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NAS WHITING FIELD
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FEASIBILITY STUDY FOR SURFACE AND SUBSURFACE SOILS AT SITE 13 NAS WHITING FIELD

3/1/2001

HARDING LAWSON ASSOCIATES

FEASIBILITY STUDY

SITE 13, SANITARY LANDFILL

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

USEPA ID NO.: FL2170023244

UNIT IDENTIFICATION CODE: N60508
CONTRACT NO.: N62467-89-D-0317/116

MARCH 2001

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA 29418

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March 2001

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/116 are complete and accurate and comply with all requirements of this contract.

DATE: March 29, 2001

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(DFAR 252.227-7036)

WhF-S13.FS
FGW.03.01

The evaluations and professional opinions rendered in this planning document describing the Feasibility Study for Site 13, Naval Air Station Whiting Field, Milton, Florida, were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document is not intended to be used for construction of the selected alternative.

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FOREWORD

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

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

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

The IR program is conducted in several stages as follows:

- The preliminary assessment (PA) identifies potential sites through record searches and interviews.

- A site inspection (SI) then confirms which areas contain contamination, constituting actual "sites." (Together, the PA and SI steps were called the Initial Assessment Study under the NACIP program).

- Next, the Remedial Investigation and Feasibility Study together determine the type and extent of contamination, establish criteria for cleanup, and identify and evaluate any necessary remedial action

alternatives and their costs. As part of the RI/FS, a risk assessment identifies potential effects on human health or the environment in order to help evaluate remedial action alternatives.

- The selected alternative is planned and conducted in the remedial design and remedial action stages. Monitoring then ensures the effectiveness of the effort.

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

Questions regarding the CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1859, at (843) 820-5574.

EXECUTIVE SUMMARY

Harding Lawson Associates (HLA), has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command to complete a feasibility study (FS) for Site 13, Sanitary Landfill, at Naval Air Station (NAS) Whiting Field, Milton, Florida. The FS report is being completed under contract number N62467-89-D-0317-116. The FS report for Site 13 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (HLA, 1998a) and Remedial Investigation (RI) report (HLA, 1998b) to present the results of the overall RI/FS for the sites. This FS report includes the development, screening, and evaluation of potential remedial alternatives that address contaminated media at Site 13.

Site 13, Sanitary Landfill, covers approximately 10 acres. The site was used as the primary sanitary landfill for NAS Whiting Field from 1979 to 1984. In 1979, waste solvents, hydraulic fluid, and residue from paint-stripping operations may have been disposed of at the site. After 1979, the landfill reportedly received only general refuse and nonhazardous waste. A vegetated "Y" drainage ditch borders the landfill to the west and south. The general slope of the land is from northwest to southeast. Surface water runoff from the site drains toward Big Coldwater Creek, located approximately 8,800 feet east of the site.

Currently, the site is predominantly covered with planted pine trees. Buried wastes are not exposed at the land surface, nor are there indications (e.g. stained soil or stressed vegetation) of other waste disposal practices.

Based on the results of the RI, which included a risk assessment, surface soil was the only media from which risks to human health and the environment were identified. At Site 13, arsenic was the primary chemical of concern (COC) detected in surface soil exceeding its Florida Department of Environmental Protection (FDEP) approved site-specific cleanup goal, Florida residential and industrial soil cleanup target level (SCTL) (Brownfields Cleanup Criteria), and posed a risk to human receptors. This FS report does not include considerations for groundwater at Site 13 as groundwater will be evaluated in the Site 40 investigation.

The purpose of the FS is to identify remedial action objectives (RAOs), identify and evaluate remedial action alternatives that will achieve those objectives. The FS contains the identification and discussion of applicable or relevant and appropriate requirements (ARARs), and contains a brief overview of the findings of the RI and the risk assessment, in order to identify RAOs.

Three RAOs were established for Site 13:

RAO 1: Address surface soil at Site 13 where concentrations of arsenic exceed the FDEP approved site-specific cleanup goal of 4.62 milligrams per kilogram.

RAO 2: Establish and maintain a land-use control (LUC) plan and recommend the alternative that best meets the evaluation criteria.

RAO 3: Complete closure of the Site 13 disposal area in accordance with State and Federal ARARs for landfill closure.

Remedial technologies that address site-specific considerations established in the RAOs were identified and screened. After screening of remedial technologies, alternatives were developed and analyzed. Four remedial alternatives were identified to address the RAOs at Site 13:

- Alternative 1: No Action
- Alternative 2: Land Use Controls (LUCs)
- Alternative 3: Limited Soil Removal and LUCs
- Alternative 4: Soil Cover and LUCs

Alternative 1: No Action, would include 5-year site reviews as required by CERCLA. Alternative 2: LUCs, would include 5-year site reviews, fence installation, and LUCs, which include a LUC Assurance Plan and LUC Implementation Plan. Alternative 3: Hot Spot Soil Removal and LUCs, would include 5-year site reviews, LUCs, and removal of selected hot spot soil areas. Finally, Alternative 4: Soil Cover and LUCs, would include 5-year site reviews, LUCs, and placement of a soil cover over the existing disposal sites.

The relative present-worth cost estimates are shown below for each alternative. In accordance with U.S. Environmental Protection Agency guidance and LUC agreements, the approximate costs for Alternatives 1, 2, 3, and 4 are based on a 30-year inspection and reporting timeframe.

- Alternative 1: $19,000
- Alternative 2: $199,000
- Alternative 3: $224,000
- Alternative 4: $1,186,000

In the comparative analysis, each alternative was compared against each other based on three criteria: threshold, primary balancing, and modifying criteria. This analysis indicates Alternative 1 would not achieve the established RAOs. The implementation of Alternative 2 would address RAO 2 and 3 by including LUCs; however, Alternative 2 would only limit exposure to arsenic in surface soil through LUCs and installed fencing barrier. Therefore, Alternative 2 may not achieve RAO 1 established for the sites.

Alternative 3 would achieve all RAOs through "hot spot" soil removal and provide a measure of continued protection of human health and the environment through LUCs. In this manner, Alternative 3 would achieve the RAOs established for the site and would therefore achieve ARARs. Alternative 4 would also achieve the RAOs, but would adversely affect the existing environment at the site. Construction of a cap at the site would result in temporary habitat destruction including destruction of pine trees and other features of the site.

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GLOSSARY

ARAR	applicable or relevant and appropriate requirement
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
ELCR	excess lifetime cancer risk
ERA	ecological risk assessment
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FS	feasibility study
GCTL	groundwater cleanup target level
GIR	General Information Report
HHRA	human health risk assessment
HI	hazard index
HLA	Harding Lawson Associates
IR	Installation Restoration
LUC	land-use control
LUCAP	Land-Use Control Assurance Plan
LUCIP	Land-Use Control Implementation Plan
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
O&M	Operation and Maintenance
PPE	personal protective equipment
RA	remedial action
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
RME	reasonable maximum exposure
ROD	record of decision

GLOSSARY (Continued)

SARA	Superfund Amendments and Reauthorization Act
SCG	soil cleanup goal
SCTL	soil cleanup target level
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
su	standard unit
TAT	turnaround time
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
yd^3	cubic yard

1.0 INTRODUCTION

Harding Lawson Associates (HLA) has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to complete a feasibility study (FS) for Site 13, Sanitary Landfill, at Naval Air Station (NAS) Whiting Field, Milton, Florida. The FS is being completed under contract number N62467-89-D-0317/116. The FS report for Site 13 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (GIR) (HLA, 1998a) and Remedial Investigation (RI) report (HLA, 1998b) to present the results of the overall remedial investigation and feasibility study (RI/FS) for the site. This FS report includes the development, screening, and evaluation of potential remedial alternatives that address contaminated media at Site 13.

Investigations at NAS Whiting Field, a facility listed on the National Priorities List, are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR], Part 300). The investigations at the facility are being conducted under the Navy's Installation Restoration (IR) program, which is designed to identify and abate or control contaminant migration resulting from past operations at naval installations while working within the aforementioned regulatory framework. SOUTHNAVFACENGCOM is the agency responsible for the Navy's IR program in the southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process NAS Whiting Field through preliminary assessment, site inspection, RI/FS, and remedial response selection.

The goals of the RI/FS for Site 13 at NAS Whiting Field are (1) to assess the extent, magnitude, and impact of soil contamination at the sites, (2) to qualitatively and quantitatively assess the risk posed to human health and the environment by site-related contamination, and (3) to develop remedial alternatives that address threats to human health and/or the environment. The first two elements have been discussed in the GIR and RI reports; the remaining element will be presented and discussed in this FS report.

The GIR provides information common to all sites at NAS Whiting Field, such as

- facility information and history,
- description of physical characteristics of the facility (climatology, hydrology, soil, geology, and hydrogeology),
- summary of previous investigations,
- summary of the field investigations conducted during the RI,
- human health and ecological risk assessment (RA) methodology, and
- an evaluation of the facilitywide background conditions.

The RI serves as the mechanism for collecting data to identify the source of contamination and migration pathway characteristics, for conducting a baseline RA, and for collecting physical measurements and chemical analytical data necessary for evaluating remedial alternatives in the FS. The RI provides the basis for determining whether or not remedial action is necessary. The RI reports for Site 13 at NAS Whiting Field provides the following information:

- a site description and a summary of previous investigations;
- a summary of the field investigation methods used during the RI;
- a site-specific data quality assessment;
- an assessment of the extent, magnitude, and impact of soil contamination; and
- a qualitative and quantitative assessment of risks to human health and the environment.

The FS, described in more detail later in this chapter, uses the results of the RI and the information presented in the GIR to identify remedial action objectives (RAOs) and to develop, screen, and evaluate potential remedial alternatives. The FS is prepared in accordance with the following regulations and guidance documents: CERCLA, as amended by SARA (references made to CERCLA in this report should be interpreted as "CERCLA, as amended by SARA"); the NCP (40 CFR, Part 300); and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (RI/FS Guidance) (U.S. Environmental Protection Agency [USEPA], 1988).

The remaining sections in this chapter describe the FS process for CERCLA sites (Section 1.1), present how this process is applied to NAS Whiting Field sites (Section 1.2), and provide the environmental conditions at Site 13 (Section 1.3).

1.1 THE CERCLA FS PROCESS. The development of remedial alternatives for CERCLA sites consists of developing RAOs and then identifying applicable technologies and developing those technologies into remedial alternatives to meet the RAOs. The NCP requires that a range of alternatives be presented in the FS to the maximum extent practicable.

The first step in the FS process is to develop RAOs specifying contaminants, media of interest, exposure pathways, and preliminary remedial goals that permit a range of alternatives to be developed. The preliminary remedial goals are developed based on chemical-specific applicable or relevant and appropriate requirements (ARARs), when available, site-specific risk-based factors, or other available information.

Once RAOs are identified, general response actions for each medium of interest are developed. General response actions typically fall into the following categories: no action, containment, excavation, extraction, treatment, disposal, or other actions, singular or in combination, satisfying the RAOs for the site.

The next step in the FS process is to identify and screen applicable technologies for each general response action. This step eliminates those technologies that cannot be implemented technically. Those technologies passing the screening phase are then assembled into remedial alternatives. Remedial alternatives are then described and analyzed in detail using seven criteria described in the NCP, including

- overall protection of human health and the environment;
- reduction of toxicity, mobility, or volume of contaminants through treatment;

- compliance with ARARs;
- long-term effectiveness and permanence;
- short-term effectiveness;
- implementability; and
- economics (i.e., cost).

Alternatives are evaluated against two additional factors after State participation and the public comment period for the FS:

- State acceptance, and
- community acceptance.

The results of the detailed analyses (for the first seven criteria) are summarized and compared in a comparative analysis. The alternatives are compared with one another against several criteria, including the following:

Threshold criteria:

- protection of human health and the environment; and

- attainment of Federal and State human health and environmental requirements identified for the site.

Primary Balancing criteria:

- cost effectiveness;

- use of permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable; and

- preference for treatment that reduces toxicity, mobility, or volume of contaminants as a principal element.

These criteria are used because SARA requires them to be considered during remedy selection. **Modifying criteria**, which include State and community acceptance, are also evaluated. State acceptance is evaluated when the State reviews and comments on the draft FS report and a proposed plan is then prepared in consideration of the State's comments. Community acceptance is evaluated based on comments received on the proposed plan during a public comment period. This evaluation is described in a responsiveness summary in the Record of Decision (ROD).

The entire FS process provides the technical information and analyses that form the basis for a proposed remedial action plan (proposed plan) and subsequent ROD documenting the identification and selection of the remedy.

1.2 PURPOSE OF THE FS REPORT. The purpose of the FS report is to document the results of the study that includes developing RAOs to address contaminated soil at the site and developing, screening, and evaluating potential remedial alternatives to meet these objectives. The FS was based on the results and conclusions of the RI completed for the site, and the information presented in the GIR. Information presented in these reports will not be repeated in this FS Report.

The FS report for Site 13 was developed in accordance with the NCP and with USEPA's *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a); both of these documents provide guidance for identifying technologies for municipal landfills. Because municipal landfill sites typically have similar characteristics, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states the USEPA expects containment technologies will generally be appropriate for waste (e.g., landfills) that poses a relatively low long-term threat or where treatment is impracticable (Section 300.430[a][1][iii][B]). Additionally, the USEPA expects treatment to be considered for identifiable areas of highly toxic and/or mobile material constituting the principal threat(s) posed by the site (Section 300.430[a][1][iii][A]).

Therefore, the purpose of this FS report is not to present all the possible variations and combinations of remedial actions that could be taken at the site, but to present distinctly different alternatives representing a range of opportunities for meeting the RAOs. It is expected these different alternatives can be modified during the proposed plan and decision process, and to a lesser extent during detailed design, to accomplish RAOs in a manner similar to the initially proposed alternative.

The following components are considered in identifying appropriate remedial action for Site 13:

- RAOs - Chapter 2.0. RAOs are developed to specify the contaminants, media of interest, exposure pathways, and remedial action goals for the site.

- Applicable Technologies - Chapter 3.0. Technologies applicable for addressing contaminated media at the site are identified and screened. Technologies that cannot be implemented are eliminated.

- Remedial Alternatives - Chapter 3.0. Technologies passing the screening phase are assembled into remedial alternatives.

- Detailed Analysis - Chapter 4.0. Selected remedial alternatives are described and evaluated using seven of the nine criteria outlined in the NCP.

- Comparative Analysis - Chapter 5.0. Remedial alternatives identified for Site 13 are compared against one another using threshold and primary balancing criteria.

Upon completion of the FS report, a proposed plan will be developed. The Proposed Plan will identify the preferred remedial alternative for Site 13. This document will be written in community-friendly language and will be made available for public comment. Upon receipt of public comments, responses to these comments will be developed in a responsiveness summary and the ROD will be prepared. The ROD will document the chosen alternative for the site and will include the responsiveness summary as an appendix. Once the ROD is signed, the chosen remedial alternative will be implemented.

1.3 ENVIRONMENTAL CONDITIONS. Site 13 covers approximately 10 acres (Figures 1-1 and 1-2). The site was used as the primary sanitary landfill for NAS Whiting Field from 1979 to 1984. In 1979, waste solvents, hydraulic fluid, and residue from paint-stripping operations may have been disposed of at the site. After 1979, the landfill reportedly received only general refuse and nonhazardous waste. A vegetated "Y" drainage ditch borders the landfill to the west and south. The general slope of the land is from northwest to southeast. Surface water runoff from the site drains toward Big Coldwater Creek, located approximately 8,800 feet east of the site (Figure 1-1).

Currently, the site is predominantly covered with planted pine trees. Buried wastes are not exposed at the land surface, nor are there indications (e.g. stained soil or stressed vegetation) of other waste disposal practices.

According to the U.S. Department of Agriculture (USDA) (USDA, 1980), the soil at Site 13 is classified as Troup loamy sand and Lucy loamy sand. Because the soil at the site is predominantly silty sand, storm water infiltrates directly into the soil.

Based on previous investigations, Site 13 potentially received wastes from a variety of sources. The results of the RI (HLA, 1998b) indicate these wastes do not pose a principal threat to human health or the environment. As a result, Site 13 exhibits the characteristics of a CERCLA municipal landfill site and will be addressed as such in this FS.

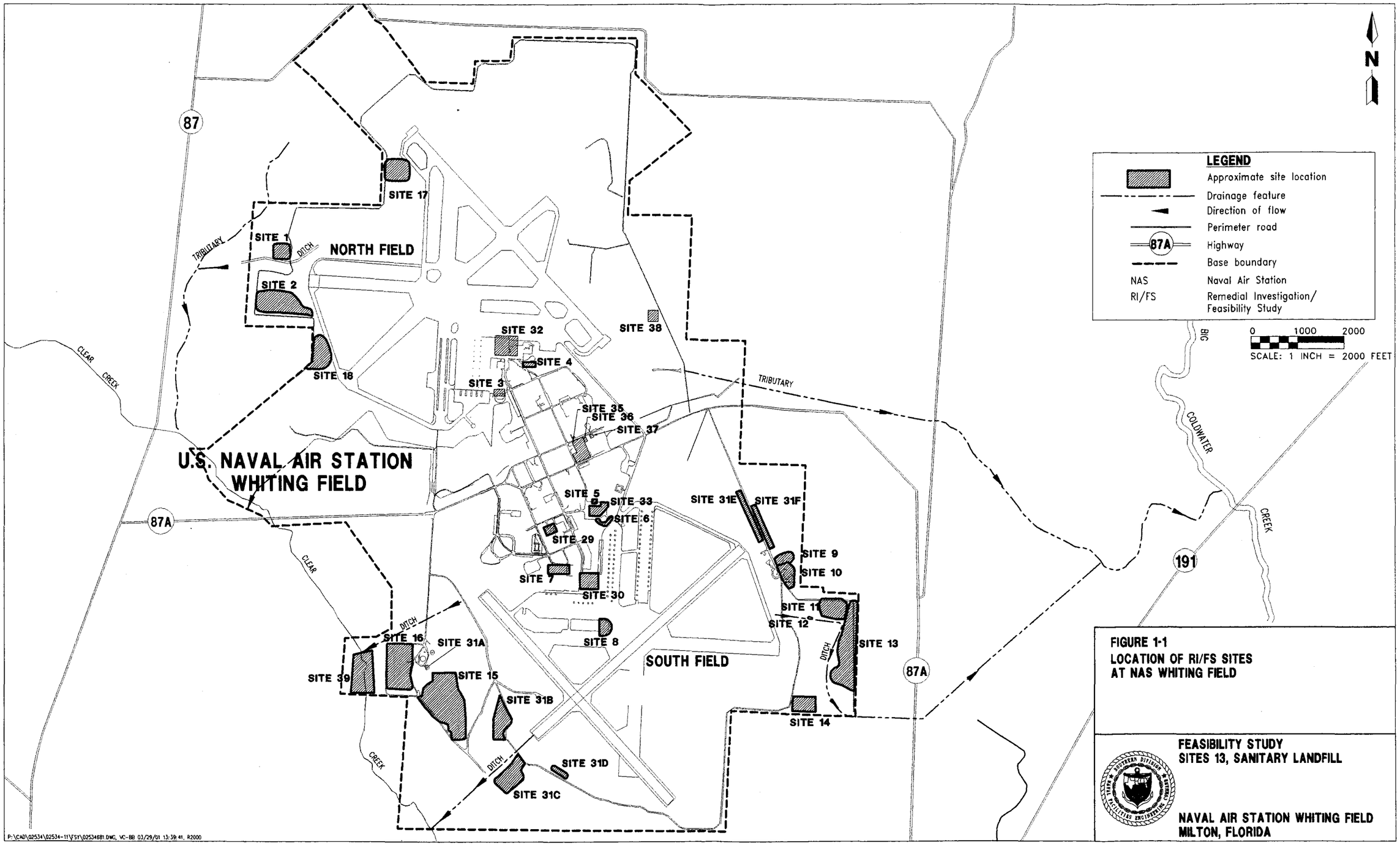

FIGURE 1-1
LOCATION OF RI/FS SITES
AT NAS WHITING FIELD

FEASIBILITY STUDY
SITES 13, SANITARY LANDFILL

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

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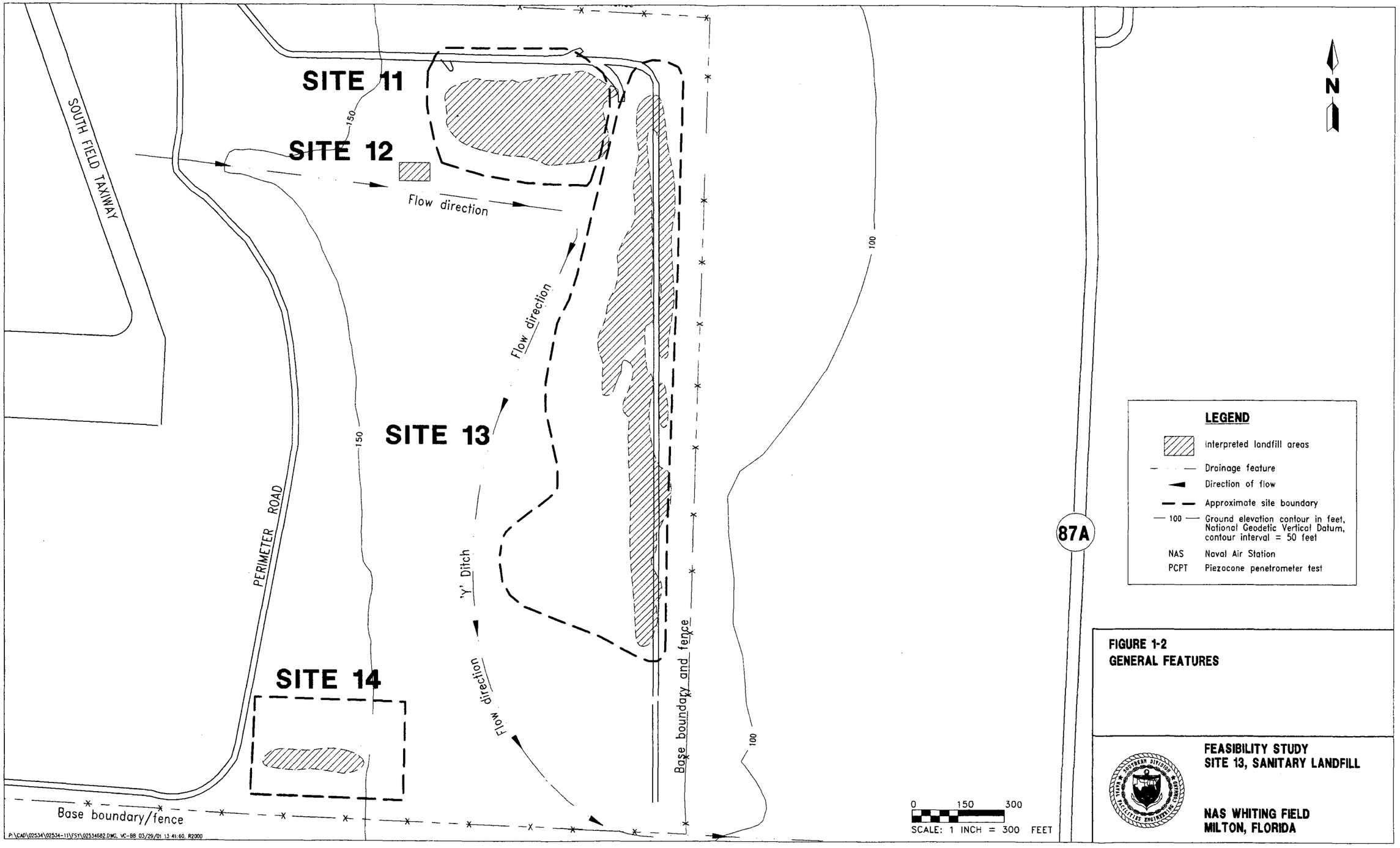
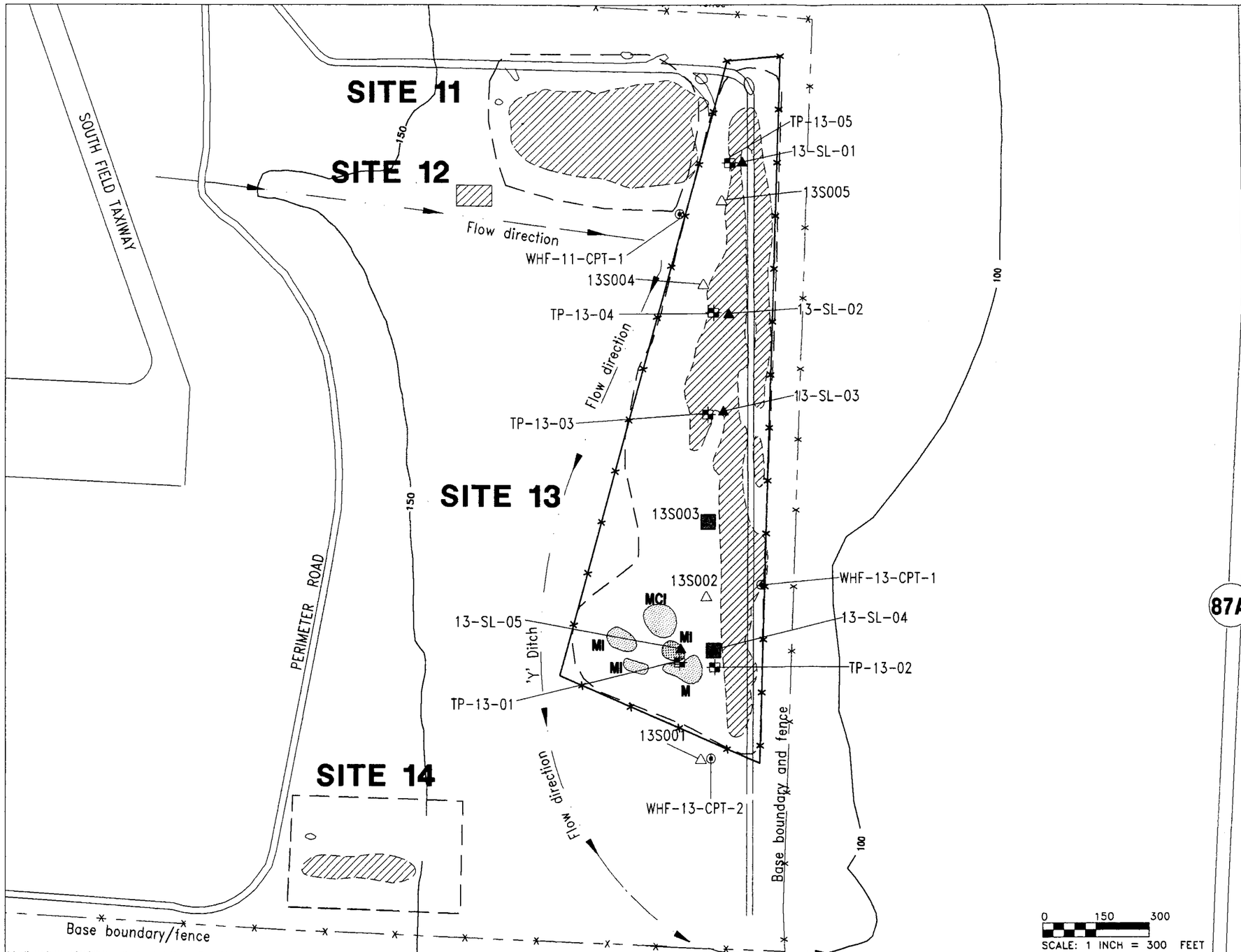


FIGURE 1-2
GENERAL FEATURES

FEASIBILITY STUDY
SITE 13, SANITARY LANDFILL

NAS WHITING FIELD
MILTON, FLORIDA



LEGEND

WHF-13-CPT-2	PCPT exploration and designation
TP-13-02	Phase IIA test pit location and designation
13-SL-03	Phase IIA surface soil sample and designation
13S004	Phase IIB surface soil sample and designation
	Isolated geophysical anomaly
	M = total magnetic field anomaly C = EM-31 conductivity anomaly I = EM-31 inphase anomaly
	High-amplitude magnetic anomaly
	Interpreted landfill areas
	Proposed fenced area
	Proposed 20'x20' excavation
— —	Approximate site boundary
— 100 —	Ground elevation contour in feet, National Geodetic Vertical Datum, contour interval = 50 feet
NAS	Naval Air Station
PCPT	Piezocone penetrometer test

NOTES:

1. Linear footage of proposed fencing is approximately 4,500'.
2. Excavated areas to be 20 feet square.

SAMPLE IDENTIFICATION	ARSENIC CONCENTRATION
13S003	6.4
13-SL-04	6.9

FIGURE C-1
HOT SPOTS AND FENCING

SITE 13, SANITARY LANDFILL

NAS WHITING FIELD
MILTON, FLORIDA

2.0 REMEDIAL ACTION OBJECTIVES

This section presents the goals and objectives for remedial action at Site 13, and provides the basis for selecting appropriate RAOs and, subsequently, identifying remedial technologies and developing alternatives to address contamination at the sites. To establish these objectives, ARARs are first identified (Section 2.1). Next, RAOs are defined based on consideration of ARARs, the results and conclusions of the RI, the RA, and other criteria (Section 2.2). Next, the volume of contaminated media for Site 13 is presented (Section 2.3). Finally, general response actions appropriate for technology identification are discussed (Section 2.4). The information presented in this chapter will be used to identify appropriate remedial technologies for the sites (presented in Chapter 3.0).

2.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS. ARARs are Federal and State human health and environmental requirements used to define the appropriate extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require remedial actions to comply with State ARARs more stringent than Federal ARARs, legally enforceable, and consistently enforced statewide.

The NCP defines two ARAR components: (1) applicable requirements, and (2) relevant and appropriate requirements.

> Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal or State environmental or facility citing laws specifically addressing a hazardous substance, pollutant, contaminant, remedial action, or other circumstance found at a CERCLA site. State standards applicable are only those which (1) have been identified by the State in a timely manner, (2) are consistently enforced, and (3) are more stringent than Federal requirements.
>
> Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements under Federal and State environmental and facility citing laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, or remedial action, address situations sufficiently similar to those encountered at the CERCLA site so their use is well suited to the particular site. State standards identified in a timely manner and more stringent than Federal requirements may be relevant and appropriate.

"Applicability" is a legal determination of jurisdiction of existing statutes and regulations, whereas "relevant and appropriate" is a site-specific determination of the appropriateness of existing statutes and regulations. Therefore, relevant and appropriate requirements allow flexibility not provided by applicable requirements in the final determination of cleanup levels. Once a requirement is identified as an ARAR, the selected remedy must comply with ARARs, even if the ARAR is not required to assure protectiveness. The general relevant and appropriate requirements apply only to actions at the site. Applicable requirements apply to both on- and off-site remedial actions.

Other requirements "to be considered guidance material" (TBC) are Federal and State nonpromulgated advisories or guidance that are not legally binding and do not have the status of potential ARARs (i.e., they have not been promulgated by statute or regulation). However, if there are no specific ARARs for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

Under the description of ARARs set forth in the NCP and SARA, State and Federal ARARs are categorized as the following:

- chemical-specific (i.e., governing the extent of site remediation with regard to specific contaminants and pollutants);
- location-specific (i.e., governing site features such as wetland, floodplains, and sensitive ecosystems, and pertaining to existing natural and man-made site features such as historical or archaeological sites); and
- action-specific (i.e., pertaining to the proposed site remedies and governing the implementation of the selected site remedy).

During the detailed analysis of remedial alternatives, each alternative will be analyzed to determine its compliance with ARARs. Chemical-, location-, and action-specific ARARs are discussed in the following subsections and presented in Table 2-1.

2.1.1 Chemical-Specific ARARs Chemical-specific requirements are standards that limit the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual cleanup levels or the basis for calculating such levels. Currently, there are no promulgated Federal or State chemical-specific ARARs that provide limits for the concentration of chemicals in soil. However, the State of Florida has promulgated Soil Cleanup Target Levels (SCTLs) under Chapter 62-777, Florida Administrative Code (FAC). The USEPA Region III has also developed a risk-based concentration (RBC) table which includes Soil Screening Levels for protection of groundwater and air (USEPA, 1997).

2.1.2 Location-Specific ARARs Location-specific ARARs govern site features (e.g., wetland, floodplains, wilderness areas, and endangered species) and manmade features (e.g., places of historical or archaeological significance). These ARARs place restrictions on concentrations of hazardous substances or the conduct of activities based solely on the site's particular characteristics or location.

As stated in the RI (HLA, 1998b), no State or federally listed rare, threatened, or endangered species or species of concern are known to inhabit Site 13 (Nature Conservancy, 1997). Furthermore, Site 13 is not located within the 100-year flood plain or known to contain areas of historical or archeological significance. Therefore, location-specific ARARs do not apply to Site 13.

2.1.3 Action-Specific ARARs Action-specific ARARs are technology- or activity-based limitations controlling activities for remedial actions. Action-specific ARARs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives,

Table 2-1
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the National Hazardous Substance and Contingency Plan Regulations (40 Code of Federal Regulations [CFR], Section 300.430)	Discusses the types of institutional controls to be established at CERCLA sites.	**Applicable.** These regulations may be used as guidance in establishing appropriate institutional controls at Site 13.	Action-specific
Occupational Safety and Health Act (OSHA) Occupational Safety and Health Standards (29 CFR, Part 1910)	Requires establishment of programs to ensure worker health and safety at hazardous waste sites.	**Applicable.** These requirements apply to all response activities conducted in accordance with the National Contingency Plan. During the implementation of any remedial alternative for Site 13, compliance with these regulations must be attained.	Action-specific
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Waste (40 CFR, Part 261)	Defines those solid wastes that are subject to regulation as hazardous wastes.	**Relevant and Appropriate.** Any alternative that would excavate and dispose of soil off-site would be sampled and analyzed for hazardous characteristics as defined by 40 CFR, Part 261.	Action-specific
RCRA Regulations, Standards Applicable to Transporters of Hazardous Wastes (40 CFR, Part 263)	Establishes the responsibilities of the generators and transporters of hazardous waste in the handling, transportation, and management of that waste. To avoid duplicative regulation, USEPA has expressly adopted certain U.S. Department of Transportation (DOT) regulations governing the transportation of hazardous waste.	**Relevant and Appropriate.** For excavation and off-site disposal alternatives, the hazardous material would need to be handled, manifested, and transported to a permitted off-site disposal facility in compliance with these regulations.	Action-specific
RCRA Regulations, Landfills (40 CFR, Part 264, Subpart N)	Provides monitoring, inspection, closure, and post-closure care requirements for landfills that contain hazardous waste.	**Applicable.** These requirements are applicable to Site 13 because it received waste until 1984. These regulations may be used for developing a landfill inspection program, as necessary.	Action-specific
RCRA Regulations, Releases from Solid Waste Management Units (40 CFR, Part 264, Subpart F)	Contains general groundwater monitoring requirements. Establishes detection and compliance monitoring programs that apply to owners and operators of solid waste units.	**TBC.** For capping alternatives, these regulations provide guidance for establishing and conducting a groundwater monitoring program at sites contaminated with RCRA wastes.	Guidance

See notes at end of table.

Table 2-1 (Continued)
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Hazardous Materials Transportation Act Regulations (49 CFR, Parts 171-179)	DOT provides requirements for packaging, labeling, manifesting, and transporting hazardous materials. Similar requirements are found in 40 CFR, Part 263.	**Relevant and Appropriate.** For excavation and off-site disposal alternatives, the hazardous material would need to be handled, manifested, and transported to a permitted off-site disposal facility in compliance with these regulations.	Action-specific
Solid Waste Disposal Act Regulations, Criteria for Municipal Solid Waste Landfills (40 CFR, Part 258)	This rule establishes minimum standards for design and operation of municipal solid waste landfills.	**TBC.** Although this regulation applies to RCRA municipal landfills, not CERCLA landfills, some applications such as closure design and final cover design for closed landfills may apply.	Guidance
Design and Construction of RCRA/ CERCLA Final Covers (USEPA, 1991b)	Provides guidance on components of landfill closure, including long-term maintenance, groundwater monitoring, and institutional controls. Recommends groundwater sampling frequency and strategy.	**TBC.** This guidance may be used for establishing remedial action alternatives for closure of the Sites 13 disposal area.	Guidance
Region III Risk-Based Concentrations (USEPA, 1997)	Provides RBCs from ingestion or exposure to chemicals in soil, tap water, ambient air, and fish consumption.	**Relevant and Appropriate.** The chemicals detected at Site 13 are screened against these standards for selection of chemicals of concern and developing remedial action alternatives.	Chemical-specific
Florida Surface Water Standards (Chapter 62-302, Florida Administrative Code [FAC])	This rule classifies Florida surface waters into five classes based on designated uses and establishes ambient water quality criteria for listed pollutants.	**Relevant and Appropriate.** Site 13 contains a "Y" drainage ditch and surface depressions where storm water ponding occurs. Although the surface water does not pose a risk to human health or ecological receptors, the rule would be used if surface water monitoring was required.	Chemical-specific; Action-specific

See notes at end of table.

Table 2-1 (Continued)
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Florida Contaminant Cleanup Target Levels (Chapter 62-777, FAC)	Rule establishes a contaminant cleanup target level applicable to the cleanup of petroleum, drycleaning solvent, and brownfield contaminated sites, and also establishes cleanup target levels for treatment of contaminated soils.	**Relevant & Appropriate.** The soil cleanup target levels should be used when evaluating remedial goal options.	Guidance
Florida Solid Waste Disposal Facility Regulations (Chapter 62-701, FAC)	Provides the minimum landfill final closure standards for inactive landfills. Chapter 62-701.600 provides information on closure procedures, permits, closure report, design plan, final cover design, and postclosure monitoring.	**Relevant and Appropriate.** Although these regulations are not directly applicable because Site 13 did not receive wastes after the effective date of regulation (1985); Chapter 62-700.600, FAC, provides guidance on landfill cover design for capping alternatives.	Action-specific; Guidance
Florida Hazardous Waste Rules (Chapter 62-730, FAC)	Adopts specific sections of the Federal hazardous waste regulations, including the section regulating hazardous waste landfills (40 CFR, Part 264, Subpart N) and makes additions to these regulations.	**Relevant and Appropriate.** These requirements are applicable to Site 13 because it received waste until 1984. These regulations may be used for developing a landfill inspection program, as necessary.	Chemical-specific; Action-specific
Florida Rules on Hazardous Waste Warning Signs (Chapter 62-736, FAC)	Requires warning signs at National Priorities List (NPL) sites to inform the public of the presence of potentially harmful conditions.	**Applicable.** This requirement is applicable for sites that are on the NPL.	Action-specific
Florida Petroleum Contaminated Site Cleanup Criteria (Chapter 62-770, FAC)	Rule establishes a cleanup process to be followed at petroleum-contaminated sites. The cleanup criteria apply to sites contaminated with petroleum or petroleum products but does not apply to sites contaminated with significant quantities of other substances.	**TBC.** Site 13 does not show evidence of petroleum contamination in soil or groundwater; cleanup criteria may be used as guidance.	Guidance

Notes: ARAR = applicable or relevant and appropriate requirement.
TBC = to be considered guidance materials.

applicable performance or design standards must be considered during the detailed analysis of remedial alternatives. During the detailed analysis of alternatives, each alternative will be analyzed to determine compliance with action-specific ARARs.

Certain action-specific ARARs include permit requirements. Under CERCLA Section 121(e), permits are not required for remedial actions conducted entirely on site at Superfund sites. This permit exemption applies to all administrative requirements, including approval of or consultation with administrative bodies, documentation, record keeping, and enforcement. However, the substantive requirements of these ARARs must be attained.

2.1.4 To Be Considered Criteria As previously stated, TBCs are Federal and State nonpromulgated advisories or guidance that are not legally binding and do not have the status of being a potential ARAR (i.e., have not been promulgated by statute or regulation). However, if there are no specific regulatory requirements for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

2.2 IDENTIFICATION OF RAOs. RAOs are defined in the CERCLA RI/FS guidance manual as media-specific goals established to protect human health and the environment and are typically based on chemicals of concern (COCs), exposure routes, and receptors present or available at the site. RAOs are developed to ensure compliance with ARARs. RAOs for Site 13 will be identified by consideration of ARARs, the RI, and the RA.

Groundwater. Groundwater at NAS Whiting Field has been identified as a separate site (Site 40) and will be investigated and remediated separately from Site 13. However, the results from the RA (HLA, 1998b) and chemical-specific ARARs and TBCs for groundwater are presented in the next paragraph and in Table 2-2.

One volatile organic compound (trichloroethene), and three inorganics (arsenic, iron, and manganese) were identified as chemicals of potential concern (COPCs) in the human health risk assessment (HHRA). The excess lifetime cancer risk (ELCR) for the aggregate resident (combined adult and child) based on ingestion of groundwater from Site 13 was estimated to be 3×10^{-5}, which is within the USEPA target risk range but exceeds the FDEP target risk threshold of 1×10^{-6} due to arsenic. The noncancer risk estimate (or the hazard index [HI]) for ingestion of groundwater at Site 13 was estimated to be 0.9 for the adult resident which is below the USEPA and FDEP target HI of 1, but the HI of 2 for the child resident exceeds both the USEPA and FDEP target HI of 1. This HI is mainly due to iron.

The ecological risk assessment (ERA) completed for Site 13 did not include exposure to groundwater by ecological receptors, due to the absence of current or future predicted exposure pathways for ecological receptors to groundwater (HLA, 1998b). The surficial aquifer at Site 13 is approximately 80 to 90 feet below ground surface (ABB-ES, 1998) and is not expected to discharge to surface water within several thousand feet of the site (Coldwater Creek). It is highly unlikely that COPCs in groundwater would affect ecological receptors.

Table 2-2
Summary of Chemicals Exceeding Chemical-Specific ARARs and TBCs in Groundwater

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection[1]	Range of Detected Analyte Concentrations	Mean Analyte Concentration[2]	Background Screening Value[3]	Federal MCL[4]	Florida Groundwater Cleanup Target Levels[5]	USEPA Region III Risk-Based Concentration[6]
Volatile Organic Compounds (μg/ℓ)							
Trichloroethene	1/6	7	7	ND	5 P	3	1.6
Inorganic Analytes (μg/ℓ)							
Arsenic	1/6	1.1	1.1	ND	50 P	50	0.045
Iron	5/6	146 to 39,600	8,650	964	300 S	300	1,100
Manganese	6/6	3.1 to 753	147	42.8	50 S	50	84

[1] Frequency of detection is the fraction of total samples analyzed in which the analyte was detected.
[2] The mean of detected concentrations is the arithmetic mean of all environmental samples in which the analyte was detected. The arithmetic mean does not include those environmental samples in which the analyte was not detected.
[3] Background screening values are two times the arithmetic mean detected background concentrations.
[4] Federal MCLs are maximum permissible concentrations of contaminants in water that are delivered to a user by a public water system.
S = secondary Federal MCL for drinking water.
P = primary Federal MCL for drinking water.
[5] Source: Contaminant Cleanup Target Levels, Chapter 62-777, Florida Administrative Code (May, 1999).
[6] Region III Risk-Based Concentrations for tap water based on an excess lifetime cancer risk of 10^{-6} or an adjusted hazard quotient of 0.1 (USEPA, 1997).

Notes: ARAR = applicable or relevant and appropriate requirement.
TBC = to be considered guidance material.
MCL = maximum contaminant level.
USEPA = U.S. Environmental Protection Agency.
μg/ℓ = micrograms per liter.
ND = not detected.

Surface Water. Site 13 does not contain any permanent surface water bodies. A "Y" drainage ditch flows south and east, but is topographically higher than the Site 13 land surface. A surface depression does exist at the former landfill surface. Storm water ponding occurs only after heavy rainfall conditions, but the depression is not linked to any other surface water feature. Thus, surface water was not sampled during the RI and a human health and ecological RA was not completed. Therefore, no RAOs will be established for surface water at Site 13.

Surface Soil. Chemical-specific ARARs and TBCs for surface soil were considered when identifying RAOs. As previously noted (Subsection 2.1.1), there are no promulgated Federal or State chemical-specific ARARs that provide limits for the concentration of chemicals in soil. However, the State of Florida has promulgated SCTLs under the Contaminant Cleanup Criteria Rule, Chapter 62-777, FAC. In addition, USEPA Region III published RBCs for ingestion of soil. Table 2-3 provides a summary of the detected concentrations for COPCs at Site 13 and their respective Brownfields SCTLs and USEPA Region III RBCs.

Five inorganics, aluminum, arsenic, iron, manganese, and vanadium, were identified as human health COPCs in surface soil.

The HHRA completed for Site 13 evaluated risks to current and future users of the site. The cancer risks posed to site maintenance workers and excavation workers, based on exposure to surface soil under current land-use via direct (dermal) contact, ingestion, or inhalation of particulates are less than the USEPA target risk range and the FDEP risk threshold.

The ELCRs posed to trespasser, occupational worker, site maintenance worker, excavation worker, and residents based on the same exposure pathways and reasonable maximum exposure (RME) assumptions under future land-use are 7×10^{-7}, 1×10^{-6}, 2×10^{-7}, 6×10^{-8}, and 1×10^{-5}, respectively, which are within the acceptable USEPA risk range. However, the future residential risk exceeds the FDEP risk level of 1×10^{-6}. These ELCRs are due mainly to the presence of arsenic in surface soil at the site. Noncancer risks under future land-use for all the receptors were within the acceptable USEPA and FDEP risk thresholds (HI equals 1), with the exception of the child resident.

An RAO to address exposure to arsenic in surface soil will be identified. An RAO will not be identified for exposure to aluminum, iron, manganese, and vanadium because the maximum detected concentrations of these chemicals in surface soil did not exceed their respective Florida SCTLs.

Because Site 13 and several other sites at NAS Whiting Field are disposal sites where the surface soil was removed and cover fill was brought to the site from an off-site borrow source, the Navy requested FDEP to consider a site-specific SCG for arsenic of 4.62 milligrams per kilogram (mg/kg) for the NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16). This request is included as Appendix A of this FS report.

The FDEP responded to this request in a letter dated April 27, 1998 (Appendix B). The FDEP concurred that a site-specific SCG for arsenic of 4.62 mg/kg is acceptable at NAS Whiting Field disposal sites, given the following conditions:

Table 2-3
Summary of Chemicals Exceeding Chemical-Specific ARARs and TBCs in Surface Soil

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection[1]	Range of Detected Analyte Concentrations	Mean Analyte Concentration[2]	Site-Specific Soil Cleanup Goal[3]	Florida Soil Cleanup Target Level[4] Residential/Industrial	USEPA Region III RBCs[5] Residential/Industrial
Inorganic Analytes (mg/kg)						
Aluminum	10/10	9,285 to 38,300	16,042	NA	72,000/1,000,000	78,000/1,000,000
Arsenic	10/10	1.6 to 6.9	3.8	4.62	0.8/3.7	0.43/3.8
Iron	10/10	5,620 to 23,500	11,427	NA	23,000/490,000	23,000/610,000
Manganese	10/10	18.7 to 407	95.4	NA	1,600/20,000	1,800/47,000
Vanadium	10/10	14.5 to 62.4	30.9	NA	15/7,700	550/14,000

[1] Frequency of detection is the fraction of total samples analyzed in which the analyte was detected.
[2] The mean of detected concentrations is the arithmetic mean of all environmental samples in which the analyte was detected, including duplicate samples. The arithmetic mean does not include those environmental samples in which the analyte was not detected.
[3] Based on Navy's request for a site-specific soil cleanup goal for arsenic at disposal sites at Naval Air Station Whiting Field (see Appendix A).
[4] Source: Contaminant Cleanup Target Levels, Chapter 62-777, Florida Administrative Code (May, 1999).
[5] USEPA Region III RBCs for soil ingestion based on an excess lifetime cancer risk of 10^{-6} or an adjusted hazard quotient of 0.1 (October 1997).

Notes: ARAR = applicable or relevant and appropriate requirement.
TBC = to be considered guidance material.
USEPA = U.S. Environmental Protection Agency.
RBC = risk-based concentration.
mg/kg = milligrams per kilogram.
NA = not available.

- In the future, the disposal sites will be used for activities that involve less than full-time contact with surface soil at the site. These activities could include parks, recreation areas, or agricultural sites.

- The Navy will incorporate these land-use considerations into a legally binding Land-Use Control (LUC) Agreement.

- The FDEP approved SCG for arsenic will not be used at any other site without prior FDEP approval.

As presented in Table 2-3, surface soil concentrations of arsenic at Site 13 exceed 4.62 mg/kg with a maximum concentration of 6.9 mg/kg. Based on this observation and consideration of ARARs/TBCs and the RA, the following RAO is established for arsenic in surface soil at Site 13:

RAO 1: Address surface soil at Site 13 where concentrations of arsenic exceed the FDEP approved SCG of 4.62 mg/kg.

In order to apply the FDEP approved site-specific cleanup goal for arsenic at NAS Whiting Field disposal sites, the Navy must adhere to the conditions of the FDEP concurrence letter. Namely, the Navy must establish a legally binding LUC agreement. Therefore, the following RAO is also established for Site 13:

RAO 2: Establish and maintain a LUC plan for Site 13.

The ERA completed for Site 13 considered exposure of terrestrial plants, terrestrial invertebrates, and wildlife to chemicals in surface soil at the site. The following is a summary of this assessment:

- Ecological COPCs detected in surface soil would not reduce invertebrate biomass or abundance such that small mammals and bird populations would be affected. Furthermore, plant biomass and plant cover are not expected to be reduced. Therefore, RAOs will not be established for terrestrial plant exposure to COPCs in surface soil at Site 13.

Based on results of the ERA, no RAO will be established for ecological exposure to surface soil at Site 13:

Subsurface Soil. Chemical-specific ARARs and TBCs for subsurface soil were considered when identifying RAOs.

Subsurface soil samples were collected and one chemical detected in subsurface soil was selected as a human health or ecological COC. Arsenic was identified as a human health COC. There are no current exposures to subsurface soil because no excavation or construction activities are ongoing at Site 13. However, in case of future development, the HHRA completed for Site 13 evaluated risks to future users of the site excavation and/or construction workers. The risks posed to excavation and/or construction workers, based on exposure to subsurface soil via direct (dermal) contact, ingestion, or inhalation is 8×10^{-8} which is below the USEPA target risk range and the FDEP risk threshold. Noncancer risks for the excavation worker are within the acceptable USEPA and FDEP risk thresholds.

Based on this analysis, no RAOs will be developed for subsurface soil at Site 13. However, if the excavation of soil occurs it would expose receptors to

contaminated soils. Restrictions to intrusive work at Site 13 should be included when considering remedial alternatives.

Waste Disposal. Action-specific ARARs related to landfill closure were considered for identifying RAOs. In order to complete this review, it was noted that Site 13 received wastes until 1984. Based on this review, landfill closure regulations were deemed not applicable to Site 13 for the following reasons:

- Federal regulations for the closure of solid waste landfills (40 CFR, Part 258) are not applicable because the disposal site did not receive waste after the effective date of the regulation, October 9, 1991; and

- Florida Solid Waste Disposal Facilities Regulations (Chapter 62-701, FAC) are not applicable because the disposal site did not receive waste after the effective date of the regulation, July 1, 1985.

The closure requirements described in these regulations do not apply to disposal areas that received their final covers before 1983.

Other Considerations. Although the above-referenced regulations are not directly applicable to remedial action at Site 13, portions of the regulations may be relevant for developing remedial alternatives for the sites. For example, the *Draft Technical Manual for Solid Waste Disposal Criteria* (USEPA, 1992) provides information regarding statistical evaluation of groundwater monitoring data. In addition, guidance published for CERCLA sites provides information regarding closure of CERCLA landfills.

As stated in *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b), closure of CERCLA landfills that are not subject to specific closure regulations can be achieved by "hybrid-landfill closure." A "hybrid-landfill closure" may be used when residual contamination poses a direct contact threat, but does not pose a groundwater threat. As indicated from the results of the RI (HLA, 1998b), chemicals in soil and groundwater at Site 13 do not pose a serious groundwater threat. Therefore, Site 13 qualifies for a hybrid-landfill closure, and USEPA guidance (USEPA, 1991b) suggests the following items be considered for hybrid-landfill closures:

- covers, which may be permeable, to prevent a direct-contact threat;
- limited long-term cover maintenance;
- minimal groundwater monitoring; and
- institutional controls (e.g., land-use restrictions), as necessary.

Based on consideration of these items and the recommendations of the RI (including the RA), some or several of these components will be considered in developing remedial alternatives for Site 13.

Summary of RAOs. Two RAOs have been established for Site 13. Table 2-4 lists these RAOs.

Table 2-4
Summary of Remedial Action Objectives

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Remedial Action Objective	Description
1	Address surface soil at Site 13 where concentrations of arsenic exceed the site-specific SCG of 4.62 mg/kg.
2	Establish and maintain a LUC plan for Site 13.

Notes: SCG = soil cleanup goal.
mg/kg = milligrams per kilogram.
LUC = land-use control.
ARAR = applicable or relevant and appropriate requirement.

2.3 VOLUME OF CONTAMINATED MEDIA. Surface soil is the only media at Site 13 for which RAOs have been established. Therefore, this section presents the basis for the calculation of the volume of surface soil containing COCs above RAOs. Appendix C contains detailed calculations and supporting information used to develop the soil volume.

The sampling locations where chemical concentrations exceeded their respective site-specific SCG (arsenic) are shown in Appendix C. These areas are referred to as "hot spots".

The only chemical for which RAOs were identified was arsenic in surface soil. Two out of ten surface soil samples collected from this site contained arsenic at concentrations greater than the site-specific cleanup goal of 4.62 mg/kg.

A "hot spot" surface soil volume was estimated instead of the entire surface soil land area (10 acres) because the analytical results from the surface soil samples indicated 2 of the 10 soil sample locations exceeded the site-specific cleanup goal for arsenic. Therefore, the entire 10-acre site would overestimate the contaminated surface soil volume. The "hot spot" soil volume is approximately 60 cubic yards (yd^3) based on the following:

- Two "hot spot" locations where COCs (arsenic) exceeded their site-specific cleanup goal.
- Each sample location included in the volume estimate was assumed to cover a 20-foot-by-20-foot area.
- The depth of contamination was assumed to be 2 feet based on a review of analytical data (surface and subsurface soil) and FDEP's application of the Florida SCTLs (FDEP, 1998).

Confirmatory soil sampling is proposed under one of the alternatives to ensure that cleanup goals are met. Based on the uncertainty of identifying all "hot spot" locations that exceed RAOs, a sensitivity analysis is presented in Section 5.3 to address additional "hot spot" locations that may be encountered during confirmatory sampling.

2.4 IDENTIFICATION OF GENERAL RESPONSE ACTIONS. General response actions describe potential medium-specific measures that may be employed to address RAOs. Potential response actions for CERCLA sites include the following general response categories:

- no action
- limited action
- containment
- treatment (either *in situ* or *ex situ*)
- disposal

To develop appropriate response actions for former disposal sites, the NCP and USEPA provide guidance for developing general response actions for such sites. The USEPA has produced a document entitled *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a). Because municipal landfill sites typically have similar characteristics as land disposal sites, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states that the USEPA expects containment technologies will generally be appropriate for landfills that pose a relatively low long-term threat or where treatment is impracticable (Section 300.430[a][1][iii][B]).

The USEPA states in *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a) that treatment technologies should be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site (Section 300.430[a][1][iii][A]). However, the RI for Site 13 did not identify highly toxic areas or materials that pose a principal threat; therefore, the general response actions identified for Site 13 do not include physical or thermal treatment technologies. As a result, the presumptive remedy for Site 13 are focused on containment rather than on physical or chemical treatment technologies.

In summary, the general response actions identified for Site 13 include the following:

- no action,
- limited action (i.e., LUCs),
- containment (i.e., soil cover), and
- disposal (i.e., hot spot removal).

3.0 REMEDIAL ACTION ALTERNATIVES

The approach and rationale leading to the development of remedial alternatives for Site 13 are presented in this chapter. The development of remedial alternatives for CERCLA sites consists of identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives that accomplish the RAOs identified in Chapter 2.0.

The NCP requires that a range of remedial alternatives be considered, and SARA emphasizes the use of treatment technologies. Treatment alternatives range from those that eliminate the need for long-term management to those that reduce toxicity, mobility, or volume of contaminants. As stated in Section 2.4, the RI did not identify areas of highly toxic or mobile material that posed a principal threat; therefore, treatment technologies are not considered applicable. Also, the relatively low concentrations of COCs in surface soil and the relatively low volume of contaminated surface soil (60 yd^3) make treatment technologies impractical and not cost effective. Therefore, the presumptive remedies for surface soil contamination include limited action, excavation, and containment alternatives.

The range of alternatives considered in this FS include alternatives from the following categories:

- no action,
- limited action (LUCs),
- limited soil removal (i.e., excavation and disposal), and
- containment (i.e., landfill capping, soil cover).

In the following sections, technologies that contribute to achieving the RAOs are identified and evaluated. Next, alternatives are developed using the selected technologies. A detailed evaluation of remedial alternatives is presented in Chapter 4.0.

3.1 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

The purpose of this section is to identify and screen appropriate technologies for assembly into remedial alternatives that address RAOs identified for Site 13. Each technology is then screened based on site- and waste-limiting characteristics.

Site characteristics considered during this process included the following:

- site geology, hydrogeology, and terrain;
- availability of space and resources necessary to implement the technology; and
- presence of special site features (e.g., wetlands, forest areas, floodplains, or endangered species).

Based on the review of site characteristics, no special site features or characteristics exist at Site 13 that would preclude any remedial technology from implementation.

The following waste characteristics were also considered:

- contaminated media,
- types and concentrations of waste constituents, and
- physical and chemical properties of the waste (e.g., volatility, solubility, and mobility).

Table 3-1 presents and screens the remedial technologies applicable for addressing the RAOs at Site 13. The technology screening process reduces the number of potentially applicable technologies by evaluating the applicability of each technology to site- and waste-limiting factors. Technologies deemed ineffective or not implementable (such as physical or chemical treatment technologies) were eliminated from Table 3-1. The remaining technologies are assembled into remedial alternatives in Section 3.2.

Currently, COCs in surface soil are not known to be leaching into groundwater nor does groundwater pose a principal threat to human health and the environment. However, several alternatives propose to manage COCs in surface soil through limited action or containment. For these alternatives, long-term groundwater monitoring may be necessary for Site 13. Because groundwater assessment and monitoring will be presented under a facilitywide groundwater RI/FS designated Site 40, groundwater monitoring will not be included as a component in any alternatives for this FS.

3.2 REMEDIAL ALTERNATIVES. Remedial technologies that passed the technology screening are assembled into alternatives that meet the RAOs. Table 3-2 presents the development of remedial alternatives for Site 13.

Based on the applicable technologies identified in the preceding section, four remedial alternatives were developed for Site 13. These alternatives are options under the no action, limited action, containment, and disposal general response categories. The no action alternative was developed to provide a baseline for comparison with other alternatives (USEPA, 1988). The alternatives developed for Site 13 are discussed in the following subsections.

3.2.1 Alternative 1: No Action The NCP requires the development of the no action alternative to provide a baseline for comparison against other remedial alternatives. This alternative does not involve the implementation of any remedial technologies to treat wastes at Site 13. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. The 5-year site review typically involves an administrative review of site records. For this FS, Alternative 1 would include 5-year reviews for a period of 30 years. A period of 30 years was chosen for costing purposes only.

3.2.2 Alternative 2: Land Use Controls Alternative 2 consists of activities necessary for complete closure of the disposal area at Site 13:

- development and implementation of LUCs,
- 5-year site reviews.

Table 3-1
Identification and Screening of Remedial Technologies

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
No Action				
No action	No remedial actions are taken at Site 13. Five-year site reviews would be required.	Applicable.	Applicable.	Retained. This alternative is retained for a baseline for comparison with other alternatives as required by CERCLA.
Five-year site reviews	Under CERCLA, if wastes are left on a site after closure, the site should be reviewed every 5 years.	Applicable.	Applicable.	Retained. This alternative is retained based on the CERCLA requirement that if wastes remain on site after closure, a review of the site must be completed every 5 years.
Limited Action				
Land-use controls (LUC)	Use of LUC documents to maintain the site for non-residential purposes.	Applicable.	Applicable.	Retained. This alternative is retained because it would achieve RAO 2.
LUC Implementation Plan (LUCIP)	Identifies each LUC objective for Site 13 and specifies actions required to achieve those objectives (i.e, install fencing, post warning signs). LUCIP includes a description of the disposal history and the status of the site conditions during inspections and sampling and analysis, if required.	Applicable.	Applicable.	Retained. May be necessary to obtain landfill closure certification. This component would achieve RAO 3.
Containment				
Closure Plan development	Development of a Closure Plan for site monitoring and maintenance. Plan includes a description of the disposal history, status of the site conditions during inspections and sampling, and effectiveness of the landfill cover design.	Applicable.	Applicable.	Retained. May be necessary to obtain landfill closure certification. This component would achieve RAO 3.

See notes at end of table.

Table 3-1 (Continued)
Identification and Screening of Remedial Technologies

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
Containment (continued)				
Soil Cover:				
Site Clearing and Grubbing	Removal of vegetation, shrubs, and small and large brush to allow for proper grading of landfill cap.	Applicable.	Not applicable.	Retained. May be necessary if the disposal areas are capped.
Placement of Compacted Soil Cover	Placement, grading, and compacting of low-permeability capping system.	Applicable. Low-permeability cap does not exist; suitable low-permeability soil will be obtained from an off-site borrow source.	Applicable. Presence of clean cover would minimize human and ecological direct contact exposure to existing surface contaminants at Sites 11 and 13.	Retained. May be necessary if the disposal areas are capped.
Vegetative Support Layer	A 6-inch-thick soil cover is placed over a compacted soil cover to reduce water infiltration and erosion and enhance evapotranspiration through vegetative growth.	Applicable. Reduces infiltration of precipitation, thus providing source control at Sites 11 and 13.	Applicable. Would reduce infiltration of precipitation into the waste.	Retained. May be necessary if the disposal areas are capped.
Vegetative Cover	Establishment of vegetation by fertilizing, mulching, seeding, and planting.	Applicable. Vegetation would reduce infiltration and reduce erosion of soil cover.	Applicable. Would reduce direct contact with exposed waste.	Retained. May be necessary if the disposal areas are capped.
Surface Water Management	The final cover design will consist of a top gradient (slope) between 3 and 4 percent and side slopes between 3 and 33 percent to comply with Florida landfill regulations.	Applicable. Would minimize erosion and maintenance.	Applicable. Would reduce erosion of contaminated soil.	Retained. This design will comply with Florida regulations to ensure adequate surface water drainage.

See notes at end of table.

Table 3-1 (Continued)
Identification and Screening of Remedial Technologies

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
Disposal				
Excavate Soil	Surface soil is excavated to a depth of 2 feet in contaminated areas.	Applicable. Site is accessible for removal or excavation activities.	Applicable. Isolated "hot spot" areas have been identified where soil containing COCs above action levels would be removed.	Retained. Would achieve RAO 1 and eliminate risks to human health and ecological receptors.
Off-site Soil Disposal:				
RCRA Subtitle D Solid Waste Landfill	Excavated soil is sampled and analyzed for waste classification. Soil is transported to a non-hazardous, solid waste landfill based on analytical results from excavated soil.	Applicable.	Applicable. Analytical results from the RI indicate that the soil would not be classified as hazardous.	Retained. Would achieve RAOs 1 and 3 and eliminate risks to human health and ecological receptors.
RCRA Subtitle C Hazardous Waste Landfill	Excavated soil is sampled and analyzed for waste classification. Soil is transported to a hazardous, solid waste landfill based on analytical results from excavated soil.	Applicable.	Not Applicable. Analytical results from the RI indicate that the soil would not be classified as hazardous.	Eliminated.

Notes: CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
RAO = remedial action objective.
COC = chemical of concern.
RCRA = Resource Conservation and Recovery Act.
RI = remedial investigation.

LUCs restricting the use of the land in the vicinity of a landfill and place regulatory controls on excavation of soil would be drafted, implemented, and enforced in compliance with local regulations as a part of this alternative. LUCs mandate that an ongoing inspection program be implemented to insure compliance while the LUCs are in effect. The controls will remain in effect until such time that the contamination at the site has been adequately addressed. The LUCIP would describe the planned operations, maintenance, inspections, and monitoring of Site 13. The LUCs will be placed on the parcel of land encompassing the disposal area, including a typical buffer zone, as is currently used at other landfill sites in the State.

Warning signs will be posted to discourage trespassing. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years.

3.2.3 Alternative 3: Limited Soil Removal and LUCs One disposal alternative was developed for Site 13 that consists of all components of Alternative 2 with the addition of "hot spot" soil removal. Disposal alternatives require no treatment of contaminated materials. This alternative would include LUCs and planning, site preparation, excavating, soil sampling, and off-site disposal.

Under this alternative, 2 hot spot surface soil areas would be excavated and transported to a Subtitle D solid waste landfill. Removal of the 2 hot spot soil areas would eliminate exposure to COCs by human and ecological receptors. A site-specific sampling and analysis plan would be developed to characterize excavated soil for disposal and confirm COC removal from the excavated areas. If confirmatory samples from the excavated areas are above action levels, additional hot spot areas would be excavated as appropriate. This alternative assumes that all soil excavated would be classified as non-hazardous based on the fact that COC concentrations in surface soil during the RI (Table 2-3) are far below the FDEP soil leaching goals (FDEP, 1998). The relatively low COC concentrations indicate that soil samples would most likely pass toxicity characteristic leaching procedure (TCLP) testing.

After the soil has been disposed, clean fill would be imported to the site and backfilled into the excavated areas. The area would be restored with a vegetative support layer and vegetative cover. All equipment would be demobilized and the site would be closed in accordance with CERCLA. Similar to Alternative 2, LUCs and LUC Plans would be implemented. A 5-year site review would be conducted to assess the need for additional site monitoring and sampling, if necessary.

3.2.4 Alternative 4: Soil Cover and LUCs One containment alternative was developed for Site 13 that consists of all components of Alternative 2 with the addition of a soil cover component. Containment alternatives require no treatment of contaminated materials.

Under this alternative, a cover system would be constructed over the former disposal site to reduce the infiltration of precipitation, control surface water runoff, and minimize potential direct contact risks. Minimizing infiltration from precipitation and surface water reduces contaminant leaching from soil and landfill wastes to groundwater. The cover design would be in accordance with USEPA guidance for hybrid-landfill closure provided in *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b).

Prior to the cover construction, the site would be cleared, grubbed, and graded. To minimize storm water infiltration and cover erosion, the landfill cover would be graded to a minimum 3:1 slope (3 horizontal:1 vertical). The soil cover would consist of clean fill placed and compacted in 6-inch lifts to a minimum thickness of 18 inches. Six inches of topsoil would then be placed on top of the clean fill for a total cover thickness of 24 inches. Once in place, the soil layer would be fertilized and seeded to promote vegetative cover.

During the construction phase of this alternative, temporary erosion control measures would remain in place until a vegetative cover was established. Post-closure monitoring and maintenance of the installed cover system would be required until the cover system stabilized. This monitoring program would include visual inspections and maintenance of the vegetative cover. For cost estimating purposes, inspection and monitoring is estimated for a period of 30 years after closure. Finally, LUCs and 5-year reviews would be implemented as previously discussed. The 5-year site reviews will assess the need for continued landfill monitoring.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

This chapter presents detailed analyses of alternatives for Site 13 at NAS Whiting Field. A detailed analysis is performed to provide decision makers with sufficient information to select the appropriate remedial alternative for a site. The detailed analysis has been conducted in accordance with CERCLA Section 121, the NCP, and USEPA RI/FS Guidance (USEPA, 1988). The detailed evaluation of each remedial alternative includes the following:

- a detailed description of the alternative, emphasizing the applications of the technology or actions proposed for each alternative; and

- a detailed analysis of the alternative against seven of the nine CERCLA criteria.

The remedial alternatives are examined with respect to the requirements stipulated by CERCLA and factors described in the USEPA's *Guidance for Conducting RI/FS Under CERCLA* (USEPA, 1988). The nine criteria from the RI/FS Guidance document are

- overall protection of human health and the environment,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction of toxicity, mobility, and volume of contaminants through treatment,
- short-term effectiveness,
- implementability,
- cost,
- State acceptance, and
- community acceptance.

This FS presents evaluation of the first seven criteria in the alternative evaluation process. Table 4-1 outlines the specific elements considered for these seven criteria.

Typically, State acceptance (i.e., the eighth factor) is addressed when comments on the draft FS report have been received from the State. Therefore, State comments will be addressed in the Final FS, and a response to State's review comments will be included in the Final FS report.

Community acceptance (i.e., the ninth factor) is addressed upon receipt of public comments on the Proposed Plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

4.1 DETAILED ANALYSIS FOR ALTERNATIVE 1: NO ACTION. Alternative 1 is a no action alternative. Under this alternative, no actions would be taken to address contamination at the site. A description of this alternative is presented in Subsection 4.1.1, and a technical assessment of this alternative is presented in Subsection 4.1.2.

4.1.1 Detailed Description of Alternative 1 In accordance with the NCP, the no-action alternative is used as a baseline for comparison against other alterna-

Table 4-1
Criteria for Evaluation of Remedial Action Alternatives

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Factors	Criteria to Consider
Overall protection of human health and the environment	How risks are eliminated, reduced, or controlled. Short-term or cross-media effects.
Compliance with ARARs	Compliance with chemical-specific ARARs. Compliance with location-specific ARARs. Compliance with action-specific ARARs.
Long-term effectiveness and permanence	Magnitude of residual risk. Adequacy of controls. Reliability of controls.
Reduction of mobility, toxicity, and volume of contaminants through treatment	Treatment process and remedy. Amount of hazardous materials destroyed or treated. Reduction of mobility, toxicity, or volume through treatment. Irreversibility of treatment. Type and quantity of treatment residual.
Short-term effectiveness	Protection of community during remedial action. Protection of workers during remedial action. Environmental effects. Time until RAOs are achieved.
Implementability	Ease of remedial construction. Reliability of technology. Ease of undertaking additional remedial action, if necessary. Coordination with other agencies.
Cost	Capital cost. Operation and maintenance cost. Total present worth of alternative.

Notes: ARAR = applicable or relevant and appropriate requirement.
RAO = remedial action objective.

tives. Because hazardous substances, pollutants, or contaminants would be left in place at Site 13, this alternative would include 5-year site reviews. Under this alternative, surface soil would remain in place and concentrations of inorganic COCs (arsenic) would not be reduced. No other additional remedial or institutional controls would be implemented under this alternative. There would be no controls on land-use types; therefore, the site could be used for residential, industrial, or commercial uses.

Five-Year Site Reviews. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. It is assumed, for this FS, that these reviews would occur over a 30-year period. These reviews would consist of evaluating changes to site conditions at the site (e.g., construction, demolition, change in potential receptors, migration pathways, qualitative risks, etc.) to assess whether or not human health and the environment continue to be protected by the alternative. The appropriateness of this alternative would then be compared to other remedial alternatives to confirm that it is still the most appropriate selection.

4.1.2 Technical Criteria Assessment of Alternative 1 This subsection provides the technical criteria assessment of Alternative 1 against the seven criteria.

Overall Protection of Human Health and the Environment. This alternative would provide no additional protection to human or ecological receptors who may be exposed to surface soil at Site 13. If this alternative were selected, 5-year site reviews would be instituted. No adverse short-term or cross-media effects are anticipated with this no-action alternative.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., maximum contaminant levels [MCLs], Florida GCTLs or SCTLs) in the short term. This alternative may comply with ARARs in the long term if natural processes including physical, chemical, and biological degradation in the soil and groundwater reduce concentrations. However, this alternative would not comply with ARARs for arsenic concentrations in soil.

Long-Term Effectiveness and Permanence. Naturally-occurring processes such as biological activity may reduce concentrations in the soil over the long term, but would not address arsenic in soil. Human risks due to exposure to site soil would not be addressed via this alternative. Therefore, these risks would remain for arsenic.

Administrative actions proposed in this alternative (e.g., 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative, but would not provide a permanent remedy for the site. Administrative actions are considered to be reliable controls.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Although treatment is not included in this alternative, this alternative may provide some reduction in toxicity through natural degradation processes. No reduction in arsenic toxicity is anticipated; however, arsenic can form low-solubility metal arsenates. This alternative would not provide a reduction in contaminant mobility or volume because active mitigation of contaminant mobility or reduction in volume is not proposed. On the other hand, treatment residuals would not be produced if this alternative were implemented.

Short-Term Effectiveness. This alternative would not reduce human health risks in the short term because no land-use restrictions or active treatment would be implemented.

This alternative would not comply with RAOs in the short term because no reduction in arsenic concentrations would be anticipated. This alternative does not pose a threat to workers through exposure to contaminated soil because remedial construction activities are not proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as 5-year site reviews, are easily implemented.

Cost. The present worth cost of Alternative 1 is presented on Table 4-2. The cost includes 5-year site reviews over a 30-year monitoring period. A 30-year period was chosen because RI/FS guidance suggests using this timeframe when contaminants are left on site. The total present worth cost of Alternative 1 is $19,087. Cost estimates are presented in Appendix D.

Table 4-2
Cost Summary Table, Alternative 1: No Action

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Operation and Maintenance Cost (O&M) (per event)	
5-year site review	$8,000
Total O&M cost (per event)	$8,000
Total O&M cost (present worth of semi-annual O&M for 30 years)	$16,000
Contingency (10 percent)	$3,000
Total cost Alternative 1: No Action	$19,000

Note: Line item costs are rounded to the nearest $1,000. See Appendix D for cost details.
Total costs are based on present worth costs.

4.2 DETAILED ANALYSIS FOR ALTERNATIVE 2: LAND USE CONTROLS. Alternative 2 consists of LUC actions and fencing to limit the exposure to surface soil at Site 13. A description of this alternative is presented in Subsection 4.2.1 and a technical assessment of this alternative is presented in Subsection 4.2.2.

4.2.1 Detailed Description of Alternative 2 Under this alternative, LUCs would be implemented. LUCs would involve the use of controls restricting the use of the land in the vicinity of Site 13. LUCs would place regulatory controls on the excavation of soil or similar activities that have the potential to disturb the site soil or increase the likelihood of exposure to the site soil.

The LUCs would be placed on a parcel of land slightly larger than the boundaries of Site 13. This would ensure that an appropriate buffer zone is created and maintained between the disposal areas and other areas of NAS Whiting Field.

The LUCs would remain in place until the level of contamination at the sites has been adequately addressed. As part of this alternative, a quarterly site inspection program would be established to insure that compliance with the agreed upon LUCs is maintained. The results of these inspections would be summarized in quarterly reports and an annual report provided to appropriate parties. The inspection and reporting activities would be performed as long as the LUCs are in place. The following components would be included as part of this alternative:

- LUCs
- 5-year site reviews

LUCs. Under new USEPA Region IV guidance (USEPA, 1998), the use of LUCs as a remedy for contaminated sites requires the development of an LUCAP, as provided in the Memorandum of Agreement dated November 1999, and an LUCIP. These documents detail the actions required when LUCs are selected as a remedy for a site.

The LUCAP is developed for the entire facility on which LUCs are necessary. This document would identify an individual at the facility who is responsible for administering the LUCs at NAS Whiting Field.

The LUCIP is then developed for each site where LUCs are necessary on the facility. The LUCIP would include details regarding additional required activities, such as quarterly and annual inspection and reporting for the specific area. These activities are required as part of the LUC agreement to insure compliance while the LUCs for the sites are in effect. Further, as LUCs will remain in effect until the contamination at the sites has been adequately addressed, the activities identified in the LUCIP will also remain in effect until such time that the contamination present at the sites has been adequately addressed.

5-Year Site Reviews. Refer to Subsection 4.1.1 for a detailed description of these reviews.

4.2.2 Technical Criteria Assessment of Alternative 2 This subsection presents the technical criteria assessment of Alternative 2.

Overall Protection of Human Health and the Environment. Human receptors would be protected if this alternative were implemented. Regulatory controls (i.e., LUCs) would prohibit potential future residents from exposure to the site because residential use of the site would be restricted under the proposed LUCs.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., MCLs, Florida GCTLs or SCTLs) in the short term. Reduction of arsenic concentrations are not expected; therefore, ARARs would not be achieved.

Long-Term Effectiveness and Permanence. Naturally occurring processes, such as biological activity, would not reduce arsenic concentrations. The risks presented to the future resident based on exposure to surface soil at the site would be addressed via fencing and the LUCs. The long-term effectiveness and permanence of these controls will be controlled by the facility under the LUCAP developed for NAS Whiting Field.

Administrative actions proposed in this alternative (e.g., LUCs and 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative. These administrative actions are considered to be reliable controls, as long as the facility maintains its LUCIP.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. No reduction in arsenic toxicity is anticipated; however, arsenic can form low-solubility metal arsenates. This alternative would not provide a reduction in contaminant mobility or volume because active mitigation of contaminant mobility or reduction in volume is not proposed. On the other hand, treatment residuals would not be produced if this alternative were implemented.

Short-Term Effectiveness. This alternative would reduce human health risks in the short term by reducing the potential exposure to Site 13 surface soil by human receptors. However, ecological risks would not be reduced by implementation of this alternative. Furthermore, the threat to trespassers is considered to be minimal. Access to the base is restricted and continued operation of the base is expected.

This alternative does not pose a threat to workers through exposure to contaminated soil because only limited construction activities are proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as LUCs and 5-year site reviews, are easily implemented.

Cost. The present worth cost of Alternative 2 is presented on Table 4-3. Both the LUCs and 5-year site reviews were costed over a 30-year monitoring period. A 30-year period was chosen because RI/FS guidance suggest using this timeframe where COCs remain on site. The total present worth cost of Alternative 2 is $140,000. Cost estimates are presented in Appendix D.

4.3 DETAILED ANALYSIS FOR ALTERNATIVE 3: LIMITED SOIL REMOVAL. Alternative 3 includes remedial actions to excavate 2 "hot spot" surface soil areas at Site 13 and dispose of the excavated soil at an FDEP-approved and permitted disposal facility. A description of this alternative is presented in Subsection 4.3.1, and a technical criteria assessment of this alternative is presented in Subsection 4.3.2.

4.3.1 Detailed Description of Alternative 3 Under this alternative, the top 2 feet of soil in areas exhibiting the highest arsenic levels would be excavated, sampled and analyzed, and transported and disposed at an approved off-site disposal facility. Based on the low COC concentrations in surface soil during the RI, the excavated soil would most likely be suitable for disposal at a Subtitle D (non-hazardous, solid waste) facility. Excavation and off-site disposal of the contaminated surface soil would eliminate COC exposure to humans and ecological receptors in Site 13 surface soil.

The following components would be included as part of this alternative:

- LUCs
- Mobilization and site preparation

Table 4-3
Cost Summary Table, Alternative 2: Land Use Controls

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land-use controls	$12,000
Total direct cost	$12,000
Indirect Costs	
Health and safety (3 percent)	$1,000
Administration and permitting (3 percent)	$1,000
Engineering and design (10 percent)	$1,000
Construction support services (10 percent)	$1,000
Total indirect cost	$4,000
Total capital cost (direct + indirect)	$16,000
Operation and Maintenance Cost (O&M) (per event)	
5-year site review	$ 5,310
Inspection and reporting	$7,000
Total O&M cost (per event)	$ 13,000
Total O&M cost (present worth of semi-annual O&M for 30 years)	$111,000
Total Capital and O&M	$127,000
Contingency (10 percent)	$13,000
Total cost Alternative 2: Land Use Controls	$140,000

Note: Line item costs are rounded to the nearest $1,000. See Appendix D for cost details. Total costs are based on present worth costs.

- Excavation and stockpiling surface soil
- Soil sampling and analysis
- Transportation and off-site disposal
- Site restoration
- Five-year site reviews

These activities are discussed in the following sections.

LUCs. Refer to Alternative 2 for a description of this component.

Mobilization and Site Preparation. Under this alternative, heavy equipment such as a front end loader and backhoe would be mobilized to the site. Mobilization and site preparation would include all activities and construction prior to excavating surface soil. Since there is no electrical power or water supply at Site 13, a portable generator and a high-pressure washer with water tank would be mobilized to the site to supply power and water during decontamination procedures. A temporary decontamination area would be constructed at the site. Equipment and vehicles used during site preparation, excavation, and soil sampling would be steam-cleaned and decontaminated at this location.

A staging area for excavated soil would be constructed on site using two layers of 6-mil plastic sheeting as lining.

Excavating and Stockpiling of Surface Soil. Two (2) "hot spot" surface soil areas will be excavated to a depth of 2 feet below surface and stockpiled for waste characterization. The 2 hot spot areas are shown in Appendix C and estimated to be 20 feet by 20 feet each. The total volume of soil that would be removed is approximately 60 yd^3. If additional hot spot areas are discovered based on confirmatory sampling of the open excavations, then additional hot spot areas would be excavated for disposal. The additional soil volume that may be required for removal is addressed in Section 5.3: Soil Volume Sensitivity Analysis.

Soil Sampling and Analysis. A soil sampling and analysis plan would be developed for two reasons: (1) to characterize the excavated soil for off-site disposal and (2) to confirm COC removal from the open excavation areas. To meet FDEP and USEPA guidance for soil disposal, one composite sample would be collected for every 100 yd^3 of excavated soil. To meet off-site disposal requirements, stockpiled soil samples would be analyzed for hazardous waste characteristics (TCLP metals, VOCs, semivolatile organic compounds, pesticide/herbicides) and total recoverable petroleum hydrocarbons. In addition, composite soil samples would be collected from the bottom of the open excavation areas to confirm contaminant removal. A total of 2 confirmatory soil samples (includes a duplicate sample) would be collected and analyzed for COCs (i.e., arsenic).

Transportation and Off-Site Disposal. Based on the relatively low concentrations of COCs in surface soil (Table 2-3), it was assumed that the excavated soil would be characterized as nonhazardous and would be disposed of in a nonhazardous, solid waste landfill (RCRA Subtitle D Landfill). Excavated soil would be loaded onto U.S. Department of Transportation-approved transport vehicles or rolloff containers (22-ton load capacity) and transported to an FDEP-approved Subtitle D landfill.

Site Restoration and Demobilization. Once contaminated soil has been removed, the excavation area would be backfilled with clean fill and topsoil. The fill

material and topsoil would be transported from a nearby off-site borrow source using dump trucks and tractor trailers. The backfill material will be tested to ensure it is suitable for backfill at Site 13. The material would be spread across the excavated areas using a front end loader. Once the excavation areas have been backfilled, the areas would be seeded and fertilized to promote vegetative growth. Hay would be used to protect the seed and fertilizer during initial development. Decontamination water generated during implementation of this alternative would be sampled and either discharged on the ground at Site 13 or transported to the NAS Whiting Field federally-owned treatment works for treatment. The storage trailer, heavy equipment, miscellaneous equipment, and tools used during the implementation of this alternative would be demobilized.

Five-Year Site Reviews. Since COCs in soil would remain in areas above Florida residential and industrial SCTLs, 5-year site reviews would be conducted to assess the effectiveness of this alternative. Refer to Alternative 1 for a description of this component.

4.3.2 Technical Criteria Assessment of Alternative 3 This subsection presents the technical criteria assessment of Alternative 3.

Overall Protection of Human Health and the Environment. This alternative would minimize human and ecological exposure to COCs in Site 13 surface soil because the hot spot soil areas would be excavated and disposed offsite. Surface soil areas where concentrations of COCs are above the Florida SCTLs or the FDEP approved SCG for arsenic (4.62 mg/kg) would be removed from the site and the resulting excavation would be backfilled with clean fill. As a result, risks posed to human and ecological receptors by exposure to contaminated surface soil would be minimized.

Compliance with ARARs. It is expected that source excavation, transportation and disposal, and backfilling activities would comply with ARARs (see Section 2.1).

Worker safety standards will be maintained during remedial activities to comply with ARARs. A site-specific health and safety plan will be developed and implemented during all site activities.

Long-Term Effectiveness and Permanence. This alternative is expected to provide long-term effectiveness and permanence by excavation and off-site disposal of hot spot contaminated surface soil. A five-year site review will be used to assess changes in site conditions to ensure long-term effectiveness and permanence. Alternative 3 can be viewed as a permanent method of reducing human health and ecological risks posed by ingestion of contaminated surface soil by excavation and removal of hot spot soil areas.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Disposal of the excavated surface soil within an approved landfill would not reduce the toxicity, mobility, or volume of the waste because active treatment of the soil would not occur. However, the toxicity, mobility, and volume of waste would be reduced on site for Site 13 surface soil because the waste would be transported and disposed of at an approved off-site disposal facility.

Short-Term Effectiveness. Through implementation of this alternative, there would be an immediate reduction in risk to human health and the environment. During excavation and soil handling activities, site workers would wear appropriate

personal protective equipment (PPE) for protection against exposure to site-related contaminants.

This alternative would also ensure the protection of non-site workers and trespassers immediately after backfilling the excavation with clean fill.

Implementability. This alternative is easily implementable. Equipment and materials are readily available for excavation and removal activities. Site work would be completed within a 2-month period, allowing for a 28-day turnaround time (TAT) for analytical results. If an expedited remedial action is required, this alternative can be completed within 2 to 4 weeks using an expedited TAT for analytical results.

Cost. The cost estimate for Alternative 3 is presented in Table 4-4 and detailed cost calculations are provided in Appendix D. Operations and maintenance activities include a 5-year review and quarterly/annual reporting and inspections for a 30-year monitoring period. The total present worth cost of Alternative 3 is approximately $224,000.

4.4 DETAILED ANALYSIS FOR ALTERNATIVE 4: SOIL COVER AND LUCS. Alternative 4 consists of constructing a soil cover in accordance with Chapter 62-701.600, FAC (Florida Landfill Closure regulation) at Site 13. A description of this alternative is presented in Subsection 4.4.1 and a technical criteria assessment of this alternative is presented in Subsection 4.4.2.

The design criteria presented in this section are intended for cost comparison purposes only and are not intended to be final design specifications. If Alternative 4 is the selected remedy for Site 13, it is recommended that land surveying, additional field sampling, and geotechnical testing be completed prior to preparing design plans and specifications. Final design plans and specifications would be prepared in accordance with Chapter 62-701.600, FAC, and sealed by a Florida-registered Professional Engineer.

4.4.1 Detailed Description of Alternative 4 Alternative 4 is designed to address closure of the disposal areas and exposure to surface soil at Site 13. The selected landfill cover design for Alternative 4 is primarily based on the Florida landfill closure regulation (Chapter 62-701.600, FAC). This regulation was used to develop appropriate criteria for a soil cover design and to formulate a cost estimate for the detailed evaluation of this alternative. The following components would be included as part of this alternative:

- LUCs
- Site preparation, clearing, and grubbing
- Soil cover design
- Surface water drainage
- Post-closure care
- Five-year site reviews

LUCs and Site Closure Plan. Refer to Alternative 2 for a description of LUCs. The Site Closure Plan would consist of a closure report, closure design plan, and closure operation plan in accordance with Chapter 62-701.600, FAC.

Table 4-4
Cost Summary Table, Alternative 3: Limited Soil Removal

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land-use controls	$12,000
Mobilization and site preparation	$8,000
Excavating and stockpiling surface soil	$4,000
Soil sampling and analysis	$5,000
Off-site transportation and disposal (Subtitle D Landfill)	$6,000
Management of decontamination liquid	$1,000
Site restoration	$4,000
Total direct cost	$42,000
Indirect Cost	
Health and safety (3 percent)	$1,500
Administration and permitting (3 percent)	$1,500
Engineering and design (10 percent)	$4,000
Construction support services (10 percent)	$4,000
Total indirect cost	$11,000
Total capital cost (direct + indirect)	$53,000
Operation and Maintenance (O&M) Cost (capitalized)	
Land-use controls - Quarterly & Annual inspections and reporting	$124,000
5-year site review	$27,000
Total O&M cost (capitalized)	$151,000
Total Capital and O&M costs	$204,000
Contingency (10 percent)	$20,000
Total cost Alternative 3: Hot Spot Soil Removal	$224,000

Note: Line item costs are rounded to the nearest $1,000. See Appendix D for cost details. Total costs are based on present worth costs.

Site Preparation, Clearing, and Grubbing. A stockpile area, with a 12-inch-thick gravel base, would be installed at the site and would be large enough to provide sufficient volume for several days of filling and grading operations associated with this alternative. An area adjacent to the stockpile area would be prepared with a 12-inch-thick gravel base to be used as a parking area for construction-support trailers and heavy equipment. Equipment mobilized to the site would include earth-moving equipment such as backhoes, front-end loaders, bulldozers, and dump trucks.

Approximately 10 percent of the site is assumed to be covered by trees; a sparse layer of groundcover covers the remainder of the site. Pine trees, shrubs, and other vegetation will be cleared with a trackhoe or other type of excavation equipment to provide a cleared surface for placement of the landfill cover. Small brush and vegetation will be chopped and spread over the landfill surface. Large trees will be disposed as yard-waste at an appropriate mulching or tree recycling facility, or chipped and spread over the landfill surface prior to construction of the soil cover.

Soil Cover. Since leaching of COCs to groundwater is not a principal threat, the primary intent of the landfill cover is to limit direct contact exposure to site soil. As a result, the soil cover will be approximately 24 inches thick and consist of an 18-inch thick barrier soil layer and 6-inch topsoil for vegetative cover per Chapter 62-701.600, FAC. This barrier layer will be placed and compacted in 6-inch lifts to ensure proper compaction and cover stability. A fine-grained, low-permeable soil layer (29,040 yd^3) will be obtained from an off-site borrow source. The borrow soil will be tested to verify that it is "clean" fill and exhibits a pH between 6 and 7.5 standard units (su).

This soil will be compacted with a sheepsfoot or smooth roller to achieve a structurally stable surface. The final compacted soil layer will consist of a minimum of 2 feet soil cover. Only minimal modification of the existing topography will be performed.

A final 6-inch layer of topsoil (9,680 yd^3) will be placed over the compacted soil to support vegetative growth. The soil will be obtained from an off-site borrow source to provide the adequate soil composition required to stimulate and support natural vegetation. The soil will be tested to verify that it is "clean" fill and exhibits a pH between 6 and 7.5 su.

Selected seed and fertilizer will be placed on the vegetative support layer to establish vegetation. Hay will be used to protect the seed and fertilizer during initial development. Post-closure care will include provisions to stimulate growth. The vegetative cover will minimize erosion by developing root systems within the vegetative support layer that overlies the compacted soil cover material. The vegetation will also provide evapotranspiration of moisture contained in the soil cover, which will increase the cover's structural stability.

Surface Water Drainage. Natural surface water drainage that exists at the site will be maintained to the maximum extent possible. The final topographic surface and permeability of the landfill cover will allow drainage which emulates current conditions closely (e.g., internal drainage).

Post-Closure Care. Post-closure care will consist of the activities listed below, performed on an annual basis for a period of 30 years after cover construction.

- Visually inspecting, seeding, watering, and otherwise maintaining the vegetation on the surface of the closed landfill.

- Visually inspecting the landfill cover for signs of wear or discontinuities, such as seeps, pits, cracks, or other imperfections that may compromise the cover's structural integrity.

Groundwater monitoring is not included in post-closure care as groundwater is being investigated on a facilitywide basis at NAS Whiting Field (designated Site 40). The need for groundwater monitoring will be assessed in the Site 40 RI for groundwater.

Five-Year Site Reviews. Refer to Alternative 1 for a description of this component.

4.4.2 Technical Criteria Assessment of Alternative 4 This subsection presents the technical criteria assessment of Alternative 4.

Overall Protection of Human Health and the Environment. Protection of human receptors would be provided by the implementation of this alternative in that a landfill cover and regulatory controls (i.e., LUCs) would prohibit potential human receptors from coming into contact with the soil at Site 13. This alternative would also provide protection for ecological receptors at the site; however, in doing so, this alternative would alter the native ecological habitat present at the site.

Compliance with ARARs. Landfill closure requirements under RCRA Subtitles C and D, as well as Florida Solid Waste Disposal Facilities Regulations, were referenced as appropriate concerning the soil cover design.

Worker safety standards will be maintained during construction activities to comply with ARARs. Dust control will be used to minimize the spread of wind-blown soil during site grading. A site-specific health and safety plan will be developed and implemented during all site activities. However, contact with landfill wastes is not anticipated during construction of the cover.

Five-year site reviews will be prepared to assess the effectiveness of the alternative.

Long-Term Effectiveness and Permanence. The construction of a soil cover will prevent human health risks posed by ingestion of surface soil and ecological risks to small mammals exposed to surface soil.

Alternative 4 can be viewed as a permanent method of reducing human health risks posed by ingestion of surface soil if the cover stability shows permanence after completion of the 5-year review. Similar to human health risk reduction, the soil cover will also be designed to prevent risks posed to ecological receptors. A vegetative cover will be placed over the compacted soil to allow growth of native vegetation. The vegetation will increase evapotranspiration and reduce cover erosion. The risk posed to local species by ingesting biota that contain

contaminants in their tissue, or by directly ingesting surface soil that contains contaminants, will be eliminated by placement of the compacted soil.

Alternative 4 will include clearing and grubbing vegetation that currently exists on the landfills. Existing vegetation will be removed, and ecological diversity will be reduced at Site 13. This ecological loss is not permanent; new vegetation will be planted on the final cover to induce continued ecological growth. However, this new vegetation will consist of mostly grasses and small brush, which is not quite as diverse as the natural vegetation that currently exists (due to the removal of some trees). The clearing and grubbing of the existing vegetation can be viewed as a permanent long-term ecological impact.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Alternative 4 does not include treatment of contaminants, and does not physically or chemically alter contaminants contained in the landfills. Thus, this alternative does not reduce the toxicity and/or volume of contaminants through treatment. However, the cover design will effectively reduce the mobility of contaminants contained in surface soil by preventing the spread of wind-blown particulates. The cover will also prevent the uptake of contaminants contained in surface soil, which will prevent biomagnification of contaminants through the local ecological food chain.

Short-Term Effectiveness. During the clearing, grubbing, and grading of the site, fugitive dust will be generated. This dust may contain hazardous particulates that pose an inhalation risk to site workers. Dust suppression by the use of water trucks and hoses is included in this alternative to minimize these potential short-term risks. Site workers may be exposed to contaminated surface soil during construction activities. Appropriate PPE can be used to minimize this increased risk.

Alternative 4 will include clearing and grubbing vegetation that currently exists. Ecological species that depend upon the surface of the landfills for food and other natural resources will be impacted by the removal of existing vegetation. This detrimental impact is an adverse short-term impact that will be reversed upon the growth of new vegetation. Construction operations are expected to last for 2 months, and new vegetation will likely require years to mature. Thus, the short-term ecological impacts as a result of clearing and grubbing the site may be significant.

Implementability. Equipment and materials are readily available to construct the cover designed for Alternative 4. Site work will be completed within a 2-month period, and will require standard construction expertise. Because of the difficulty in obtaining borrow soil in the vicinity of the site, compacted soil will be obtained from a non-local borrow source. The lack of local borrow sources would result in additional transportation cost, but does not render the alternative infeasible.

Cost. The cost estimate for Alternative 4 is presented in Table 4-5 and detailed cost calculations are provided in Appendix D. This estimate is based on the preliminary design criteria presented in this section. If this alternative is selected, land surveying, additional field sampling, and geotechnical testing should be performed during design to prepare a complete set of design plans and specifications. The total present worth cost of Alternative 4 is approximately $1,186,000.

Table 4-5
Cost Summary Table, Alternative 4: Soil Cover and LUCs

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land-use controls	$12,000
Mobilization and site preparation	$54,000
Site clearing and grubbing	$43,000
Soil cover	$564,000
Dust control	$5,500
Site restoration	$20,000
Total direct cost	$700,000
Indirect Cost	
Health and safety (3 percent)	$21,000
Administration and permitting (3 percent)	$21,000
Engineering and design (10 percent)	$70,000
Construction support services (10 percent)	$70,000
Total indirect cost	$182,000
Total capital cost (direct + indirect)	$880,000
Operation and Maintenance (O&M) Cost (capitalized)	
Soil cover inspection and maintenance	$45,000
Land-use controls - Quarterly & Annual inspections and reporting	$93,000
5-year site review	$17,000
Total O&M cost (capitalized)	$156,000
Total capital and O&M costs	$1,038,000
Contingency (10 percent)	$104,000
Total cost Alternative 4: Site Closure and Capping	$1,186,000

Note: Line item costs are rounded to the nearest $1,000. See Appendix D for cost details.

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Remedial alternatives for Site 13 were developed in Chapter 3.0 and were individually evaluated in Chapter 4.0 using seven technical criteria. For comparative purposes, these criteria are grouped into the following categories:

- threshold criteria,
- primary balancing criteria, and
- modifying criteria.

This chapter presents a comparison of remedial alternatives with respect to these criteria. This comparison is intended to provide technical information required to support the selection of a preferred alternative for Site 13. It is anticipated that modifying criteria (i.e. State and community acceptance) will be used in conjunction with the information presented herein to select an appropriate remedial alternative. The remainder of this chapter presents this comparison.

5.1 OVERALL APPROACH TO COMPARATIVE ANALYSIS. As presented in Chapter 4.0, remedial alternatives were developed to accomplish the RAOs identified for the site. The three sets of criteria identified above are used to streamline the comparison between alternatives while ensuring compliance with the RAOs. Components of these criteria are described below.

5.1.1 Threshold Criteria Because the selected remedy must be protective of human health and the environment, as well as comply with ARARs, the following two threshold criteria are essential:

- overall protection of human health and the environment, and
- compliance with ARARs.

An individual assessment of each alternative with respect to these criteria was presented in Chapter 4.0. An overall comparative analysis of alternatives using threshold criteria is presented in Section 5.2.

5.1.2 Primary Balancing Criteria Primary balancing criteria consist of the following five components:

- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume of contaminants through treatment;
- short-term effectiveness;
- implementability; and
- cost.

These criteria are used to provide an assessment of the permanence of each remedial alternative, while ensuring the implementability and cost-effectiveness of each remedial alternative. An individual assessment of each alternative with respect to these criteria is presented in Chapter 4.0. An overall comparative analysis of alternatives using primary balancing criteria is presented in Section 5.2.

5.1.3 Modifying Criteria The final two criteria are as follows:

- State acceptance, and
- community acceptance.

Typically, State acceptance (i.e., the eighth factor) is addressed when comments on the draft FS report have been received from the State. Therefore, State comments will be addressed in the Final FS, and a summary of State acceptance of this FS will be included in the Final FS report.

Community acceptance (i.e., the ninth factor) is addressed upon receipt of public comments on the Proposed Plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

Based on this information, an evaluation of modifying criteria is not included in this FS.

5.2 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES. This section provides the comparative analysis for remedial alternatives for Site 13 with respect to the criteria described in Section 5.1. Alternatives presented in this FS include the following:

- Alternative 1: No Action
- Alternative 2: Land Use Controls
- Alternative 3: Limited Soil Removal and LUCs
- Alternative 4: Soil Cover and LUCs

5.2.1 Comparison of Threshold Criteria The remedial alternatives for Site 13 were first compared to the two threshold criteria, overall protection of human health and the environment and compliance with ARARs.

Alternative 1 would not achieve any of the RAOs. Alternative 1 does not provide a means of restricting future land use of the area. Site closure of the landfills would not be achieved via implementation of this alternative. Therefore, this alternative does not protect potential future residents from environmental conditions at the site.

The implementation of Alternative 2 would provide a limited measure of protection of human health and the environment because the alternative includes LUCs and fence installation. Alternative 2 would achieve RAOs 2 and 3 (maintain a LUC plan and landfill closure), but would only address RAO 1 by restricting access to the site by installing a fence. Therefore, Alternative 2 would not provide optimal protection of human health or the environment and would not achieve compliance with all ARARs.

Alternative 3 would achieve all RAOs through hot spot soil removal and provide a measure of continued protection of human health and the environment through LUCs. In this manner, Alternative 3 would achieve the RAOs established for the site and would therefore achieve ARARs. Implementation of Alternative 3 may have potential short-term effects of exposure to site workers.

Alternative 4 would also achieve the RAOs, but would adversely affect the existing environment at the site. Construction of a soil cover at the site would result in habitat destruction including destruction of planted pine tree area and other features of the site. Implementation of Alternative 4 may also have potential short-term effects of exposure to site workers.

Because the implementation of Alternative 3 would achieve the RAOs and eliminate COC exposure in surface soil as opposed to leaving COCs in surface soil (i.e., Alternatives 1, 2, and 4), Alternative 3 is the best alternative in providing overall protection of human health and the environment. Furthermore, Alternative 3 would not destroy habitat in meeting RAOs, unlike Alternative 4.

5.2.2 Comparison of Primary Balancing Criteria A comparison is made between alternatives with respect to five criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume; short-term effectiveness; implementability; and cost.

Alternative 3 would provide long-term effectiveness by removing surface soil where COC concentrations exceed cleanup levels established in the RAOs. Alternative 4 would provide long-term effectiveness by limiting exposure to COCs and through natural degradation processes for organic contaminants. Furthermore, background levels of arsenic are 3.2 mg/kg (slightly below the FDEP approved SCG of 4.62 mg/kg) and may be the result of naturally occurring sources of arsenic in the site soil.

The alternatives evaluated for Site 13 would not reduce the toxicity or volume of contaminants at the site, as none of the alternatives involve treatment of contaminants in media at the site. Alternative 3 is the only alternative where off-site removal of contaminated surface soil would reduce the toxicity and volume on site. Also, Alternatives 3 and 4 would provide a reduction in the mobility (i.e., leaching) of contaminants from the soil; however, it does not appear that contaminants are currently leaching to the groundwater.

Alternative 4 would provide the greatest direct adverse short-term impacts on potential ecological receptors via clearing and grubbing activities that would destroy habitat. These impacts could be mitigated if Alternatives 1, 2, or 3 were implemented; no short-term impacts to the environment are expected during implementation of Alternatives 1 and 2.

The implementability of Alternatives 1, 2, and 3 would be relatively easy. For Alternatives 2, 3, and 4, a LUCAP and a LUCIP would need to be developed. The documents should be relatively easy to complete.

For Alternative 4, design plans would need to be prepared and the appropriate substantive requirements of the permit requirements for landfill capping would need to be met prior to implementation of that alternative.

The relative present-worth cost estimates are shown below for each alternative. In accordance with USEPA guidance for contaminants left in place, the costs for Alternative 1, 2, 3, and 4 are based on a 30-year timeframe.

- Alternative 1: $19,000
- Alternative 2: $140,000
- Alternative 3: $224,000
- Alternative 4: $1,186,000

As expected, Alternative 1, the no-action alternative, has the lowest estimated overall cost. Alternative 2 involves LUCs and quarterly/annual inspections and reporting over 30 years. Alternatives 3 and 4 incorporate all the components (and costs) of Alternative 2 with either soil removal or soil capping. A comparison of Alternatives 3 and 4 shows that Alternative 3, "hot spot" soil removal, is more cost-effective because its capital costs are much lower than those of Alternative 4, Soil Cover and LUCs.

The cost estimated for Alternative 3 may vary depending on the extent and distribution of hot spots. For this reason, a cost-sensitivity analysis was performed. This analysis is described in Section 5.3.

5.2.3 Modifying Criteria As stated in Subsection 5.1.3, an evaluation of modifying criteria will not be included in this FS.

5.3 SOIL VOLUME SENSITIVITY ANALYSIS. If Alternative 3 is selected, there is a degree of uncertainty in identifying all "hot spot" locations that exceed action levels prior to implementing the alternative. Two options are available to address this uncertainty. First, additional soil sampling for arsenic for the entire site using a sampling grid may be implemented as an interim measure to better delineate the site for hot spots (using standard statistical methods). Second, a soil volume sensitivity analysis may be conducted by estimating additional hot spot areas that would be encountered during confirmatory sampling, thus increasing soil volume and total cost. The first option is beyond the scope of this FS; however, the second option is summarized in Table 5-1.

Table 5-1
Soil Volume Cost Sensitivity Analysis

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Alternative 3: No. of Hot Spots	Sensitivity to Baseline Hot Spots	Total Soil Volume (cubic yards)	Approximate Total Cost
2	baseline	60	$237,000
6	3 × baseline	180	$258,000
12	6 × baseline	360	$290,000
30	15 × baseline	900	$385,000

The detailed cost estimates for each scenario are presented in Appendix D. As the number of hot spots increases (Table 5-1), the total volume and total cost increase. Each hot spot location is assumed to cover a 20-foot by 20-foot area. Therefore, 30 hot spot areas would encompass a total surface area of about 1/4 acre, or 1 percent of the total acreage of the site. Based on existing data collected during the RI, it is reasonable to assume that the total soil volume above action levels would be within these limits.

REFERENCES

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Nature Conservancy/Florida Natural Areas Inventory. 1997. "Rare Plant, Rare Vertebrate, and Natural Community Survey of NAS Whiting Field..." Final Report, sub-agreement (N62467-95-RP00236) to the 1995 Cooperative Agreement between Department of Defense and the Nature Conservancy.

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USEPA, 1997. *Risk-Based Concentration Table*. USEPA Region III, Philadelphia, Pennsylvania (October 17).

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APPENDIX A

NAVY'S REQUEST FOR SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC AT DISPOSAL SITES AT NAS WHITING FIELD

Evaluation of Background Arsenic Concentrations for Covered Landfill Sites

At Naval Air Station (NAS) Whiting Field, nine soil types, as identified by the U. S. Department of Agriculture, Soil Conservation Service (USSCS), are present. The Remedial Investigation (RI) sites at NAS Whiting Field are associated with seven of the nine soil types. The background surface soil data set for each RI site was initially determined to be comprised of background surface soil samples from the same USSCS soil types as occur on the individual sites. However, available information and review of historical aerial photographs indicated that in the construction of landfills at the facility, a borrow pit was dug to an approximate depth of 10 to 15 feet below land surface and the excavated soil was piled to the side. Following landfill operations, the borrow materials comprised of undifferentiated surface and subsurface soils were used for the landfill cover. Any additional soils required to complete the landfill cover are believed to have been obtained from other borrow pits located at the facility.

If a mix of surface and subsurface soils were used in the cover for landfills, it would be appropriate to use the combined data set of surface and subsurface soil samples as the background screening value. However, in order to be protective of human health and the environment, it is proposed that the background surface and subsurface data set be combined to a single value as the "Industrial Use Soil Cleanup Goal." This modified "Industrial Use Soil Cleanup Goal" is specifically limited to the covered landfill sites including Sites 1, 2, 9, 10, 11, 13, 14, 15, and 16, and to the inorganic analyte arsenic.

Tables 3-8 through 3-18 in the General Information Report present the detected concentrations and summarize the analytical data for the individual background soil samples collected at NAS Whiting Field. A summary of the arsenic background data set and the modified "Industrial Use Soil Cleanup Goal" for arsenic is presented in Table A-1. As indicated on the table, the modified "Industrial Use Soil Cleanup Goal" for arsenic to be used at covered landfill sites is 4.62 milligrams per kilogram.

Table A-1
Summary of Arsenic Detected in Surface and Subsurface Background Soil Samples

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection Surface Soil Samples[1]	Mean of Detected Concentrations Surface Soil Samples[2]	Frequency of Detection Subsurface Soil Samples[1]	Mean of Detected Concentrations Subsurface Soil Samples[2]	Frequency of Detection Surface and Subsurface Soil Samples[1]	Mean of Detected Concentrations Surface and Subsurface Soil Samples[2]	Surface and Subsurface Soil Background Screening Concentration (modified Industrial Use Cleanup Goal)
Inorganic Analytes (mg/kg)							
Arsenic	15/15	1.54	14/14	3.14	29/29	2.31	4.62

[1] Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: mg/kg = milligrams per kilogram.

Table A-2
Comparison of Detected Arsenic Concentrations in Surface and Subsurface Soil Samples to Florida Soil Cleanup Target Levels

Feasibility Study
Site 13, Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Analyte	Minimum Detected Concentration	Maximum Detected Concentration	Mean of Detected Concentrations	Florida Soil Cleanup Target Levels (Residential/Industrial)[1]	Modified Industrial Use Cleanup Goal[2]
Inorganic Analyte (mg/kg)					
Arsenic	0.52	6.3	2.31	0.8/3.7	4.62

[1] Source: Florida Soil Cleanup Target Levels, Chapter 62-777 F.A.C, April 1998.
[2] The modified cleanup goal is based on FDEP approved site-specific concentrations for perimeter road sites at NAS Whiting Field.

Notes: mg/kg = milligrams per kilogram.

APPENDIX B

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S RESPONSE AND ACCEPTANCE OF THE SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC FOR DISPOSAL SITES AT NAS WHITING FIELD

Department of Environmental Protection

/rton Chiles
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

April 27, 1998

Ms. Linda Martin
Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, PO Box 190010
North Charleston, SC 29419-9010

file: arsenic1.doc

RE: Request for Site-Specific Arsenic Soil Cleanup Levels: Covered Landfill Sites, NAS Whiting Field

Dear Ms. Martin:

I have reviewed the request for approval of a site-specific Soil Cleanup Goal for arsenic at the "covered landfill sites" at NAS Whiting Field from Mr. Gerald Walker, ABB Environmental Services, dated April 22, 1998 (received April 22, 1998). Based on the prior presentation to Department Staff and the summary information furnished in the letter and the attached Appendix I, the request is granted to utilize a site-specific Soil Cleanup Goal for arsenic of 4.62 mg/kg at Sites 1, 2, 9, 10, 11, 12, 13, 14, 15 and 16., with the following conditions:

1. The sites may be utilized for activities that involve less than full-time contact with the site. This may include, but is not limited to, a.) parks b.) recreation areas that receive heavy use (such as soccer or baseball fields) or, c.) agricultural sites where farming practices result in moderate site contact (approximately 100 days/year, or less).

2. The Navy must assure adherence to the land use by incorporating the site and conditions in a legally binding Land Use Contol agreement.

3. The above Soil Cleanup Goal shall not be utilized at any other site without specific Department approval.

If you have questions or require further clarification, please contact me at (904) 921-4230.

Sincerely,

James H. Cason, P.G.
Remedial Project Manager

APPENDIX C

VOLUME ESTIMATES FOR CONTAMINATED MEDIA

FEASIBILITY STUDY - NAS WHITING FIELD SITE 13

CONTAMINATED SOIL VOLUME FOR LIMITED SOIL REMOVAL

SITE	SAMPLE LOCATION*	CONTAMINANTS	CONCENTRATION	SURFACE AREA (sq.ft.)	DEPTH (ft.)	VOLUME (cft)	VOLUME (cyd)
13	13S00301	Arsenic	6.4 mg/kg	400	2	800	29.63
	13-SL-04	Arsenic	6.9 mg/kg	400	2	800	29.63
			TOTAL "HOT SPOT" VOLUME			1600	59

NOTE: *See Attached Figure for Soil Sample Locations

FEASIBILITY STUDY - NAS WHITING FIELD SITE 13

ALTERNATIVE 3: LIMITED SOIL REMOVAL
BACKFILL VOLUME REQUIRED FOR EXCAVATED AREAS

MATERIAL	HOT SPOT LOCATIONS	SURFACE AREA (sq.ft.)	DEPTH (ft.)	VOLUME (cft)	VOLUME (cyd)	UNIT COST ($/cyd)	TOTAL COST ($)
Common Fill	2	400	1.5	1200	44	$10	$444
Topsoil	2	400	0.5	400	15	$16	$237
		TOTAL			59		$681

FEASIBILITY STUDY - NAS WHITING FIELD SITE 13

ALTERNATIVE 4: CAPPING AND LUCS
VOLUME REQUIRED FOR 2' THICK SOIL COVER OVER ENTIRE SITE

MATERIAL	AREA (Acres)	THICKNESS (ft.)	VOLUME (cyd)	BULK FACTOR (20%xVol)	TOTAL VOL (cyd)	UNIT COST ($/cyd)	TOTAL COST ($)
Common Fill	10	1.5	24,200	4,840	29,040	$10	$290,400
Topsoil	10	0.5	8,067	1,613	9,680	$10	$96,800
		TOTAL			38720		$387,200

APPENDIX D

COST CALCULATIONS FOR REMEDIAL ALTERNATIVES

ALTERNATIVE #1: NO ACTION, SITE13

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	15	hrs	$90.00	$1,350
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$5,310*
Present Worth of 5-year costs at i=6%				*$17,352*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$17,352**
CONTINGENCY @ 10 PERCENT				**$1,735**
TOTAL COST OF ALTERNATIVE #1				**$19,087**

ALTERNATIVE #2: LAND USE CONTROLS, SITE13

	Quantity	Unit	Unit Cost	Total Cost
DIRECT COSTS				
Land Use Controls (LUCs)				
Survey Plat	1	lump sum	$2,500.00	$2,500
Land Use Restriction Fees (Filing, Legal, etc.)	1	lump sum	$5,000.00	$5,000
Land Use Implementation Plan:				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	40	hrs	$60.00	$2,400
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
TOTAL DIRECT COSTS				**$11,950**
INDIRECT COSTS				
Health & Safety (@3%)				$359
Administrative, Legal, & Permitting Fees (@3%)				$359
Engineering and Design (@10%)				$1,195
Construction Support Services				$1,195
TOTAL INDIRECT COSTS				**$3,108**
Total CAPITAL COSTS				**$15,058**
Operation and Maintenance (O&M) Costs				
Quarterly Inspection				
Senior Scientist	0	hrs	$90.00	$0
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$320.00	$320
Quarterly Reporting				
Senior Scientist	8	hrs	$90.00	$720
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$1,000.00	$1,000
Annual Reporting				
Senior Scientist	2	hrs	$90.00	$180
Mid-level Engineer	8	hrs	$60.00	$480
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$250.00	$250
Subtotal				$6,790
Present Worth of Land Use Control costs at i=6%				*$93,464*
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440

ALTERNATIVE #2: LAND USE CONTROLS, SITE13

	Quantity	Unit	Unit Cost	Total Cost
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	15	hrs	$90.00	$1,350
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Subtotal				$5,310
Present Worth of 5-year costs at i=6%				*$17,352*
TOTAL O&M COSTS				**$110,816**
COST OF ALTERNATIVE #2				**$125,874**
CONTINGENCY @10 PERCENT				**$12,587**
TOTAL COST OF ALTERNATIVE #2				**$138,462**

ALTERNATIVE #3: LIMITED REMOVAL OF SURFACE SOIL, SITE 13

	Quantity	Unit	Unit Cost	Total Cost
DIRECT COSTS				
Land Use Controls (LUCs - see Alternative #2)				$13,200
Equipment Delivery (Mob/Demob)				
Front End Loader	1	LS	$1,000.00	$1,000
Backhoe	1	LS	$1,000.00	$1,000
Pressure Washer & Water Tank	1	each	$250.00	$250
Pick-up Truck	2	wk	$350.00	$700
Site Preparation				
Decontamination Pad Materials	1	LS	$250.00	$250
Staging Area for Excavated Soil	1	LS	$500.00	$500
Storage Trailer	1	mon	$150.00	$150
Pressure Washer	2	weeks	$175.00	$350
Miscellaneous Equipment	1	LS	$2,500.00	$2,500
Labor (Site Preparation)				
Laborers (2 men @ 1 dys @ 10 hrs/dy)	20	hr	$36.00	$720
Equipment Operators (2 @ 1 dys @ 10 hrs/dy)	20	hr	$40.00	$800
Mobilization and Site Preparation				$8,220
Excavating and Stockpiling of Surface Soil (59 cy = 72 tons)				
Backhoe and operator	1	dy	$1,200.00	$1,200
Laborers(2 @ 1dys @ 10hrs/dy)	20	hr	$36.00	$720
Site Superintendent (1 wk * 40 hr/wk)	40	hr	$60.00	$2,400
Excavating and Stockpiling Soil				$4,320
Soil Sampling and Analysis (Waste Characterization and Confirmatory Sampling)				
Sampling Plan:				
Mid-level Engineer/Scientist	24	hrs	$75.00	$1,800
ODCs	1	LS	$250.00	$250
Sample Collection:				
Associate Scientist	16	hrs	$60.00	$960
Technican	16	hrs	$40.00	$640
ODCs, Sample Equipment, Supplies	1	LS	$500.00	$500
Waste Characterization (1 composite sample/59 cyds)				
TCLP Metals, VOCs, SVOCs, Pest/Herb, TRP	1	ea	$800.00	$800
Confirmatory Samples (1 composite sample/open excavation)				
PPL Metals (including Arsenic)	2	ea.	$200.00	$400
Soil Sampling & Analysis				$5,350
Loading and Off-site Landfill disposal (60 tons)				
Front End Loader and operator	1	dy	$1,200.00	$1,200
Laborers(2 @ 1dy @ 10hrs/dy)	20	hr	$36.00	$720

ALTERNATIVE #3: LIMITED REMOVAL OF SURFACE SOIL, SITE 13

	Quantity	Unit	Unit Cost	Total Cost
Site Superintendent	20	hr	$60.00	$1,200
RCRA Subtitle D (Solid Waste) Landfill				
Transportation	60	ton	$10.00	$600
Disposal	60	ton	$32.00	$1,920
Loading and Off-site Landfill disposal				$5,640
Mangement of Decontamination Fluid				
55-gallon drums (delivery and disposal)	3	drums	$150.00	$450
Laborers (2 @ 1dy @ 10 hrs/dy)	20	hr	$36.00	$720
Management of Decontamination Fluid				$1,170
Site Restoration				
Front End Loader and operator	1	dy	$1,200.00	$1,200
Laborers(2 @ 1dys @ 10hrs/dy)	20	hr	$36.00	$720
Backfill (common fill)	44	cyds	$10.00	$440
Topsoil	15	cyds	$16.00	$240
Fertilize, Seed, and Mulch	800	ft^2	$2.00	$1,600
Site Restoration				$4,200
TOTAL DIRECT COSTS				**$42,100**
INDIRECT COSTS				
Health and Safety (@3%)				$1,263
Administrative, Legal, and Permitting Fees (@3%)				$1,263
Engineering and Design (@10%)				$4,210
Construction Support Services (@10%)				$4,210
TOTAL INDIRECT COSTS				**$10,946**
TOTAL CAPITAL COSTS (Direct + Indirect Costs)				**$53,046**
OPERATION AND MAINTENANCE COSTS (annual)				
5-Year Site Review (see Alternative #1)				
Total LOE				$7,800
Total ODCs				$360
Subtotal Cost				$8,160
Present Worth (capitalized @ 6%, 30 years)				**$26,665**
Land Use Controls - Quarterly and Annual Inspection and Reporting (see Alt. #2)				
Total LOE				$6,180
Total ODCs				$2,820
Subtotal Cost				$9,000
Present Worth (capitalized @ 6%, 30 years)				**$123,883**

ALTERNATIVE #3: LIMITED REMOVAL OF SURFACE SOIL, SITE 13

	Quantity	Unit	Unit Cost	Total Cost
TOTAL O&M COSTS (5-Year Review and LUCs)				**$150,548**
TOTAL CAPITAL COSTS AND O&M COSTS				**$203,594**
CONTINGENCY (@ 10 PERCENT)				**$20,359**
TOTAL COST OF ALTERNATIVE #3				**$223,954**

ALTERNATIVE # 4: SOIL COVER AND LUCS, SITE 13

	Quantity	Unit	Unit Cost	Total Cost
DIRECT COSTS				
Land Use Controls (LUCs - See Alternative # 2				**$13,200**
Equipment Delivery (Mobilization)				
Front End Loader	2	LS	$1,000.00	$2,000
Dozer	2	LS	$1,000.00	$2,000
Grad-all	2	LS	$1,000.00	$2,000
Dump Truck (15 cyd)	4	LS	$250.00	$1,000
Water Truck	1	LS	$250.00	$250
Backhoe	1	LS	$1,000.00	$1,000
Pressure Washer	1	LS	$250.00	$250
Equipment	1	LS	$1,200.00	$1,200
Site Preparation				
Office Trailer	3	mon	$150.00	$450
Storage Trailer	3	mon	$150.00	$450
Trailer Delivery, Setup, Removal	1	each	$300.00	$300
Telephone Service	3	mon	$50.00	$150
Electrical Hookup/Power	3	mon	$50.00	$150
Toilet/Water Cooler Service	3	mon	$50.00	$150
Miscellaneous Equipment	1	LS	$2,500.00	$2,500
Labor (Site Preparation)				
Electrician (2 men @ 5 days @ 10 hrs/day)	100	hrs	$42.00	$4,200
Carpenter (2 men @ 5 days @ 10 hrs/day)	100	hrs	$42.00	$4,200
Foreman (1 man @ 5 days @10 hrs/day)	50	hrs	$60.00	$3,000
Laborers (2 men @ 2 days @ 8 hrs/day)	32	hrs	$36.00	$1,152
Equipment and Disposal Costs (Site Preparation)				
Backhoe and Operator	3	days	$1,200.00	$3,600
Front End Loader and Operator	3	days	$700.00	$2,100
Micellaneous Tools	1	LS	$300.00	$300
Trans and Disposal - Concrete Debris	0	tons	$30.00	$0
Silt fencing	4200	lf	$5.00	$21,000
Signs	15	ea	$50.00	$750
Mobilization and Site Preparation				**$54,152**
Clearing and Grubbing				
Foreman (2 wk @ 50 hrs/wk)	100	hrs	$60.00	$6,000
Grubbing, Removal and Stockpile (Labor Included)	10	acres	$3,500.00	$35,000
Transport and Disposal (Grub and Stumps)	74	tons	$30.00	$2,220
Clearing and Grubbing				**$43,220**
Soil Cover - 10 Acres				
Grade Site (2 Dozers and Operators)	15	dy	$1,650.00	$24,750

ALTERNATIVE # 4: SOIL COVER AND LUCS, SITE 13

	Quantity	Unit	Unit Cost	Total Cost
Common Fill - minimum 1.5' layer, Purchase & Ha	29040	cy	$10.00	$290,400
Common Fill - min. 1.5' layer, Spread & Compact	29040	cy	$2.00	$58,080
Site Superintendant (12.0 wks @ 50 hrs/wk)	600	hr	$60.00	$36,000
Topsoil - 6" layer, Purchase & Haul	9680	cy	$10.00	$96,800
Topsoil - 6" layer, Spread	9680	cy	$6.00	$58,080
Soil Cover				**$564,110**
Dust Control				
Water Truck and Driver	10	wk	$550.00	$5,500
Dust Control				**$5,500**
Site Restoration				
Fertilize, Seed, Mulch	10.00	acres	$2,000.00	$20,000
Site restoration				**$20,000**

TOTAL DIRECT COSTS $700,182

INDIRECT COSTS

Health and Safety (@3% of Direct Costs)	$21,005
Administrative Fees (@3% of Direct Costs)	$21,005
Engineering and Design (@10% of Direct Costs)	$70,018
Construction Support Services (@10% of Direct Costs)	$70,018

TOTAL INDIRECT COSTS $182,047

TOTAL CAPITAL COSTS = Direct Costs + Indirect Costs **$882,229**

OPERATION AND MAINTENANCE COSTS (annual)

Soil Cover Inspection and Maintenance (Annual)

Replacement of Soil	20	ton	$20.00	$400
Dump Truck and Driver	2	dy	$730.00	$1,460
Laborers (2 @ 2dy @ 10 hrs/day)	40	hr	$36.00	$1,440
Subtotal Cost				$3,300
Present Worth (capitalized @ i = 6%, 30 years)				**$45,424**

5-Year Site Review (see Alternative #1)

Total LOE	$7,800
Total ODCs	$360
Subtotal Cost	$8,160

ALTERNATIVE # 4: SOIL COVER AND LUCS, SITE 13

	Quantity	Unit	Unit Cost	Total Cost
Present Worth (capitalized @ i = 6%, 30 years)				**$26,665**
Land Use Controls - Quarterly and Annual Inspection and Reporting (see Alt. #2)				
Total LOE				$6,180
Total ODCs				$2,820
Subtotal Cost				$9,000
Present Worth (capitalized @ i = 6%, 30 years)				**$123,883**
TOTAL O&M COSTS (5-Year Reviews and LUCs)				**$195,972**
TOTAL CAPITAL COSTS AND O&M COSTS				**$1,078,201**
CONTINGENCY (@ 10 PERCENT)				**$107,820**
TOTAL COST OF ALTERNATIVE #4				**$1,186,021**

APPENDIX E

RESPONSE TO AGENCY COMMENTS

Response to EPA Review Comments
Site 13, Sanitary Landfill
Draft Feasibility Study

1. **Cover Page**. The EPA ID number should be included on the cover page both inside and outside.

   Response: The EPA ID number will be added to the cover page and the report title page.

2. **Executive Summary, Page –iii-**. The seventh sentence in the second paragraph states runoff typically ponds onsite; however, the eighth sentence states that surface water runoff drains toward Big Coldwater Creek.

   Response: Surface water runoff is towards Big Coldwater Creek. The 7th sentence will be deleted.

3. **Glossary, Page –viii-**. The abbreviation "BRA" for "baseline risk assessment" should be included. "CPC" should be changed to "COPC". In the definition for "LUCIP", change the word "Installation" to "Implementation". The definition for "RA" should be "remedial action" instead of risk assessment. On page –vii-, remove "guidance material" from the definition for "TBC". These abbreviations should be changed throughout the document, accordingly, wherever they occur.

   Response: As suggested by the reviewer, the abbreviation "BRA" for "baseline risk assessment" will be included. Also "CPC" will be changed to "COPC". In the definition for "LUCIP", the word "Installation" will be replaced by "Implementation". The report will be revised to reflect "RA" means "remedial action" and not risk assessment. On page –vii-, the phrase "guidance material" will de deleted from the definition for "TBC". These abbreviations will be changed throughout the document.

4. **Section 1.0, Page 1-1**. Change the word "Priority" to "Priorities" in the first sentence of the second paragraph.

   Response: The word "Priority" will be changed to "Priorities" in the first sentence of the second paragraph.

5. **Section 1.1, Page 1-3**. In the discussion of the modifying criteria, community acceptance is generally evaluated based on comments received on the proposed plan and not the FS.

   Response: The paragraph will be revised to read as follows.
   "Alternatives are evaluated against two additional factors after State participation and the public comment period:" The words "for the FS" will be deleted.

6. **Section 1.2, Page 1-3**. In the second sentence of the first paragraph, change the word "each" to "the".

   Response: The word "each" will be changed to the word "the".

7. **Section 1.3, Page 1-4**. In the second sentence of the first paragraph, change the word "and" to "an".

   Response: The word "and" will be changed to the word "an".

8. **Section 1.3, Page 1-5**. See Comment No. 2 as it relates to the last two sentences in the first paragraph of this section.

   Response: The surface runoff issue will be corrected as per information presented in the RI report.

9. **Table 2-1, Page 2-4**. Remove the reference to the Safe Drinking Water Act. Groundwater monitoring will

be addressed within the context of the Site 40 RI/FS. On page 2-5, remove the references to the Florida Groundwater Classes and the Florida Drinking Water Standards.

Response: Agree. The reference to Safe drinking Water Act will be deleted from the table. Also, references to the Florida Groundwater classes and the Florida drinking Water Standards will be deleted.

10. **Section 2.2, Page 2-9**. In the Surface Soil discussion, the Brownfields Cleanup Criteria Rule is cited; however, this site does not qualify for Brownfields designation.

Response: Agree. Citations to the Brownfields Cleanup Criteria will be deleted.

11. **Section 3.2.2, Page 3-6**. The first sentence of the second paragraph states that a fence will be installed; however, the need for a fence may not be necessary with appropriate application of land use controls.

Response: Agree. References to the installation of a fence will be deleted.

12. **Section 4.0, Page 4-1**. The fourth paragraph states that a summary of State acceptance will be included in the final FS; however, only a response to the State's comments is typically prepared.

Response: Agree. The fourth paragraph will be revised to state a response to the State's comments will be included in the final FS

13. **Section 4.2.1, Page 4-4, First paragraph**. See Comment No. 11 as it relates to fencing.

Response: Agree. References to the installation of a fence will be deleted.

14. **Section 4.2.1, Page 4-5, LUCs**. The third sentence of the second paragraph should be reworded as follows: "This document would identify an individual at the facility who is responsible for administering the LUCs at NAS Whiting Field." Please see Comment No. 11 as it relates to the use of fencing at Site 13.

Response: Agree. The third sentence of the second paragraph will be reworded as follows: "This document would identify an individual at the facility who is responsible for administering the LUCs at NAS Whiting Field." References to the installation of a fence will be deleted.

15. **Section 4.3.1, Page 4-8**. Insert "...in areas exhibiting the highest arsenic levels..." in between the words "soil" and "would" in the first sentence of this section. In the Mobilization and Site Preparation section on this page, please verify whether "6-millimeter" should be "6-mil".

Response: The phrase "...in areas exhibiting the highest arsenic levels..." will be inserted between the words "soil" and "would" in the first sentence of Section 4.3.1. In the Mobilization and Site Preparation section on this page, "6-millimeter" will be revised to read "6-mil".

16. **Section 4.3.1, Page 4-9**. Sampling of clean fill material should be included in the Site Restoration and Demobilization section.

Response: The sampling of clean fill material will be included in the Site Restoration and Demobilization section.

17. **Section 5.2.2, Page 5-3**. In the fifth paragraph, place a period after the word "complete" and delete the remainder of the sentence.

Response: Agree. The sentence will be revised as suggested by the reviewer.

18. **References, Page Ref-1**. Delete the words "Washington, D.C." in the last reference. Jon Johnston is the

Branch Chief of the Federal Facilities Branch within EPA, Region IV.

Response: The words "Washington, D.C." will be deleted.

Response to Comments
For FDEP Comments on the Draft Site 13 Feasibility Study
NAS Whiting Field, Milton, Florida

1. In the Executive Summary, page iii, paragraph four, please state that this document does not include considerations for ground water at Site 13, since ground water will be evaluated in the Site 40 investigation. The ground water exclusion should also be discussed in the first paragraph of the Introduction.

   Response: Paragraph four of thre Executive Summary will be revised to state that this document does not include considerations for ground water at Site 13, since ground water will be evaluated in the Site 40 investigation.

   The exclusion of ground water exclusion in the FS will be discussed in the first paragraph of the Introduction.

2. In the Introduction, paragraph three, first sentence; add "soil" after the "of" where it says, "and impact of contamination at the sites," on page 1-2, fourth bulleted item following "and impact of.." and in Section 1.2, Purpose of the FS Report: in the first line, replace "media" with "soil."

   Response: Text will be revised as suggested by the reviewer.

3. Figure 1-2: the "Y" ditch is a physical feature and should be shown in the figure.

   Response: The "Y" ditch is depicted on Figure 1-2.

4. Section 2.1.1, Chemical-Specific ARARs: State of Florida SCTLs are contained in Chapter 62-777, F.A.C., not in Chapter 62-785, F.A.C.

   Response: All references to Chapter 62-785 , F.A.C. will be replaced with Chapter 62-777, F.A.C.

5. Table 2-1, page 2-6: the reference to Chapter 62-785, F.A.C. should be deleted. This also applies to the reference in Table 2-2, page 2-8, where Chapter 62-777, F.A.C. should be inserted.

   Response: Please see response to FDEP Comment 4.

6. Page 2-11, Subsurface Soil: the statement that soil cleanup goals only apply to surface soil is not correct. Please correct this sentence to include the subsurface soils and the fact that if subsurface soils do not meet direct exposure 1 criteria, they will have to be addressed if they are removed since receptors could come in contact with them. Please also delete the reference to brownfield sites at the end of the paragraph.

   Response: Reference to brownfield sites will be deleted. Subsurface soils will be compared against the residential exposure. If necessary, text will be revised appropriately.

7. Page 2-12, third line: the statement that RAOs will not be developed for subsurface soils at Site 13 is not entirely true. Even though they may not be remediated, they will at least be considered when determining if the site is clean or if land use controls are imposed. Please make this correction to account for any contaminated subsurface soils.

   Response: Based on the evaluation completed per FDEP Comment 6, text will be revised appropriately.

8. Page 2-13, Table 2-4: RAO three discusses "complete" closure. Please correct as we have previously discussed at the Partnering meetings. Please reconsider the third sentence in the same paragraph, which discusses surface soil.

Response: RAO3 will be deleted as the disposal area covered prior to 1983.

9. Page 2-13, third bulleted item: as long as the assumptions that are made here are used only for estimates, they are acceptable. If actual cleanup is done, the assumptions are not valid.

   Response: The reviewer is correct. The calculations are used for estimates. Actual cleanup area will depend on analytical results from samples collected to delineate the hot spot location(s).

10. In the References, please include a reference to Chapter 62-777, F.A.C. and delete the reference to Chapter 62-785, F.A.C. unless it has actually been used or considered.

    Response: The reference to Chapter 62-777, F.A.C. will be included in the references and the reference to Chapter 62-785, F.A.C. will be deleted.