidance.

Correct packaging, storing, and shipping of environmental samples is necessary to:

- ensure that samples remain sealed in original containers
- prevent breakage
- prevent cross contamination of individual samples
- ensure that sample characteristics are preserved
- prevent contamination to receiving personnel
- ensure that samples are protected against tampering when not in sampler's possession

Prior to packaging, each sample container will be inspected to verify correct labeling. Labels will be secured to containers with clear tape. Each container will have a signed and dated chain-of-custody (COC) seal over the cap, secured with clear tape. Samples will be shipped to the laboratory via commercial ground or air carrier within 24 hours of sample collection.

All breakable sample containers (glass) will be protected with packing. Bubble-pack bags or strips are acceptable. (Strips should extend 0.5 inch below the base of the container.) Sample containers will be placed in sealable plastic bags such as a zip-lock type. Bottles up to 1 liter capacity will be placed in 1-gallon bags.

Samples will be shipped in durable coolers packed with bubble-pack or vermiculite. Samples will be kept cool with blue ice or with double-bagged clean ice.

Bottles with Teflon™ septums (volatile organics and ethylene dibromide) will be placed inverted with top of bottle facing downward. Completed COC forms will be placed in a plastic bag and taped to the inside lid of the shipping container. If COC forms refer to multiple containers, they will be placed in the lead container.

A signed and dated COC seal will be secured with clear tape over the front of the container lid. The container will be sealed by wrapping it in filament tape. The airbill or manifest number and container sequence (if multiple containers are being shipped with a single COC) will be written on the tape on the container lid. "This Side Up" with a vertical arrow will be written on both sides of the container.

Until relinquished to the carrier, the shipping containers are to remain with ABB personnel or remain in locked vehicle so as not to be accessible to others. Upon shipping departure, the laboratory will be contacted and advised of the contents, arrival date and time, carrier, and number of containers.

**4.9 SAMPLE IDENTIFICATION.** Samples that are collected for laboratory analysis during the field investigation will be labeled with computer-generated labels. The labels will display a sample identification code, which identifies the site sample location, sample type, sample position, and modifier as described below.

The sample identification system consists of no more than nine (9) alphanumeric characters in four (4) information groups.

- Site \_\_\_\_\_
- Type \_\_\_\_\_
- Sample Position \_\_\_\_\_
- Modifier \_\_\_\_\_

Site The two-character site code identifies a specific area of investigation. Examples include:

GPT, the NCBC Gulfport site, or  
01, Site 1 at the NCBC Gulfport site.

**Type** The two-character sample type code identifies the general source type and medium of the sample. The physical location coordinates are addressed in the horizontal and vertical codes.

Codes can include:

GW - groundwater	FE - final effluent
SW - surface water	SS - surface soil
WW - waste water	SB - soil boring
DW - drinking water	TP - test pit
WS - water supply	RC - rock core
LT - leachate	SL - sludge
PC - primary clarifier effluent	SD - sediment
SC - secondary clarifier effort	WT - waste
RW - raw water	WP - wipe
RI - raw influent	
AA - ambient air, grab sample	BT - blank, trip
LA - ambient air, long-term sample	BS - blank, sampler
SG - soil gas	BF - blank, filtration
LV - landfill vent gas	

**Sample Position** Also known as the "sampling point," this code locates the sampling or exploration on the surface of the site (x, y coordinates). The horizontal locator allows designation of a variety of samples (AA, headspace, SS, SB, or MW) all from the same point onsite. Two approaches may be used.

- (1) A number sequence for the exploration (e.g., MW-10) may be used. For wells and borings it is important to note that a boring #10 which subsequently has a monitoring well installed has the same horizontal locator, #10.
- (2) A grid system may be used. If a sampling program uses a grid system, as surface soil sampling often does, it is recommended that the grid system be used for all horizontal locations. A three-character grid system allows about 2,600 locations (A00 through Z99). If more locations are needed, the site may be subdivided and the two or more areas designated by the site code.

**Modifier.** Examples of modifiers include:

- D, duplicate sample
- R, replicate sample
- H, headspace portion of a sample
- MS, matrix spike
- MD, matrix spike duplicate
- ER, equipment rinseate
- FB, field blank.

**4.10 QUALITY CONTROL SAMPLES.** An estimate of the number and types of QC samples to be collected for screening and laboratory analyses are listed in Section 3.0 of this SAP. A brief description of QC samples and frequency of collection is presented below.

Duplicate Samples Duplicate samples (two or more) are collected simultaneously into separate containers from the same source under identical conditions. One duplicate will be collected for every 10 samples of a single matrix (from a single site). Duplicate samples are intended to assess the homogeneity of the sampled medium and the precision of the sampling protocol.

Trip Blanks Trip blanks are prepared by the laboratory prior to the sampling event. They are kept with the investigative samples throughout the sampling event and are packaged and shipped with the investigative samples. These containers should never be opened prior to laboratory analysis. One trip blank will be included with each shipment of samples scheduled for VOC analysis. Trip blanks are required for assessing the potential for contaminating samples with VOCs during sampling or in transit.

Equipment Rinseate Blanks Equipment rinseate blanks are collected by running organic-free water over and/or through sample collection equipment after it has been decontaminated. Equipment rinseate blanks will be collected at a frequency of one per day per type of sampling tool used. These blanks are used to assess the adequacy of decontamination procedures and to trace potential cross contamination.

Matrix Spike and Matrix Spike Duplicates Matrix spike and matrix spike duplicate samples are additional samples collected in the field from a single sampling location. These samples are spiked in the laboratory with a known compound (or set of compounds) of known concentration. The concentration detected, after analysis, provides an estimate of the amount of compound "lost" (e.g., sorbed to glassware, volatilized, degraded, etc.) during the analytical procedure. A comparison of the original concentration to the final concentration provides data concerning analytical precision and accuracy. One set of matrix spike/matrix spike duplicate samples will be collected per 20 or fewer samples per matrix per day.

Field-Water Blanks Field-water blanks include a complete set of samples collected from each water source used in the investigation. One set of samples will be collected from each water source (tap, deionized, and organic free) used during the program. These samples should account for potential artifacts that could be introduced through decontamination procedures.

Preservative Blanks Preservative blanks are prepared by filling sample containers with organic-free water and adding the appropriate preservative. One set of preservative blank samples will be collected at the initiation of the field sampling program and one set will be collected at the conclusion of the sampling program. These blanks should identify potential artifacts that may be introduced through the use of preservatives in sample containers.

Background Samples Background samples are collected from areas upgradient and away from known or suspected contaminated areas. Several background (also called upgradient) samples will be collected from each matrix. The estimated number and location of these samples at each site are presented in Section 3.0. Background samples allow identification of possible upgradient sources and/or confirm upgradient delineation. In addition, background inorganic analyses allow the estimation of concentrations for naturally-occurring compounds.

4.11 SAMPLING RECORDS. The maintenance of proper records is a significant aspect of sample collection. At the time samples are obtained, the following should be recorded by the sampler in the field logbook:

- sample site location
- sample type and depth
- date and time of sampling
- project and sample designations
- sampler identification
- analyses requested

Additionally, the sampler must initiate COC procedures and describe the sample site in adequate detail to allow collection of additional samples from the same sample site, if necessary.

4.12 SAMPLE AND DOCUMENT CUSTODY PROCEDURES. The control of a sample is accomplished through a COC record. The chain-of-custody is initiated during bottle preparation by the laboratory, will be maintained through sample collection, shipment, storage, and analysis as a legal record of possession of the sample. Possession will be traceable by means of a COC form that will remain with the samples at all times and will bear the name of the person responsible for the samples. Procedures for maintaining the appropriate sample custody information will be in accordance with USEPA Region IV SOPs (USEPA, 1991a).

Samples other than those collected for in-situ measurements analyses are identified by using a sample label that is attached to the sample container. The following information will be included on the sample container label:

- project number
- field identification or sample station number (a unique number identifying the sample)
- date and time of sample collection
- type of sample (water, soil, sediment, etc.) and a brief description of the sampling location
- the signature(s) of the sampler(s)
- whether the sample is preserved or unpreserved
- the general types of analyses to be conducted
- any relevant comments regarding the sample

A COC form is used to record the custody of all samples or other physical evidence that is collected and maintained by ABB-ES personnel. The following information must be supplied in the indicated spaces in detail to complete the COC record:

- project number
- site name and address
- project name
- signature of sampler in the designated signature blank
- the sampling station number, date and time of sample collection, a brief description of the type of sample, and the sampling location
- the sample bottle type (i.e., 40-ml G) plus the intended analysis (i.e., VOA-624)
- for each sample the number of containers for each bottle type

- field investigator and subsequent transferee(s) signatures. Both the person relinquishing the samples and the person receiving them must sign the form along with the date and time that the exchange occurred.

When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill/receipt shall be recorded on the sample COC form. As necessary, ABB-ES uses carriers (i.e., United Parcel Service, Federal Express, Greyhound, etc.) to ship samples. In these cases the airbill becomes part of the COC.

All samples shall be accompanied by the COC record. The original and one copy of the record will be shipped inside the shipping container if samples are shipped. One copy of the record will be retained by the field investigator. The original record will be transmitted to the field investigator after samples are accepted by the laboratory. This copy will become part of the project records.

In the event that a legal COC is required for a project, custody will begin at the time of receipt of the clean sample containers from the contract laboratory. The COC form has appropriate spaces to allow signatures and dates to document the transfer of the cleaned sample containers from the laboratory to the sample team. In addition, use of custody seals will be implemented during shipment of bottles and samples in order to document the integrity of the samples and bottles. The custody seal will be placed on the shipping container so that the container cannot be opened without breaking the seal. The seal will be signed, dated, and the time recorded by the field investigator. By using a unique sample identification number for each sample, all ancillary records can be traced to specific sampling events.

**4.13 CALIBRATION PROCEDURES.** Procedures and documentation that are required for calibration of laboratory instruments and equipment are contained in USEPA Region IV SOPs (USEPA, 1991a) and USEPA CLP procedure manuals for organic and inorganic analyses (USEPA, 1991b, 1991c).

Field instruments and equipment will be calibrated and inspected daily before field activities begin, as suggested by the manufacturers. Calibration information will be recorded in a calibration log, which will be kept on file at the field office trailer. Malfunctioning instruments will be repaired or replaced. Monitoring equipment will be protected (as much as possible) from contamination during field exploration activities without hindering operation of the unit. Equipment maintenance will be performed according to manufacturer specifications before field use, or by cycling units out of the field. As appropriate, routine periodic maintenance may be performed as a function of field calibration.

**4.14 ANALYTICAL PROCEDURES.** Laboratory analytical procedures will be conducted in conformance with USEPA CLP requirements. Laboratory analytical methods for this RI include TCL volatile organic compounds, semivolatile organic compounds, pesticides and PCBs, and inorganic compounds. Laboratory analytical samples will be collected and analyzed in conformance with Level IV DQOs and USEPA Region IV SOPs (USEPA, 1991a). The subcontract laboratory will be qualified to perform CLP analysis, will have an active internal QA/QC program, and will be NEESA approved. Field analytical procedures include GC analysis for selected volatile organic compounds. The following describes the GC volatile purge-and-trap field screening methodology, sample preparation, and calibration:

Purge-and-Trap Method This methodology involves purging samples at ambient temperature with helium and concentrating the volatile organic analytes (VOAs) on a polymer trap. The VOAs are then desorbed onto the gas chromatograph for compound separation and identification. Retention-time windows that are based on calibration runs generated at the field site will be compared to sample retention times for identification. Compounds will be quantified using a three-point calibration curve with one point at or near the detection limit (approximately 1 part per billion).

Purge-and-Trap Sample Preparation A 5-ml aqueous sample aliquot is transferred to the sparger using a gas-tight syringe. The sample is purged with helium for 11 minutes, desorbed for 4 minutes, and the trap baked for 5 minutes. For low-level soil samples, a 5-g aliquot is transferred to the sparger, 5 ml of organic-free water is added, and the sample is purged as described.

Medium-level samples (including product) may be run via a methanol extraction. A 4-g aliquot of soil is transferred to a wide-mouth test tube. Ten ml of purge-and-trap grade methanol is added, and the soil methanol slurry is shaken. One hundred microliters of the methanol extract is added to a syringe containing 5 ml of organic-free water, and this is transferred to the sparger for purging.

Total solids analysis will be performed in accordance with USEPA Method SW 846 so that dry-weight calculations can be performed for soil samples (USEPA, 1985b).

Surrogates and Matrix Spikes To evaluate recovery, a surrogate such as bromofluorobenzene (BFB) may be added to selected samples. Matrix spikes may be prepared and analyzed in duplicate to assess precision and accuracy.

Gas Chromatography, Column, and Target Compounds Two HNu™ gas chromatographs (or equivalent) will be set up at NCBC Gulfport for the analysis of selected VOAs. This analysis will be conducted using either single or multi-position purge-and-trap devices. A chemical electrolytic conductivity cell will be used for detection of volatile halocarbons, whereas a PID will be used for detection of aromatic compounds. A DB624, 30-meter (m) megabore column (0.53 millimeter [mm] ID) or equivalent will be used for the separation of target VOAs. Actual run conditions will be site specific, depending on which volatiles of concern are present. Compounds that will be selected as standards for analysis include previously detected compounds and selected related compounds: benzene, toluene, ethyl benzene, xylenes (BTEX), chlorobenzene, 1,2-dichlorobenzene, 1,1,2,2-tetrachlorethane (TCA), trichloroethene (TCE), tetrachloroethylene (PCE), 1,2-dichloroethylene (DCE), vinyl chloride, methylene chloride, and carbon tetrachloride. Additional compounds may be added based upon site-specific needs or previous screening results.

Method Blanks Before analyzing any samples or standards, the chemist will ensure that the system is free from organic interferences. A method-blank run is analyzed as the first run of the day, after the calibration check standard, and after any high-level sample to ensure that carry over is not occurring.

Calibration The system is calibrated using the external-standard technique. For each analyte of interest, calibration standards are prepared at a minimum of three concentrations. These calibration standards are analyzed in the same manner as the samples. Continuing calibration check standards are run at the beginning of the day, after every 10 samples, and at the end of the day. The continuing calibration check standard contains each analyte of concern at mid-

level concentrations. The relative standard deviation (RSD) of the continuing calibration check standard must be within 30% of the calibration. If the RSD exceeds 30%, a new calibration curve will be prepared. Samples with results that exceed the calibration range may be diluted and re-run or reported as estimated, as determined by the analytical field chemist.

**4.15 DATA REDUCTION, VALIDATION, AND REPORTING.** ABB-ES will reduce and review data collected during the field investigation and report the findings in a standard format.

Data Reduction Data reduction at the laboratory is the process of converting measurement system outputs to an expression of the parameter that is consistent with the comparability objective. Calculations made during data reduction are described in the referenced analytical methods and in the participating laboratories' QA program documents.

Upon receipt, each analytical data package is turned over to the ABB-ES data-entry staff for reduction to standard data tabulations. Reduction may occur in one of three ways:

- the data are manually entered into data table templates,
- the data are downloaded directly from the laboratory computer, or
- the data are loaded from magnetic media supplied with the data package by the laboratory.

Completed data tabulations are provided to the data-review staff. As described below, two additional data tabulations will be prepared.

The original data, tabulations, and magnetic media are stored in a secure and retrievable fashion.

Data Validation All analytical data that are generated during the field investigation at the NCBC Gulfport will be reviewed by the ABB-ES project chemist and a data-evaluation staff. The data review will involve checking the precision and accuracy of matrix spike and matrix spike duplicates, checking precision of field duplicates and blanks, and correcting analytical data. The precision and accuracy results from the matrix spike and matrix spike duplicates will be compared to quality control objectives that are established in the QAPP. If advisory limits are not met for percent recovery or relative percent difference (RPD), then the compound, sample, and fraction will be listed. In addition, sample data will be flagged using the following qualifiers.

- When the percent recovery is out for both the matrix spike and the matrix spike duplicate, the compound will be flagged on the unspiked sample data summary report: J(+) R(ND).
- When 50% or more of the compounds for each fraction is outside of the acceptance range for the matrix spike or the matrix spike duplicate, which ever is least, the entire fraction will be flagged: J(+) R(ND).
- When the RPD is greater than the contractual advisory limit, the results for the compound in the unspiked sample will be approximated: J(+) UJ(ND).

- When 50% of the RPDs are greater than the contractual advisory limit for any one fraction, the whole fraction in the unspiked sample will be approximated: J(+) UJ(ND).

Definition of qualifiers are as follows:

J, approximate data due to quality control results  
UJ, approximate detection limit due to quality control results  
R, rejected data due to quality control results  
(+), positive compound identification  
(ND), non-detected compound

Other auditing activities will include checking field sample data records and COC.

Data Reporting Three presentations of the analytical data will be prepared. The data tables will represent:

- the raw data as received from the laboratory, tabulated by media and analytical fraction;
- the annotated data resulting from the review process, tabulated in a similar format; and
- a summary table, presenting only the data that survives the review process and is considered suitable for site interpretation.

4.16 INTERNAL QUALITY CONTROL. Table 4-3 lists the percentage of field QC samples that are planned for each sample matrix. The field QC samples will be analyzed by the analytical laboratory.

Trip Blanks Trip blanks are defined as samples that originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile organic samples. One trip blank will accompany each cooler containing samples for volatile organic analyses. It will be stored at the laboratory with the samples, and analyzed with the sample set. Trip blanks are only analyzed for VOCs.

Equipment Rinseates Equipment rinseates are the final analyte-free water rinse from equipment cleaning and are collected daily during a sampling event. Initially, samples from every other day will be analyzed. If analytes that are pertinent to the project are found in the rinseate, the remaining samples must be analyzed. The results from the blanks will be used to qualify the levels of analytes in the samples. This qualification is made during data validation. The rinseates are analyzed for the same analytes as the samples that are collected that day.

Field Blanks Field blanks, also known as source-water samples, are the water used in decontamination and steam cleaning. At a minimum, one sample from each event and each source of water will be collected and analyzed.

Field Duplicates and Splits Duplicates or splits for water samples and for soil samples, except for samples to be analyzed for VOCs, are collected, homogenized, and then split. Samples that are to be analyzed for VOCs are not mixed, but taken as grab samples. For soils, select segments of soil will be taken from the

Table 4-3 Field Quality Control Samples Per Sampling Procedure, RI/FS Sampling and Analysis Plan, NCBC Gulfport, Mississippi

Type of Sample	LEVEL D		LEVEL C		LEVEL E	
	Metal	Organic	Metal	Organic	Metal	Organic
Trip Blank (for volatiles only)	NA <sup>1</sup>	1/cooler	NA <sup>1</sup>	1/cooler	NA <sup>1</sup>	1/cooler
Equipment rinseate <sup>2</sup>	one source and event for all levels and all analytes.					
Field Duplicates <sup>3</sup>	10%	10%	10%	10%	5%	5%
Referee duplicates <sup>3</sup>	Collect at direction of Installation Restoration Program (IRP) Engineer in Charge.					

- 1 Not Applicable  
 2 Samples are collected daily; however, only samples from every other day are analyzed. Other samples are held and analyzed only if evidence of contamination exists.  
 3 The duplicate must be taken from the same sample that will become the laboratory matrix spike duplicate for organics or for the sample used as a duplicate in inorganic analysis.

length of the core and placed in 40-ml glass vials. Cores may be sealed and shipped to the laboratory for subsampling if appropriate. The duplicates for water samples will be collected simultaneously. Field duplicates will be collected at a frequency of 10% per sample matrix.

The matrix constitutes soil, water, or waste from a given site. The same samples used for field duplicates will be taken in sufficient volume to be split by the laboratory and be used as the laboratory duplicate or matrix spike. This means that for the duplicate sample, there will be the normal sample analysis, the field duplicate analysis, and the laboratory matrix spike/matrix spike duplicate analysis.

**Field Screening Splits** Twenty-five percent of samples analyzed by field GC methods will be split and sent to the analytical laboratory for Level III analysis.

**4.17 PERFORMANCE AND SYSTEM AUDITS.** Audits are performed to verify that work being completed within the RI/FS program complies with Quality Assurance Program goals. Internal ABB-ES audits of laboratory subcontractors are routinely conducted and subcontracted laboratories must be CLP-qualified and NEESA-approved.

Systems audits may be conducted on systems components to evaluate appropriate selection and utilization. The project systems audit includes evaluation of field, office, and laboratory procedures. Systems audits may address the following components:

- organization and personnel
- facilities and equipment
- analytical methodology
- sampling and sample handling procedures
- data handling

All primary documents will receive internal technical reviews and a minimum of one internal audit will be scheduled for the RI/FS field program. Technical reviews and internal audits will be performed in accordance with the ABB-ES CLEAN Generic Quality Assurance Program Plan (ABB-ES, 1991). A minimum of one internal audit will be scheduled by the Quality Assurance Manager (QAM) in coordination with the Task Order Manager (TOM) during the RI/FS activities. All audit records, including audit plans, reports, written responses, and corrective action forms, will be maintained with the project files.

**4.18 PREVENTIVE MAINTENANCE.** Preventive maintenance for laboratory equipment and instruments will be performed in accordance with CLP requirements and the individual laboratory QA/QC program.

Problem prevention can be applied to all phases of project implementation. The key to preventing and resolving problems is careful advanced planning and close communications between management and technical personnel in both client and contractor organizations. Problems will be anticipated and prevented by undertaking the following measures:

- identifying possible problems that have a high probability of occurrence or a potentially significant negative impact on performance (e.g., quality of services performed, schedules, and costs);

- identifying events, observations, or other signals possibly indicative of a developing problem;
- identifying the organization level most likely to recognize a developing problem and the level with authority to react to the problem;
- developing preventive measures for avoiding or reducing the impact of a problem that preferably can be implemented at the same organizational level at which the problem is recognized; and
- communicating the information generated in the preceding steps to appropriate staff.

**4.19 PROCEDURES FOR ASSESSING DATA.** Data that are generated during the RI will be compared with QA objectives for precision, accuracy, and completeness using procedures outlined in Section 3. Data quality will be validated and the data will be marked with appropriate qualifiers as described in Section 4.15. Once the data quality has been established, results from GC screening and laboratory analyses will be compared. Results will be compiled and the type and extent of chemical delineation at the site will be defined.

**4.20 CORRECTIVE ACTION.** Corrective or preventive actions to improve project quality will be implemented if potential or existing conditions are identified that may have an adverse impact on data quantity or quality. Corrective actions may be immediate or long-term. Corrective action identification, implementation and recording will be conducted in accordance with the ABB-ES CLEAN Quality Assurance Program Plan.

Any member of the NCBC Gulfport program who identifies a condition that adversely affects quality can initiate corrective action by completing a nonconformance report, or by issuing a memo to the QAM. The written communication must identify the condition and explain how it may affect data quantity or quality.

Immediate corrective action is applied to spontaneous, nonrecurring problems, such as instrument malfunctions. Staff members who detect or suspect nonconformance to previously-established criteria or protocol in equipment, instruments, data, or methods should immediately notify his or her Task Leader. If the problem is limited in scope, the Task Leader decides on the corrective action measure, documents the solution, and notifies the Project Manager and the QAM in a memorandum. If the problem has impaired the quality of the project or could re-occur in the future, the TOM will follow procedures that are outlined in the ABB-ES CLEAN Generic Quality Assurance Program Plan (ABB-ES, 1991) and a corrective action form will be placed with the project files.

Corrective actions may also be initiated as a result of performance evaluations; system audits; laboratory/field comparison studies; QA project audits conducted by the QRT or QAM, or Navy CLEAN QA specialists; or other activities. The QAM is responsible for documenting notifications, recommendations, and final decisions. The Project Manager is jointly responsible for notifying the program staff and implementing the agreed-upon course of action. The QAM is responsible for verifying the efficacy of the implemented actions. To the extent possible, the development and implementation of preventive and corrective actions should be timed to not adversely impact project schedules or subsequent data generation and processing activities. The QAM will also be responsible for developing and

implementing routine program controls to minimize the need for corrective actions.

**4.21 REPORTS TO MANAGEMENT.** Management personnel at all levels will receive QA reports appropriate to their level of responsibility. The TOM receives copies of all QA documentation. The QC documentation is retained within the department that generated the product or service (e.g., field data documentation) except where this documentation is a deliverable for a specific contract. The QC documentation is also submitted to the QAM for review and approval. Previous sections of this document detailed the QA activities that are integral to ABB-ES's QA program and the reports that they are to generate. A final audit report for each project may also be prepared. The reports would include:

- periodic assessment of measurement data accuracy, precision, and completeness;
- results of performance audits and/or systems audits;
- significant QA problems and recommend solutions for future projects;  
and
- status of solutions to any problems previously identified.

Additionally, any incidents that require corrective action will be fully documented. Procedurally, the TOM will prepare the reports to management. These reports will be addressed to the technical reviewer for review. The summary of findings shall be factual, concise, and complete. Any required supporting information will be appended to the report.

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## REFERENCES

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