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REMEDIAL INVESTIGATION FEASIBILITY STUDY SAMPLING AND ANALYSIS PLAN FOR OUTLYING LANDING FIELD BARIN VOLUME 2 OF 3 PARTS A AND B NAS WHITING FIELD FL

4/1/1993

ABB ENVIRONMENTAL

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
VOLUME II: SAMPLING AND ANALYSIS PLAN

OUTLYING LANDING FIELD (OLF) BARIN
FOLEY, ALABAMA

VOLUME II, PART A: FIELD SAMPLING PLAN
VOLUME II, PART B: QUALITY ASSURANCE PROJECT PLAN

CTO: 031

Navy CLEAN - District I

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AWTP	Abandoned Wastewater Treatment Plant
bls	below land surface
BOD	biological oxygen demand
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action, Navy
CTO	Contract Task Order Number
CWA	Clean Water Act
DO	dissolved oxygen
DQOs	data quality objectives
FICCDC	Federal Interagency Coordinating Committee for Digital Cartography
EO	Executive Order
FEMA	Federal Emergency Management Agency
FIRMs	Floodplain Insurance Rate Maps
FOL	Field Operations Leader
FSP	Field Sampling and Analysis Plan
GC/MS	gas chromatography/mass spectroscopy
GPR	ground penetrating radar
HASP	Health and Safety Plan
HRS II	Hazard Ranking System II
IDW	investigation-derived wastes
IR	Installation Restoration
ml	milliliter
mph	miles per hour
msl	mean sea level
MTBE	methyl tert-butyl ether
$\mu g/\ell$	micrograms per liter
NAAS	Naval Auxiliary Air Station
NCP	National Contingency Plan
NERI	Northeast Research Institute, Inc.
OLF	Outlying Landing Field
OVA	organic vapor analyzer

GLOSSARY (Continued)

PA	Preliminary Assessment
PAHs	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	photoionization detector
PPE	personnel protective equipment
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
RBP	Rapid Bioassessment Protocol
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation and Feasibility Study
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOPs	standard operating procedures
SVOCs	semivolatile organic compounds
TAL	target analyte list
TCL	target compound list
TOC	total organic carbon
TPH	Total Petroleum Hydrocarbon
TSCA	Toxic Substances Control Act
USCs	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
USTs	underground storage tanks
VOCs	volatile organic compounds
WWII	World War II
WWTP	wastewater treatment plant

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION. This Sampling and Analysis Plan (SAP) for the Phase I Remedial Investigation at Outlying Landing Field (OLF) Barin consists of two primary parts:

Part A, Project Description and Field Sampling and Analysis Plan (FSP); and

Part B, Quality Assurance Project Plan (QAPP)

The SAP itself is part of a four volume set of Remedial Investigation and Feasibility Study (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 (HASP); and
Volume IV, Community Relations Plan.

Together the four volumes present the scope of the RI/FS program. The workplan (Volume I): 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 SAP (Volume II) focuses on the field investigation, analytical methods, and 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 QA/QC requirements for sample collection, sample analysis, data assessment, corrective action, and reporting. The FSP and the QAPP have been incorporated into one document (the SAP) to provide one comprehensive document that can be used by onsite 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; 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 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 (Volume IV) describes procedures for public meetings, public comment, and methods of keeping the community informed.

Volumes I through III of the RI/FS planning documents have been prepared by ABB Environmental Services, Inc. (ABB-ES) under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) contract (Contract Task Order Number [CTO]-31). Volume IV, Community Relations Plan, will be prepared at a later date after public interviews have been completed. The format and scope of these documents

will comply with the 1988 RI/FS guidance under Superfund and the Navy Installation Restoration (IR) Program Manual of 1988.

1.2 PURPOSE OF REMEDIAL INVESTIGATION (RI) PHASE I. Based on the results of the Site Inspection (SI), Phase I Remedial Investigation was recommended to more completely describe the nature and extent of contamination at the five identified sites and to verify the contamination status of five additional sites identified during or after the SI. ABB-ES was contracted under the CLEAN contract (contract number N62467-89-D-0317, to prepare an RI/FS Workplan for the 10 sites.

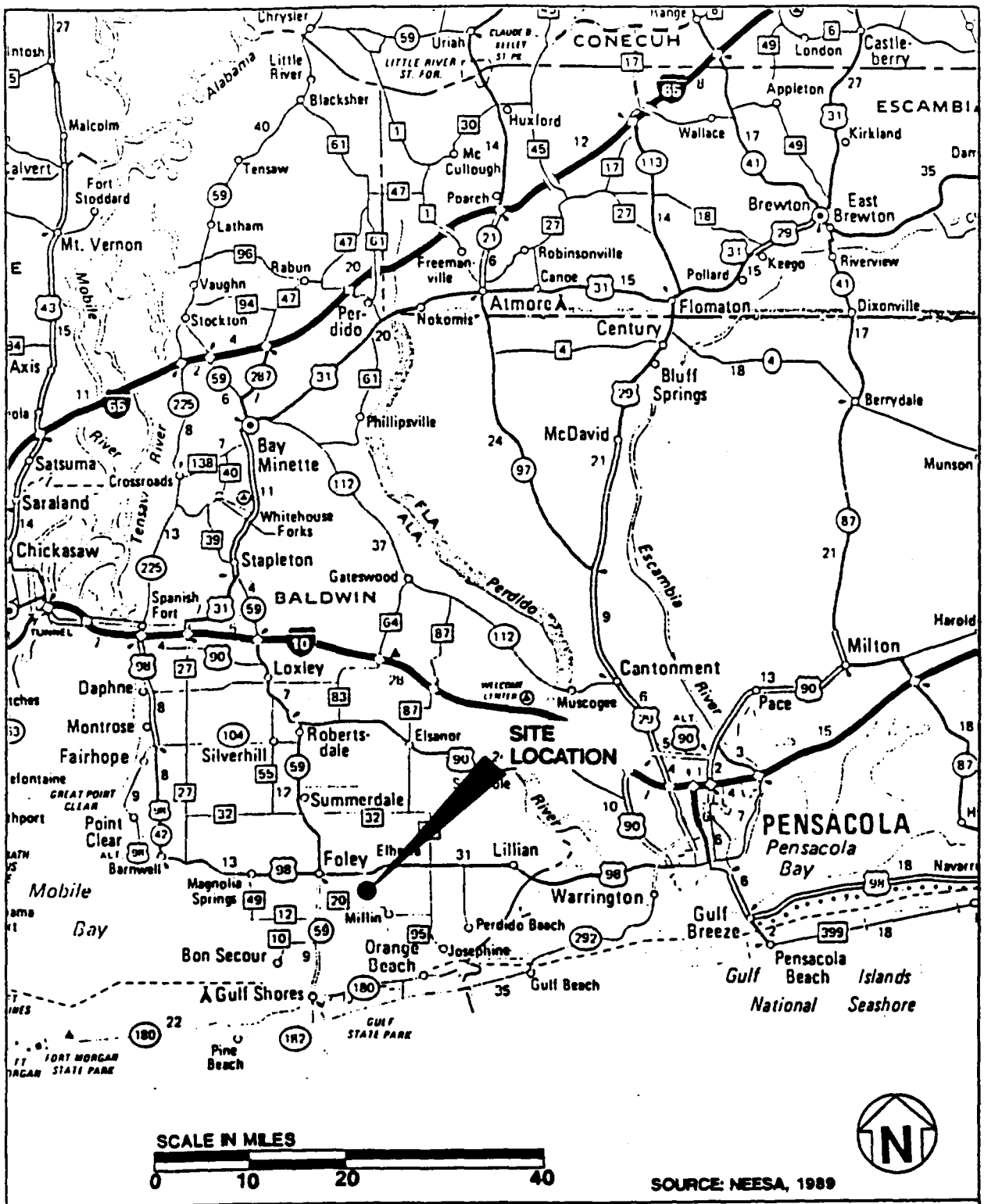
The purpose of the OLF Barin RI/FS is to identify a range of remedial alternatives to address any identified risk to public health and the environment posed by contaminants present due to past waste disposal or spill sites. To achieve this objective the RI must collect data sufficient to assess the nature and distribution of contaminants associated with each site. The FS will use the data collected in the RI to screen, evaluate, and select remedial alternatives to provide permanent, feasible solutions to environmental contamination problems at OLF Barin.

1.3 SITE DESCRIPTION. OLF Barin is located in Baldwin County, Alabama, 40 miles southeast of Mobile, Alabama. It is approximately 10 miles north-northeast of Gulf Shores, Alabama, and 35 miles west of Pensacola, Florida, near the Gulf of Mexico coast (Figure 1-1). Presently, OLF Barin consists of approximately 490 acres, considerably less than the nearly 1,000 acres that comprised the station during World War II (WWII) and the Korean Conflict. A major part of the land within the activity boundaries is used for three active airstrips.

The Foley, Alabama, municipal airport was leased from the city of Foley and commissioned by the U.S. Navy as the Naval Auxiliary Air Station (NAAS) Barin on December 5, 1942. The airport consisted of three airstrips covering 310 acres that became the OLF Barin West Field. The Navy acquired another 655 acres east of the original airport to build another three airstrips (East Field) and an administration and housing area. Figure 1-2, taken from the Preliminary Assessment (PA) (NEESA, 1989), depicts the layout of NAAS Barin during WWII.

NAAS Barin was deactivated on January 5, 1947, and remained closed until the Korean Conflict. Reopened in 1952, the airfield again functioned as a training facility until 1959. Upon closing in 1959, the original airstrip area west of the facility was transferred back to the City of Foley. The majority of the installation buildings were either sold or dismantled at this time. The east field remained unoccupied until 1985. At that time, pilots from Naval Air Station (NAS) Whiting Field, Milton, Florida, began using the field for "touch-and-go" practice. NAS Whiting Field began construction of a crash crew building in 1985 and the field was officially reopened in May 1988 and renamed OLF Barin.

1.4 PHYSICAL SETTING. OLF Barin lies within the Coastal Plain physiographic province of Alabama. The area is more specifically known as the Southern Pine Hills/Coastal Lowlands District Region of the East Gulf Coastal Plain. Elevations of OLF Barin range from 10 to 53 feet above mean sea level (msl). The installation is characterized by a relatively flat topographic surface, except in the extreme eastern part where topography slopes steeply down to the narrow floodplain of Sandy Creek.



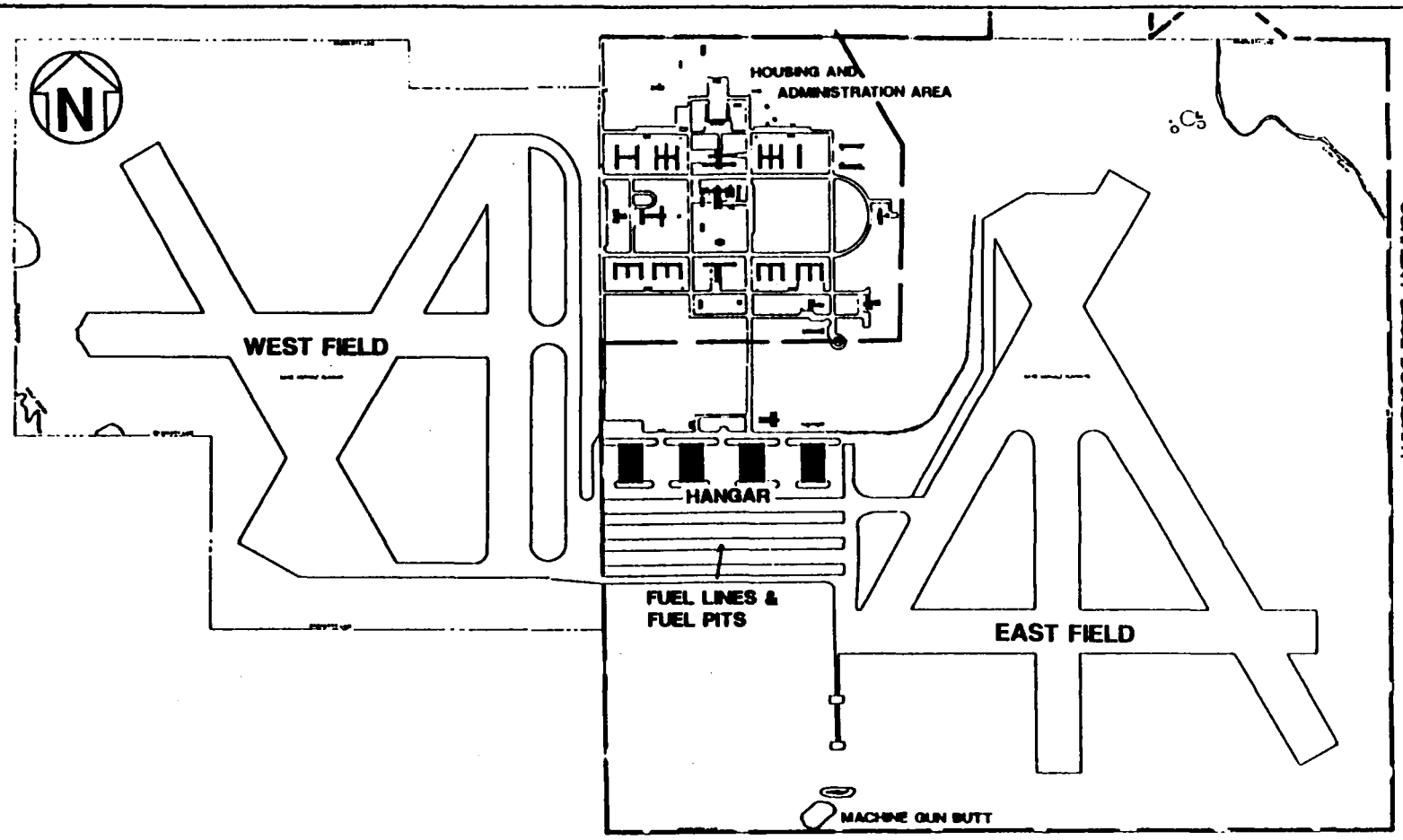
SOURCE: NEESA, 1989

FIGURE 1-1

LOCATION OF OLF BARIN
FOLEY, ALABAMA

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
SAMPLING & ANALYSIS PLAN

OLF BARIN
FOLEY, ALABAMA



APPROX. SCALE

0 600 1,200

SOURCE: NEESA 1989

FIGURE 1-2

HISTORICAL SITE SKETCH

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
SAMPLING & ANALYSIS PLAN

OLF BARIN
FOLEY, ALABAMA

OLF Barin is located in a region of humid, near subtropical climate with an average annual temperature of 68 degrees Fahrenheit (°F). The region can be characterized as having a long spring and fall, extremely hot summers, and short, mild winters. Average yearly precipitation of 64.6 inches.

The installation is situated on the surface exposure of the Citronelle Formation of Pliocene age. The sediments that comprise the Citronelle are generally reddish brown, massive, gravely silica sands with thin mottled sandy to silty clay lenses.

The principal water-bearing unit in the vicinity of OLF Barin is the Pliocene-Miocene aquifer. Most wells completed in this unconfined aquifer range from 40 to 1,100 feet deep and can yield up to 700 gallons per minute.

2.0 FIELD SAMPLING PLAN

The FSP consists of three elements: site management, remedial investigation data collection procedures, and site-specific explorations. Site management (Section 2.1) comprises support activities to the data collection activities. 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 Procedures) includes descriptions of the methods employed to gather information required to meet the RI/FS objectives. Among these methods are exploratory geophysics programs; gas surveys; shallow and deep subsurface explorations; monitoring well installations; aquifer characterization; groundwater, soil, surface water, and sediment sampling; ecological and population surveys; and topographic and elevation surveys.

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

2.1 SITE MANAGEMENT.

2.1.1 Mobilization The following activities will be performed at OLF Barin as part of mobilization:

- kick off meeting with base Public Works Department and operations personnel;
- command post setup, including office and sample management trailer, communications, and utility hookups;
- staking and utility clearance (i.e., excavation permits) of all exploration locations;
- field team orientation, including clearances for work in airplane flight pathways and adjacent areas; and
- a field team and subcontractor health and safety meeting.

2.1.2 Site Access and Control OLF Barin is an active Navy airfield with controlled site access. Several areas on base are in or adjacent to the flightlines and an escort is required to enter these areas. Drilling or other activities conducted at the end or within 1,000 feet of the runway will require, at a minimum, a Navy escort and may have to be postponed to the weekend when flight training is not in session. Access to fuel storage areas and the use of radios will be coordinated with base security.

2.1.3 Documentation 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. All visitors will be required to sign in and sign out. 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 logbook or field notebooks will be crossed out with a single line and initialed. 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, 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 Project Workplan and SAP. The FOL will be responsible for completing the logbook.

2.1.3.5 **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 (or equivalent) will be used during field activities at OLF Barin:

- photoionization detector (PID),
- organic vapor analyzer (OVA),
- explosimeter,
- pH-temperature-specific conductance meter,
- oil-water interface probe,
- electronic water level meter,
- metal detector,
- two-way radios or cellular telephones, and
- instrument calibration supplies.

Instruments will be calibrated and inspected daily before field activities begin, as suggested by the manufacturers. Calibration information will be recorded on 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 from contamination during field exploration activities (as much as possible) 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 will 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 U.S. Environmental Protection Agency (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 acid and deionized water.

Tap or potable water will be treated water from any municipal water treatment system.

Deionized water is water that has been treated by passing through a standard deionizing resin column.

Organic-free water is water that has been treated with activated carbon and deionizing units. It should contain no pesticides, herbicides, extractable organic compounds, and less than 5 micrograms per liter ($\mu g/\ell$) of purgeable organic compounds as measured by a low level gas chromatography/mass spectroscopy (GC/MS) scan. This organic-free water produced through treatment with deionizing resin columns and activated carbon filters will be used for blank preparation and for final rinse in decontamination (where applicable). Equipment blanks provide further documentation concerning purity of the water source.

Solvent will be pesticide-grade isopropanol.

2.1.5.1 **In-House Decontamination 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. When possible, field decontamination of equipment will be preformed the day before its use in order to allow sufficient time for air drying.

The following subsections describe cleaning procedures for sampling, pumping, and measuring 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. Equipment will be washed and scrubbed thoroughly with laboratory detergent and hot water.

2. Equipment will be rinsed thoroughly with hot tap water.

3. Equipment will be rinsed with at least a 10 percent nitric acid solution.

4. Equipment will again be rinsed thoroughly with tap water.

5. The equipment will be rinsed twice with solvent (pesticide-grade isopropanol).

6. The equipment will be air dried for at least 24 hours.

7. The equipment will be wrapped in aluminum foil. The edges of the foil will be rolled into a "tab" to allow easy removal. The foil-wrapped equipment will be sealed in plastic and dated.

8. 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 of the foil will be rolled into a "tab" to allow easy removal. The foil-wrapped equipment will be sealed in plastic and dated.

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. 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, tap water will be pumped through the system.

3. The equipment will be rinsed with deionized water, deionized water will be pumped through the system.

4. The equipment 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. Use only new Teflon™ tubing and pre-clean as follows:

1. The tubing will be pre-cut to appropriate length.

2. The outside of tubing will be rinsed with solvent.

3. The interior of tubing will be rinsed with solvent.

4. The tubing will be dried overnight in a drying oven at 105 degrees celsius.

5. The tubing and cap ends will be wrapped with aluminum foil and sealed in plastic to prevent contamination during storage and transport.

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 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.

6. Tubing and cap ends will be wrapped with aluminum foil and sealed in plastic to prevent contamination during storage and transport.

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

1. The tubing will be rinsed with solvent,

2. air dried for at least 24 hours, and

3. tubing wrapped and ends capped with aluminum foil and sealed in plastic to prevent contamination during storage and transport.

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

1. The equipment will be washed with laboratory detergent and tap water.

2. The equipment will be rinsed with tap water.

3. The equipment will be rinsed with deionized water.

4. 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 date.

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

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

2. The chests and containers will be rinsed with tap water.

3. The chests and containers 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. If obvious contamination remains after rinsing the probes will be solvent rinsed (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, sealed 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 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. However, when this is not possible, 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 (biological oxygen demand [BOD], total organic carbon [TOC], etc.) including, but not limited to, Kemmerers, buckets, 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 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 allowed 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. The equipment will be rinsed again with deionized or distilled water.

2.1.5.3 **Large Equipment Decontamination** Large equipment (eg. 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 portion of the drill rig or backhoe that will be over the borehole or sampling location (e.g., kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) 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, Teflon™ string will be used to tighten drill stem.

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 should be capable of generating a pressure of at least 2500 pounds per square inch (PSI) and producing hot water and/or steam (200 degrees Fahrenheit 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: PVC materials will not be rinsed with solvent.

6. The equipment will be rinsed thoroughly with organic-free water and allowed to air dry. The equipment will not be rinsed again with deionized or distilled water.

7. If organic-free water is not available, the equipment will be allowed to air dry. The equipment will not be rinsed 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 and Fluid and Sediment Disposal** 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 a shallow excavated inclined pit lined with heavy duty plastic sheeting for containment of washwater and waste. The pit will be designed such that washwater and solvent rinsates will drain into the pit and be pumped into storage containers. Large portable equipment (drill rods, auger flights, well casing and screen, etc.) will be cleaned on saw horses or other supports constructed above the plastic sheeting.

All wastewater will be pumped from the decontamination pit into 55-gallon drums. The drums will be transported to a 10,000-gallon tanker truck (to be used for decontamination wastewater only) parked in a central location and emptied. Once the tanker is full, a wastewater sample will be collected and analyzed for target compound list (TCL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), target analyte list (TAL) metals and total cyanides (Level V data quality objectives [DQOs]). If the results of laboratory analyses are below the Resource Conservation and Recovery Act (RCRA) hazardous waste criteria, the wastewater will be transported to a local wastewater treatment plant for disposal. If the wastewater exceeds RCRA hazardous waste criteria, it will be classified as a hazardous waste and the activity (NAS Whiting Field) will be responsible for appropriate disposal.

Sediment collected from the decontamination pit will be piled on plastic sheeting adjacent to the pit and covered with the same plastic sheeting. At the end of the field program, the sediments will be sampled and analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanides (Level V DQOs). If the results of the laboratory analyses are below the RCRA hazardous waste criteria, the sediments will be spread onsite. If the laboratory analyses results exceed the RCRA hazardous waste criteria, the sediment is classified as a hazardous waste and it will be the responsibility of the activity (NAS Whiting Field) to dispose of the sediments in an appropriate manner. ABB-ES will provide NAS Whiting Field with laboratory results and a recommendation for disposition of hazardous waste materials.

2.1.6 Control and Disposal of Investigation-Derived Waste The following Waste Management Plan has been prepared to address the disposal of investigation-derived wastes (IDW). These wastes can include drill cuttings or other soils and sediments, purge and development water, decontamination fluids, protective clothing, and other disposable items (including disposable equipment and/or parts).

Investigation-derived purge and development water will be handled in a similar way as the decontamination wastewater described in Section 2.1.5. Purge and development water will be pumped from the wells into 55-gallon drums. The drums will be transported to a second 10,000-gallon tanker truck (to be used for purge and development water only) and emptied. Once the tanker is full, a water sample will be collected and analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanides (Level V DQOs). If the laboratory results are below the RCRA hazardous waste criteria, the wastewater will be transported to a local wastewater treatment plant for disposal. If the purge and development water exceeds RCRA criteria it will be classified as a hazardous waste and the activity will be responsible for appropriate disposal.

Soil cuttings from soil borings will be piled (two separate piles; one unsaturated soils, and one saturated soils) on plastic sheeting at a central location and covered. At the end of the drilling program one sample will be collected from each soil pile and analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanides (Level V DQOs). If the laboratory results are below the RCRA hazardous waste criteria the soils will be spread onsite. If

the laboratory analytical results exceed RCRA hazardous waste criteria the soils will be classified as a hazardous waste and the activity will be responsible for appropriate disposal.

Personnel protective equipment (PPE) and other disposable items will be drummed until receipt of laboratory analysis of the associated matrix. If no contaminants are detected in the associated soil or water samples, the PPE or other items will be disposed in an OLF Barin dumpster. If contaminants are detected, these items will be disposed of by the activity in an appropriate manner.

Any drummed materials left by field personnel at the site will become the property of the OLF Barin. ABB-ES will maintain a log of the drums and their contents and will clearly identify the containers, on weather-resistant labels, with the drum contents, site and sample location number, date filled, and corresponding log entry number. OLF Barin will take responsibility for the drums and their contents.

The materials will be handled, transported, and disposed according to Applicable or Relevant and Appropriate Requirements (ARARs) for IDW. The ARARs may include RCRA, the Clean Water Act (CWA), the Toxic Substances Control Act (TSCA), and/or existing State regulations. ABB-ES will provide OLF Barin with the pertinent laboratory results and a recommendation for disposition of drummed materials. Non-hazardous (non-contaminated) materials will be returned to the site where they originated and disposed onsite or in an OLF Barin dumpster, as appropriate.

2.2 REMEDIAL INVESTIGATION DATA COLLECTION PROCEDURES. This section provides a description of each investigative technique to be used during the OLF Barin RI of the 10 identified sites.

2.2.1 Exploratory Geophysics Program Geophysical investigations at OLF Barin may include 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. Geophysical investigations will be conducted in accordance with Level I DQOs.

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. The terrain conductivity instrument is sensitive to metal objects; therefore, on-site fences, pipes, and power lines may cause interference. 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 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 OLF Barin will be mainly delineation of landfill perimeters.

The GPR 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 (buried utilities, tanks, drums, etc.). 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 and 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 manmade 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 Soil Gas Survey Soil gas surveys can be used to identify the areal extent of waste deposition and to define areas of subsurface exploration and sample collection. Sample gas analysis can be performed using different methodologies, each with unique DQOs. The method that will be used during the RI will be the Petrex™ passive soil gas technique. This technique consists of utilization of charcoal tipped ferromagnetic wire collectors for 7 to 12 days (depending on soil gas flux), retrieval and analysis of absorbed chemicals by GC/MS (Level III DQOs). SOPs for the Petrex™ passive soil gas technique are presented in Appendix A.

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., caving sands), other investigative techniques such as solid-stem auger, water or mud rotary, and air rotary, may be used. The above drilling methods follow guidelines presented in

Appendix E of USEPA Region IV SOP (USEPA, 1991). The borings will be sampled either continuously or at 5-foot intervals, depending on site-specific data needs as described in Section 3.0 of this document. 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. Soil samples for chemical analysis will be collected in accordance with Level IV DQOs. In general, samples collected for laboratory analysis will be selected based on previous field screening results, field monitoring results (i.e., elevated PID or GC readings), visual examination, and/or at pre-designated depth intervals. Most soil boring locations will correspond with monitoring well installations. Soil borings not used for monitoring well installation will be grouted to ground surface after sampling.

2.2.3.1 Subsurface Soil Sample Collection Procedures 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 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, and
- 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 characteristics will be recorded using the Unified Soil Classification System (e.g., texture, color, consistency, moisture content, layering, and other pertinent data).

3. The portion(s) of the sample selected for chemical analysis will be removed and placed it into appropriate containers using a clean spatula. Soil intended for VOC analysis will be placed in 40-milliliter (mℓ) containers and capped as quickly as possible. Soil 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 labelled and chain-of-custody documents will be prepared. Record sample location, description, sample numbers, and other pertinent information in the field logbook.

6. The sampling device will be decontaminated in accordance with specified procedures.

The sampler must 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. Sample volume will be conserved, because under certain soil conditions it may be difficult or impossible to achieve good sample recovery with split spoons.

Procedures 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 technique and procedures to be used, particularly the use of drilling fluids, will be carefully evaluated for each site.

2.2.4 Test Pits Test pits or trenches may be excavated at sites selected after geophysical screening to locate potentially hazardous objects (i.e., buried drums), to examine subsurface conditions, and to assess the vertical and horizontal distribution of shallow soil contamination (i.e., at depths of approximately 0 to 12 feet). A backhoe will be used to excavate the test pits and trenches. Soils, stratigraphy, perched groundwater conditions, and evidence of contamination will be logged by ABB-ES personnel. Excavated soil will be backfilled in the excavation area. Analytical soil samples will be selected based on field monitoring results (i.e., elevated PID readings) and visual indications of contamination.

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 in accordance with USEPA Region IV SOPs (USEPA, 1991) for laboratory analysis (Level III and 10 percent Level IV DQOs). 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.

2.2.5.1 **Surface Soil Sample Collection Procedures** Equipment and materials 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; and

- an Eckman™ or Ponar™ dredge for deep water sediment sampling.

The following describes steps for sample collection.

1. The personnel protective clothing and equipment will be donned, 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 location, soil description, sample number, and other pertinent information will be documented.

4. The top 1 to 2 cm (4 to 8 mℓ) of exposed soil will be carefully removed before sample collection (not necessary for sediment samples).

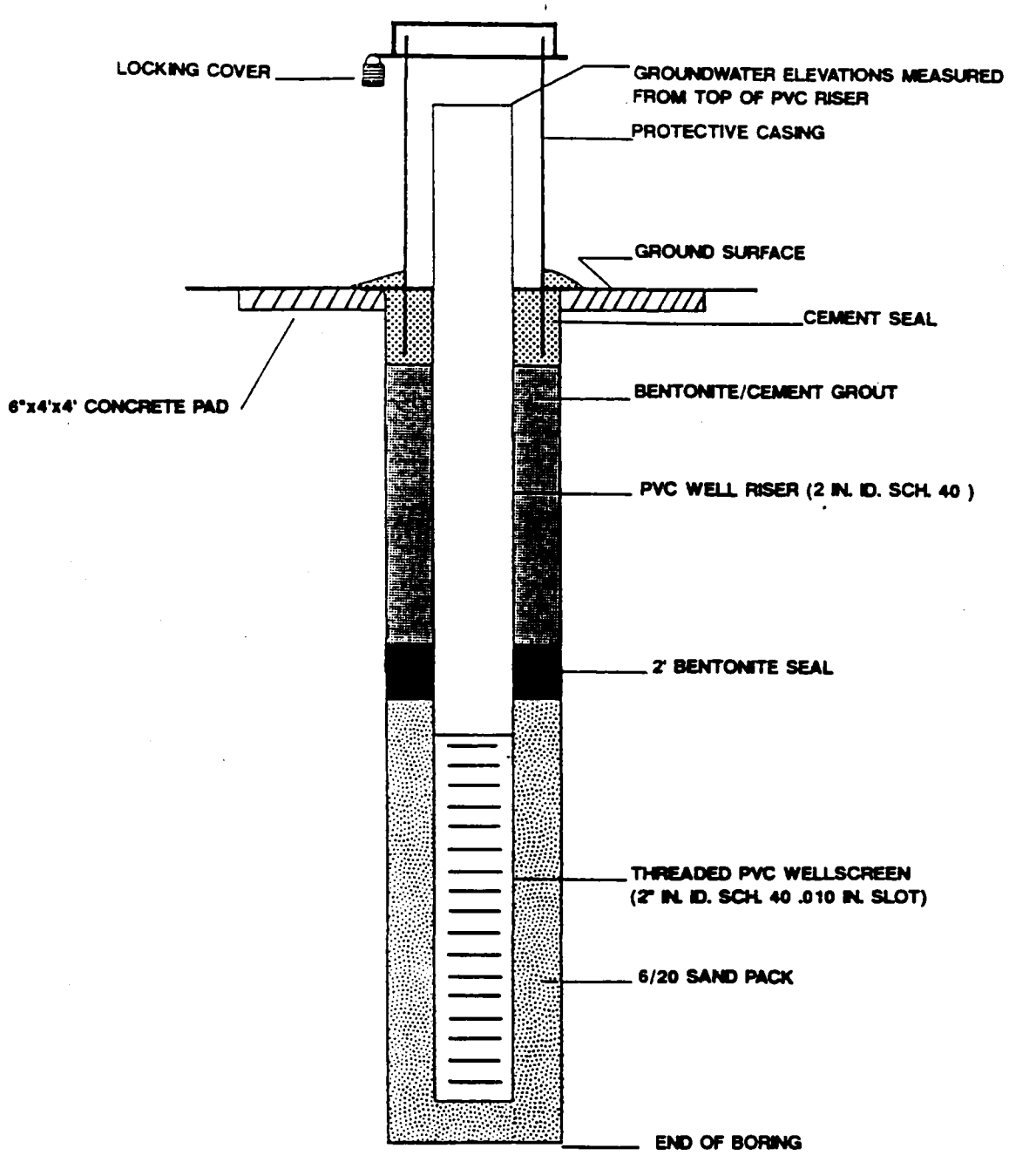
5. A clean stainless-steel or Teflon™-lined scoop, trowel, or shovel will be used to obtain a minimum of three sample volumes or the volume needed to fill the specified sample container.

6. Each sample container will be filled and capped.

7. Each sample container will be labelled with the appropriate information. Fill out chain of custody forms and package samples.

2.2.6 Monitoring Well Installation Groundwater monitoring wells will be installed to provide groundwater samples in accordance with Level III (10 percent Level IV) DQOs for 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 designed to intercept suspected site-specific contaminants.

Monitoring wells will be constructed of 2-inch inside-diameter (ID), Schedule 40, flush-threaded, PVC screen and riser (Figure 2-1). Five and 10-foot well screens with slotting appropriate for the representative formation will be used to construct all wells. Monitoring wells will be constructed and installed in accordance with Southern Division Naval Facilities Engineering Command *Guidelines For Groundwater Monitoring Well Installation* (Workplan, Appendix B; and Appendix E of USEPA Region IV SOPs [USEPA, 1991]). 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 2 feet below the bottom of the well screen to 3 feet above the top of the screen. A minimum 2-foot 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. The well



NOT TO SCALE

FIGURE 2-1

TYPICAL MONITORING WELL CONSTRUCTION

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
SAMPLING & ANALYSIS PLAN

OLF BARIN
FOLEY, ALABAMA

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 a gasoline-powered centrifugal pump, a submersible 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 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 SOUTHNAVFACENGCOM guidance (Workplan, Appendix B).

2.2.7 Groundwater Sampling 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 collected for laboratory analysis using stainless-steel or Teflon™ bailers and clean nylon or monofilament line. Samples from deep monitoring wells may require the use of a sampling pump. Groundwater samples will be collected in accordance with Level III (10 percent Level IV) DQOs.

2.2.7.1 **Groundwater Sample Collection Procedures** Groundwater samples for laboratory analyses will be collected from existing and new permanent monitoring wells. The purging and sampling techniques outlined below help ensure the collection of a representative sample.

2.2.7.1.1 Purging Technique Wells will be purged before groundwater sampling to remove stagnant water so that a representative sample may be obtained. Wells should 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;
- personnel protective equipment as specified in the site-specific HASP;
- decontamination supplies; and
- waste disposal drums, if required.

Two common procedures 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 used in the field will be site specific. 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; and

(3) the well has been pumped dry.

Volumetric Method of Well Purging

1. Personnel protective clothing and equipment will be donned as specified in the site-specific health and safety plan (HASP).

2. The well cover will be opened and the condition of the wellhead will be checked.

3. The volume of water in well will be determined by measuring the 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 1/10th of a foot. Note: more stringent measurements may be required for specific project programs (i.e., 1/100th of a foot).

4. The well volume will be calculated by using the follow formula (or its equivalent):

$$v = .041 d^2 h \qquad (1)$$

where, h = height of standing water column,
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 lower it into casing.

6. The number of well volumes will be removed as specified in project plans, by measuring the length of time taken to purge a measured amount of water, calculating the flow rate, and allowing the well to purge for the necessary length of time.

7. If well goes dry during pumping or bailing, one is assured of removing all water which had prolonged contact with the well casing or air.

8. 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. Produced water will be disposed of as required by project workplan.

Indicator Parameter Method of Well Purging

1. Personnel protective clothing and equipment will be donned as specified in the site-specific health and safety plan.

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) will be set up in a clean beaker. Allow probes to equilibrate according to manufacturer's specifications.

5. Readings will be recorded in field logbook (include time of day measurement was made).

6. The pump and tubing, or bailer will be assembled, and lowered into casing.

7. Pumping or bailing will then begin.

8. Indicator parameter readings will be recorded at predetermined intervals.

9. A record of appropriate volumes of water produced will be maintained.

10. Pumping or bailing will continue until indicator parameter readings remain stable within ±10 percent for two consecutive recording intervals (5 minutes apart) and at least 3 well volumes have been purged.

11. Purging will continue until the discharge stream is clear.

12. Pump assembly or bailer will be removed from the well and decontaminate as required.

13. The well cover will be locked before leaving.

14. Produced water will be disposed as required by the project workplan.

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 will be equipped with a check valve, and centrifugal pumps will have a foot valve. When sampling for organics or metals, certain precautions will 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 will be constructed of Teflon™ and stainless steel.

2.2.7.1.2 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 constructed of appropriate material (Teflon™, stainless steel, or polypropylene),
- 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),
- 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

- personnel protective clothing and equipment, if required by the site-specific HASP.

Groundwater sampling procedures include the following steps.

1. Protective clothing and equipment will be donned as necessary.

2. The site for sample collection will be prepared 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. Vapors will be checked for using vapor analyzing equipment.

4. The static water level and depth to well bottom will be determined using water-level meter/tape. Record this information will be recorded in field logbook.

5. The purge volume will be determined and the well will be purged.

6. Sample containers will be arranged in order of use. VOC samples, if required will be sampled first, followed in order by semivolatiles (SVOC) and other samples.

7. The bailer or pump intake (as appropriate for parameters of concern) will be lowered into well. The bailer will enter the water slowly to prevent aeration, particularly when VOC and SVOC samples are being collected. The filled bailer will be retrieved to the surface.

8. The samples will then be collected.

   - VOC samples will be filled directly from Teflon™ or stainless-steel bailer with as little agitation as possible. The vial will be filled until the sample forms a convex meniscus above the top edge of the vial, and then carefully cap the vial. Invert VOC sample vials and tap 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.

9. Preservative will be added (if needed), and all containers will be cap, seal and properly labelled. 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. Chain-of-custody will be prepared and samples will be shipped to the laboratory.

11. Sampling equipment sampling equipment will be decontaminated (as required) and lanyard will be disposed.

Groundwater sampling (or purging) with a bailer for metals and organic compounds will only be done with a stainless-steel or Teflon™ bailer.

2.2.8 Surface Water and Sediment Sampling Surface water and sediment samples will be collected (Level III and 10 percent Level IV DQOs) at selected sites to assess potential contaminant migration through groundwater-surface water interaction, surface runoff, or soil erosion. Both upgradient and downgradient samples will be collected from the site to distinguish potential source areas.

2.2.8.1 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:

- personnel 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; and
- 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.

2.2.8.1.1 Method of Collecting Samples of Near-Shore Surface Water for Volatile Organic Analysis

1. Required protective clothing and gear will be donned, as necessary.

2. Unpreserved volatile organic analysis vials will be inverted and slowly submerged completely into the water and slowly turned upright to fill. Disruption of bottom sediments should be avoided. The open end of the vial should be pointed upstream in undisturbed gently flowing water.

3. The VOC vial will be capped under water. Be sure to dislodge air bubbles from the cap before sealing the vial. The vial will be turned upside down and checked for air bubbles. The bottom of the VOC vials will be tapped to dislodge any bubbles that may have formed around the cap or sides. If bubbles are present, the sample will be discarded and recollected.

4. The vial caps will be sealed, the outside of sample vials will be rinsed with deionized water, wiped dry, and labelled. The sample container(s) will be placed in zip-top or other plastic bags and immediately placed in a sample cooler.

2.2.8.1.2 Method for Shallow Surface Water Sample Collection for Non-volatile 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. If possible, extension handles will be used to reach into the sample site.

2. The collector will be inverted and immersed into the water and reinverted to fill. Disruption of underlying sediments should be avoided. Sufficient volume of water will be collected to fill all sample containers.

3. Sample containers will be sealed, wiped dry, and labelled. Samples will be documented in the field logbook.

Based on observed flows and depths of water at the designated sampling locations, water samples will be collected at approximately mid-depth levels in the water column. At water depths of 2 to 6 feet, the samples will be collected using a discrete stainless-steel water sampler. 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.

<u>2.2.9 Aquifer Characterization</u> An aquifer pumping test and single-hole permeability tests (slug tests) will be performed (Level I DQOs) at Pliocene-Miocene aquifer wells using the base supply well and selected monitoring wells during the RI field investigation.

Aquifer Pumping Test. A pumping test of the surficial Pliocene-Miocene aquifer will be conducted to estimate the aquifer characteristics (i.e., hydraulic conductivity, transmissivity, and storativity) necessary to support the development of groundwater remedial alternatives and evaluate the hydrogeologic and contaminant migration relationships between the production zone and the source areas.

The pumping test will be performed using the production well as the pumping well. The production well will pump at a constant known rate for 72 hours, and monitoring wells will be used as observation wells. The water levels in the observation wells will be continuously monitored with data loggers prior to, during, and after the actual pumping of the production well.

All groundwater produced during the pumping test will pass through a granular activated carbon system and will be discharged into the sanitary sewer.

Slug Tests. Slug tests will be performed (Level I DQOs) 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 H. Bouwer and R.C. Rice, 1976 for calculating the hydraulic conductivity of an aquifer from partially penetrating wells in an unconfined aquifer. 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 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 head tests will be performed on wells that are screened across the water table. Rising and/or falling head tests will be performed on wells that are screened below the water table.

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 will 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.

Wetland and Floodplain Evaluation. According to the preamble of the National Contingency Plan (NCP) (40 Code of Code of Federal Regulations [CFR], Part 300), Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] actions will consider Federal environmental standards such as the Floodplains Management Executive Order (EO) 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, 1985). To evaluate the impact of remedial alternatives on wetlands and floodplains, it may be necessary to first identify the location of floodplains and wetlands and then determine wetland functional attributes.

Wetlands and floodplains 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) 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 onsite inspection. Wetland functional attributes may be identified based on a qualitative evaluation of the ecological survey information and hydrogeology of the area.

Aquatic Habitat Assessment. Aquatic survey locations will be established at six locations in Sandy Creek and three locations along Wolf Creek in proximity to OLF Barin (Figure 2-2). On Sandy Creek, an upstream reference location will be established at the facility boundary just upstream of the uncontrolled dumpsite. Other locations will be located downstream of the potential discharge areas of the uncontrolled dumpsite, the abandoned wastewater treatment plant, the rubble landfill, and the drainage ditch that runs just to the north of the runways. A sixth location will be established approximately 1/2 mile downstream of the drainage ditch discharge area to determine whether long range impacts are occurring.

In addition to an upstream reference location on Wolf Creek, two additional locations will be established to evaluate potential stream impacts associated with discharge from the old firefighting demonstration area and the machine gun butt sites (Figure 2-2).

Physical and chemical characteristics of the aquatic environments will be measured at each aquatic survey location and will include creek width, depth, flow rate, type of bottom substrate, temperature, water clarity, conductivity, salinity, pH, and dissolved oxygen levels. The measurements will be recorded by a field biologist in either a field notebook or tape recorder and then transferred to a summary sheet.

Terrestrial habitat proximate to the aquatic survey locations will be classified as to dominant species and major vegetation community types. Plant identification will be recorded in a field notebook and will include notation of the vegetative keys used. Vegetated areas will be photographed and particular voucher plant specimens will be collected and pressed to document the identifica-

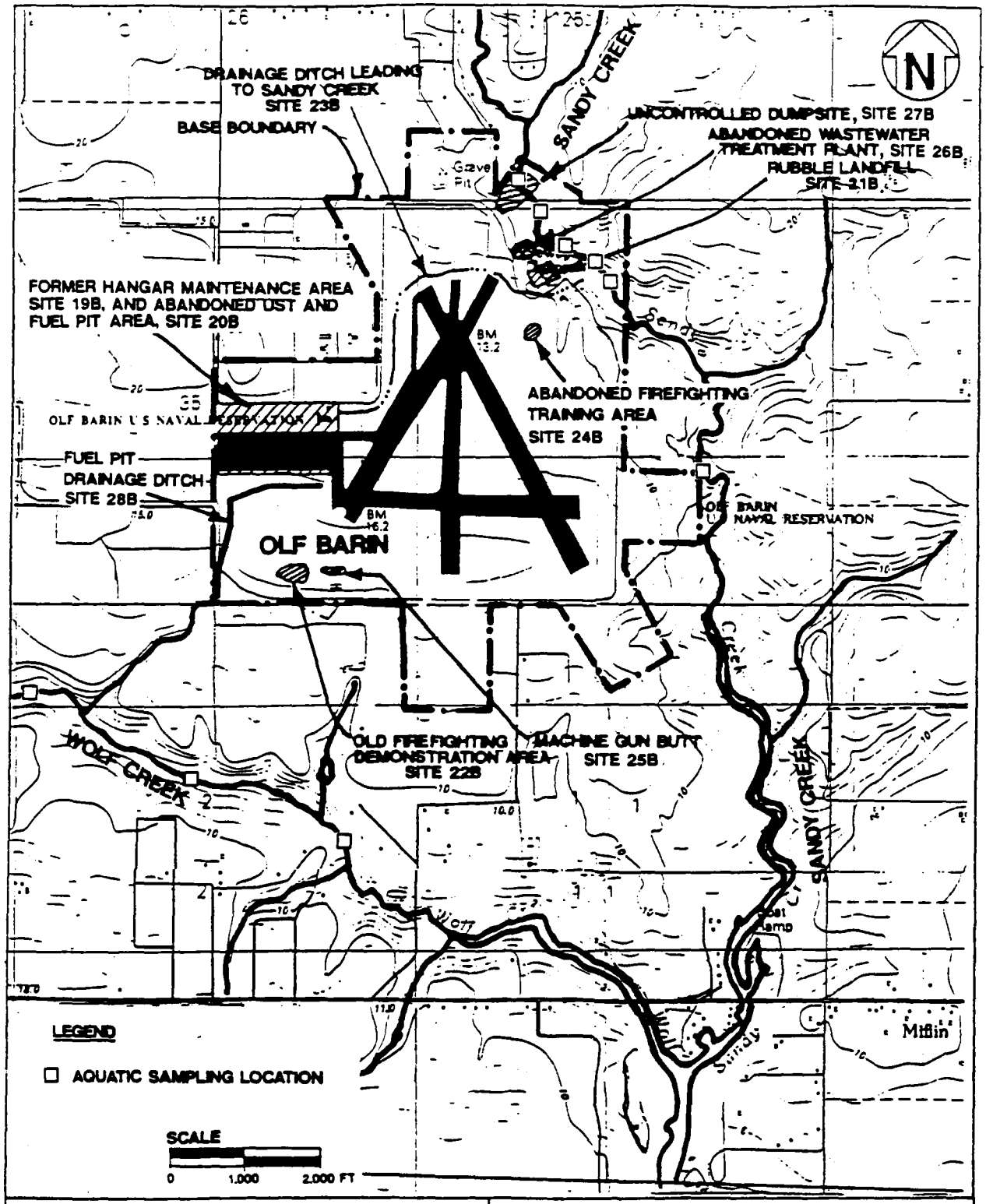


FIGURE 2-2
AQUATIC SAMPLING LOCATIONS AT OLF BARIN

SOURCE: MODIFIED FROM USGS 7.5' QUADRANGLE MAP, FOLEY AL, (1980 a)

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tion and classification. Any available information on vegetation from remote sensing or aerial photography will be incorporated in mapping the vegetation boundaries.

Aquatic organisms will be qualitatively collected from as may different habitats as possible at each location. Stream macroinvertebrates will be sampled using D-frame aquatic dip nets, hand collection, and kick nets. In addition, minnow traps will be employed to characterize the fish fauna in these creeks.

The USEPA Rapid Bioassessment Protocol (RBP) methodology (Plafkin and others, 1989) will be used in conjunction with Hester-Dendy artificial substrates to quantitively determine whether Sandy Creek and Wolf Creek have been impacted by site-related contamination. Four replicate Hester-Dendy artificial substrates will be placed at each of the nine sampling locations and allowed to incubate for 28 days. The invertebrate species that settle on the Hester-Dendy plants will be enumerated and classified to the lowest feasible level of taxonomic resolution for each replicate. Various comparative statistics, including Shannon-Weaver diversity measure, species evenness, species richness, and community similarity indices will be calculated. These data will be used to determine whether the aquatic communities at downstream locations in these two creeks have been impaired relative to the upstream reference stations.

2.2.10.2 Population Survey A population 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 sources. 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 OLF Barin will be used as a base map for additional survey data collection.

An elevation and location survey will be performed (Level II DQOs) by an Alabama-licensed surveyor under contract to ABB-ES to locate all sampling locations including monitoring wells, soil borings, surface soil samples, test pits, 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 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 C). These documents require the identification of sampling locations in terms of latitude and longitude coordinates in accordance with the Federal Interagency Coordinating Committee for Digital Cartography (FICCDC) recommendations.

3.0 SITE-SPECIFIC TECHNICAL APPROACH

The RI technical approach developed for each site is based on several considerations including:

- the physical characteristics and geographic location of the site;
- the history and previous use of each site;
- results, conclusions, and recommendations of previous investigations; and
- site reconnaissance.

This section provides a summary of the proposed technical approach for each of the RI activities to be conducted at the 10 sites. Site-specific investigative objectives and methodologies are summarized in Table 3-1. The proposed field exploration and sampling program for the 10 sites is presented in Table 3-2.

Each subsection provides the rationale for proposed remedial investigative activities and a description of RI exploration and sampling programs to be conducted at each site. Details of the field exploration and sampling methods are presented in Section 2.2.

3.1 RECOMMENDED INSTALLATION-WIDE EVALUATION. Significant data gaps exist for evaluating the presence of inorganic chemicals in soils and sediments, surface water, and groundwater, as well as polynuclear aromatic hydrocarbons (PAHs) and pesticides in soils and sediments, because no site-specific background or upgradient data exist. To properly evaluate the significance of these analytes and their relationship to site-specific releases, eight background soil samples will be collected on OLF Barin. These will be located in areas remote from past activities. Three of these will be collected in the Scranton Loamy Fine Sand Series (characteristic of the Old Firefighting Demonstration Area and Machine Gun Butt) and three to five samples will be collected in the Lakeland Fine Sand Series (which represents the soil type most prevalent on the installation and in the upstream drainage basin of Sandy Creek). Each of these samples will be analyzed for the TAL metals, pesticides and PCBs, and PAHs. Figure 3-1 shows the proposed location of the background soil samples.

Background or upstream concentrations of metals, cyanide, PAHs, and pesticides and PCBs will be documented in sediments and surface water in Sandy Creek as it enters OLF Barin to adequately evaluate contamination from the Uncontrolled Dumpsite, the Abandoned Wastewater Treatment Plant (AWTP), the Rubble Landfill (Site 21B), and the storm drainage ditches. The sample location is shown in Figure 3-1 and discussed in Section 3.5.

Installation of additional monitoring wells recommended for follow-on action will provide sufficient groundwater elevation data to establish depth to groundwater and flow gradients in the northeast corner of the installation. Establishing background metals concentrations in groundwater is essential to properly evaluate potential contamination of the aquifer due to metals (especially lead and mercury) from Sites 19B and 20B, and to evaluate the Rubble Landfill, Site 21B. Upgradient wells will be installed at each of these locations. At the Rubble

Table 3-1
Site-Specific Objectives and Methodologies

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Site	Objectives	Methods
Site wide background	Evaluate the presence of naturally occurring inorganic chemicals in soils, sediments, surface water, and groundwater.	• Collection of soil, sediment, surface water, and groundwater samples.
19B and 20B	Confirm the status of the sites as a source of groundwater contamination.	• Sampling of existing monitoring wells and supply wells. • Monitoring well installation and groundwater sampling.
	Evaluate the existence of residual soil contamination.	• Soil gas survey • Test pitting • Soil boring • Subsurface sampling
21B	Define landfill depth and boundaries and locate buried wastes.	• EM and GPR
	Characterize and quantify the extent of soil contamination.	• Test pitting • Surface and subsurface soil sampling
	Characterize and quantify the extent of groundwater contamination.	• Monitoring well installation • Groundwater sampling
22B and 25B	Characterize and quantify the extent of soil contamination.	• Surface soil sampling • Soil boring and subsurface sampling
	Define the boundaries of the old fire-fighting area.	• Review aerial photographs • Evaluate drainage patterns through site reconnaissance. • Surface soil sampling
23B	Characterize and quantify the extent of soil contamination in the upper drainage ditch.	• Soil boring and subsurface soil sampling.
	Characterize and quantify the extent of soil contamination in the storm drainage ditches.	• Surface soil or sediment sampling
	Characterize and quantify the extent of surface water and sediment contamination in Sandy Creek.	• Surface water and sediment sampling.
24B	Characterize and quantify the extent of soil and groundwater contamination.	• Surface and subsurface soil sampling • Soil borings • Monitoring well installation • Groundwater sampling • Surface soil sampling
26B	Verify the contamination status of the wastewater treatment plant.	• Site reconnaissance • Sludge or sediment sampling

See notes at end of table.

Table 3-1 (Continued)
Site-Specific Objectives and Methodologies

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Site	Objectives	Methods
27B	Characterize and quantify the extent of soil contamination.	• Site reconnaissance • Surface soil sampling
28B	Characterize and quantify the extent of soil contamination in the unlined part of the fuel pit drainage ditch.	• Surface soil sampling
	Characterize and quantify the extent of surface water and sediment contamination in Wolf Creek.	• Surface water and sediment sampling.

Notes: EM = electromagnetic induction.
GPR = ground penetrating radar.

Table 3-2
Summary of Proposed Field Exploration and Sampling Program

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Site	Geophysics EM/GPR	Soil Gas	Monitoring Well Installation		Groundwater Sampling	Exploratory Soil Borings	Test Pits	Surface Soil Samples	Subsurface Soil Samples	Surface Water and Sediment Samples
			Production Zone	Water Table						
Site wide background	0	0	(see Sites 19B/20B)	(see Site 21B and Sites 19B/20B)	0	0	0	8	0	(see Sandy Creek)
Supply well (full scan)	0	0	0	0	1	0	0	0	0	0
During pumping test	0	0	0	0	3	0	0	0	0	0
Former Hangar Maintenance Area, Abandoned USTs, and Fuel Pits Area, Sites 19B and 20B	0	100 points	3	11	22	0	40	0	[1]20	0
Pumping test (VOC only)	0	0	0	0	15	0	0	0	0	0
Rubble Landfill, Site 21B	3.1 acres	0	0	3	3	0	[2]3	0	3	0
Old Firefighting Demonstration Area, Site 22B	0	0	0	0	0	1	0	22	4	0
Displaced Machine Gun Butt Soils	0	0	0	0	0	0	0	2	0	0
Drainage Ditch leading to Sandy Creek, Site 23B										
Upper Ditch at Guadalcanal Road	0	0	0	0	0	1	0	0	3	0
Southern Ditch Outfall	0	0	0	0	0	0	0	1	0	0
North Area Ditch Outfall	0	0	0	0	0	0	0	1	0	0
18-inch Storm Sewer Outfall	0	0	0	0	0	0	0	3	0	0
Sandy Creek	0	0	0	0	0	0	0	10	0	10
Firefighting Training Area, Site 24B	0	0	0	5	5	0	0	6	4	0

See notes at end of table.

Table 3-2 (Continued)
Summary of Proposed Field Exploration and Sampling Program

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Site	Geophysics EM/GPR	Soil Gas	Monitoring Well Installation		Groundwater Sampling	Exploratory Soil Borings	Test Pits	Surface Soil Samples	Subsurface Soil Samples	Surface Water and Sediment Samples
			Production Zone	Water Table						
Machine Gun Butt, Site 25B	0	0	0	0	0	1	0	14	4	0
Abandoned Wastewater Treatment Plant, Site 26B	0	0	0	0	0	0	0	3	0	0
Uncontrolled Dumpsite, Site 27B	0	0	0	0	0	0	0	5	0	0
Fuel Pit Drainage Ditch, Site 28B	0	0	0	0	0	0	0	2	0	0
Wolf Creek	0	0	0	0	0	0	0	2	0	3
Total Installation	3.1 acres	100 points	3	19	49	3	43	79	38	13

[1]From test pits.
[2]Depends on geophysics.

Notes: EM = electromagnetic induction.
GPR = ground penetrating radar.
USTs = underground storage tanks.
VOC = volatile organic compound.

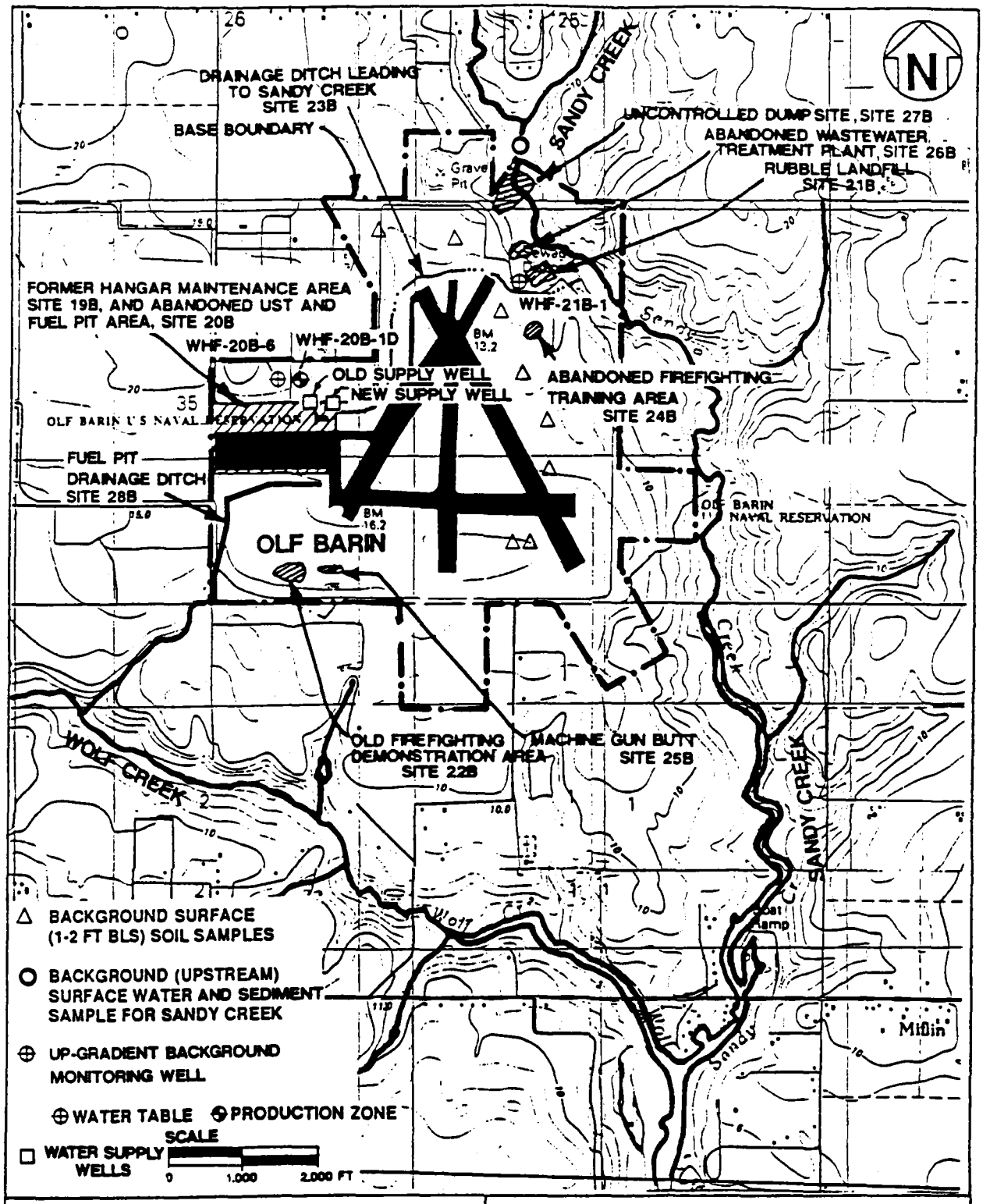

FIGURE 3-1
LOCATION OF INSTALLATION-WIDE RECOMMENDED SAMPLING LOCATIONS

SOURCE: MODIFIED FROM USGS 7.5' QUADRANGLE MAP, FOLEY AL, 1980

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Landfill, inorganic chemicals (TAL metals and cyanide) are the background parameters recommended to be analyzed upgradient. At the western part of the installation (upgradient of Sites 19B and 20B) the complete TCL and TAL should be analyzed to rule out sources upgradient of these sites on or off current Navy property. Locations of wells these are shown in Figure 3-1 and discussed along with their respective sites in Sections 3.2 and 3.3.

3.2 SITE 19B, FORMER HANGAR MAINTENANCE AREA AND SITE 20B ABANDONED UNDERGROUND STORAGE TANK AND FUEL PIT AREA.

3.2.1 Site Description and History

3.2.1.1 **Site 19B** Site 19B consists of the location of four former large aircraft maintenance hangars that had dimensions of approximately 350 feet by 1,460 feet (11.8 acres). These hangars (former building numbers 1221, 1222, 1223, 1235) were built during WWII for the purpose of aircraft maintenance.

As reported in the Preliminary Assessment (PA), maintenance shops were located at the northern end of each hangar area. Maintenance operations likely included cleaning and degreasing of aircraft and aircraft parts, corrosion control, inspection, and testing.

Between 1942 and 1959, the Site 19B hangars were periodically used for aircraft maintenance. The periods of activity mainly occurred during WWII and the Korean Conflict. Numerous types of solvents, oils, and fuels were reportedly used by maintenance personnel in these operations.

The aircraft required oil changes every 40 hours of flying time. The waste oils were put into underground waste oil tanks at the north and south ends of each hangar. When the tanks were full, the wastes were reportedly pumped out by local contractors and transported off station (NEESA, 1989).

3.2.1.2 **Site 20B** Site 20B consists of the abandoned aircraft fuel storage and dispensing facility at OLF Barin. The fuels system consisted of an aquafarm-type system installed in the 1940's and operated during the WWII period until 1947 and again in the 1950's until the installation was placed on inactive status in 1959. Site 20B comprises an area of 19.8 acres and includes the 1-acre fuel underground storage tanks (USTs) area and pumping system area and the 18.8-acre hardstand area where the fueling pits are located.

The USTs at Site 20B were removed in January 1992. A reported 60 abandoned fuel pits and 2.15 miles of underground fuel lines remain at Site 20B. All of the pits and lines are reportedly still in place. The fuel pit area is drained by a 2,000-foot concrete-lined drainage ditch located approximately 100 feet south of Site 20B.

3.2.2 Rationale for Technical Approach The objectives of the proposed RI field investigation of Sites 19B and 20B are to confirm the status of the sites as a source of groundwater contamination and evaluate the existence of residual soils contamination.

The six proposed RI field investigative methods that will be used to achieve the objectives include: soil gas survey, test pitting, subsurface soil sampling,

monitoring well installation, and groundwater sampling. Soil gas exploration area, prospective test pit locations, and prospective monitoring well placement are shown in Figure 3-2 and site-specific objectives and methodologies are summarized in Table 3-1.

3.2.3 Proposed Investigation The following paragraphs provides brief descriptions of proposed field investigative methods and sampling and analysis plans for Sites 19B and 20B. Due to the close proximity to each other and investigated together during the RI.

Monitoring Well Installation. A total of 14 monitoring wells including 11 shallow water table wells and 3 deep production zone wells will be installed during the RI field investigation. Shallow wells will be screened from approximately 14 to 24 feet below land surface (bls) and the deep wells will be screened from approximately 90 to 100 feet BLS. Proposed locations of the monitoring wells are shown in Figure 3-2. Well installation details and specific rationale used to propose and locate each monitoring well are presented in Table 3-3.

All wells will be constructed of flush threaded, 2-inch diameter, schedule 40 PVC with 10 feet of machine-slotted (0.010-inch slots) standard PVC well screen (see Section 2.2.6 of the SAP for more detailed construction and installation). Wells will be constructed and installed in conformance with USEPA Region IV SOPS (USEPA, 1991) and SOUTHNAVFACENGCOM guidelines (Workplan, Appendix A).

Monitoring and Supply Well Groundwater Sampling. Groundwater samples will be collected from the new (raw groundwater) supply well, 8 existing monitoring wells (5 shallow and 3 deep) and 14 newly installed wells (3 deep and 11 shallow including 2 background wells).

Groundwater samples will be collected and analyzed in conformance to Level III (10 percent Level IV) DQOs. Laboratory analysis will include TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, and total cyanide. A summary of the sampling and analysis schedule for groundwater at Sites 19B and 20B is presented in Table 3-4.

Soil Gas Survey. The soil gas survey will consist of the collection of approximately 100 soil gas samples in the vicinity of Sites 19B and 20B. Proposed locations of sample collection include the demolished hangar area (20 samples), the fuel pit area (44 samples) upgradient of Sites 19B and 20B (5 samples), along the storm sewer and drainage ditch (10 samples), and along fuel distribution lines and underground storage tanks (21 samples). Proposed soil gas sampling locations are presented in Figure 3-3. Specific rationale for the areas of soil gas sampling is presented in Table 3-5. Soil gas samples will be shipped to the laboratory and analyzed for the following VOC compounds: benzene, toluene, ethyl benzene, xylenes, trichloroethylene, tetrachloroethylene, and trans-1,2-dichloroethylene. The samples will be analyzed by GC/MS (Level III DQOs).

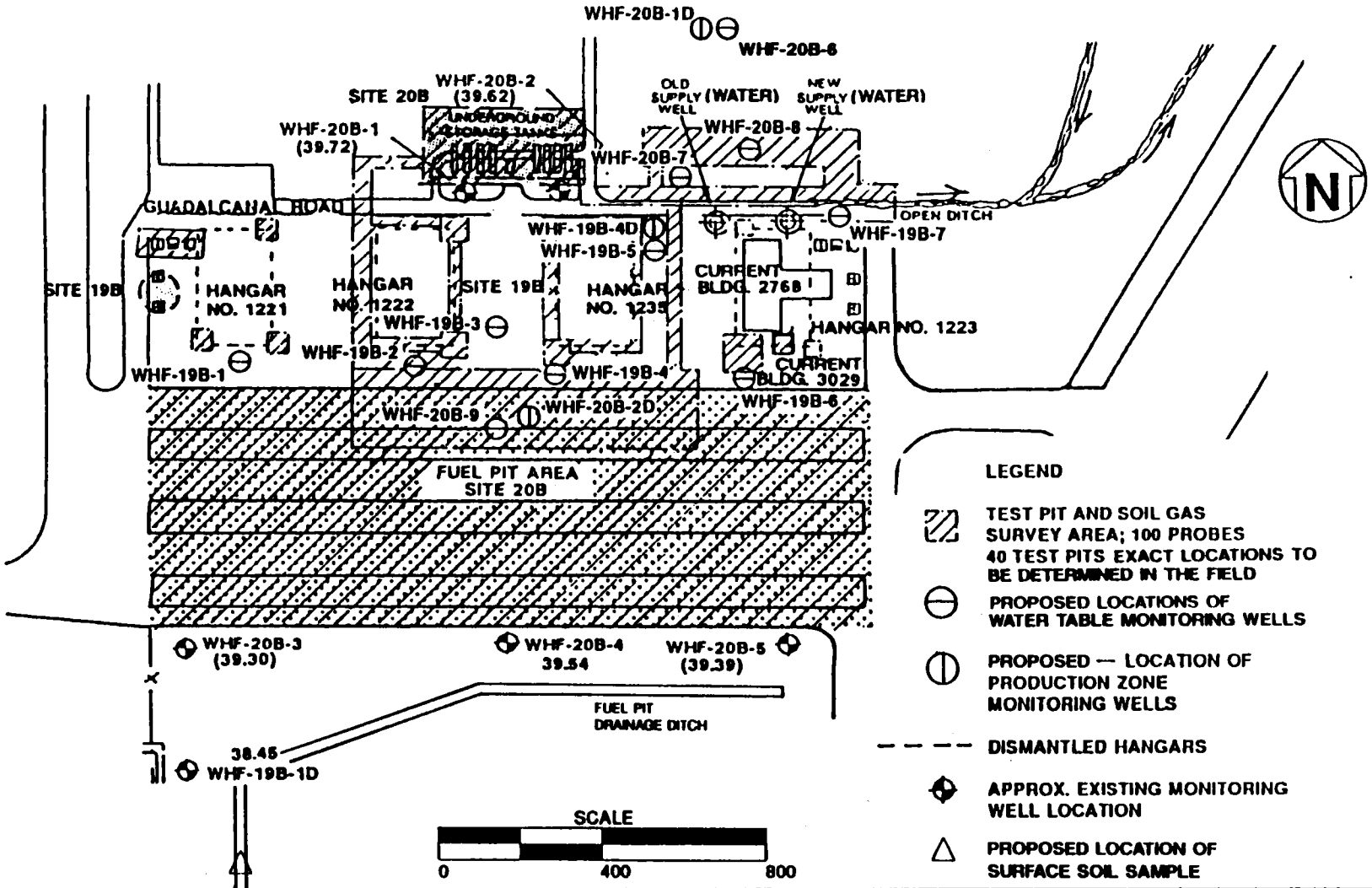

FIGURE 3-2
SITES 19B, FORMER HANGAR MAINTENANCE AREA, & 20B, ABANDONED UNDERGROUND STORAGE TANK & FUEL PIT AREA EXPLORATION PROGRAM

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
SAMPLING & ANALYSIS PLAN

OLF BARIN
FOLEY, ALABAMA

Table 3-3
Proposed Monitoring Well Installation and Rationale

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Proposed Monitoring Well	Total Depth (ft bls)	Screened Interval (ft bls)	Rationale
WHF-19-1S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-19B-2S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-19B-3S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-19B-4S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-19B-4D	100	90 to 100	Characterize and quantify the extent of groundwater contamination and to evaluate vertical gradients.
WHF-19B-5S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-19B-6S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-19B-7S	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-20B-1D	100	90 to 100	Establish background metals concentrations in groundwater and calculate potential of upgradient sources.
WHF-20B-2D	100	90 to 100	Characterize and quantify the extent of groundwater contamination and to evaluate vertical gradients.
WHF-20B-6	24	14 to 24	Establish background metals concentrations in groundwater and calculate potential of upgradient sources.
WHF-20B-7	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-20B-8	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-20B-9	24	14 to 24	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.

Note: ft bls = feet below land surface.

Table 3-3 (Continued)
Proposed Monitoring Well Installation and Rationale

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Proposed Monitoring Well	Total Depth (ft bls)	Screened Interval (ft bls)	Rationale
WHF-21B-1	13	3 to 13	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-21B-2	13	3 to 13	Characterize and quantify the extent of groundwater contamination and provide groundwater flow information.
WHF-21B-3	18	8 to 18	Provide groundwater flow information and upgradient groundwater quality data.
WHF-24B-1	18	8 to 18	Provide groundwater flow information and upgradient groundwater quality data.
WHF-24B-2	18	8 to 18	Provide groundwater flow information and downgradient groundwater quality data.
WHF-24B-3	18	8 to 18	Provide groundwater flow information and downgradient groundwater quality data.
WHF-24B-4	18	8 to 18	Provide groundwater flow information and downgradient groundwater quality data.
WHF-24B-5	18	8 to 18	Provide groundwater flow information and downgradient groundwater quality data.

Note: ft bls = feet below land surface.

Table 3-4
Summary of Sampling and Analysis Schedule

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Environmental Samples (Level III DQOs)

Site	Type of Sample	VOC by GC (including xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesticides/ PCBs	PAHs by HPLC	Total Petroleum Hydrocarbons	Metals			Total Cyanide
								TAL	Lead Only	Copper Only	
Site wide background (Groundwater background included with upgradient wells for Sites 19B/20B and 21B; surface water and sediment with Sandy Cre[illegible]	SO	0	0	0	8	8	0	8	0	0	8
Former Hangar Maintenance Area, Abandoned UST Area and Fuel Pits Area, Sites 19B/20B											
Production well	GW	0	1	1	1	0	0	1	0	0	1
Production well (pumping test)	GW	3	0	0	0	0	0	0	0	0	0
Monitoring wells (29 new and existing wells	GW	0	22	22	22	0	0	22	0	0	22
Monitoring wells (pumping test)	GW	15	0	0	0	0	0	0	0	0	0
Test pits	SO	0	20	0	0	0	0	0	0	0	0
Rubble Landfill, Site 21B											
Monitoring wells (3 wells)	GW	0	3	3	3	0	0	3	0	0	3
Surface soil	SO	0	3	3	3	0	0	3	0	0	3
Test pits	SO	0	3	3	3	0	0	3	0	0	3

See notes at end of table.

Table 3-4 (Continued)
Summary of Sampling and Analysis Schedule

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Environmental Samples (Level III DQOs)

Site	Type of Sample	VOC by GC (including xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesticides/ PCBs	PAHs by HPLC	Total Petroleum Hydrocarbons	Metals			Total Cyanide
								TAL	Lead Only	Copper Only	
Old Firefighting Demonstration Area, Site 22B											
Surface soil	SO	0	0	0	0	0	0	0	22	22	0
1 soil boring (4 samples - 0, 3, 10 & WT)	SO	0	0	0	0	4	0	0	4	4	0
Displaced Machine Gun Butt soil	SO	0	0	0	0	0	0	0	2	2	0
Drainage Ditch Leading to Sandy Creek, Site 23B											
Upper ditch at Guadalcanal Road (soil boring, 3 samples)	SO	0	3	3	3	0	0	3	0	0	3
Northern ditch outfall	SO/SD	0	1	1	1	0	0	1	0	0	1
Southern ditch outfall	SO/SD	0	1	1	1	0	0	1	0	0	1
18-inch storm sewer outfall	SO/SD	0	3	3	3	0	0	3	0	0	3
Sandy Creek	SW	0	10	10	10	0	0	10	0	0	10
	SD	0	10	10	10	0	0	10			10
Firefighting Training Area, Site 24B											
Monitoring wells (5 wells)	GW	0	5	5	5	0	0	5	0	0	5
Surface soil	SO	0	6	0	0	6	6	6	0	0	6
Soil boring (4 samples - 0, 5, 10, WT)	SO	0	4	0	0	4	4	4	0	0	4

See notes at end of table.

Table 3-4 (Continued)
Summary of Sampling and Analysis Schedule

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Environmental Samples (Level III DQOs)

Site	Type of Sample	VOC by GC (including xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesticides/ PCBs	PAHs by HPLC	Total Petroleum Hydrocarbons	Metals			Total Cyanide
								TAL	Lead Only	Copper Only	
Machine Gun Butt, Site 25B	SO	0	0	0	0	0	0	0	14	14	0
Surface soil											
1 soil boring (4 samples - 0, 3, 10 & WT)	SO	0	0	0	0	4	0	0	4	4	0
Abandoned Wastewater Treatment Plant, Site 26B	SO	0	0	3	3	0	0	3	0	0	3
Uncontrolled Dumpsite, Site 27B	SO	0	5	5	5	0	0	5	0	0	5
Fuel pit drainage ditch, Site 28B, Wolf Creek	SO	0	2	2	2	0	0	2	0	0	2
	SW	0	3	3	3	0	0	3	0	0	3
	SD	0	3	3	3	0	0	3	0	0	3

See notes at end of table.

Table 3-4 (Continued)
Summary of Sampling and Analysis Schedule

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

QC Samples (Level IV)

Site	Type of Sample	VOC by GC (including xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesticides/ PCBs	PAHs by HPLC	Total Petroleum Hydrocarbons	Metals			Total Cyanide
								TAL	Lead Only	Copper Only	
Matrix spike/matrix spike duplicates	GW	2	8	8	8	0	0	8	0	0	10
	SW	0	2	2	2	0	0	2	0	0	2
	SD	0	2	2	2	0	0	2	0	0	2
	SO	0	12	12	14	8	2	16	6	6	16
Field duplicates	GW	2	5	5	5	–	–	5	–	–	5
	SW	–	1	1	1	–	–	1	–	–	1
	SD	–	1	1	1	–	–	1	–	–	1
	SO	–	7	5	4	4	1	6	5	5	6
Field Blanks		1	10	9	10	4	1	11	2	2	11
Rinsate Blanks		6	44	38	39	7	2	41	5	5	41
Trip Blanks		6	33	0	0	0	0	0	0	0	0

Notes: VOC = volatile organic compound.
GC = gas chromatography.
MTBE = methyl tert-butyl ether.
GC/MS = gas chromatography/mass spectroscopy.
SVOC = semivolatile organic compounds.
PCB = polychlorinated biphenyls.
PAH = polynuclear aromatic hydrocarbons.
HPLC = high performance liquid chromatography.
TAL = target analyte list.
SO = soil
UST = underground storage tanks.
GW = groundwater
SO/SD = soil/sediment
WT = water table

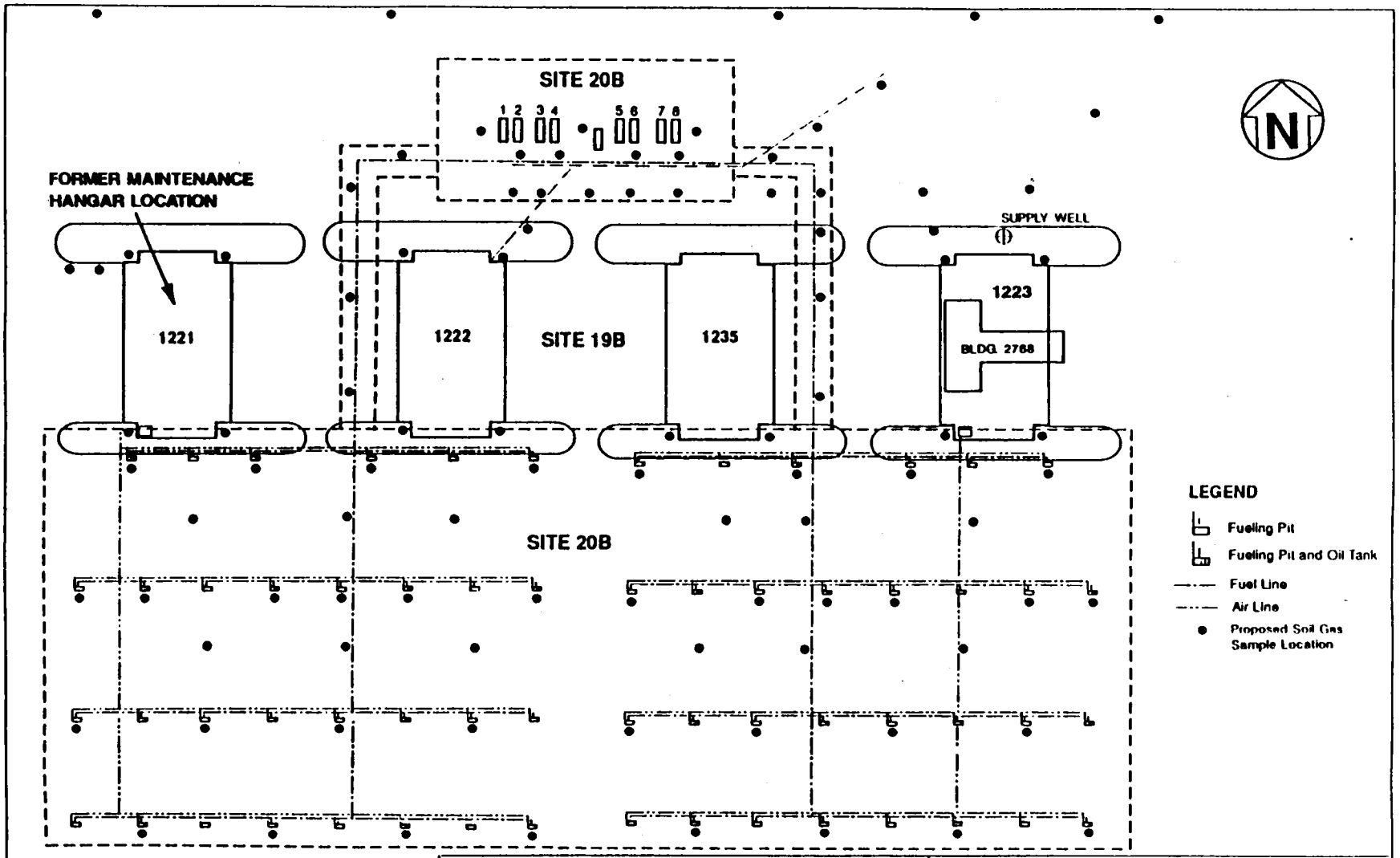

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FIGURE 3-3
SITES 19B, FORMER HANGAR MAINTENANCE AREA, & 20B, ABANDONED UNDERGROUND STORAGE TANK & FUEL PIT AREA PROPOSED SOIL GAS SAMPLING LOCATION

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Table 3-5
Soil Gas Sample Location Rationale

RI/FS Sampling and Analysis Plan
OLF Barin, Foley, Alabama

Site	Soil Gas Sample Location	Approximate Number of Samples (feet)	Rationale
19	Former Hangars Nos. 1221, 1222, 1235, and 1223.	20	Identify areas of VOC contamination resulting from waste and/or spills associated with aircraft maintenance and underground waste oil tanks.
20	Fuel Pit Area	60	Identify areas of VOC contamination resulting from leaks and/or spills associated with the fuel pits.
19 and 20	Upgradient of Site 19 and 20.	5	Investigate and identify areas of VOC contamination resulting from contaminant migration from potential upgradient sources.
19 and 20	Along storm sewer and drainage ditch between Sites 19 and 20.	10	Identify areas of VOC contamination resulting from storm sewer leaks and local fuel spills.
19 and 20	Along fuel distribution lines and underground storage tanks.	21	Identify areas of VOC contamination resulting from leaking fuel distribution lines and underground storage tanks and isolated fuel spills.

Note: VOC = volatile organic compound.

This task will be subcontracted to Northeast Research Institute, Inc. (NERI), of Farmington, Connecticut. NERI will be responsible for providing collectors, supplies, and training of ABB-ES personnel. Once ABB-ES personnel are adequately trained they will be responsible for placement, retrieval, and shipment of collectors.

Test Pitting. Based on the results of the soil gas survey, test pits will be dug with a backhoe at Sites 19B and 20B (Figure 3-2). The test pits will be used to evaluate the existence of residual soils contamination in the demolished hangar areas, fuel pits area, and surrounding areas.

A maximum of 20 subsurface soil samples will be collected from the 40 test pits. Samples will be collected from areas of visible contamination or areas exhibiting above background OVA or PI readings. Each sample will be shipped to the laboratory for VOC analysis following Level III and 10 percent Level IV DQOs.

During excavation of the soils, test pit locations, lithology, presence of groundwater, and evidence of contamination will be logged by ABB-ES personnel.

Upon completion of the test pit, the pit will be filled with the excavated material.

Subsurface Soil Sampling (see Test Pitting section for additional sampling). Soil samples were collected in December 1991 and January 1992 by SOUTHNAVFAC-ENGCOM's tank removal subcontractor from soil-filled tanks and from below the tanks at Site 20B.

Soil samples collected from the soil-filled fuel tanks and below the tanks were analyzed for lead and total petroleum hydrocarbons. Results of the chemical analyses were forwarded by the subcontractor to ABB-ES for incorporation into the RI/FS.

Aquifer Pumping Test. A 72-hour pumping test will be performed using the OLF Barin groundwater supply well as the pumping well. Water level readings in four adjacent monitoring wells will be recorded during the entire test using pressure transducers and a data logger.

The pumping test will consist of three parts as follows.

1. Pre-pumping Recovery. Three days before pumping begins the supply well will be taken off line to allow for recovery of the potentiometric surface in the vicinity of the supply well and water level measurements will be collected manually with an electronic water level indicator.

2. Pumping. The supply well will be pumped for 72 hours and water levels in adjacent monitoring wells will be recorded.

3. Post-pumping Recovery. Water level measurement in the adjacent monitoring wells will be recorded during the recovery of the potentio-

metric surface to static conditions once the pumping has been discontinued.

Other measurements, specifically barometric pressure and supply well discharge, will be collected during the entire pumping test.

To evaluate the effects the pumping of the supply well has on contaminant concentrations in groundwater, groundwater samples will be collected from supply well and five adjacent monitoring wells during the pumping test. One sample will be collected from the supply well and each of five adjacent monitoring wells (not the wells recording changes in water levels) at the beginning of pumping, at the end of pumping, and after recovery. The groundwater samples will be analyzed for TCL VOCs (USEPA Methods 601 and 602 including xylenes and methyl tert-butyl ether [MTBE]).

3.3 SITE 21B, RUBBLE LANDFILL.

3.3.1 Site Description and History The Rubble Landfill is located in the northeast section of OLF Barin. This fill area reportedly received debris from dismantled buildings that were destroyed when the station was decommissioned and the north and west areas released in 1959. The landfill appears to be approximately 3.1 acres in area and lies just to the west of Sandy Creek.

According to the PA (NEESA, 1989), only waste debris from dismantled buildings was discarded on this site. No burial of the rubble was reported and all disposal was on the surface. During the PA site visit, no evidence of drums or other containers that might have contained hazardous waste were located. The site is overgrown with Kudzu vine so visibility was limited.

3.3.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 21B are to define the landfill boundaries, determine the depth and nature of the fill material, and characterize and quantify the extent of soil and groundwater contamination.

The proposed exploration and sampling methods for the RI field investigation include EM and GPR geophysical surveys, test pitting, surface and subsurface soil sampling, monitoring well installation, and groundwater sampling. Locations of the proposed exploration for Site 21B are presented in Figure 3-4. RI/FS objectives and exploration and sampling methods to be used during the field investigation are summarized in Table 3-1.

3.3.3 Proposed Investigation The following provides brief descriptions of proposed field investigative methods and sampling and analysis plans for Site 21B.

Geophysical Survey. A geophysical survey will be performed at the 3.1 acre Site 21B using terrain conductivity (EM-31) and ground penetrating radar (GPR) techniques. The survey will be conducted to define the landfill boundaries and locate buried wastes.

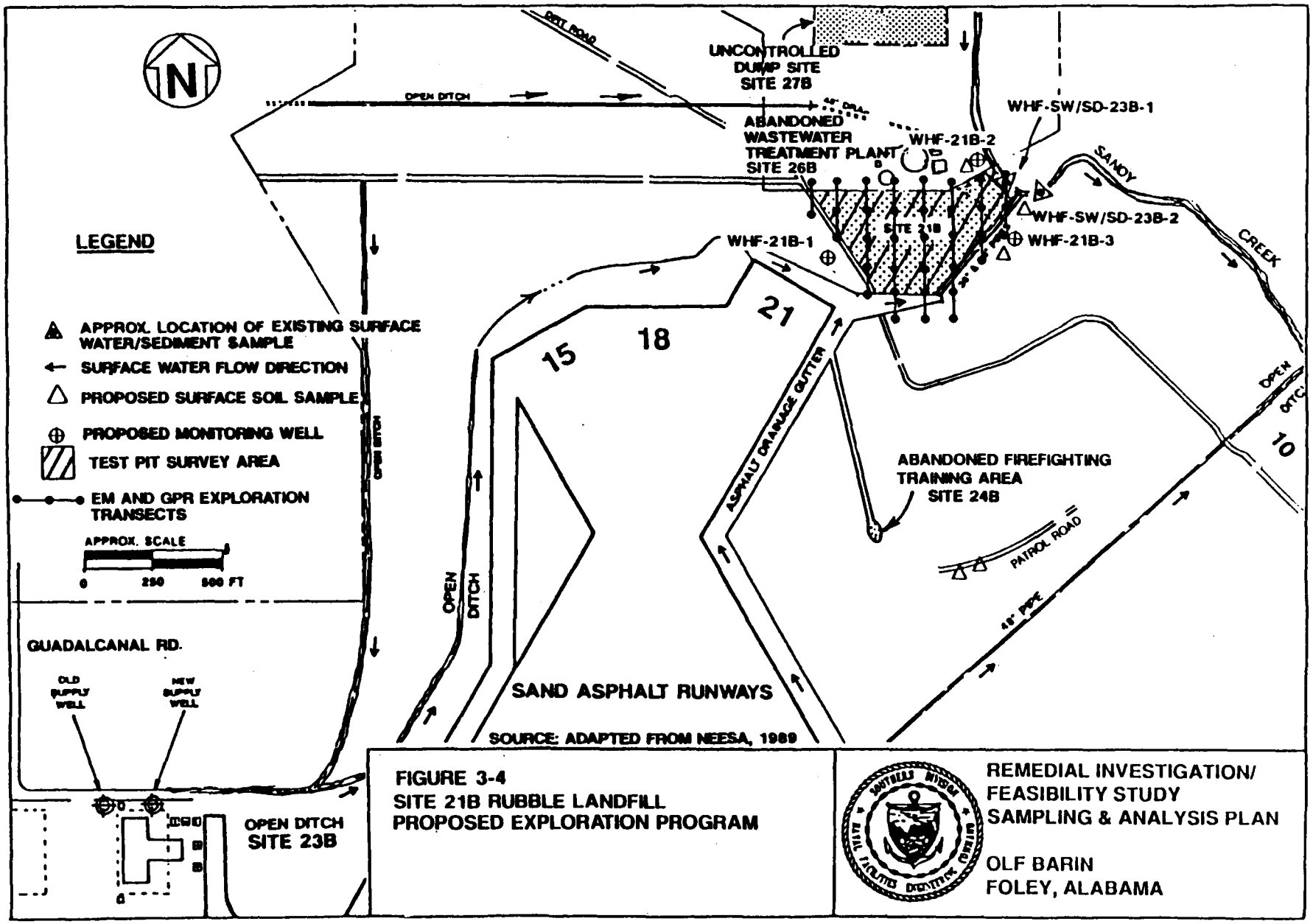

FIGURE 3-4
SITE 21B RUBBLE LANDFILL
PROPOSED EXPLORATION PROGRAM

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Transect lines across the apparent site area will be spaced 50 feet apart with data collection points every 50 feet (Figure 3-4). Areas where subsurface objects appear to be present will be marked for excavation during the test pitting task.

Test Pitting. A total of three test pits will be dug at locations where buried objects appear to be present based on the results of the geophysical survey. Test pits will be dug with a backhoe to approximately 10 feet bls.

One soil sample will be collected from each test pit. Samples will be collected from areas of apparent visible contamination or elevated OVA or PID readings. Selected soil samples will be shipped to the laboratory for chemical analysis of TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanide (Level III and 10 percent Level IV DQOs).

Surface Soil Sampling. A total of three surface soil samples will be collected from the downslope area of the floodplain from the filled area (Figure 3-4). These samples will be collected to identify if contaminants are being transported from the landfill toward the floodplain via overland flow of surface water and sediment. The soil samples will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanide (Level III and 10 percent IV DQOs).

Monitoring Well Installation. Three shallow watertable monitoring wells (one upgradient and two downgradient) will be installed at Site 21B (Figure 3-4). The upgradient well will be screened across the water table from approximately 6 to 16 feet BLS and will provide groundwater flow information and background quality data. The two downgradient wells will also be screened across the water table from approximately 3 to 13 feet BLS to provide groundwater flow information and characterize and quantify the extent of groundwater contamination. Well installation details and specific rationale used to propose and locate each monitoring well are presented in Table 3-3.

All wells will be constructed of flush threaded, 2-inch diameter, schedule 40 PVC with 10 feet of machine slotted (0.010-inch slots) standard PVC well screen (Section 2.2.6 of the SAP details construction and installation). Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991) and SOUTHNAVFACENGCOM guidelines (Workplan, Appendix A).

Groundwater Sampling. Groundwater samples will be collected from each of the three newly installed wells at Site 21B and analyzed in accordance to Level III and 10 percent Level IV DQOs. Laboratory analysis will include TCL VOCs, SVOCs, pesticides/PCBs, TAL metals, and total cyanide.

3.4 SITE 22B, OLD FIREFIGHTING DEMONSTRATION AREA.

3.4.1 Site Description and History The exact location of the Old Firefighting Demonstration Area is not known, but the PA (NEESA, 1989) locates it just west of the machine gun butt. The suspected location is a level, poorly vegetated area with poor drainage. More than 45 years have elapsed since firefighting exercises were staged in this area. The last firefighting demonstrations to take

place occurred during WWII and probably numbered fewer than 12 to 15 total demonstrations.

Discussions with station firefighting personnel resulted in an estimate of 400 to 1,000 gallons of combustible liquids including contaminated fuel that could have been ignited on a wrecked aircraft for each demonstration. During WWII it is likely that oils and spent solvents were commingled with the fuel. No records exist describing the total amount of liquid flammables that were actually used during the WWII demonstrations.

3.4.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 22B are to define the boundaries of the old firefighting area and characterize and quantify the extent of soil contamination of the firefighting area.

Explorations and activities at the Old Firefighting Demonstration Area include surface and subsurface soil sampling, review of aerial photographs, and an evaluation of site drainage patterns to determine sampling locations for surface soils.

3.4.3 Proposed Investigation. The following paragraphs provide brief descriptions of proposed field investigative methods and sampling and analysis plans for Site 22B.

Surface Soil Sampling. Surficial soil samples will be collected at Site 22B to characterize and quantify the extent of lead and copper soil contamination. The soil sampling grid (100 feet centers) used for the SI will be expanded for the collection of 22 soil samples (Figure 3-5) from a depth of 1 to 2 feet bls. The expanded grid will enable areas adjacent to elevated lead concentrations in soil to be evaluated for lead contamination resulting from firefighting activities and corrosion of lead and copper bullets and shells from the machine gun butt.

All soil samples will be analyzed (Level III and 10 percent Level IV DQOs) for lead and copper to assess their potential origin.

Soil Boring Program. One soil boring will be advanced to the water table at Site 22B to assess the vertical migration of contaminants. The location of the proposed boring is shown in Figure 3-5.

Soil samples from the surface, 3 feet bls, 10 feet bls, and at the water table will be collected via split-spoon sampling and analyzed (Level III and 10 percent Level IV DQOs) for lead, copper, and PAHs.

Aerial Photograph Survey. Historical aerial photographs, either from Naval archives on the U.S. Department of Agriculture Soil Conservation Service, will be reviewed, if available, to attempt to more accurately locate the Old Firefighting Demonstration Area.

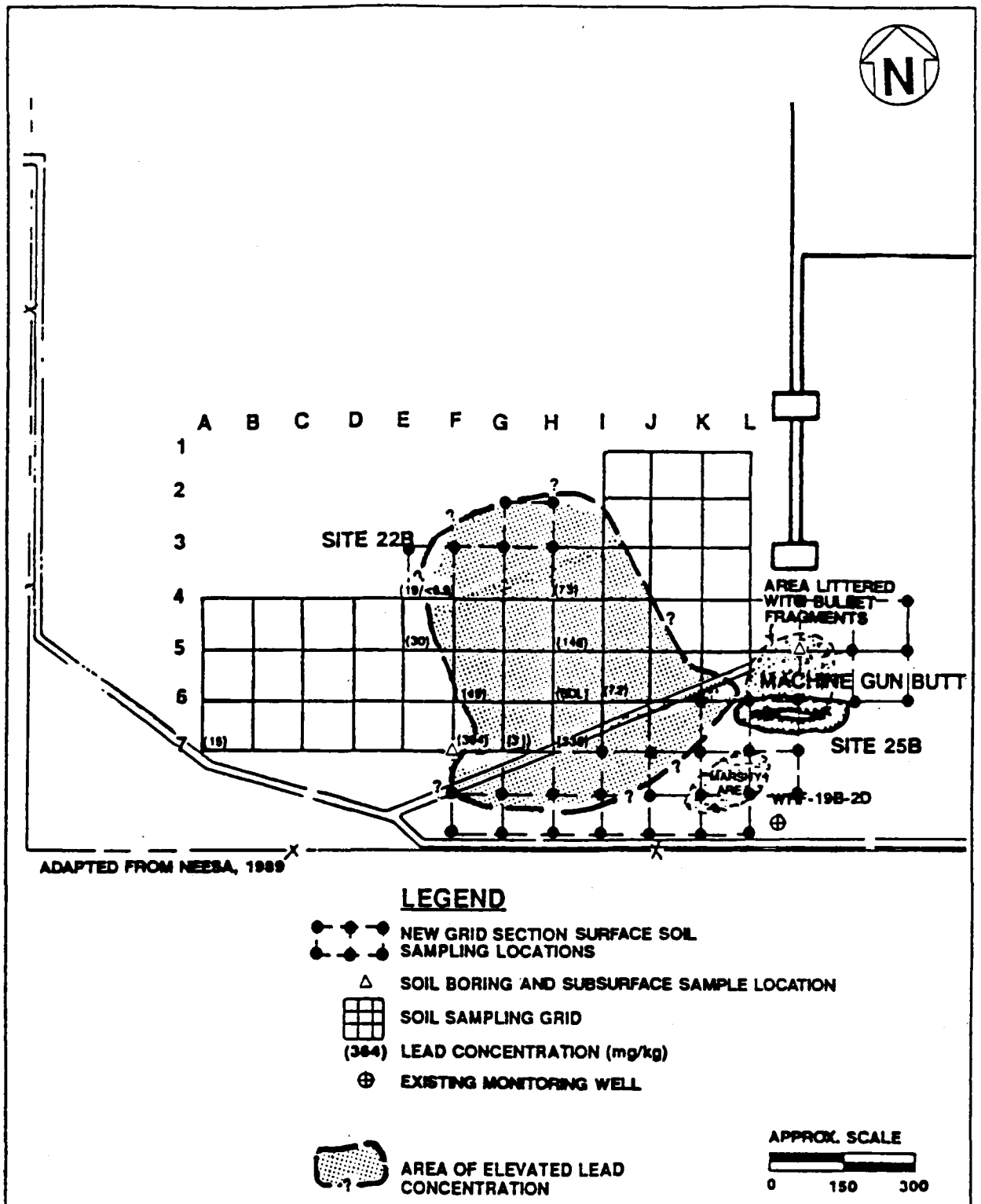

FIGURE 3-5
SITE 22B, OLD FIREFIGHTING DEMONSTRATION AREA AND SITE 25B, MACHINE GUN BUTT PROPOSED EXPLORATION PROGRAMS

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3.5 SITE 23B, DRAINAGE DITCH LEADING TO SANDY CREEK.

3.5.1 Site Description and History The drainage ditch system runs east from Guadalcanal Road, turns north approximately 500 feet east of the Command Building (Building 2768), travels approximately 2,500 feet north, and intersects another open ditch, which flows approximately 2,000 feet east to Sandy Creek. This drainage ditch is unlined throughout its length from Guadalcanal Road to the ends of the runway. The ditch exists only as a swale along the north end of the runway.

The drainage ditch system reportedly carried runoff from the Former Hangar Maintenance Area, Site 19B, as well as discharged water from the aquafarm fuel system (Site 20B) and provided an avenue for contaminants to travel toward Sandy Creek. A 2,000-gallon fuel spill, which occurred in 1954, migrated toward Sandy Creek via the drainage ditch. During the 1940's, aircraft were washed on wash racks in the Former Hangar Maintenance Area using kerosene as a cleaner. Reportedly (NEESA, 1984), kerosene was reclaimed through the use of an oil-water separator. Discharge of rinse water through the oil-water separators was conveyed toward Sandy Creek via the Site 23B ditch.

Sandy Creek was reported to be unfishable due to kerosene contamination when the aircraft washing operations were underway at OLF Barin. Fishing in Sandy Creek was discontinued in the early 1950's according to the PA (NEESA, 1989).

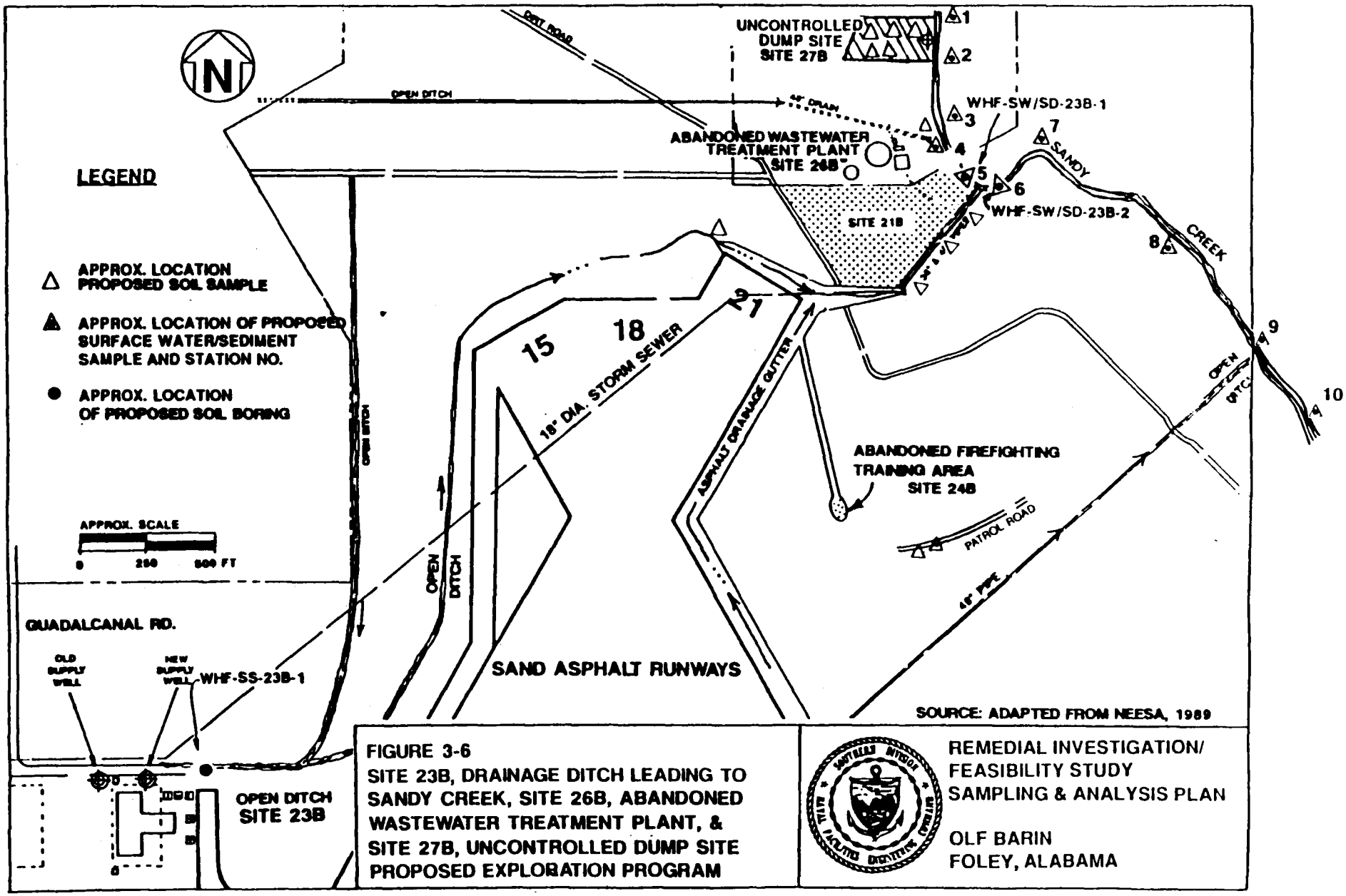
After the SI field investigation was completed, additional blue line drawings of underground utilities were obtained by ABB-ES from the Public Works Department at NAS Whiting Field. One of the blue line drawings showed an 18-inch diameter reinforced concrete storm sewer running along the north side of Guadalcanal Road, under the northern end of the runways and discharging into a ditch adjacent to the 48-inch pipe used to drain the runways (Figure 3-6). The ditch is approximately 400 feet long and discharges into Sandy Creek.

The 18-inch storm sewer drained runoff from the underground storage tank area, Guadalcanal Road, the aircraft maintenance hangars, and the aircraft wash racks.

Six-inch diameter vitrified clay pipe drained stormwater from the four maintenance hangars and fluids generated from wash rack activities. These 6-inch drainage pipes discharged fluids into the 18-inch storm sewer on the north side of Guadalcanal Road. All of the storm sewer lines are reportedly still in place.

3.5.2 Rationale for Technical Approach The objectives of the RI/FS program at Site 23B are to characterize and quantify the extent of soil, sediment, and surface water contamination of the OLF Barin drainage system from the upper drainage ditch and 18-inch storm sewer to the discharge ditch and Sandy Creek.

Surface and subsurface soil, sediment, and surface water samples will be collected for laboratory analysis to characterize and quantify the extent of contamination in the drainage ditch, discharge ditch, and Sandy Creek. Site 23B exploration and sampling locations are presented in Figure 3-6. RI/FS objectives and exploration and sampling methods to be used during the field investigation are summarized in Table 3-1.



SOURCE: ADAPTED FROM NEESA, 1989

FIGURE 3-6
SITE 23B, DRAINAGE DITCH LEADING TO SANDY CREEK, SITE 26B, ABANDONED WASTEWATER TREATMENT PLANT, & SITE 27B, UNCONTROLLED DUMP SITE PROPOSED EXPLORATION PROGRAM

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3.5.3 Proposed Investigation The following paragraphs provide a brief descriptions of proposed field investigative methods and sampling and analysis plans for Site 23B.

Surface Soil Sampling. A total of five surface soil or sediment samples will be collected from the two storm drainage and storm sewer ditches immediately prior to discharge into Sandy Creek (Figure 3-6). These samples will evaluate potential contaminant migration from Sites 19B and 20B, runway areas, and the former industrialized area. All samples will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanide (Level III and 10 percent Level IV DQOs).

Soil Boring and Sampling. One soil boring will be advanced to the water table (15 to 20 feet BLS) at the end of Guadalcanal Road (Figure 3-6). Up to three soil samples will be collected from split-spoon samples that appear to be contaminated based on visual observation or elevated OVA or PID readings. Laboratory analyses will include TCL VOCs, SVOCs, pesticides and PCBs, and TAL metals (Level III and 10 percent Level IV DQOs).

Surface Water and Sediment Sampling. Surface water and sediment samples will be collected from 10 locations along Sandy Creek (Figure 3-6). The sampling locations and rationale are detailed as follows:

(1) at the northern installation boundary where Sandy Creek enters OLF Barin (upgradient background),

(2) downstream of the north area storm drain outfall but upstream of the Uncontrolled Dumpsite,

(3) downstream of the Uncontrolled Dumpsite but upstream of the Abandoned Wastewater Treatment Plant (AWTP) outfall,

(4) downstream of the AWTP Outfall but upstream of the Rubble Landfill and the second storm drain outfall,

(5) at WHF-SSD-23B-1 (resample for confirmation),

(6) at WHF-SSD-23B-2 (resample for confirmation),

(7) 100 feet downstream of the storm drain outfall and WHF-SW/SD-23-2 to evaluate the downstream extent of pesticide and aromatic VOC contamination migration,

(8) 600 feet downstream of sample (7) to evaluate the downstream migration potential from upstream sources.

(9) evaluate downgradient contaminant migration from the firefighting training area,

(10) evaluate downstream migration potential from all upstream sources.

The purpose of the surface water and sediment sampling program is to collect data to evaluate possible ecological exposure pathways and to determine the potential for off-site transport of contaminants.

Surface water and sediment samples will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL inorganics, and total cyanide in conformance with Level III and 10 percent Level IV DQOs.

3.6 SITE 24B, ABANDONED FIREFIGHTING TRAINING AREA.

3.6.1 Site Description and History The firefighting training area was built in 1989 to comply with the Navy's crash crew firefighting training requirements. The burn pit is approximately 50 feet in diameter and is located about 1,000 feet south of Site 21B (Figure 3-7). According to the OLF Barin fire chief, firefighting exercises occurred on a weekly basis and used approximately 500 gallons of JP-5 jet fuel per exercise. Only JP-5, which was either clean or contaminated with water or hydraulic fluid, was used. No other fuels, solvents, or other chemicals were used in the exercises.

The burn pit consists of a synthetic polyethylene liner covered with 18 inches of clay and 6 inches of sand. The berm around the burn pit has recently been built up to prevent ponding water contaminated with JP-5 from overflowing.

However, stressed vegetation and stained soils indicate that contaminated water from the burn pit has previously overflowed. The runoff path from the burn pit is approximately 30 feet wide and is toward Sandy Creek. Surface soils of the runoff path contain a slight diesel odor.

The firefighting training area was deactivated in December 1991 and was subsequently added to the RI. The Navy plans to construct a state of the art firefighting training area to prevent the contamination of soil and groundwater.

3.6.2 Rationale for Technical Approach The objective of the RI field program at the abandoned firefighting training area is to characterize and quantify the extent of soil and groundwater contamination.

The field investigation will include downgradient and upgradient monitoring well installation and sampling, and surface soil sampling from the runoff pathway. To prevent the spread of burn pit contamination through the synthetic liner, no exploration will be conducted within the boundary of the burn pit.

Abandoned Firefighting Training Area exploration and sampling locations are presented in Figure 3-7. RI/FS objectives and exploration and sampling methods are summarized in Table 3-1.

3.6.3 Proposed Investigation The following paragraphs provide brief descriptions of proposed field investigative methods and sample and analysis plans for the abandoned firefighting training area.

Surface Soil Sampling. Six surface soil samples will be collected from the burn pit runoff pathway (Figure 3-7). These samples will determine the distance (with

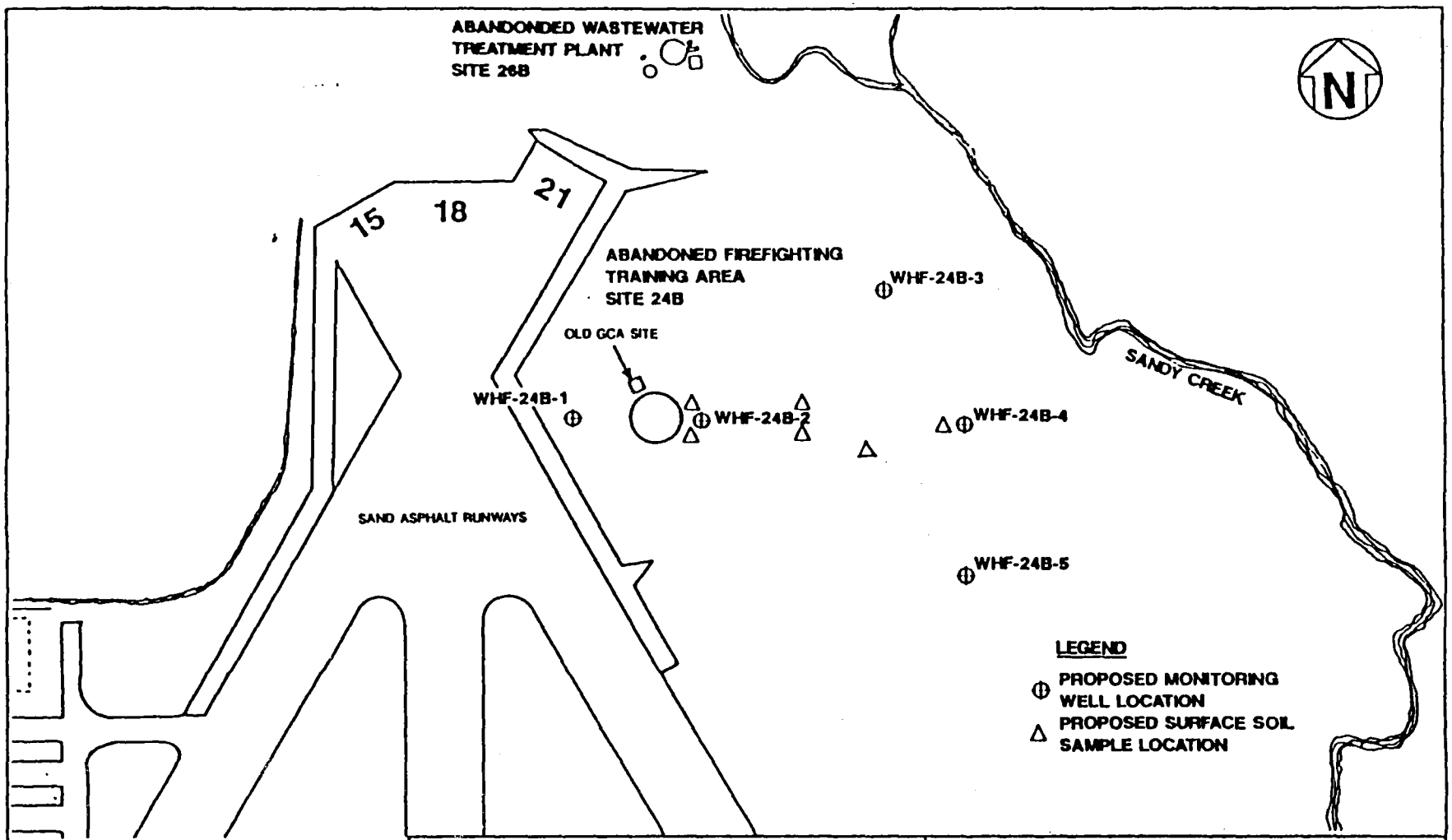

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FIGURE 3-7
SITE 24B, ABANDONED FIREFIGHTING TRAINING AREA
PROPOSED EXPLORATION PROGRAM

REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
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associated concentrations) burn pit contaminants have traveled downgradient via overland flow. All soil samples will be analyzed for TCL VOCs, PAHs, total petroleum hydrocarbon (TPH), and TAL metals (Level III and 10 percent Level IV DQOs).

Subsurface Soil Sampling. A total of four subsurface soil samples (0, 5, 10, and 15 feet BLS) will be collected from the boring for monitoring well WHF-21B-2 to assess the vertical extent of soil contamination. Laboratory analysis will included TCL VOCs, PAH, total petroleum hydrocarbons (TPH), TAL metals (Level III and 10 percent Level IV DQOs).

Monitoring Well Installation. Five shallow water table monitoring wells (one upgradient and four downgradient) will be installed at the abandoned Firefighting Training Area (Figure 3-7). The upgradient well will be screened across the water table from approximately 8 to 18 feet BLS and will provide groundwater flow information and background quality data. The four downgradient wells will also be screened across the water table from approximately 8 to 18 feet BLS to provide groundwater flow information and characterize and quantify the extent of groundwater contamination. Well installation details and specific rationale used to proposed and locate each monitoring well are presented in Table 3-3.

All wells will be constructed of flush threaded, 2-inch diameter, schedule 40 PVC with 10 feet of machine slotted (0.010-inch slots) standard PVC well screen (Section 2.2.6 of the SAP details construction and installation). Wells will be constructed and installed in conformance with USEPA Region IV SOPs (USEPA, 1991) and SOUTHNAVFACENGCOM guidelines (Appendix B).

Groundwater Sampling. Groundwater samples will be collected from each of the four newly installed wells at the abandoned Firefighting Training Area and analyzed in accordance to Level III and 10 percent IV DQOs. Laboratory analysis will include TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanide.

3.7 SITE 25B, MACHINE GUN BUTT

3.7.1 Site Description and History The machine gun butt was used as a target for fire from 0.50 caliber machine guns and other firearms. Spent lead, steel, and copper jacketed bullets were observed littering the north side of the machine gun butt. The machine gun butt was identified as an area of concern during SI and Hazard Ranking System II (HRS II) site visits and warranted investigation. No previous investigations have been conducted at the machine gun butt.

3.7.2 Rationale for Technical Approach The objective of the RI/FS program at Site 25B is to characterize the nature and extent of soil contamination at the machine gun butt and the area where soil from the machine gun butt containing lead, steel, and copper jacketed bullets was moved to repair a washed-out patrol road.

The contamination status of the machine gun butt has not been assessed. Therefore, surface and subsurface soil samples will be collected at the machine gun butt to determine the nature and extent of soil contamination. Surface soil samples will also be collected from the displaced machine gun butt soil on the patrol road to assess the presence of contaminants.

3.7.3 Proposed Investigation The following sections provide brief descriptions of proposed field investigative methods and sampling and analysis plans for Site 25B.

Surface Soil Sampling. Surface soil samples will be collected at Site 25B to characterize the nature and extent of lead and copper soil contamination. The soil sampling grid from Site 22B will be expanded to include the machine gun butt and surrounding area (see Figure 3-5).

A total of 14 soil samples will be collected from the grid locations at depths of 1 to 2 feet bls. In addition, two soil samples will be collected from the displaced machine gun butt soil along the patrol road (see Figure 3-4) to assess lead and copper soil contamination.

All soil samples will be analyzed (Level III and 10 percent Level IV DQOs) for lead and copper.

Soil Boring Program. One soil boring will be advanced to the water table at Site 25B to assess the vertical extent of lead and copper soil contamination. The location of the proposed soil boring is presented in Figure 3-5.

Soil samples from the surface, 3 feet bls, 10 feet bls, and at the water table will be collected via split-spoon sampling and analyzed (Level III and 10 percent Level IV DQOs) for lead, copper, and PAHs.

3.8 SITE 26B, ABANDONED WASTEWATER TREATMENT PLANT

3.8.1 Site Description and History The OLF Barin Wastewater Treatment Plan was taken out of service in 1959 when the installation was deactivated and the Administrative Area and West Field was transferred back to the City of Foley.

The AWTP is located directly north and adjacent to the rubble landfill (see Figure 3-4). The AWTP covers an area of approximately 160 feet by 260 feet (1 acre) and is overgrown with vegetation, limiting visibility. Remaining components of the AWTP include primary and final settling tanks, trickling filter, digester tank, chlorination chamber, and a 46 foot by 56-foot sludge drying bed.

The AWTP site was identified during SI and HRS II site visits in 1991. No previous investigations have been conducted at the AWTP.

3.8.2 Rationale for Technical Approach The objective of the RI/FS program at Site 26B is to assess the sludge or sediment contamination status in the sludge drying beds at the AWTP. Therefore, sludge or sediment samples will be collected from the sludge drying beds for analysis.

3.8.3 Proposed Investigation

Sludge or Sediment Sampling. A total of three sludge or sediment samples will be collected from the AWTP sludge drying beds. Samples collected will be analyzed for TCL SVOCs, pesticides and PCBs, TAL inorganics, and total cyanide.

3.9 SITE 27B, UNCONTROLLED DUMPSITE

3.9.1 Site Description and History This site comprises an area estimated as 0.5 to 0.75 acre located at the northeastern boundary of OLF Barin (see Figure 3-4). Motor vehicle access is possible to the area and it has become a dump area for used appliances, paint cans, garbage, as well as tires, auto parts, and used motor oil cans. Three rusted 55-gallon drums were observed during the limited inspection. Much of the site is overgrown with vines and brush, restricting visibility.

In addition to uncontrolled dumping of trash, garbage, and unknown material, which appears to be ongoing, the area also represents an attractive play area for children. A housing area consisting of approximately 30 homes and mobile homes is located from 500 to 1,500 feet north of the dumpsite along U.S. Highway 98. During the HRS II site visit there was abundant evidence of fishing activities, picnicking, and body contact water sports activities along Sandy Creek adjacent to the uncontrolled dumpsite.

The uncontrolled dumpsite was identified during SI and HRS II site visits in 1991. No previous investigations have been conducted at the uncontrolled dumpsite.

3.9.2 Rationale for Technical Approach The objective of the RI/FS program at Site 27B is to assess the nature and extent of soil contamination at the uncontrolled dumpsite. To achieve this objective, surface soil samples from Site 27B will be collected and analyzed.

3.9.3 Proposed Investigation

Surface Soil Sampling. A maximum of five surface soil samples will be collected from areas within the uncontrolled dumpsite that appear to be visibly contaminated. The soil samples will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL inorganics, and total cyanide.

3.10 SITE 28B, FUEL PIT DRAINAGE DITCH

3.10.1 Site Description and History The fuel pit drainage ditch is located at the south end of the fuel pit area (see Figure 3-8). The ditch runs west to the installation boundary, turns south, travels approximately 700 feet to an open ditch, continues south approximately 70 feet, runs out the southwest corner of the installation boundary, and travels approximately 2,600 feet to discharge into Wolf Creek.

The first 2,000 feet of the drainage ditch are lined with concrete; however, it is unlined throughout its remaining length to Wolf Creek. A review of historical aerial photographs show the concrete part of the ditch was originally an unlined swale. The ditch received stormwater that drained from the concrete fuel pit area. The potential releases to the unlined ditch and eventually Wolf Creek include solvents, waste oil, and fuel.

The drainage ditch was identified as an area of concern during a RI site visit in January 1992.

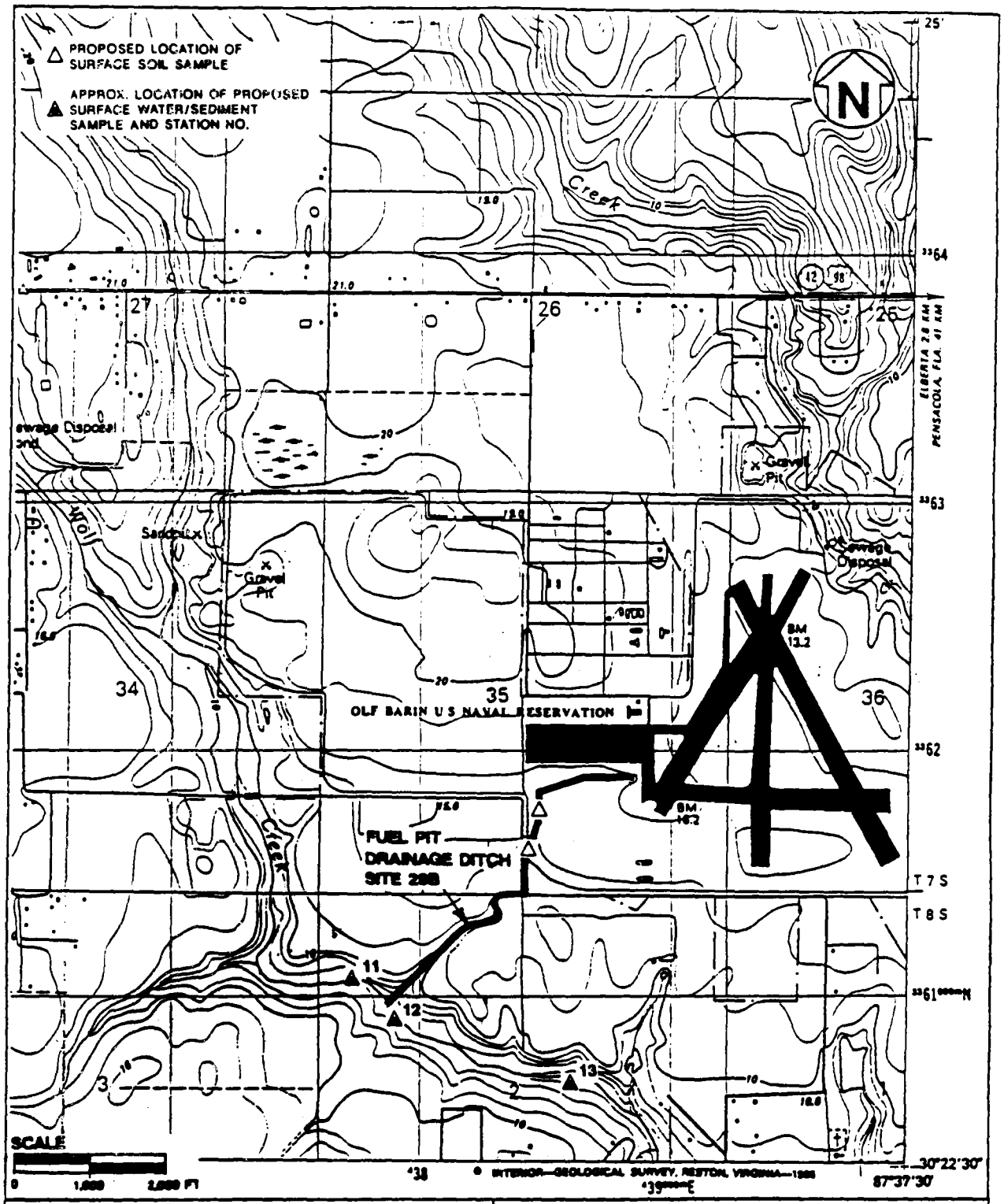

FIGURE 3-8

LOCATION OF SITE 28B, FUEL PIT DRAINAGE DITCH

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY SAMPLING & ANALYSIS PLAN

OLF BARIN FOLEY, ALABAMA

3.10.2 Rationale for Technical Approach The objective of the RI/FS program at Site 28B is to assess the nature and extent of contamination in the sediments of the unlined part of the fuel pit drainage ditch and Wolf Creek and the surface water of Wolf Creek. To achieve this objective, sediment and surface water samples from Wolf Creek and sediments samples from Site 28B will be collected and analyzed.

3.10.3 Proposed Investigation

Surface Soil Sampling. Two soil samples will be collected from the fuel pit area drainage ditch (Figure 3-8). One soil sample will be collected where the ditch changes from concrete to dirt along the western boundary of OLF Barin. The other soil sample will be collected from the ditch at the southwest corner of the installation where the ditch leaves the installation. Samples will be collected to identify if contaminants were washed from the fuel pit and deposited in the ditch sediments. The soil samples will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL metals, and total cyanide (Level III and 10 percent IV DQOs).

Surface Water and Sediment Sampling. Surface water and sediment samples will be collected from three locations along Wolf Creek (Figure 3-8). The locations and rationale are detailed as follows:

(11) upstream of all surface water discharge from OLF Barin,
(12) downstream of the fuel pit area drainage ditch outfall, and
(13) downstream of the OLF Barin's southern drainage ditch outfall.

The purpose of the surface water and sediment sampling program is to collect data to evaluate possible ecological exposure pathways and to determine the potential for off-site transport of contaminants.

Surface water and sediment samples will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, TAL inorganics, and total cyanide in conformance with Level III and 10 percent Level IV DQOs.

3.11 INVESTIGATIVE ACTIVITIES COMMON TO MULTIPLE SITES. Investigative activities common to two or more sites include: aquifer characterization, ecological survey, public health survey, sample location survey, and disposal of investigation-derived waste.

3.11.1 Aquifer Characterization Slug tests will be conducted at selected monitoring wells to obtain an estimate of the horizontal hydraulic conductivity of the water bearing zone. 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.

3.11.2 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

APPENDIX A

SOIL GAS TECHNIQUE

STANDARD OPERATING PROCEDURES FOR APPLYING THE PETREX TECHNIQUE TO ENVIRONMENTAL SOIL GAS SURVEYS

1.0 OPENING STATEMENT CONCERNING THE PURPOSE OF THIS DOCUMENT

As the title of this document points out, the steps and information herein are the "Standard Procedures" for carrying out a Petrex environmental survey. Possible deviations from standard procedures may occasionally be implemented onsite by our field staff to adjust for unique survey conditions. The Petrex Technique is also frequently used for oil and gas, geothermal, and mineral exploration which force slight variations on these "Standard Operating Procedures". Also, surveys performed in winter in frozen ground offer a unique situation and slightly different field practices.

The fact that the standard procedures may occasionally be altered is done to maintain quality service while using the Petrex Technique. It must also be understood that the ion flux data from one survey at a given site and a given time interval should not be compared to the flux numbers from another survey. Since the data is semi-quantitative, only the flux patterns of a survey or the relative difference between flux values off two samples from the same survey should be considered during interpretation.

If any questions arise upon review of this document, please address your questions to NERI technical staff at:

Northeast Research Institute, Inc. (203) 677-9666
309 Farmington Avenue, Suite A-100, Farmington, Connecticut 06032

-or-

Northeast Research Institute, Inc. (303) 238-0090
605 Parfet Street, Suite 100, Lakewood, Colorado 80215

2.0 SAMPLE PRODUCTION AND PREPARATION

2.1 Charcoal Sieving

The static VOC (Volatile Organic Compound) collector is prepared by applying presieved activated charcoal to the end of a ferromagnetic wire.

2.2 Charcoal Bonding

The details of the procedure for preparing the activated charcoal is proprietary information. The procedure results in the production of a collector consisting of size-sorted activated charcoal bonded to the area within 1 cm of the end of a ferromagnetic wire with a Curie point of 358°C.

2.3 Collector Containers

Culture tubes, measuring 25 mm X 125 mm and having a screw cap closure, are washed in a biodegradable detergent, rinsed in methanol, and baked at 180°C for one hour.

2.4 Wire Cleaning

The previously constructed wires are cleaned by heating in a special apparatus at 358°C a total of 35 times under high vacuum. The wires are cleaned in lots of 32 wires. From each lot, two wires are removed for immediate analysis to verify the cleanliness of the lot. The remaining 30 wires are then sealed in one clean culture tube under an inert atmosphere and placed in inventory.

2.5 Packaging for Client

Immediately prior to shipping the wires to the field, the tubes containing 30 wires are removed from inventory and the wires are repackaged under an inert atmosphere in individual tubes. All of the repackaged tubes contain two wires. Ten percent of these have three wires. The collectors are packaged by bagging in Ziploc bags in an inert atmosphere. These bags are then placed in inventory in a temperature-controlled room. The basis for having two wires in each tube is that it allows NERI to analyze one wire by our standard Thermal Desorption-Mass Spectrometry (TD-MS) while the second sample is available for TD-GC/MS or as a backup to the TD-MS. The third wire in selected samples from each survey is used to establish optimum instrument parameters.

2.6 Quality Control and Quality Assurance

Prior to releasing stocked wires for a field survey, two single wires from each lot are checked for cleanliness and collecting potential. This QA/QC phase measures and documents collector preparedness when leaving the laboratory. One of these wires is analyzed without exposure in order to demonstrate that the lot is clean, and the other wire is exposed to hexane vapor for two seconds and then analyzed in order to verify that the charcoal is highly adsorptive. The triplicate wires are used when the wires return from the field. These wires help determine the required machine sensitivity and act as a measure of reproducibility.

2.7 Custody Document

A "custody document" accompanies each group of collectors leaving the laboratory and remains with the group until the collectors have been exposed, analyzed, and disposed of.

3.0 FIELD OPERATIONS

3.1 Locating Sample Sites

Sample placement sites, usually predetermined on an accepted survey proposal, are located from a nearby, surveyable landmark using a compass and pacing or some other measuring device (e.g., pacing wheel, hip chain, or tape measure). A transit may be used for more accurate placement, but such accuracy is seldom required.

3.2 Soil Coring

Once a sample site has been established, a hole is cored to a predetermined depth (sample placement depth is held constant for a given survey). This is accomplished using a variety of tools depending on the nature of the material to be cored. The holes should be vertical and as free from debris as possible. When the sampling is performed in areas covered by asphalt or concrete, a generator-powered rotary hammer drill with a carbide-tipped bit is used to drill a 1-1/2 inch diameter hole in the cover. A hand auger is used to remove the cuttings and road base from the hole.

3.3 Collector Placement

Immediately after the hole is cored, a collector tube is removed from the Ziploc bag and the bag is resealed. The cap is then removed from the tube, and the tube is placed vertically, open end down, into the hole. The hole is then backfilled with the soil core which was removed. The cap is placed in a clean Ziploc bag

and stored until collector retrieval. Collectors placed under asphalt or concrete are treated the same as those in uncovered soil, except for modifications to permit easy retrieval and to avoid potential down-hole contamination from surface cuttings. To allow retrieval of these collectors, a piece of galvanized wire is twisted around the neck of the tube and run to the surface so that the sample may be recovered by pulling the retrieval wire. An aluminum plug is then placed near the top of the hole, and the remainder of the hole is plugged with quick setting hydraulic cement.

3.4 Site Identification

Each site is flagged using pin flags, spray paint or ribbon flagging, and the site location is marked and numbered on a base map. A field notebook is used to record the date, collector number, site location description, soil type, and general observations.

3.5 Exposure Time

Time calibration collectors are included as part of every survey. These are QA collectors used to monitor sample loading during the survey. These collectors are placed in an area of known or suspected contamination, and sets are retrieved and analyzed at intervals to indicate the appropriate residence time for survey samples. Separate "travel blank" collectors are also included as a QC measure in every survey. These collectors are transported along with the survey collectors but the tubes are never opened. These control collectors monitor for potential contamination during transport or placement.

3.6 Collector Retrieval

The collectors are retrieved when the time calibration collectors reveal that there has been sufficient loading of gases on the charcoal absorbent. In the field, the soil is removed until the tube is exposed. A cap is taken from the sealed Ziploc bag. The Viton seal is checked to make sure it is seated inside the cap. The culture tube is removed from the hole and any dirt that is on the threads of the tube is wiped off with a clean cloth. In the event the tube is broken or cracked, the collector wire is transferred to a new tube using forceps. The tube is capped and sealed. All flagging material is retrieved.

3.7 Collector Numbering

Each tube is immediately numbered according to the scheme established in the field notes and on the base map. The collector number is written on adhesive labels which are applied to the tube cap. No two sites may have the same number.

3.8 Collector Shipment

Once the collectors have been retrieved, they are sealed in Ziploc bags and then wrapped with bubble packing. Material such as Styrofoam peanuts or newsprint can introduce possible contaminants to the collectors and should not be used for packaging. The collectors, field notes, base map, and chain-of-custody document are either hand carried back to NERI's analytical laboratories, or are shipped by overnight carrier service.

3.9 Decontamination

All down-hole equipment and tool parts which contact excavated soil are constructed of heavy gauge steel and have no natural or synthetic components which could absorb and retain most soil-borne organic contaminants. These tools are decontaminated between use at each sampling location by rotation through a four step cleaning process. These steps are:

1. Immersion and vigorous scrubbing in a mild solution of laboratory grade detergent until all visual accumulations of soil are removed.

2. Thorough rinsing with potable water.

3. Spray rinsing with methyl alcohol.

4. Air Dry.

All derived liquids (and sediment) are contained in dedicated disposable vessels.

4.0 COLLECTOR ANALYSIS

4.1 Numbering Check

Upon receipt of the collectors, the number on each tube is recorded and any missing or duplicated numbers are noted. A missing number generally indicates that the collector could not be retrieved. Samples with identical numbers generally cannot be used unless their true site location can be established.

4.2 Sample Holding

A Petrex soil gas sample consists of a minute quantity of various volatile organic compounds sorbed onto a charcoal element and enclosed in a protective container with a near impervious Viton seal.

Maximum sample holding time is a function of both the chemical stability of the sorbed compounds and the integrity of the seal of the container.

It has been the experience of Northeast Research Institute, Inc. (NERI) that Petrex soil gas samples that are properly repackaged after retrieval from the field and stored under environmentally controlled conditions typically remain compositionally and quantitatively unchanged through periods of greater than four months.

All samples scheduled for analysis via Curie-point pyrolysis/mass spectrometry are analyzed within three weeks of retrieval from the field.

4.3 Instrumentation

Thermal desorption is accomplished using a Fisher radio frequency power supply and a Curie point pyrolyzer designed by NERI and Extrel. The mass spectrometer used is an Extrel SpectrEL quadrupole mass spectrometer. The analysis is controlled and recorded by DEC PDP 11/23 microcomputer. Following the analysis, all data are collected and archived on a PDP 11/73 microcomputer. Data for all active jobs are stored on both of the PDP 11 computers, as well as on magnetic tape. Data for all completed jobs are stored on magnetic tape in perpetuity.

4.4 Calibration

An Extranuclear Quadrupole Spectrometer equipped with a Curie-point pyrolysis/thermal desorption inlet is used for collector analysis. Mass assignment and resolution are manually adjusted using a Perfluorotributylamine (PFTBA) standard. A linear correction, based on the known spectrum of PFTBA, is calculated. This correction is applied to a second PFTBA spectrum. If correct mass (M/Z) values are obtained, the operator proceeds to the next turning step. If not, Step 1 is repeated until correct masses are obtained.

Peak intensity ratios are set from the major peaks in the PFTBA spectrum using the following values:

Mass (M/Z)		Spectrum Intensities
69	=	100%
131	=	25%±5%
219	=	35%±5%
502	=	5%±2%

During the ion signal for mass (M/Z) 69 of PFTBA is measured at a preset sample pressure and detector voltage and compared to previous values at the same setting.

Electron energy is set to 70 electron volts and emission is set at 12 milliseconds. All other operating parameters, such as scans, scan range, mass offset are established in the computer program. These values may only be changed by the laboratory manager.

Tuning is performed at the beginning of a run, so that an individual survey is analyzed at the same set of instrument conditions. The samples are analyzed in random order.

4.5 Instrument Parameters

The instrument is operated with the following parameters.

Vacuum	-	$< 3 \times 10^{-6}$ torr
Ionization Energy	-	70.0 eV
Ionization Current	-	12.0 mA
Desorption Time	-	5.0 sec
Desorption Temperature	-	358°C
Number of Scans/Sample	-	30
Scan Rate	-	1,250 amu/sec

4.6 Mass Spectrometer Analysis and QA/QC

Each collector wire is analyzed in random order. The entire group of survey collectors are analyzed as one run without interruption from other surveys.

The organic gases adsorbed on the carbon are thermally desorbed from the carbon, separated according to ion mass, counted, and a mass spectrum of masses from 29 to 240 is obtained.

Periodic (approximately every 20 samples) machine background analyses are performed as a QC measure to assure minimal influence from internal communication. If there are peaks that are not related to atmospheric gases, the supervisor is notified and the mass spectrometer is shut down and cleaned as necessary.

A written sample number record is kept during the analysis to prevent accidental cross numbering.

The mass spectrometer control program prompts the operator with a warning if a sample number is entered that has already been used. The operator then checks the current number, along with the disk storage location of the previously entered number, to resolve the true numbering situation.

4.7 Data Filing

The raw data file generated by the sample analysis is labeled for storage under a unique file name.

4.8 Schedule of Maintenance

1,000 Samples	Cleaning of sample introducion area, ion source, and expansion chamber by in-house technicians.
4,000 Samples:	Above noted procedures plus cleaning of lenses and quadrapoles
Annually:	Preventative maintenance program conducted by manufactures's service representative.

5.0 DATA INTERPRETATION AND PRESENTATION

5.1 Map Generation

The sample location maps are created by placing the field base map on a digitizing board and entering each site as an X-Y coordinate relative to an orgin. The relative ion counts for each compound can then be plotted at the sample locations. Cultural and topographic features can also be digitized onto the map as reference points.

5.2 Compound Identification

The mass spectrum that is drawn for each sample is compared to a library of mass spectra derived from known volatile organic compounds. Several thousand pure compound spectra have been developed by the Bureau of Standards and are available for spectra comparison. NERI has also developed its own library of spectra through headspace analysis of pure compounds using the Petrex wires. Once a compound has been identified in this manner, the ion current or "flux" for this compound is defined as the total ion current for the "parent peak" or least interfered peak of that compound.

5.3 Relative Flux Determination

The process of determining ion currents (relative intensities) of indicator peaks is computerized. All ion current data are extracted from the original data file and are processed for identification.

The relative ion current intensity (relative intensities) of the gases that are desorbed from the collectors are matched with sample locations on a map of the survey area. These relative intensities are useful for inferring the areal extent of contamination and relative differences in the concentrations of the compounds in the soil or groundwater. This can aid in determining the location of source areas or direction of movement of contamination.

These surface collections and analyses cannot be used to determine the depth to the source contaminants or the precise concentration at depth.

Because compounds can be differentiated by their spectra, analyses from the carbon collectors can be used to help differentiate multiple compounds and multiple source areas within a single survey.

5.4 Data Interpretation

Once the relative intensities for a compound are mapped, the data can be contoured to reveal those areas with "hot spots" and the orientation of plume migration. All other available data, such as geologic setting, soil types, groundwater conditions, type of contaminant, site history, and other factors are taken into account as the interpreter draws his conclusions.

5.5 Additional Uses of Petrex Collectors

Some of the other uses of the Petrex Technique that are utilized in surveys are headspacing of soil and water samples and depth profiling.

5.5.1 Headspace

A headspace soil sample is analyzed by collecting approximately 25 grams of soil, which are transferred to a thermochemically cleaned headspace container. Several adsorption wires are added and the headspace container is sealed and allowed to equilibrate for up to 24 hours, depending on the level of contamination. The wires are then removed and prepared for desorption mass spectrometric analysis as described earlier. An identical process is performed for screening water samples.

5.5.2 Depth Profiling

In order to determine if the source of the soil gas signal is near surface or in a deeper vadose/saturated zone, depth profiling can be used.

At each selected location, shallow bore holes are drilled a few feet apart to depths such as 1, 2, 4, and 6 feet deep. After all the loose cuttings and cavings have been removed from the bottom of the hole, a core of soil may be taken for headspace analysis. Next, a Petrex collector is lowered into the hole and backfilled. The collectors remain in place for the same length of time as the survey wires.

Each of the sampling methods addresses a different aspect that will help indicate the nature of the VOC source. In the case of composite soil sampling, detection of VOCs during analysis implies that the VOCs are actually contained within the soil matrix. When the VOC is anthropogenic in nature, the VOC presence is indicative of soil contamination at that depth interval.

When performing an in situ time-integrated sampling program with Petrex collectors, the collector serves as both an extended headspace sampler relative to the soil matrix in its immediate vicinity, as well as measuring the soil gas flux through that zone during the exposure period.

Soil gas movement through the vadose zone is theorized to be a diffusion process. If the headspace data indicate that the VOC is not present in the soil matrix, then the in situ depth profiling collectors should show a relative increase of ion counts as the depth increases. By combining both pieces of data, the nature of the VOC source (near surface or deep vadose/saturated) can be inferred.

5.6 Data Presentation

Once the data have been compiled, interpreted, and mapped, a report is produced for the client's use. Also, the maps are printed which display the relative intensity of the compounds of the client's specifications. These reports and maps are for the client's use only, and no report or map is released to anyone else without prior written consent of the client. This confidentiality policy is never breached.

6.0 INTERPRETATION OF PETREX MAPS

The policies outlined in this Standard Operating Procedure are strictly followed on each survey. It should be noted that the relative intensities for any compound at one sample location can only be compared to another location within the same survey for the same compound. Relative intensities of different compounds cannot be compared to each other. Also, the relative intensities of one survey cannot be compared to the relative intensities of any other survey, even between two surveys at different times of the year over the same site. However, the same "hot spots" and plumes should contour in the same place over multiple surveys at a given site, allowing for migration.