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FINAL FEASIBILITY STUDY AT OPERABLE UNIT 3 (OU 3) SITE 7 AND SITE 8 NAS CECIL FIELD FL

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ABB ENVIRONMENTAL SERVICES INC

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FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

UNIT IDENTIFICATION CODE: N60200
CONTRACT NO.: N62467-89-D-0317/090

AUGUST 1997

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
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FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Unit Identification Code: N60200

Contract No.: N62467-89-D-0317/090

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August 1997

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/090 are complete and accurate and comply with all requirements of this contract.

DATE: August 25, 1997

NAME AND TITLE OF CERTIFYING OFFICIAL: Rao Angara
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Gopi Kanchibhatla, P.E.
Project Technical Lead

(DFAR 252.227-7036)

The engineering evaluations and professional opinions rendered in this planning document that describes the Feasibility Study for Operable Unit 3, Naval Air Station Cecil Field, Jacksonville, 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.

Gopi Kanchibhatla
Professional Engineer No. 0049494
Expires February 28, 1999

FOREWORD

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

The Navy's IR program consists of Preliminary Assessment and Site Inspection (PA/SI), Remedial Investigation and Feasibility Study (RI/FS), and Remedial Design and Remedial Action (RD/RA) at sites where disposal of hazardous materials allegedly occurred. The PA/SI identifies the presence of pollutants. The RI/FS analyzes the nature and extent of contamination and determines the optimum remedial solution. The RD/RA completes the implementation of the solution.

Previous investigations have determined that Naval Air Station (NAS) Cecil Field has 18 sites that may pose a threat to human health or the environment. Therefore, an RI/FS will be performed at each site to address the extent and magnitude of contamination at these sites.

This report presents the FS for Operable Unit 3, consisting of Site 7 (the Old Firefighting Training Area) and Site 8 (the Boresite Range, Hazardous Waste Storage Area, and Former Firefighting Training Area). This report includes a discussion of remedial action objectives (RAOs), applicable and/or relevant and appropriate requirements, the identification and screening of applicable technologies to address the RAOs, the identification and description of remedial alternatives, and a detailed analysis of the identified alternatives against nine criteria.

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

EXECUTIVE SUMMARY

ABB Environmental Services, Inc. has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command to complete a Feasibility Study (FS) for Operable Unit (OU) 3 at Naval Air Station Cecil Field, Jacksonville, Florida. The FS is being completed under contract number N62467-89-D-03170/90. This report presents the results of the FS for OU 3, Sites 7 and 8, which include the development, screening, and evaluation of potential remedial alternatives that address contaminated media at the OU.

The purpose of this FS is to identify remedial action objectives (RAOs), identify remedial action alternatives that will achieve those objectives, and evaluate the alternatives to provide the basis for selection of a preferred remedial action alternative. The FS contains an overview of the remedial investigation (RI) and risk assessment (RA) for OU 3 and contains identification and discussion of applicable or relevant or appropriate requirements (ARARs) to develop RAOs. Next, remedial technologies that address site-specific considerations established in the RAOs are identified and screened; those technologies that pass the screening phase are developed into remedial alternatives. Remedial alternatives are then developed and analyzed in detail for comparison in the comparative analysis.

The RI/RA completed for OU 3 concluded as follows:

Site 7.

- Contaminants in Site 7 surface soil pose a human health threat if they are incidently ingested by occupational workers, trespassers, or future potential residents. These contaminants also pose risk to small mammals and invertebrates. Site 7, however, is in an industrial, controlled-access area and does not present ideal wildlife habitat.

Site 8.

- Based on the Florida Department of Environmental Protection cancer threshold criterion, contaminants in Site 8 groundwater would pose a human health threat if the surficial aquifer groundwater were used for residential purposes.

- Slight ecological risks at Site 8 are estimated to be posed by contaminants detected in drainage ditch sediments, which provide poor wildlife and aquatic habitat.

Location-, chemical-, and action-, specific ARARs were examined to assess the need to develop RAOs to comply with ARARs. One RAO has been developed for Site 7 to address surface soil; two RAOs have been developed for Site 8 to address groundwater and sediments. These RAOs are summarized below.

RAO 1. Prevent exposure to contaminants that pose an unacceptable human health risk and are present at concentrations exceeding the Florida soil cleanup goal for industrial sites.

RAO 2. Prevent exposure to groundwater at Site 8 that contains 1,1-dichloroethene at concentrations greater than the maximum contaminant level and Florida Groundwater Guidance concentration and causes unacceptable risk to human health and environment.

RAO 3. Prevent exposure to sediment within the ditch at Site 8 that contains Aroclor-1260 at concentrations exceeding threshold effect level and posing unacceptable ecological risk.

The following remedial alternatives were developed:

Site	Media	Alternatives	
Site 7	Surface Soil	Alternative 1 (7SS1)	No action
		Alternative 2. (7SS2)	Excavation and off-site disposal
Site 8	Groundwater	Alternative 1. (8GW1)	No action
		Alternative 2. (8GW2)	Natural attenuation
	Sediment	Alternative 1. (8SD1)	No action
		Alternative 2. (8SD2)	Dredging and off-site disposable

Evaluation of the alternatives was presented for seven of the nine criteria presented in the National Oil and Hazardous Substances Pollution Contingency Plan. The eighth and ninth criteria, State and public acceptance, will be addressed for OU 3 once the review comments are received from the State and once the public comment period for the proposed plan for OU3 has ended.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ARARs	applicable or relevant and appropriate requirements
BCT	Base Realignment and Closure Cleanup Team
bls	below land surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCE	dichloroethene
DOT	Department of Transportation
ECPC	ecological contaminant of potential concern
ELCR	excess lifetime cancer risk
EPC	exposure point concentration
FDEP	Florida Department of Environmental Protection
FGGC	Florida Groundwater Guidance concentration
FS	Feasibility Study
FSCG	Florida Soil Cleanup Goals
GIR	General Information Report
HI	hazard index
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
$\mu g/\ell$	micrograms per liter
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
OU	Operable Unit
PAH	polynuclear aromatic hydrocarbon
PPL	priority pollutant list
RA	Risk Assessment
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
redox	oxidation-reduction
RGO	remedial goal option
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command

GLOSSARY (Continued)

SVOC	semivolatile organic compound
TCLP	toxicity characteristic leaching procedure
TEL	threshold effect level
TRPH	total recoverable petroleum hydrocarbons
TSDF	treatment, storage, and disposal facility
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VC	vinyl chloride
VOC	volatile organic compound
yd^3	cubic yard

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to complete a Feasibility Study (FS) for Operable Unit (OU) 3 at Naval Air Station (NAS) Cecil Field, Jacksonville, Florida. NAS Cecil Field is located in western Duval County, Florida, approximately 14 miles west of Jacksonville, Florida. The FS is being completed under contract number N62467-89-D-0317/90. This report presents the results of the FS for OU 3, Sites 7 and 8, which include the development, screening, and evaluation of potential remedial alternatives that address contaminated media at the OU. Figure 1-1 shows the location of Sites 7 and 8 at NAS Cecil Field.

This report was prepared in accordance with the following regulations and guidance documents: the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) (references made to CERCLA in this report should be interpreted as "CERCLA, as amended by SARA"); the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (U.S. Environmental Protection Agency [USEPA], 1990); and Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (RI/FS Guidance) (USEPA, 1988).

Two reports provide additional information on OU 3, which will not be repeated in this FS: the *General Information Report* (GIR) (ABB-ES, 1996a) and the *Remedial Investigation for Operable Unit 3* (ABB-ES, 1997).

The GIR provides information common to all OUs at NAS Cecil Field and specific to OU 3, such as

- facility information and history,
- summary of previous investigations,
- description of physical characteristics of the facility (climatology, hydrology, soil, geology, hydrogeology, demography, and land use),
- site history for OU 3,
- risk assessment (RA) approach, and
- FS methodology.

The remedial investigation (RI) for OU 3 provides the following information:

- procedures for analytical data management and evaluation;
- physical site characteristics such as geology and hydrogeology;
- an assessment of the extent, magnitude, and impact of contamination at the sites; and

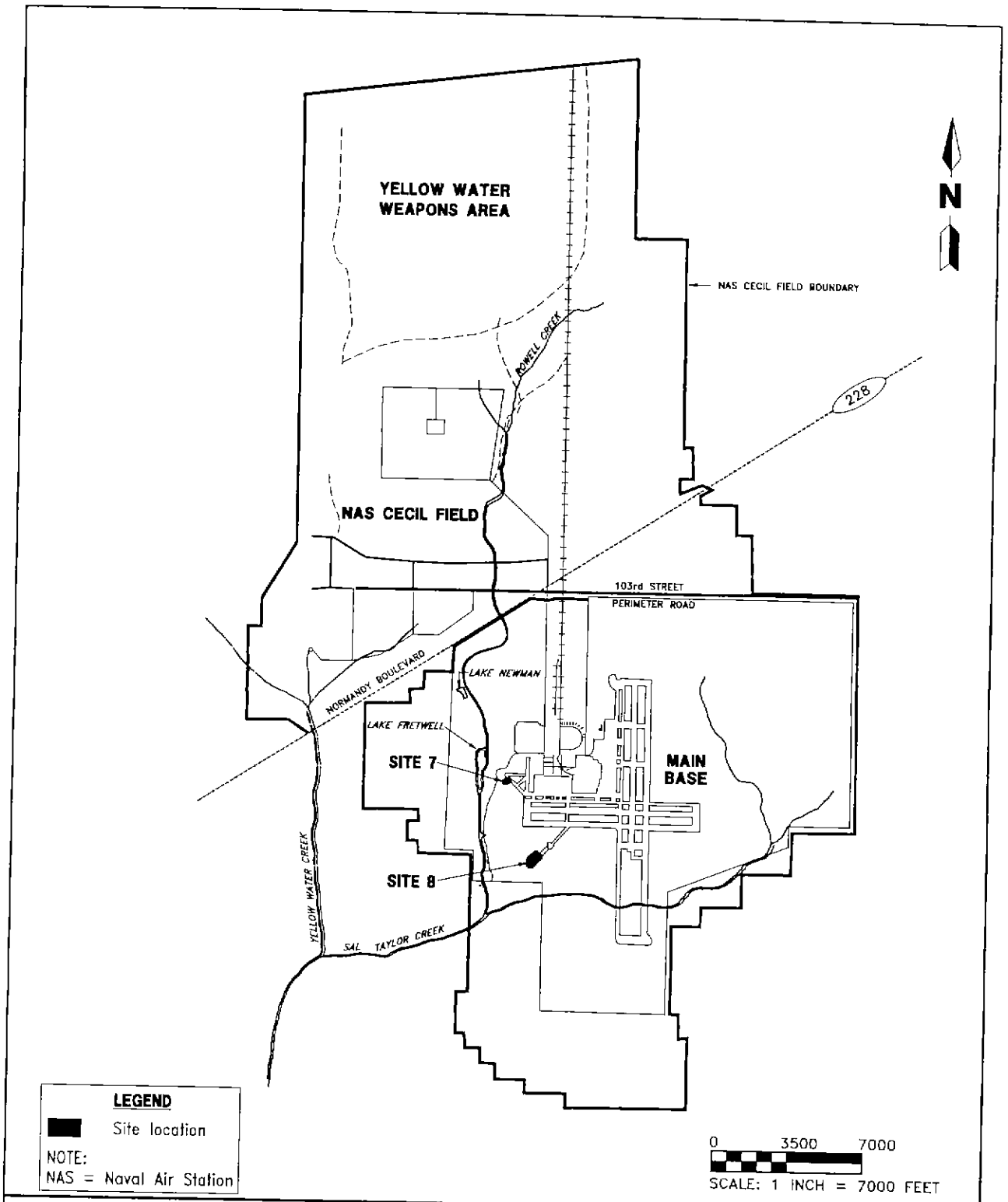

FIGURE 1-1
LOCATION MAP
SITES 7 AND 8

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- a qualitative and quantitative assessment of risks to human health and the environment.

This FS report was prepared according to the process described in Chapter 26.0 of the GIR. The RI, which includes the RA, for OU 3 was prepared based on the site conditions through January 1997. The site conditions are detailed in the RI and are briefly summarized in this report.

1.1 **PURPOSE**. The purpose of this FS is to identify and evaluate remedial alternatives for OU 3. The following components are considered in identifying appropriate remedial action:

- Remedial Action Objectives (RAOs) - Chapter 3.0. RAOs are developed to specify the contaminants, media of interest, exposure pathways, and remedial action goals for a site.

- Applicable Technologies - Chapter 4.0. Technologies applicable for addressing contaminated media at each site are identified and screened. Technologies that cannot be implemented are eliminated.

- Remedial Alternatives - Chapter 4.0. Technologies that pass the screening phase are assembled into remedial alternatives.

- Detailed Analysis - Chapter 5.0. Selected remedial alternatives are described and evaluated using nine criteria.

- Summary of the FS (in lieu of a Comparative Analysis) - Chapter 6.0. Remedial alternatives identified for Sites 7 and 8 are summarized.

2.0 DESCRIPTION OF CURRENT CONCEPTUAL UNDERSTANDING OF OU 3

ABB-ES has been contracted by SOUTHNAVFACENGCOM to complete an RI, including an RA, and FS for OU 3. The RI (ABB-ES, 1997) collected and compiled historical information, field measurements, sampling and analyses for various media, and data validation and evaluation.

Information presented in the Data Document (ABB-ES, 1996b) included topographical, chemical, geological, hydrological, ecological, and cultural features of the sites. Analyses and evaluations included the direction, rate of groundwater flow, and other characteristics of various media at each site; fate and transport of contaminants in each medium; and assessment of associated risks to human health and the environment.

This chapter presents a brief description of the conceptual understanding of each site as a means of developing appropriate, site-specific RAOs and remedial alternatives. Sufficient details will be presented to support the engineering analyses and calculations needed for detailed evaluation of alternatives.

OU 3 is made up of two sites: Site 7, Old Firefighting Training Area, and Site 8, Boresite Range, Hazardous Waste Storage Area, and Firefighting Training Area.

2.1 SITE 7, OLD FIREFIGHTING TRAINING AREA. Site 7, Old Firefighting Training Area, situated near the northwest end of the old 310 flightline, is located approximately 800 feet east of Lake Fretwell (see Figure 2-1) and 1,200 feet northwest of the east-west flightline. From the 1950s to 1965 aircraft frames were placed on the old asphalt flightline, doused with flammable waste liquids, and ignited. Site 7 consisted of a burn area on the old asphalt flightline and an unlined pit adjacent to the flightline. These are presented on Figure 2-1 as former Firefighting Training Areas. Firefighting personnel then practiced fire containment and extinguishing techniques on the burning frames.

From the 1950s until 1975, waste paints and paint thinners, spent chlorinated and nonchlorinated solvents, and petroleum, oil, and lubricant wastes were burned during firefighter training exercises. Extinguishing material and unburned wastes were left onsite, where they would evaporate, infiltrate through the cracks in the asphalt and into the soil, or migrate from the site via surface runoff.

Currently, Site 7 is used as an ordnance storage area. Storage structures are located at the end of the old flightline. Explosive ordnance is stored in Building 865, and unarmed ordnance is stored in portable storage units. Building 865 was erected sometime after firefighting training ceased in 1975 and before 1980, as evidenced by aerial photographs.

Based on topography and visual observations, it was interpreted that surface runoff from the paved training area drains toward the end of the old 310 flightline, while residual fluids in the pit would have percolated downward into the soil. Site 7 groundwater in the unconfined aquifer is interpreted to flow in a northwest direction toward a drainage canal and Lake Fretwell at a rate of 15 to 28 feet per year with a hydraulic conductivity of 2 to 4 feet per day.

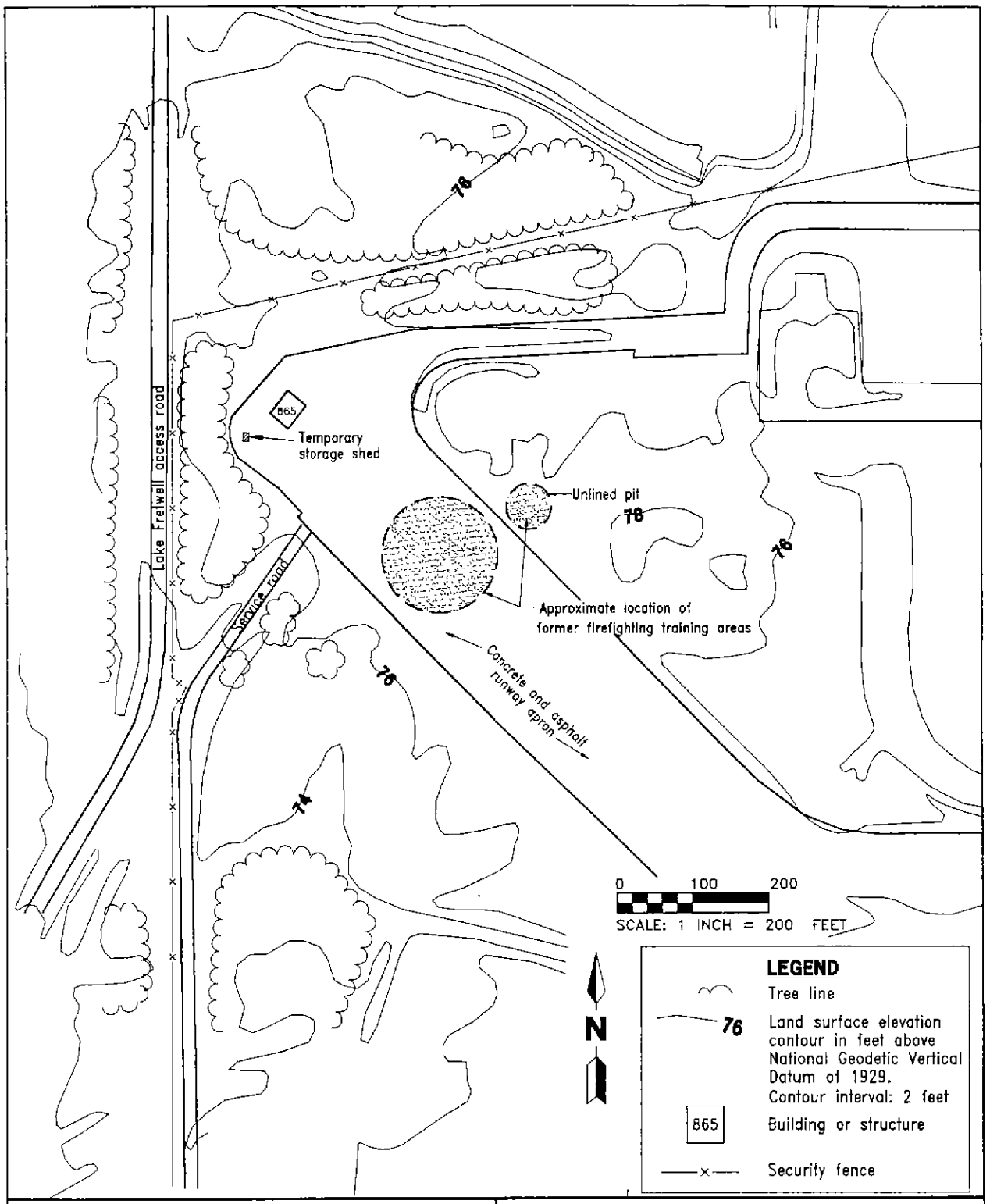

FIGURE 2-1
SITE 7, GENERAL FEATURES

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2.2 SITE 8, BORESITE RANGE, HAZARDOUS WASTE STORAGE AREA, AND FIREFIGHTING TRAINING AREA. Site 8, Boresite Range, Hazardous Waste Storage Area, and Firefighting Training Area, is located approximately 1,600 feet south to the east-west flightline (Figure 2-2). Historically, Site 8 was used as a boresite testing area for aircraft gunnery. Aircraft would taxi to the concrete pad and "sight in" aircraft guns by firing at targets in front of a backstop overhang located 600 feet southwest of the concrete pad. Upon closure of Site 7, three unlined pits were excavated adjacent to the concrete terminus of the boresite taxiway. Two pits were located along the west side of the concrete pad and one along the south side. Again, aircraft frames were set into the pits, doused with flammable waste liquids, ignited, and extinguished by firefighting personnel. Training activities utilizing the pits took place from 1975 until 1984.

From the late 1970s until 1980, the site was also used for storage of unlabeled drums containing hazardous waste. Reportedly, some of the drums stored in the open field between the concrete pad and the backstop overhang were shot through by aircraft guns, spilling liquid waste onto the ground.

Currently, ordnance is loaded onto aircraft at Site 8. Loading activities take place on the taxiway, topographically upgradient of Site 8 sample locations. Presently, no firefighting training occurs at Site 8.

Based on topography and visual observations, it was interpreted that surface runoff from the training area drains southward, downhill toward Perimeter Road. Residual fluids in the pits would have percolated downward into the soil. Site 8 groundwater in the unconfined aquifer is interpreted to flow southward toward Perimeter Road and Sal Taylor Creek at a rate of 19 to 47 feet per year with a hydraulic conductivity of less than 1 to approximately 2 feet per day.

2.3 SUMMARY OF RI AND RA. Currently aviation-related activities are conducted at both sites. Based on the NAS Cecil Field Reuse Plan, the future use of the land at both sites has been designated as industrial (aviation-related).

Environmental samples for laboratory analysis were collected from both sites. Samples were collected from surface soil, subsurface soil, groundwater, and sediment and surface water. Chemical analysis results indicate surface soil, subsurface soil, and groundwater contamination (detection of organics and inorganics above background screening concentrations) at Site 7 and surface soil, groundwater, and sediment and surface water contamination at Site 8.

Site 7 Nature and Extent of Contamination. Surface soil contamination at Site 7 consists of polynuclear aromatic hydrocarbons (PAHs), total recoverable petroleum hydrocarbons (TRPH), and inorganics. Contamination was detected in the vicinity of the firefighting training areas and at the end of the old flightline, an area that could receive surface runoff from the training areas. Subsurface soil contamination consists of TRPH, which was detected in the vicinity of the training areas. Groundwater contamination consists of petroleum-related compounds, which were detected in the vicinity of the training areas, and inorganics, which were detected over much of the site.

Site 7 Risks. Ecological and human health risks were identified for contaminants detected in surface soil and groundwater at Site 7. Most of the ecological risk

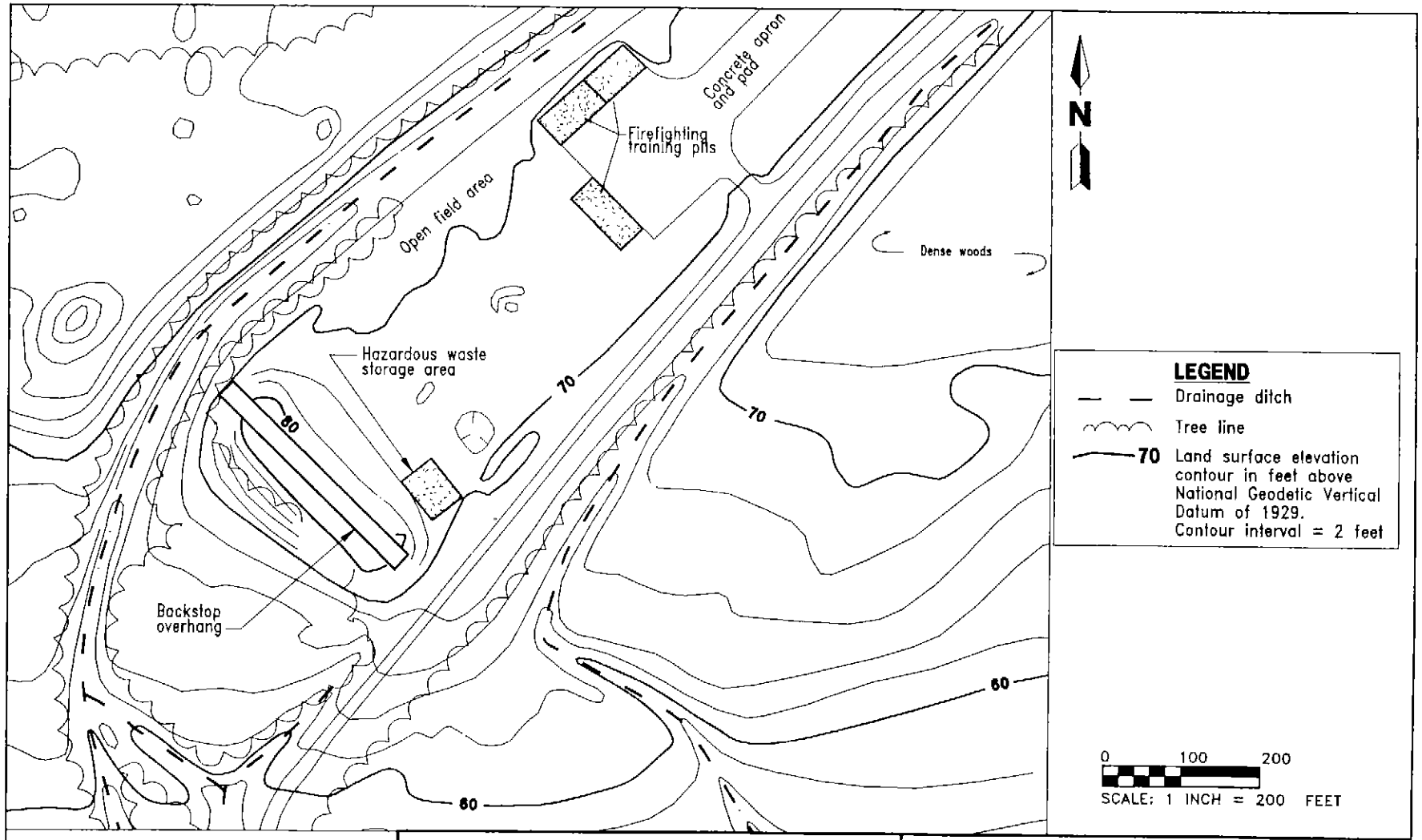

FIGURE 2-2
SITE 8, GENERAL FEATURES

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was derived from a single concentration of lead. Supporting data indicate this single concentration is an anomalous measurement. Risk to wildlife, such as small mammals, is low without the anomalous lead measurement, and it is unlikely that terrestrial plants and invertebrates are impacted by Site 7 contaminants.

Human health risks were estimated for contaminants in Site 7 surface soil and groundwater. Seven PAHs and arsenic in Site 7 surface soil account for all of the incremental cancer risk above the national baseline of 1 in 2 for men and 1 in 3 from women. Benzo(a)pyrene concentrations contribute to most of the risk (Figure 2-3).

Total incremental cancer risk due to exposure to surface soil contaminants by a trespasser (4×10^{-6}), possible future occupational worker (7×10^{-6}), and aggregate resident (adult and child) (6×10^{-5}) are within the USEPA acceptable risk range of 1 in 1,000,000 (1×10^{-6}) to 1 in 10,000 (1×10^{-4}). The noncancer risk to a child resident has a hazard index (HI) of 2; the USEPA HI threshold is 1. Antimony, arsenic, and TRPH are major contributors to the HI value.

If the surficial aquifer groundwater were used as a potable water supply, ingestion of that groundwater would pose a noncancer HI of 2 for a child. No single chemical caused the hazard quotient to be greater than 1. Major contributors to the HI value are iron, aluminum, antimony, and a single detection of benzene. Although low flow sampling techniques were used, samples were turbid (suspended solids), with iron and aluminum detected within the range reported for NAS Cecil Field background conditions. If aluminum and iron are considered background, then the HI drops to 1, the HI threshold. Benzene was detected in one groundwater sample collected within the upper 15 feet of the surficial aquifer.

Site 8 Nature and Extent of Contamination. Surface soil contamination at Site 8 consists of beryllium, TRPH, and PAHs. Surface water contamination consists of low concentrations of chlorinated solvents, pesticides, and inorganics; sediment contamination consists of TRPH and polychlorinated biphenyl, Aroclor-1260.

Chlorinated solvents, particularly 1,1-dichloroethene (DCE), and petroleum-related contaminants were detected in the shallow groundwater of Site 8. The chlorinated solvents are interpreted to discharge to a drainage ditch in the southeastern part of the site. Other contaminants of concern detected in groundwater include naphthalene, bis(2-ethylhexyl)phthalate, aluminum, and iron.

Site 8 Risks. Ecological and human health risks were estimated for contaminants detected in groundwater, surface water, and sediment at Site 8. Ecological risk posed by Aroclor-1260 in sediment is slight with a maximum concentration less than the Federal sediment quality criterion. Aroclor-1260 concentrations were greater than Florida Department of Environmental Protection (FDEP) threshold effects level (TEL), but less than the probable effects level of 0.189 milligrams per kilogram (mg/kg) (Figure 2-4). Ecological risk was estimated to be posed by TRPH in sediment. TRPH is interpreted to pose only slight risk, if at all. The low ecological risks may not actually occur because the sediment samples were collected from ditches, which by their nature present poor aquatic habitat. It is uncertain whether the presence of the contaminants or the poor habitat quality is responsible for low species diversity at these sample locations.

Ecological risk posed by aluminum in groundwater discharging to surface water may be overestimated, because reference species used in the RA are northern-climate species and are not found at NAS Cecil Field.

Total incremental cancer risks within the USEPA acceptable range were identified for the trespasser exposed to 4,4'-dichlorodiphenyltrichloroethane in surface water onsite (2×10^{-6}) and to the possible future aggregate (adult and child) resident exposed to beryllium in surface soil (6×10^{-6}) and 1,1-DCE in groundwater used as a potable water supply (6×10^{-5}). Minor contributors to the groundwater risk included naphthalene and bis(2-ethylhexyl)phthalate.

Ecological and human health risks at OU 3 are summarized in Table 2-1.

Based on these risks, remedial goal options (RGOs) were developed for use in the FS and for risk management decisions.

Conclusions regarding the physical characteristics of the OU 3 study area and contaminants detected in the surface soil, groundwater, sediment, and surface water include the following:

- Sufficient information has been collected and compiled to identify the nature and extent of contamination, estimate human and ecological risks, and develop remedial alternatives.

- Contaminants in Site 7 surface soil pose a human health threat if they are incidently ingested by occupational workers, trespassers, or future potential residents. These contaminants also pose risk to small mammals and invertebrates. Site 7, however, is in an industrial, controlled-access area and does not present ideal wildlife habitat.

- Contaminants in Site 7 surficial aquifer groundwater may pose a human health threat if the groundwater were used for residential purposes. However, two of the contaminants in groundwater, iron and aluminum, are within the range of background concentrations, which drops the HI for residential use of groundwater from 2 (initial risk estimate with iron and aluminum contributing) to 1, the HI threshold value.

- Slight ecological risks at Site 8 are reported to be posed by contaminants detected in drainage ditches, which provide poor wildlife and aquatic habitat.

- Contaminants in surface water in the drainage ditches within Site 8 pose an estimated human health risk to trespassers, but access to the industrial site is controlled.

- Based on the FDEP cancer threshold criterion, contaminants in Site 8 groundwater pose a human health threat if the surficial aquifer groundwater were used for residential purposes. Beryllium in surface soil poses a human health threat to future residents.

Based on the evaluation of information gathered during the OU 3 RI, the following data limitations were identified.

Table 2-1
Summary of Human Health and Ecological Risk Assessments*

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

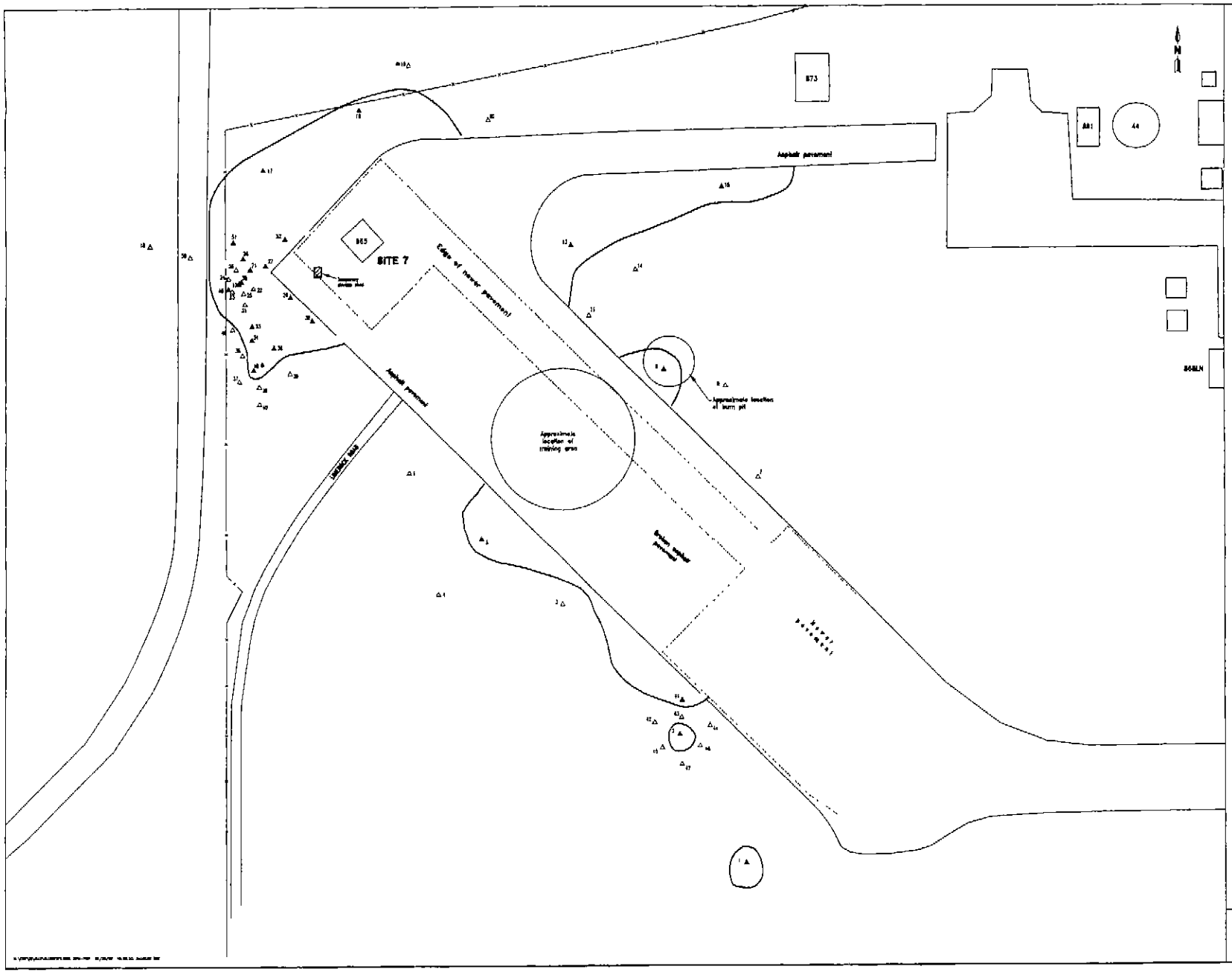
Location	Human Health Incremental Cancer Risk	Human Health Noncancer Risk	Ecological Risk	Remedial Action Required?	Supporting Information
Site 7					
Surface Soil	resident - 6×10^{-5} trespasser - 4×10^{-6} worker, occupational - 7×10^{-6} [7 PAHs, and As]	HI = 2	Unlikely [Pb]	Yes	See Table A-1 and Figure 2-3.
Subsurface Soil	worker, occupational - 7×10^{-8}	None	NA	No	NA
Groundwater	worker, occupational - 8×10^{-8}	HI = 2 [benzene, Sb, Fe, Al]	NA	No	Analyte / Frequency[1] / Concentration benzene / 1/13 / 13 $\mu g/\ell$ Sb / 1/13 / 2.6 $\mu g/\ell$ Al / 12/13 / 38.1 to 33,300 $\mu g/\ell$ Fe / 13/13 / 180 to 7,9600 $\mu g/\ell$
Site 8					
Surface Soil	resident - 6×10^{-6} [Be]	None	None	No	Be / 3/22 / [2]0.23 to 0.27 mg/kg
Subsurface Soil	None	None	NA	No	NA
Groundwater	trespasser - 6×10^{-5} [1,1-DCE]	None	NA	Yes	See Table A-2.
Surface Water	trespasser - 2×10^{-6} [4,4'-DDT]	None	Unlikely [Al]	No	Surfacewater body is ephemeral. Access is restricted.
Sediment	None	None	low probability [Aroclor-1260, TRPH]	Yes	Concentrations are below the method detection limits and slightly above the TEL. See Tables A-3 and A-4 and Figure 2-4.

[1] Frequency is number of detections/number of samples.
[2] Cleanup goal for beryllium is 0.2 mg/kg.

Notes: * Combines both current and future land-use scenarios.

Shaded areas indicate media of concern.
Brackets [ ] indicate the contaminants of potential concern.

HI = hazard index.
Pb = lead.
PAH = polynuclear aromatic hydrocarbons.
As = arsenic.
NA = not applicable.
Sb = antimony.
Fe = iron.
Al = aluminum.
$\mu g/\ell$ = micrograms per kilogram.
Be = beryllium
mg/kg = milligrams per kilogram.
DCE = dichloroethene.
DDT = dichlorodiphenyltrichloroethane.
TRPH = total recoverable petroleum hydrocarbons.
TEL = threshold effect level.



LEGEND

J	Estimated result
NA	Not analyzed
ND	Not detected
TRPH	Total recoverable petroleum hydrocarbons
HHCPC	Human health chemicals of potential concern
FDEP	Florida Department of Environmental Protection
BAG	Not showing good
PAC	PAC exceeding noncarcinogenic predicate
	Confirmatory surface soil sampling location (0 to 1 foot below land surface)
	Geoprobe location or test sampling location in surface soil
	Area where HHCPC had designation (exceedance) not greater than not display good for residential land-use scenario
	Fence
	Building or structure
1	Key for sample location
2	Sample ID
A	Benzo (a) anthracene
A	Benzo (a) pyrene
B	Benzo (b) fluoranthene
B	Benzo (k) fluoranthene
7	Phenol (4,4) methanamine
8	Indeno (1,2,3-cd) pyrene
9	TRPH
10	Antimony
11	Arsenic
12	Iron
13	Lead
14	Thallium

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	CF75501		0.14J										
2	CF75502		0.22J					484		1.2J			
5	CF75505		0.13J					538					
8	CF75508		0.11J										
10	CF75510		0.78J			0.12J		438					
10	CF75510D	1.2	1.6J			0.25J	0.96J	798					
12	CF75512	7.8J	8.2J	13J		1.2	4.1J	1,400	57.5	3.5		170000	5.3J
13	CF75513		0.68J	1.4J				430					
15	CF75515		0.14J										
17	CF75517		0.16J										
18	CF75518		0.13J										
27	CF75527	1.3	1.7	2.3		0.27J	1.1						
28	CF75528	7.8	8.5	18		0.84J	2.8			0.98J			
29	CF75529		0.78	1.2		0.11J				2.8			
30	CF75530	1.4	1.8	2.7		0.25J	1.2						
32	CF75532		0.86	1.5		0.12J							
33	CF75533	32	39	45	18	3.5J	14			3.2			
34	CF75534		0.73	1.2		0.11J							
36	CF75536		0.13J							0.35J			
41	CF75541		0.17J										
45	CF75545	1.2	2.8	4.3J		0.58	1.8						
51	CF75551		1.5	1.7		0.18J							
53	CF75553	4.3	5.1	8.3		1J	3.5						
[redacted]													

* Based on Table IV FDEP Petroleum Contamination Site Cleanup Criteria 62-770

NOTES:

All values are in milligrams per kilogram.

SCALE: 1 inch = 50 FEET

FIGURE 2-9

SITE 7, CONCENTRATIONS OF VOCPCs IN SURFACE SOILS

FEASIBILITY STUDY
OPERABLE UNIT 2

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

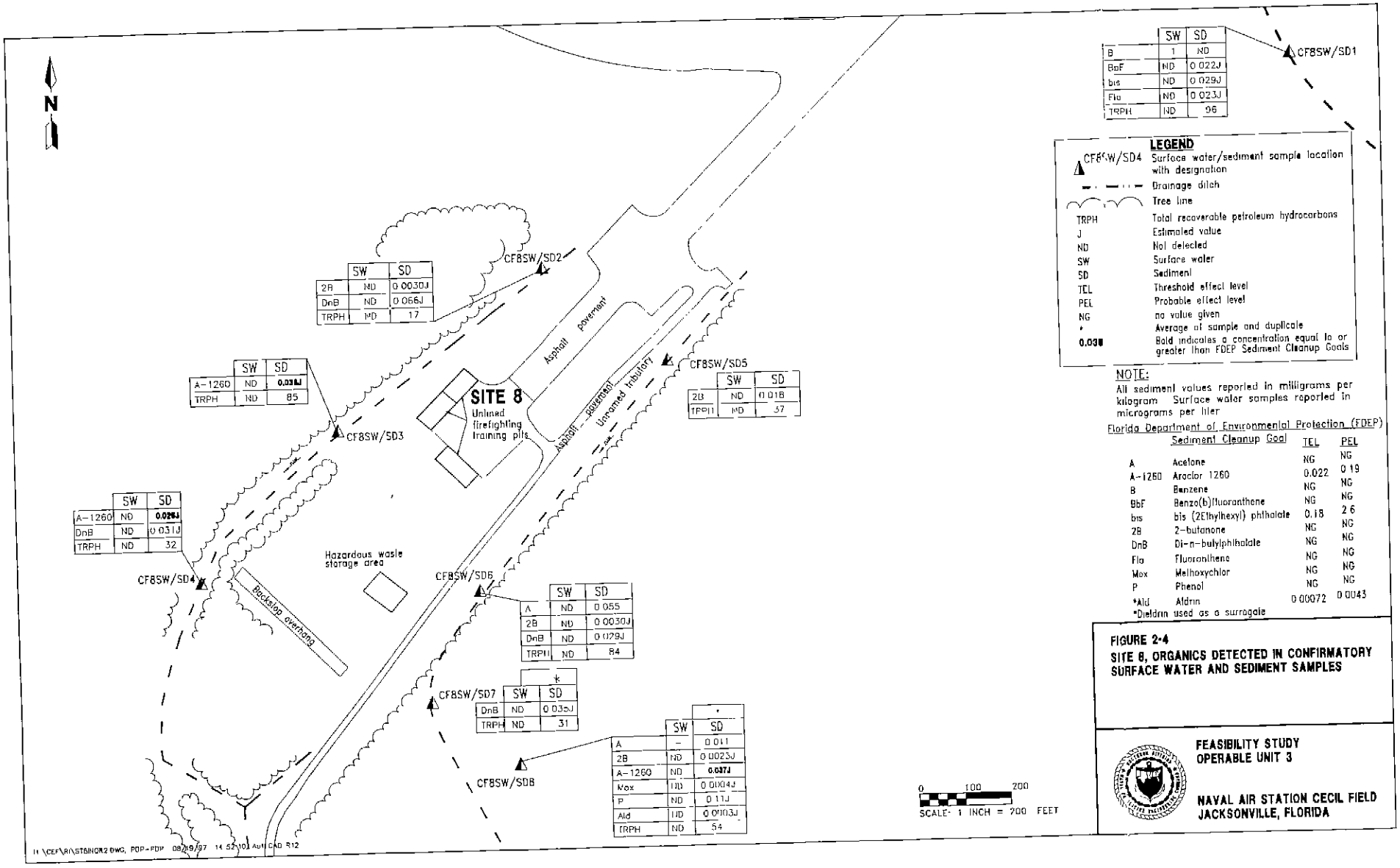


FIGURE 2-4
SITE 8, ORGANICS DETECTED IN CONFIRMATORY SURFACE WATER AND SEDIMENT SAMPLES

- There is no site-specific reference (baseline or background) sample for the biological toxicity data. Data were compared to a laboratory control. Statistical significance of the field data relates to the laboratory control.

- A surface water and sediment background sample location could not be established for this investigation, because the Site 8 drainage system is isolated from upgradient drainage systems. As a result, surface water and sediment data were compared to site-related upgradient data.

- Two sets of data were collected approximately 10 days apart from sample location CF8SD4. The two data sets are not similar. In particular are the dissimilar concentrations of TRPH and the detection of Aroclor-1260 in one sample, but not in the other. Exposure to sediment containing TRPH and Aroclor-1260 posed ecological risk at Site 8. Because the analytical results were not consistent, it is unclear if these contaminants are present and pose the estimated risk.

Despite the data limitations above, the type and extent of contamination identified in the OU resulted in relatively low human health and ecological risks. It is recommended that an FS be conducted to address these risks for the following media:

- Site 7 – surface soil
- Site 8 – groundwater and sediment

CHAPTER 3.0

3.0 IDENTIFICATION OF RAOs

This chapter presents the RAOs for OU 3. The RAOs will provide the basis for selecting appropriate remedial technologies and developing remedial alternatives from those technologies for OU 3. Section 3.1 presents the chemical-, location-, and action-specific applicable or relevant and appropriate requirements (ARARs) that were considered prior to defining alternatives for OU 3. Section 3.2 presents an overview of various remedial considerations, such as regulatory drivers and risk issues, that are evaluated prior to defining RAOs. Section 3.3 presents the RAOs for the OU.

3.1 ARARs. ARARs are Federal and State human health and environmental requirements used to (1) evaluate the appropriate extent of site cleanup, (2) scope and formulate remedial alternatives, and (3) control the implementation and operation of a selected remedial action. Potential chemical-, location-, and action-specific ARARs are defined in the GIR and described in detail in the *Handbook of ARARs for Navy Sites within the State of Florida* (ABB-ES, 1995). 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 presented on Table 3-1 and are discussed in the following subsections.

3.1.1 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. Chemical-specific ARARs for a site may also be used to indicate acceptable levels of discharge for determining treatment and disposal requirements and to assess the effectiveness of future remedial alternatives.

Currently, there are no promulgated Federal or State chemical-specific ARARs that provide limits for the concentration of chemicals in soil or sediment. However, the State of Florida has provided guidance values for soil cleanups (FDEP, 1995). The RI contained a comparison of chemicals detected in soil at OU 3 compared to these Florida Guidance values. Groundwater and surface water ARARs are available at the State and Federal levels.

3.1.2 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 solely based on the site's particular characteristics or location.

3.1.3 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, applicable performance or design standards must be considered during the detailed analysis of remedial alternatives (see Chapter 4.0).

Table 3-1
Synopsis of Federal and State Regulatory Requirements for OU 3

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Wastes (40 Code of Federal Regulations [CFR] Part 261)	Defines the listed and characteristic hazardous wastes subject to RCRA. Appendix II contains the Toxicity Characteristic Leaching Procedure.	These regulations would apply when determining whether or not waste onsite is hazardous, either by being listed or exhibiting a hazardous characteristic, as described in the regulations.	Chemical-specific Action-specific
Endangered Species Act Regulations (50 CFR Parts 81, 225, 402)	The Act requires Federal agencies to take action to avoid jeopardizing the continued existence of federally listed endangered or threatened species.	If a site investigation or remediation could potentially affect an endangered species, these regulations would apply.	Location-specific
Clean Water Act Regulations, Water Quality Standards (40 CFR Part 131)	Establishes ecological and health-based Federal Ambient Water Quality Criteria (AWQC) that are non-enforceable guidelines used by states to set their state-specific water standards for surface water.	These AWQCs may be used as a basis for determining cleanup levels in the absence of State water quality standards.	Chemical-specific
Historic Sites Act Regulations (36 CFR Part 62)	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	Prior to remedial activities onsite, including remedial investigations, the existence of Natural Landmarks must be identified.	Location-specific
Safe Drinking Water Act Regulations, Maximum Contaminant Levels (MCLs) (40 CFR Part 141)	Establishes enforceable standards for potable water for specific contaminants that have been determined to adversely affect human health.	MCLs can be used as protective levels for groundwaters or surface waters that are current or potential drinking water sources.	Chemical-specific
Florida Hazardous Waste Rules (Florida Administrative Code [FAC], 62-730)	Adopts by reference sections of the Federal hazardous waste regulations and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes.	These regulations would apply if waste onsite is deemed hazardous and needs to be stored, transported, or disposed of.	Action-specific
Florida Surface Water Quality Standards (FAC, 62-302)	Rule distinguishes surface water into five classes based on designated uses and establishes ambient water quality standards (called Florida Water Quality Standards) for listed pollutants.	Because these standards are specifically tailored to Florida waters, they should be used to establish cleanup levels rather than the Federal AWQC.	Chemical-specific
Florida Groundwater Classes, Standards and Exemptions (FAC, 62-520)	Rule designates the groundwaters of the State into five classes and establishes minimum "free from" criteria. Rule also specifies that Classes I & II must meet the primary and secondary drinking water standards listed in Chapter 62-550.	These regulations may be used to determine cleanup levels for groundwater that is a potential source of drinking water.	Chemical-specific

See notes at end of table.

Table 3-1 (Continued)
Synopsis of Federal and State Regulatory Requirements for OU 3

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Florida Drinking Water Standards (FAC, 62-550)	Rule adopts Federal primary and secondary drinking water standards.	These regulations apply to remedial activities that involve discharges to potential sources of drinking water.	Chemical-specific
Petroleum-Contaminated Site Cleanup Criteria (FAC, 62-770)	Establishes a cleanup process to be followed at all petroleum-contaminated sites. Cleanup levels for the G-I and G-II groundwater are provided in the gasoline and kerosene/mixed product analytical groups.	Because groundwater at the site is Class II, these regulations would apply.	Chemical-specific Action-specific
Florida Groundwater Guidance, Bureau of Groundwater Protection, June 1994.	The document provides maximum concentration levels of contaminants for groundwater in the State of Florida. Groundwater with concentrations less than the listed values are considered "free from" contamination.	The values in this guidance should be considered when determining cleanup levels for groundwater. Although some values are not promulgated, Florida Department of Environmental Protection considers them applicable or relevant and appropriate requirements for setting cleanup criteria.	To be considered

Note: OU = Operable Unit.

Certain action-specific ARARs include permit requirements. Under CERCLA Section 121(e), permits are not required for remedial actions conducted entirely onsite 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.

Table 3-1 identifies general action-specific ARARs for OU 3. During the detailed analysis of alternatives, action-specific ARARs for each alternative will be identified and analyzed to determine compliance.

3.1.4 To Be Considered Criteria Other criteria not promulgated by statute or regulations will be identified as "to be considered" and are summarized in Table 3-1.

3.2 REMEDIAL CONSIDERATIONS. Prior to establishing RAOs for OU 3, the identification of NAS Cecil Field under the Base Realignment and Closure (BRAC) Act was considered. NAS Cecil Field is scheduled for closure in September 1999. As a standard procedure at closing military bases, a Base Reuse Plan is developed. A Final Base Reuse Plan has been developed for NAS Cecil Field, but this plan has not yet been finalized (Anderson, 1996). Currently, the runways and areas surrounding them (including OU 3) have been designated for aviation use in the Base Reuse Plan.

There are two possibilities for future use of the OU 3 property: industrial use and unrestricted future land use. Under the industrial use scenario, the area in the vicinity of the OU would continue to be used for aviation. This future land use is reasonable for OU 3 according to the Final Base Reuse Plan (Anderson, 1996). Under the unrestricted future land use scenario, the area in the vicinity of OU 3 would be used for human residence. Although the base is served with a potable water supply system, water distribution lines are only a few hundreds of feet from Site 7 or Site 8. Therefore, there is a possibility that if the land were used for residential purposes, there could be private wells screened in the surficial aquifer. The possibility of this future land use at OU 3 is unlikely as the OU is located on top of and adjacent to the runways.

The RA completed for OU 3 assumed an unrestricted future land use scenario (i.e., humans living on OU 3 and consuming unfiltered water from the surficial aquifer), but this scenario is unlikely for OU 3, and should be considered a conservative estimate of the risks posed by the site.

3.3 RAOs. This section presents the goals and objectives for remedial action at OU 3. RAOs are established for the OU based on consideration of the RI, RA, and ARARs. Information presented in this section will be used to identify appropriate remedial technologies for OU 3 (i.e., Chapter 4.0).

RAOs are defined in the CERCLA RI/FS guidance manual as media-specific goals that are established to protect human health and the environment (USEPA, 1988). The RAOs are typically based on chemicals of concern, exposure routes, and receptors present or available at the site. Additionally, RAOs are developed to ensure compliance with ARARs; these ARARs were identified in Section 3.1. RAOs are identified separately for Site 7 and Site 8.

3.3.1 RAOs, Site 7, Old Firefighting Training Area The RI for Site 7 evaluated the nature and extent of contamination resulting from past firefighting training activities at Site 7 and estimated probable risks to human health and the environment due to exposure to chemicals found in surface soil at the site.

For the current land use scenario, the cancer risk associated with surface soil ingestion, dermal contact, and fugitive dust inhalation is 4 in 1,000,000 (4×10^{-6}) for an aggregate (combined adult and adolescent) trespasser; 1×10^{-6} for the site maintenance worker; and 3×10^{-7} for the excavation worker. None of the excess lifetime cancer risk (ELCR) for these potential exposed populations exceeds USEPA's allowable cancer risk range (1 in 10,000 [10^{-4}] to 1 in 1,000,000 [10^{-6}]). However, the current and potential future site maintenance worker and trespasser, and the potential future resident and occupational worker risks exceed the FDEP target risk level of 10^{-6}.

Under potential current or future land uses with exposure to contaminants in surface soil, the HI for the child resident is 2. The HIs for the other current and future land-use receptors are lower than USEPA's threshold HI of 1. Antimony, TRPH, and arsenic contribute 65 percent of the total HI for the child resident.

Toxicity values are not available for lead; however, the maximum and exposure point concentration (EPC) values were in excess of a risk-based screening value.

Therefore, based on the RGOs, estimated risks, ARARs, and State criteria, and as a result of discussions with the NAS Cecil Field BRAC cleanup team (BCT) (which consists of representatives from the Navy, USEPA, and FDEP), the following RAO was established for Site 7:

RAO 1. Prevent exposure to contaminants that pose an unacceptable human health risk and are present at concentrations exceeding the Florida soil cleanup goal (FSCG) for industrial sites.

3.3.2 RAOs, Site 8, Boresite Range, Hazardous Waste Storage Area, and Firefighting Training Area The RI evaluated the nature and extent of contamination resulting from past activities at Site 8, and estimated risks to human health and the environment due to exposure to chemicals found in media at the site. This evaluation indicates that, while chemicals were detected in surface soil, subsurface soil, and surface water, the concentrations of these chemicals were not at levels posing unacceptable risk to human health or the environment. However, risks exceeding the risk management criteria of the State of Florida and the USEPA were estimated for groundwater and the sediments at Site 8. Therefore, no action is recommended for either surface soil, subsurface soil, or surface water based on the results of the human health and ecological assessment.

3.3.2.1 Groundwater Groundwater at Site 8 was also evaluated. Groundwater data from the RI are summarized in Table A-2. The ELCR associated with exposure to groundwater via ingestion (i.e., a future resident installing a well in the surficial aquifer and drinking unfiltered water) is 6×10^{-5}. This estimate is due to the presence of 1,1-DCE in groundwater. The EPC used in the risk estimate, 7.2 micrograms per liter ($\mu g/\ell$), is only slightly higher than the Federal maximum contaminant level (MCL) and Florida Groundwater Guidance concentration (FGGC) of 7 $\mu g/\ell$. The RI presented an RGO of 0.1 $\mu g/\ell$ at a 10^{-6} risk.

RAO 2. Prevent exposure to groundwater at Site 8 containing 1,1-DCE at concentrations greater than the MCL and FGGC and causing unacceptable risk to human health and the environment.

3.3.3.2 Sediment The sediment at Site 8 was also evaluated. The risk calculations for sediment exposure to human receptors indicated no unacceptable risks. Risks to wildlife and aquatic organisms from exposure to sediment were evaluated in the Site 8 ecological risk assessment.

Wildlife. Based on the results of food-web modeling, no lethal or sublethal risks to wildlife receptors from exposure to Site 8 sediment ecological contaminants of potential concern (ECPCs) are expected to occur.

Aquatic Organisms. Risks to aquatic organisms from exposure to Site 8 sediment may occur from exposure to TRPH and Aroclor-1260. Based on the results of benchmark comparisons, Aroclor-1260 detected in sediment at CF8SD3 and CF8SD4 may cause adverse effects to aquatic life.

Poor habitat quality at CF8BIO2 may be responsible for the low species diversity and high level of pollution-tolerant organisms observed during the macroinvertebrate analysis.

Reduced midge survival and growth was observed at sediment locations CF8SD3, CF8SD4, and CF8SD7 in sediment toxicity tests using the species *C. tentans*. The results of regression analyses that relate the observed effect with sediment concentrations of TRPH indicated that there is no correlation. It is likely that other factors caused the adverse effects to midges.

Reduced amphipod survival and growth was observed at sediment locations CF8SD3 (reduced survival only) and CF8SD4 in sediment toxicity tests using the species *H. azteca*. The results of regression analyses that relate the observed effect with sediment concentrations of TRPH indicated that there may be a correlation. It is also possible that other factors caused the adverse effects to amphipods.

Based on this evaluation, the BCT has concluded that active sediment remediation for Site 8 may be required.

Therefore, the following RAO was established for Site 8 sediment:

RAO 3. Prevent exposure to sediment containing Aroclor-1260 within the ditch at Site 8, with concentrations exceeding TEL and posing unacceptable ecological risk.

3.3.3 Summary of RAOs

RAO 1. Prevent exposure to contaminants that pose an unacceptable human health risk and are present at concentrations exceeding the FSCG for industrial sites.

RAO 2. Prevent exposure to groundwater at Site 8 that contains 1,1-DCE at concentrations greater than the MCL and FGGC and causes unacceptable risk to human health and environment.

RAO 3. Prevent exposure to sediment containing Aroclor-1260 within the ditch at Site 8, at concentrations exceeding TEL and posing unacceptable ecological risk.

CHAPTER 4.0

4.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

The approach and rationale leading to the development of remedial alternatives for OU 3, Site 7, and Site 8, are presented in this chapter. The development of remedial alternatives for CERCLA sites, and hence for OU 3, consists of identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives to accomplish the RAOs identified in Chapter 3.0. The following sections identify alternatives for Sites 7 and 8 that will achieve RAOs. A detailed evaluation of remedial alternatives is presented in Chapter 5.0.

4.1 REMEDIAL ALTERNATIVES FOR SITE 7. The objective for remedial action at Site 7 is to address surface soil contaminants at concentrations that may pose a potential risk to human health.

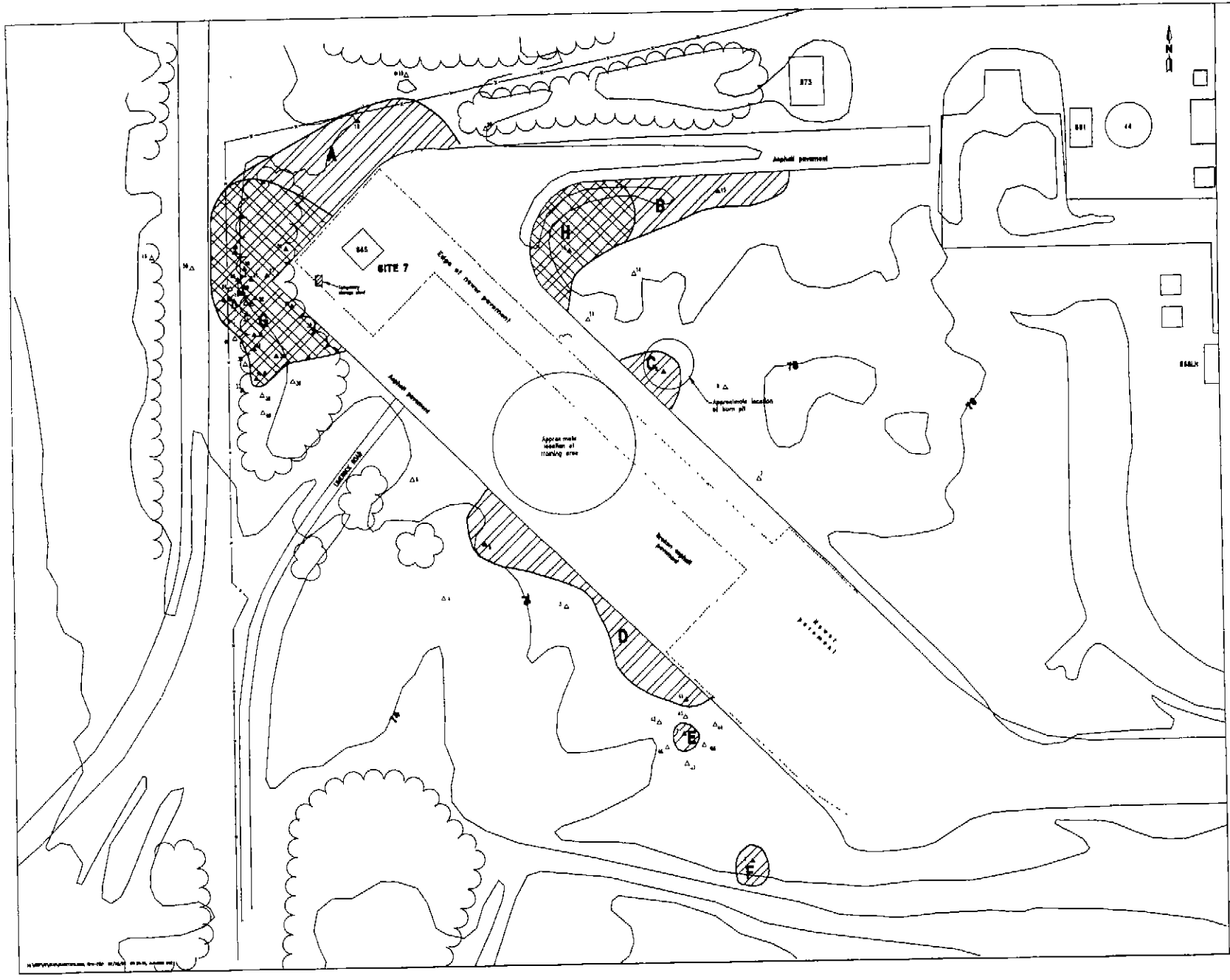
Based on the distribution of the contaminants including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)-anthracene, ideno(1,2,3-cd)pyrene, arsenic, antimony, cadmium, iron, lead, thallium, and TRPH, areal extent of soil to be addressed at this site is presented in Figure 4-1. The depth of contamination was assumed to be approximately 1 to 2 feet below land surface (bls), as the RA did not identify unacceptable risk based on exposure to subsurface soil at the site (the depth of excavation is 1 foot deeper than the depth of surface soil samples collected during the RI, 0 to 1 foot). The volume (in-place) of soil to be addressed is therefore equal to approximately 2,468 cubic yards (yd^3) (1-foot depth) to 4,936 yd^3 (2-foot depth) for residential land-use scenario and 910 yd^3 (1-foot depth) to 1,820 yd^3 (2-foot depth) for industrial land-use scenario.

Although the NCP requires that a range of remedial alternatives be considered when developing alternatives for a CERCLA site, the volume of soil to be addressed at Site 7 is minimal (910 yd^3 to 936 yd^3), thus raising a question whether or not the implementation of *in situ* or containment technologies is practical.

A "no action" alternative is also developed to provide a baseline for comparison of costs.

Implementation of *in situ* treatment technologies, such as soil vapor extraction, are most likely not practical at Site 7. First, contamination is within the surface zone (0 to 2 feet bls) and, therefore, the effectiveness of *in situ* technologies to treat contamination in the top 2 feet of soil is questionable. Also, the implementation of an *in situ* technology is cost prohibitive given the long-term monitoring costs that would be necessary (under the 5-year review requirement) if wastes were left onsite. Based on this, *in situ* technologies were eliminated from further consideration.

Containment would eliminate exposure to surface soil at the site, but would not reduce the toxicity, mobility, or volume of contamination onsite. SARA emphasizes the use of treatment technologies that reduce the toxicity, mobility, or volume of contaminants rather than technologies that solely prevent exposure. Also, the implementation of a containment technology is cost prohibitive given the long-term monitoring costs that would be necessary (under the 5-year review



	Designation	Surface Area ft²
Residential	A	33,443
	B	17,113
	C	2,447
	D	11,840
	E	679
	F	1,317
Industrial	G	14,859
	H	9,718

Legend

- J Estimated value
- NA not analyzed
- NR Not detected
- TRPH Total recoverable petroleum hydrocarbons
- PAH/PC Polycyclic aromatic hydrocarbons and potential carcinogens
- FDEP Florida Department of Environmental Protection
- SCS Soil conservation service
- NRC No corresponding representative available
- PP Propane fuel
- Surface soil sampling location (0 to 1 foot below local surface)
- Subsurface soil sampling location (6 to 7 feet below local surface)
- Sampling of sample and duplicate
- Area where sample and duplicate collected
- Area where sample and duplicate collected
- Fence
- Building or structure
- Area of surface soil to be remediated based on FDEP SCS (Residential) (total area is 0 ft²)
- Area of surface soil to be remediated based on FDEP SCS (Industrial) (total area is 0 ft²)
- Topographic line
- Tree line
- Key for sample number
  1 Sample ID
  2 Metals (s) sediment
  3 Metals (s) pesticides
  4 Metals (s) herbicides
  5 Metals (s) semivolatiles
  6 Metals (s) volatiles
  7 Metals (s,w) sediment
  8 Metals (1,2,4-m) pesticides
  9 TRPH
  10 Inorganics
  11 Arsenic
  12 Iron
  13 Lead
  14 Manganese

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	CF75501		0.14J										
2	CF75508		0.55J					430		1.3J			
5	CF75506		0.53J					530					
8	CF75508		0.11J										
10	CF75510		0.78J			0.12J		430					
16	CF75516D	1.3	1.8J			0.25J	0.94J	790					
17	CF75517	7.8J	6.3J	1.3J		1.3	4.1J	1,400	37.5	7.5		170000	5.3J
13	CF75513		0.66J	1.4J				430					
15	CF75515		0.14J										
17	CF75517		0.16J										
18	CF75518		0.14J										
27	CF75527	1.3	1.7	3.8		0.27J	1.1						
28	CF75528	7.2	6.5	19		0.84J	2.8			0.68J			
29	CF75529		0.78	1.2		0.11J				3.8			
30	CF75530	1.4	1.6	2.7		0.25J	1.2						
32	CF75532		0.88	1.5		0.12J							
33	CF75533	32	29	45	16	3.5J	14			2.3			
34	CF75534		0.72	1.2		0.11J							
36	CF75536		0.15J							0.55J			
41	CF75541		0.17J										
48	CF75549	1.2	3.8	4.3J		0.56	1.8						
51	CF75551		1.2	1.7		0.16J							
52	CF75552	4.5	6.1	9.3		1.3	3.5						
[redacted]													

* Based on Table IV FDEP Petroleum Contamination Site Cleanup Criteria 62-770

NOTES:

All values are in milligrams per kilogram.

SCALE: 1 inch = 30 FEET

FIGURE 4-1

SITE 7, AREAL EXTENT OF SURFACE SOIL CONTAMINATION

FEASIBILITY STUDY
OPERABLE UNIT 2

NAVAL AIR STATION MCCA FIELD
JACKSONVILLE, FLORIDA

requirement) if wastes were left onsite. Based on this, containment technologies were eliminated from further consideration.

Therefore, the technology screening phase for Site 7 was limited to identifying *ex situ* treatment technologies. These technologies are presented in Table 4-1; it should be noted that only technologies applicable to the contaminant of concern (i.e., benzo(a)pyrene) at the site are considered. Table 4-1 also presents the technology evaluation and screening process.

Based on the screening process presented in Table 4-1, two technologies passed the screening step: (1) excavation and off-site soil recycling, and (2) excavation and off-site disposal. Only one remedial alternative was developed for Site 7, excavation and off-site management, as the two technologies that passed the screening step are actually representatives of one management (alternative) option.

Under this alternative, soil within the identified area would be excavated and transported to an appropriate off-site land disposal facility. Prior to transportation, four composite samples of the excavated material (two per focus area) would be collected and analyzed as required by FDEP and Resource Conservation and Recovery Act (RCRA) disposal regulations. The samples would be submitted for analysis of full RCRA hazardous waste characteristics, including ignitability, corrosivity, reactivity, toxicity characteristic leachate procedure (TCLP) metals, pesticides, herbicides, and priority pollutant list (PPL) volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). Depending on these analytical results, the soil may be eligible for disposal in an RCRA Subtitle D (solid waste) landfill. Otherwise, the soil would require disposal in an RCRA Subtitle C (hazardous waste) land disposal facility. Other off-site soil disposal options exist, such as thermal desorption and soil recycling; however, these costs would most likely be between the off-site disposal as solid waste cost and the off-site disposal as hazardous waste cost.

4.2 REMEDIAL ALTERNATIVE FOR SITE 8.

4.2.1 Groundwater The objective for remedial action at Site 8 is to prevent exposure to groundwater at Site 8 containing 1,1-DCE at concentrations greater than ARARs.

The concentration levels of 1,1-DCE in groundwater (see Figure 4-2) at Site 8 already demonstrated (U.S. Geological Survey [USGS], 1996) as amenable to natural attenuation. Under this alternative, naturally occurring biological, physical, and chemical processes within the surficial aquifer at Site 8 would be relied on to reduce the concentrations of VOCs (in particular 1,1-DCE) in groundwater over time. This alternative would include groundwater monitoring to verify that aquifer conditions continue to be amenable to natural attenuation (i.e., biodegradation).

Typically, a "no action" alternative is developed in an FS to provide a baseline for comparison to other alternatives. Even though the "no action" alternative would not achieve the RAO established for Site 8, the "no action" is included to provide a baseline comparison of performance as measured by nine criteria. Based on this, the "no action" alternative was included and developed for Site 8.

Table 4-1
Remedial Technologies, Surface Soil, Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Technology	Description	Applicability to Site 7
Treatment or Disposal (*Ex situ*)		
Onsite Thermal Treatment	Contaminated surface soil is excavated, and heat is applied to vaporize or destroy organic contaminants. Thermal treatment can be conducted at varying temperatures. Off-gases and solid residuals are generated through thermal treatment and must be treated or disposed of properly. Examples of thermal treatment include incineration, pyrolysis, and thermal desorption.	Not applicable. While onsite thermal treatment is effective for PAHs, this option is cost prohibitive given that only 4 cubic yards of waste would be treated and considering the cost of mobilizing a unit to the site.
Off-site Soil Recycling	Surface soil is excavated and transported off-site for treatment and subsequent reuse. Standard asphalt batching equipment can be used and is similar to thermal treatment; organic contaminants are vaporized or destroyed through application of heat. Treated soil is used in asphalt production.	Applicable. Off-site soil recycling is a proven technology for soils containing PAHs. However, if the soil is considered a hazardous waste, it could not be recycled.
Off-site Landfilling	Soil is excavated and transported to an off-site RCRA land disposal facility. The type of disposal facility that could accept soil from Site 7 would depend on the nature and concentrations of contaminants.	Applicable. Landfilling is a viable alternative for addressing surface soil contamination at the site. Concentrations of Site 7 contaminants are below land disposal restrictions, allowing the soil to be disposed of in either an RCRA Subtitle C or D landfill (whichever is appropriate) without pretreatment.

Notes: PAHs = polycyclic aromatic hydrocarbons.
RCRA = Resource Conservation and Recovery Act.

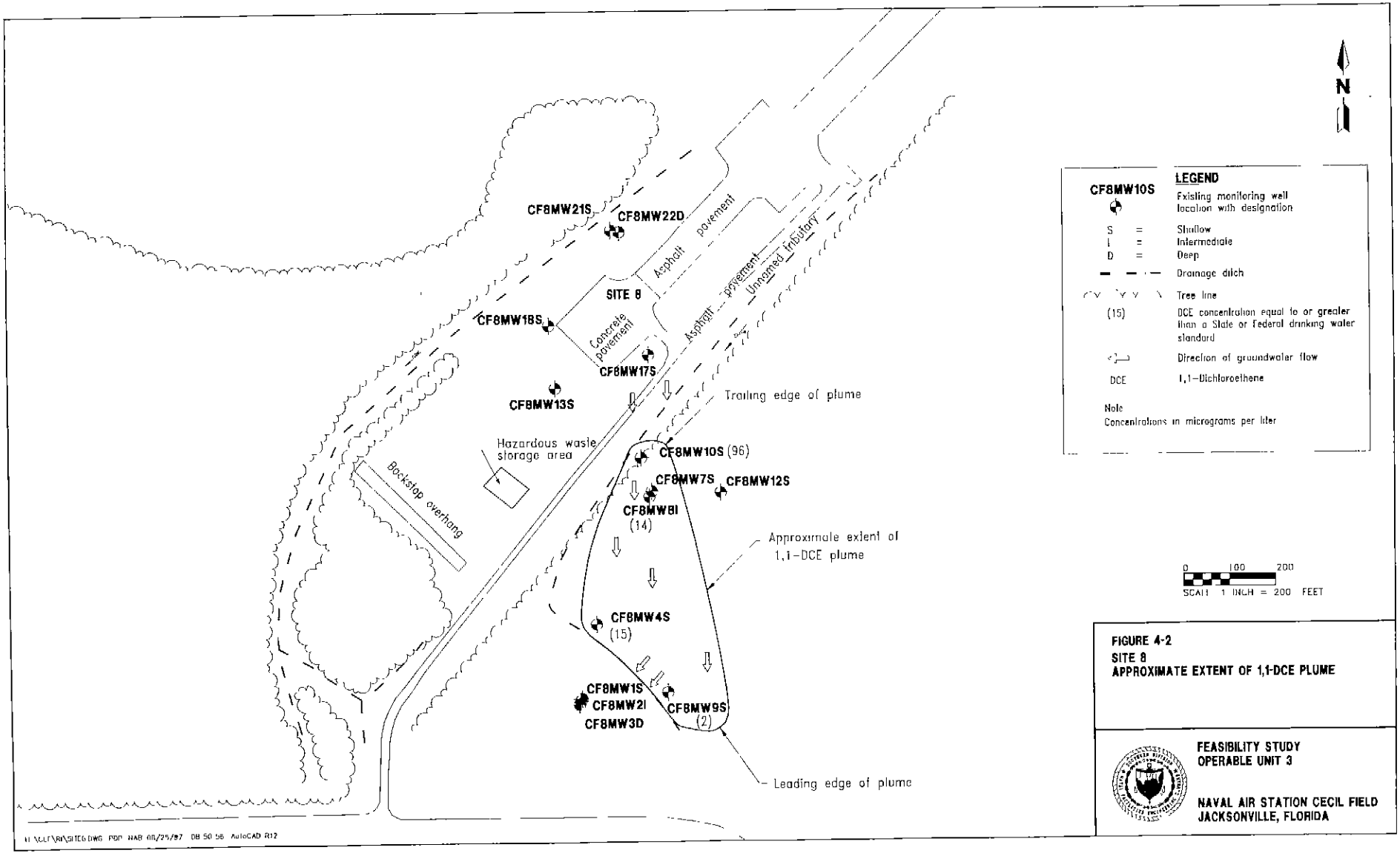


FIGURE 4-2
SITE 8
APPROXIMATE EXTENT OF 1,1-DCE PLUME

FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

Other technologies, such as air sparging, biosparging, pump and treat, containment, and treatment walls were considered; these provided limited benefits or advantages not provided by natural attenuation. Also, some represented substantial long-term operational, treatment, and disposal costs. Since the current groundwater only slightly exceeds the cleanup goal, and natural attenuation is already demonstrated to be actively reducing 1,1-DCE at Site 8 by destroying the compound, it is unnecessary to identify alternative treatment methods with associated capital and operation and maintenance (O&M) costs.

The BCT for NAS Cecil Field has discussed the need for developing an RAO for Site 8, considering the following:

- the EPC used in the conservative RA is only slightly above the MCL and FGGC, and
- the possibility of a future resident establishing a residence adjacent to a taxiway (i.e., the location of Site 8) and consuming unfiltered surficial aquifer water is unlikely.

The BCT discussed the benefits of active groundwater remediation at the site. Also considered in this evaluation was a paper published by Dr. Frank Chapell of the USGS discussing the environment at Site 8 as conducive to natural attenuation (USGS, 1996). Based on this evaluation, the BCT concluded that active groundwater remediation for Site 8 was not appropriate, given that natural attenuation would most likely decrease concentrations of 1,1 DCE in groundwater to below the MCL and FGGC. Therefore, it was agreed that the best available option for groundwater at Site 8 is natural attenuation.

4.2.2 Sediment The objective for remedial action at Site 8 is to prevent exposure to sediments that contain Aroclor-1260 at concentrations that may pose a potential risk to ecological receptors.

Based on the distribution of the ECPCs, areal extent of sediment to be addressed at this site is presented in Figure 4-3. The depth of contamination was assumed to be up to 2 feet below the bottom of the ditch, as the sediment samples collected during the RI are 0 to 1 foot. The volume (in-place) of the sediment to be addressed is therefore equal to approximately 280 yd^3 (1-foot depth) to 560 yd^3 (2-foot depth).

Although the NCP requires that a range of remedial alternatives be considered when developing alternatives for a CERCLA site, the volume of sediment to be addressed at Site 8 is minimal (280 yd^3 to 560 yd^3), thus raising a question as to the economic feasibility of *in situ* or containment technologies.

A "no action" alternative is also developed to provide a baseline for comparison of costs.

Implementation of *in situ* treatment technologies, such as *in situ* solidification or *in situ* vitrification, are most likely not practical at Site 8. First, contamination is within the surface zone (0 to 2 feet bls) and, therefore, the effectiveness of *in situ* technologies to treat contamination in the top 2 feet of sediment is questionable.

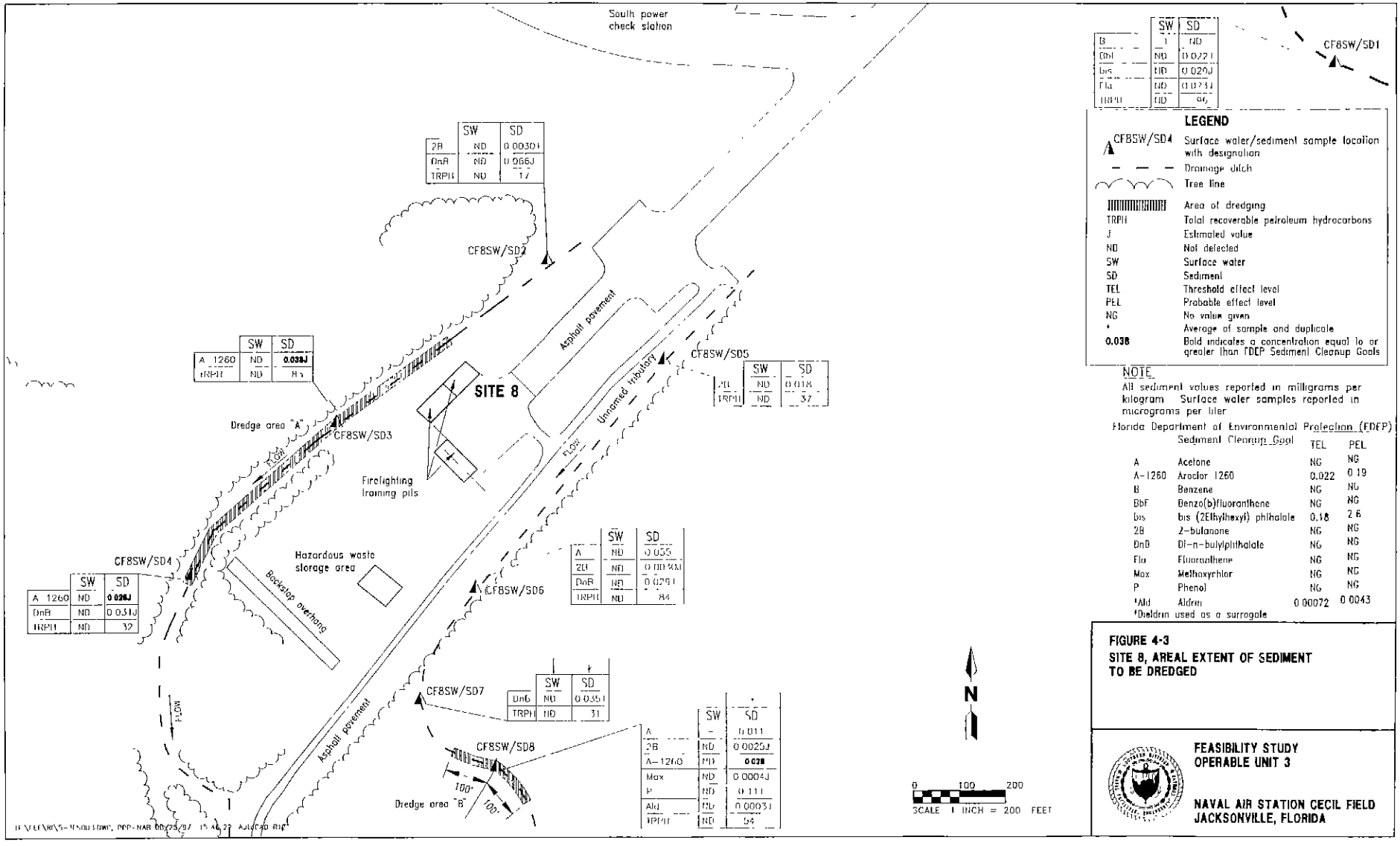


FIGURE 4-3
SITE 8, AREAL EXTENT OF SEDIMENT TO BE DREDGED

Containment would eliminate exposure to sediment at the site, but would not reduce the toxicity, mobility, or volume of contamination onsite. SARA emphasizes the use of treatment technologies that reduce the toxicity, mobility, or volume of contaminants rather than technologies that solely prevent exposure. Also, the implementation of a containment technology is cost prohibitive given the long-term monitoring costs that would be necessary (under the 5-year review requirement) if wastes were left onsite. Based on this, containment technologies were eliminated from further consideration.

Therefore, the technology screening phase for Site 8 was limited to identifying *ex situ* treatment technologies. These technologies are presented in Table 4-2; it should be noted that only technologies applicable to the contaminant of concern (i.e., Aroclor-1260) at the site are considered. Table 4-2 also presents the technology evaluation and screening process.

Based on the screening process presented in Table 4-2, two technologies passed the screening step: (1) excavation and off-site sediment treatment, and (2) excavation and off-site disposal. Only one remedial alternative was developed for Site 8, excavation and off-site management, as the two technologies that passed the screening step are actually representatives of one management (alternative) option.

Under this alternative, sediment within the identified area, would be dredged and transported to an appropriate off-site land disposal facility. Prior to transportation, four composite samples of the excavated material (two per focus area) would be collected and analyzed as required by FDEP and RCRA disposal regulations. The samples would be submitted for analysis of full RCRA hazardous characteristics, including ignitability, corrosivity, reactivity, TCLP metals, pesticides, herbicides, and PPL VOCs and SVOCs. Depending on these analytical results, the sediment may be eligible for disposal in an RCRA Subtitle D (solid waste) landfill. Otherwise, the sediment would require disposal in an RCRA Subtitle C (hazardous waste) land disposal facility. Other off-site sediment disposal options exist, such as thermal desorption and sediment recycling; however, these costs would most likely be between the off-site disposal as solid waste cost and the off-site disposal as hazardous waste cost.

4.3 SUMMARY OF ALTERNATIVES.

Site 7.

Surface Soil Alternative 7SS1 No action.
Surface Soil Alternative 7SS2 Excavation of surface soil and off-site disposal.

Site 8.

Groundwater Alternative 8GW1 No action.
Groundwater Alternative 8GW2 Natural attenuation and long-term monitoring.

Sediment Alternative 8SD1 No action.
Sediment Alternative 8SD2 Dredging of sediment and off-site disposal.

Table 4-2
Remedial Technologies, Sediment, Site 8

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Technology	Description	Applicability to Site 8
Treatment or Disposal (*Ex situ*)		
Onsite Thermal Treatment	Contaminated sediment is excavated, and heat is applied to vaporize or destroy organic contaminants. Thermal treatment can be conducted at varying temperatures. Off-gases and solid residuals are generated through thermal treatment and must be treated or disposed of properly. Examples of thermal treatment include incineration, pyrolysis, and thermal desorption.	Not applicable. While onsite thermal treatment is effective for PCBs, this option is cost prohibitive given that only 4 cubic yards of waste would be treated and considering the cost of mobilizing a unit to the site.
Off-site Sediment Treatment	Sediment is excavated and transported off-site for treatment and subsequent reuse. Standard asphalt batching equipment can be used and is similar to thermal treatment; organic contaminants are vaporized or destroyed through application of heat. Treated sediment is used in asphalt production.	Applicable. Off-site sediment recycling is a proven technology for sediment containing PCBs. However, if the sediment is considered a hazardous waste, it could not be recycled.
Off-site Landfilling	Sediment is excavated and transported to an off-site RCRA land disposal facility. The type of disposal facility that could accept sediment from Site 8 would depend on the nature and concentrations of contaminants.	Applicable. Landfilling is a viable alternative for addressing sediment contamination at the site. Concentrations of Site 8 contaminants are below land disposal restrictions, allowing the sediment to be disposed of in either an RCRA Subtitle C or D landfill (whichever is appropriate) without pretreatment.

Notes: PCBs = polychlorinated biphenyls.
RCRA = Resource Conservation and Recovery Act.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This chapter presents the detailed analyses of alternatives for OU 3 at NAS Cecil Field. 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 description of the alternative, emphasizing the applications of proposed technologies or actions, and
- an analysis of the alternative against eight criteria.

The remedial alternatives are examined with respect to the requirements stipulated by CERCLA and factors described in the USEPA RI/FS guidance manual (USEPA, 1988). The nine criteria from the USEPA RI/FS guidance manual are as follows:

Threshold Criteria

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

Primary Balancing Criteria

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

Stakeholder Criteria

- State acceptance
- community acceptance

Because the State (FDEP) and USEPA have participated in the review of the RI and have concurred with the issuance of this FS, the only criterion not specifically addressed by this FS is community acceptance. Community acceptance will be addressed upon receipt of public comments on the FS and the Proposed Plan.

A summary of the factors considered during detailed analysis for each criterion is presented in the GIR. Costs associated with the technical criteria assessment for each alternative are intended to be accurate within +50 to -30 percent of the estimated cost, as suggested by CERCLA guidance (USEPA, 1988). Cost estimate

calculations and information to support the detailed analysis of alternatives are presented in Appendix B.

5.1 DETAILED ANALYSIS FOR SITE 7, SURFACE SOIL, ALTERNATIVE 7SS1. This alternative is a "no action" alternative. The "no action" alternative provides a baseline against which other alternatives can be compared. This alternative does not involve remedial actions to treat contaminated soil.

5.2 DETAILED ANALYSIS FOR SITE 7, SURFACE SOIL, ALTERNATIVE 7SS2. This alternative includes excavation of surface soil from the identified areas at Site 7 and disposal of the excavated material in an approved off-site disposal facility. A description of this alternative is presented in Subsection 5.2.1, and the technical criteria assessment of this alternative is presented in Subsection 5.2.2.

In recognition of the need to remove contaminated soils posing significant risk at Site 7, it is expected that the soil will be excavated and removed in accordance with the framework described in this alternative. This activity is expected to be completed prior to completing the administrative procedures leading to a Record of Decision.

5.2.1 Description of Site 7, Surface Soil, Alternative 7SS2 Under this alternative, soil in the vicinity of the surface soil locations (refer to Chapter 2.0), with concentrations of PAHs or TRPH exceeding the risk management criteria based on an industrial land use scenario, would be excavated to a depth of approximately 2 feet below grade and transported to an appropriate off-site land disposal facility. As described in the RI (ABB-ES, 1997), benzo(a)pyrene concentrations in these surface soil samples posed an estimated incremental cancer risk to humans exposed to these concentrations that exceeded the cancer risk threshold of 1×10^{-6}. The sample locations and the concentration distribution of the human health chemicals of potential concern are shown on Figure 2-3.

Major components of this alternative include the following:

- site preparation
- excavation of surface soil
- waste characterization
- transportation and disposal of excavated soil
- excavation backfilling
- site restoration

These activities are discussed in the following sections. A site layout for this alternative is provided on Figure 4-1, which shows the focus areas of surface soil to be excavated.

Site Preparation. Site preparation would include all activities necessary prior to excavation of surface soil.

Fluorescent-yellow caution tape would be used around the areas to be excavated to define the exclusion zone at the site during removal activities.

A temporary decontamination area would be constructed at the site for cleaning of equipment and personnel. The decontamination area would consist of two layers of 6-milliliter thick plastic sheeting and Department of Transportation (DOT)-approved 55-gallon drums to containerize any liquids generated during cleaning. The decontamination area would be bermed using a temporary wood frame for collection of decontamination fluid. A backhoe and minor equipment (power washer, tools, etc.) would be mobilized to the site to excavate soil from the focus areas.

Excavation of Surface Soil. Surface soil would be excavated using a backhoe from an area as presented on Figure 4-1 to a depth of approximately 2 foot bls. The RA did not identify unacceptable risk based on exposure to subsurface (greater than 2 feet bls) soil at the site. Therefore, the depth of excavation is 1 foot deeper than the depth of surface soil samples collected during the RI (i.e., 0 to 1 foot), ensuring that the targeted contaminated soils are adequately removed. Excavated soil (approximately 1,820 yd^3) would be transferred directly into DOT-approved 55-gallon drums for waste characterization and disposal.

Waste Characterization. Prior to transportation of the excavated soil off-site, two composite samples of the excavated material (one per focus area) would be collected as required by FDEP and RCRA disposal regulations. The samples would be submitted for full RCRA characteristics, including ignitability, corrosivity, reactivity, TCLP metals, pesticides, herbicides, and PPL VOCs and SVOCs. In addition, one sample of the decontamination fluid from each focus area would be collected and submitted for full RCRA hazardous waste characteristics. The analytical results from the excavated soil and decontamination fluid would be forwarded to the off-site disposal facility for review and approval. Disposal of the excavated soil and decontamination fluid will be in conformance with Navy, USEPA, and FDEP standards and regulations.

Transportation and Disposal of Excavated Soil. Upon disposal approval by the Navy, the containerized soil would be transported to a preapproved disposal facility. The waste will be labeled in accordance with DOT regulations and loaded onto fully placarded and DOT-approved transport vehicles to be transported to the appropriate facility.

Depending on the results of the waste characterization, excavated surface soil may be eligible for disposal in an RCRA Subtitle D (solid waste) landfill. If the soil is not eligible for disposal in an RCRA Subtitle D (solid waste) facility, then it would be transported to an RCRA Subtitle C (hazardous waste) land disposal facility. The costs for both disposal options are presented in the detailed analysis. These two options represent the lowest and highest cost scenarios for off-site disposal. Based on surface soil analyses reported in the RI, it is unlikely that the excavated soil will exhibit characteristics of a hazardous waste.

Backfilling the Excavation. Once contaminated soil has been removed, the excavation area would be backfilled using certified clean topsoil. The topsoil would be transported from a nearby off-site source to Site 7, backfilled directly into the open excavation areas, and spread and graded.

Site Restoration. Once the areas have been backfilled, seed and fertilizer would be added to promote vegetative growth. Hay would be used to protect the seed and fertilizer during initial development.

Decontamination pad materials would be removed and disposed of properly. Decontamination water would be sampled for full RCRA characteristics described previously. Depending on the waste characterization results, the decontamination fluid would be discharged to the ground surface at Site 7, transported to the onsite wastewater treatment plant, or disposed of off-site (if necessary). Equipment and vehicles used during construction would be demobilized.

5.2.2 Technical Assessment of Site 7, Surface Soil, Alternative 7SS2 This subsection provides the technical assessment of Site 7, Alternative 7SS2.

Overall Protection of Human Health and the Environment. According to the RI (ABB-ES, 1996b), human health risks for exposure to Site 7 surface soil were within the USEPA acceptable risk range, but greater than 1×10^{-6}. This alternative would eliminate human receptor exposure to chemicals of concern in Site 7 surface soil because the surface soil would be excavated and disposed of off-site. Furthermore, the excavation would be backfilled using clean topsoil. As a result, risks posed to human receptors by potential exposure to surface soil would be eliminated.

The slight risk estimated for ecological receptors and the environment would be eliminated based on excavation and off-site disposal of the surface soil. Site restoration activities, such as seeding and fertilizer, would promote vegetative growth and enhance current environmental conditions.

Compliance with ARARs. This alternative would comply with both chemical-specific and action-specific ARARs, as waste characterization of the surface soil and decontamination fluid would be performed prior to off-site disposal. Table 5-1 is a summary of ARARs for Site 7 surface soil. The analytical results of the waste characterization for excavated soil will determine which ARARs apply (i.e., whether or not hazardous waste regulations would apply) and the types of off-site facilities that can accept the waste.

Comparison of the concentrations of chemicals detected in Site 7 surface soil to Universal Treatment Standards indicates that treatment of soil prior to disposal would not be required. However, waste characterization results will determine whether or not the soil can be disposed of in an RCRA Subtitle D (nonhazardous) disposal facility or RCRA Subtitle C (hazardous) disposal facility. Documentation, such as waste profile sheets and waste manifests, would be prepared in accordance with ARARs, as necessary.

Long-Term Effectiveness and Permanence. Under this alternative, surface soil would be removed and transported off-site to an appropriately permitted landfill for long-term containment and monitoring. In this manner, this alternative is effective in preventing further exposure by humans to contaminants currently in surface soil at Site 7.

Reduction of Toxicity, Mobility, and Volume through Treatment. Based on the small quantity of soil to be excavated, onsite treatment alternatives were not considered. As a result, the toxicity, mobility,

Table 5-1
Synopsis of Federal and State Regulatory Requirements for Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Wastes (40 Code of Federal Regulations [CFR] Part 261)	Defines the listed and characteristic hazardous wastes subject to RCRA. Appendix II contains the Toxicity Characteristic Leaching Procedure (TCLP) used for testing contaminated soils.	These regulations would apply when determining whether waste onsite is listed as hazardous, as defined in the regulations, or exhibits a hazardous characteristic based on the TCLP. Disposal option would also be determined based on the TCLP.	Chemical-specific Action-specific
RCRA, Regulations for Transporters of Hazardous Waste (40 CFR Part 263)	Establishes the responsibilities of transporters for handling, transporting, and managing hazardous wastes. To avoid duplicative regulation with Department of Transportation (DOT), U.S. Environmental Protection Agency has expressly adopted certain DOT regulations governing the transportation of hazardous materials (see entry directly below).	These regulations would apply if soil from Site 7 needs to be deposited in an off-site hazardous waste disposal area.	Action-specific
Hazardous Materials Transportation Act Regulations (49 CFR Parts 171-179)	Establishes the procedures for packaging, labeling, and transporting of hazardous materials.	Same as above.	Action-specific
RCRA Regulations, Land Disposal Restrictions (40 CFR Part 268)	Identifies those wastes that are restricted from land disposal and defines those limited circumstances in which a prohibited waste may continue to be disposed of on land.	If a remedial action involves the thermal treatment of soil, the treated soil would have to meet the land disposal restriction for metals before being redeposited on the ground.	Action-specific
Florida Hazardous Waste Rules (Florida Administrative Code [FAC], 62-730)	Adopts by reference sections of the Federal hazardous waste regulations and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes.	These regulations would apply if soil at Site 7 must be disposed of in a hazardous waste disposal area.	Action-specific Chemical-specific
Florida Petroleum Contaminated Site Cleanup Criteria (FAC, 62-770)	Establishes a cleanup process to be followed at all petroleum-contaminated sites.	Since this is a petroleum-contaminated site, the procedures for cleanup in this rule would apply.	Chemical-specific Action-specific

See notes at end of table.

Table 5-1 (Continued)
Synopsis of Federal and State Regulatory Requirements for Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Florida Soil Thermal Treatment Facilities Regulations (FAC, 62-775)	Establishes criteria for the thermal treatment of petroleum or petroleum product-contaminated soils. The rule outlines procedures for excavating, receiving, handling, and stockpiling contaminated soils prior to thermal treatment in both stationary and mobile facilities.	If the contaminated soil is sent to a thermal treatment facility, these regulations would apply.	Chemical-specific Action-specific
Soil Cleanup Standards for Florida, September 1995	The document provides guidance for determining soil cleanup levels that can be developed on a site-by-site basis, using the calculations found in Table 1 of the document.	After thermal treatment is performed, the soil would have to meet the goals in this guidance before it could be redeposited.	Chemical-specific Action-specific
Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities	Establishes soil guidance values for lead.	If excavated soil at Site 7 contains lead, then the guidance values established should be met before disposal.	Chemical-specific Action-specific

and volume of waste would be reduced *onsite* for Site 7 focus area soil because the waste would be transported and disposed of off-site.

Depending on the waste characterization results, off-site treatment may be required prior to land disposal in accordance with RCRA land disposal restrictions stated in Table 5-1. However, based on sampling data from the RI (ABB-ES, 1997), off-site treatment of focus area soil prior to disposal does not seem likely. Furthermore, the chemical of concern at Site 7 (benzo(a)pyrene) is not land-ban restricted, and, therefore, is not subject to applicable treatment standards prior to land disposal.

If treatment is required, the toxicity, mobility, and volume would be reduced. If no treatment is required, the soil would be disposed of in an RCRA Subtitle D (solid waste) facility, and the toxicity or volume of the waste would not be reduced.

Other off-site soil disposal options exist, such as thermal desorption and soil recycling; however, these costs would most likely be between the low and high disposal costs presented in Table 5-2.

Short-Term Effectiveness. Through implementation of this alternative, there would be an immediate reduction in risk to human health. During excavation and soil handling activities, site workers would wear personal protection equipment to address potential exposure to site-related contaminants. Because Site 7 is in a primarily industrial area, activities proposed under this alternative would not affect the surrounding community.

Implementability. This alternative is relatively easy to implement. This alternative involves mobilizing a backhoe and minor equipment to Site 7 to remove focus area soil. It is estimated that it would take approximately 1 to 3 days to conduct mobilization, site preparation, excavation, confirmation sampling, transportation and disposal, backfilling, and site restoration activities.

Furthermore, disposal of soil is easy to implement. Several solid waste landfills exist in the Jacksonville area that accept nonhazardous soil. In addition, FDEP has an approved list of thermal treatment facilities, if off-site treatment is required. Finally, hazardous waste treatment, storage, and disposal facilities (TSDFs) exist in Alabama, if the soil is determined hazardous by waste characterization.

The implementation of this alternative may impact NAS Cecil Field activities planned, if any, at the firefighting training area. During implementation for this alternative, activities planned near the focus area would need to be restricted.

State Acceptance. Based on BCT meetings between the Navy, FDEP, and USEPA, removal of the focus area surface soil from Site 7 was considered a viable solution. As a result, excavation and off-site disposal of the focus area soil at Site 7 is acceptable to the State.

Cost. The estimated present worth cost of Alternative 7SS2 is $530,100 to $5,422,900 for a residential use scenario and is presented in Table 5-2. The estimated present worth cost of Alternative 7SS2 is $221,300 to $2,025,200 for

Table 5-2
Site 7, Alternative 7SS2: Excavation and Off-Site Disposal of Surface Soil
Residential Land Use

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Cost Item	Cost: RCRA Subtitle D Disposal (Solid Waste)	Cost: RCRA Subtitle C Disposal (Hazardous Waste)
DIRECT COST		
Site Preparation and Mobilization	$5,500	$5,500
Excavation of Soil	$11,900	$11,900
Waste Characterization	$25,000	$25,000
Off-site Transportation and Land Disposal	$371,880	$4,448,400
Backfill Excavation Area	$6,000	$6,000
Site Restoration and Demobilization	$3,900	$3,900
Total Direct Cost	$424,180	$4,500,700
INDIRECT COST		
Health and Safety Plan	$7,500	$7,500
Preparation of a Workplan	$12,500	$12,500
Administration and Permitting Fees	$1,000	$2,000
Direct Cost Contingency (@ 20%)	$84,840	$900,140
Total Indirect Cost	$105,840	$922,140
TOTAL CAPITAL COST **(Direct Cost plus Indirect Cost)**	$530,100	$5,422,900
Operation and Maintenance Cost	$0	$0
TOTAL COST	$530,100	$5,422,900

Notes: RCRA = Resource Conservation and Recovery Act.
% = percent.
@ = at.

Table 5-3
Site 7, Alternative 7SS2: Excavation and Off-Site Disposal of Surface Soil
Industrial Land Use

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Cost Item	Cost: RCRA Subtitle D Disposal (Solid Waste)	Cost: RCRA Subtitle C Disposal (Hazardous Waste)
DIRECT COST		
Site Preparation and Mobilization	$2,920	$2,920
Excavation of Soil	$5,780	$5,780
Waste Characterization	$14,200	$14,200
Off-site Transportation and Land Disposal	$137,800	$1,640,200
Backfill Excavation Area	$3,000	$3,000
Site Restoration and Demobilization	$3,200	$3,200
Total Direct Cost	$166,900	$1,669,300
INDIRECT COST		
Health and Safety Plan	$7,500	$7,500
Preparation of a Workplan	$12,500	$12,500
Administration and Permitting Fees	$1,000	$2,000
Direct Cost Contingency (@ 20%)	$33,380	$333,860
Total Indirect Cost	$54,380	$355,860
TOTAL CAPITAL COST **(Direct Cost plus Indirect Cost)**	$221,300	$2,025,200
Operation and Maintenance Cost	$0	$0
TOTAL COST	$221,300	$2,025,200

Notes: RCRA = Resource Conservation and Recovery Act.
% = percent.
@ = at.

an industrial use scenario and is presented in Table 5-3. A range of total costs is given based on disposal of soil and decontamination fluid as solid waste (RCRA Subtitle D) or hazardous waste (RCRA Subtitle C). Direct costs include site preparation and mobilization, excavation of focus area soil, waste characterization, off-site transportation and disposal, backfilling, site restoration, and demobilization. Indirect costs include preparation of a health and safety plan, workplan, administrative and permitting fees, and direct costs contingency. Because this alternative involves immediate removal action, long-term monitoring or O&M costs are not associated with this alternative.

5.3 DETAILED ANALYSIS FOR SITE 8, GROUNDWATER, ALTERNATIVE 8GW1.

No Action Alternative. The "no action" alternative provides a baseline against which other alternatives can be compared. This alternative does not involve remedial actions to treat contaminated groundwater. The contaminant plume would not be removed from the aquifer.

5.3.1 Technical Assessment of Site 8, Groundwater, Alternative 8GW1 This subsection provides the technical assessment of Site 8, Alternative 8GW1.

Overall Protection of Human Health and the Environment. This alternative would not provide protection to future human receptors who may use Site 8 groundwater as a potable water supply.

Compliance with ARARs. Compliance with ARARs may be achieved for this Alternative; however, this may not be verified. ARARs are summarized in Table 5-4.

Long-Term Effectiveness and Permanence. Long-term effectiveness is not verifiable for this alternative.

Reduction of Toxicity, Mobility, and Volume through Treatment. Because of the "no action" nature of the alternative, contaminant toxicity of VOCs and SVOCs can not be verified.

This alternative would not increase the rate of natural transformation processes that reduce the toxicity, mobility, or volume of contaminants in groundwater.

Short-Term Effectiveness. This alternative would not comply with RAOs or treatment levels both in the short term as well as the long term.

Implementability. This alternative does not require any construction for implementation.

State Acceptance. State acceptance is not provided at this time.

Cost. No cost is associated with this alternative.

5.4 DETAILED ANALYSIS FOR SITE 8, GROUNDWATER, ALTERNATIVE 8GW2.

Naturally occurring biological, physical, and chemical processes within the surficial

Table 5-4
Synopsis of Federal and State Regulatory Requirements for Site 8

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Federal Safe Drinking Water Act (SDWA) Regulations, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) (40 Code of Federal Regulations [CFR] Part 141, subpart B)	The SWDA MCLs are legally enforceable Federal drinking water standards. MCLs are commonly identified as applicable or relevant and appropriate requirements for existing or potential drinking water sources.	MCLs can be used as protection levels for surface waters or groundwater that are potential sources of drinking water.	Chemical-specific
Florida Groundwater Classes, Standards and Exemptions Florida Administrative Code [FAC], 62-520)	The rule designates the groundwater of the State into five classes and establishes minimum "free from" criteria. Rule also specifies that classes I and II must meet the primary and secondary drinking water standards listed in FAC, Chapter 62-550 (see next entry).	The groundwater at this site is considered Class II; therefore, the primary and secondary standards would apply.	Chemical-specific
Florida Drinking Water Standards, Monitoring and Reporting [FAC, 62-550]	The regulations implement the Federal SDWA by adopting primary and secondary drinking water standards.	The primary drinking water standard for 1,1 dichloroethylene is 7 micrograms per liter ($\mu g/\ell$).	Chemical-specific
Groundwater Guidance, Florida Bureau of Groundwater Protection, June 1994.	The document provides maximum concentration levels for groundwater contaminants in the State of Florida. Groundwater with concentrations less than the listed values are considered "free from" contamination.	The values in this guidance may be used as groundwater monitoring levels for monitoring at Site 8. The guidance concentration for 1,1-dichloroethylene is 7 $\mu g/\ell$.	Chemical-specific

aquifer at Site 8 would be relied on to reduce the concentrations of VOCs (in particular 1,1-DCE) and SVOCs in groundwater over time. This alternative includes groundwater monitoring (1) to verify that aquifer conditions continue to be amenable to natural attenuation (i.e., biodegradation), (2) to monitor the ongoing rate of degradation, and (3) to monitor that contamination does not spread beyond its current limits. A description of this alternative is presented in Subsection 5.4.1, and the technical criteria assessment of this alternative is presented in Subsection 5.4.2.

5.4.1 **Description of Site 8, Groundwater, Alternative 8GW2** Natural biological and chemical processes occurring within the surficial aquifer would reduce contaminant concentrations in groundwater at Site 8. Microorganisms within the aquifer use organic contaminants such as VOCs and SVOCs as substrate (food), reducing contaminant concentrations through metabolic activity. Physical processes such as volatilization, sorption, advection, and dispersion further reduce contaminant concentrations naturally within the aquifer. Previous reports by ABB-ES (GIR, 1996a and RI, 1997) and studies by USGS (USGS, 1996) suggest that natural attenuation would reduce contaminant concentrations below the MCLs and FDEP guidance concentrations.

According to the RI, it would take approximately 44 to 78 years for the trailing edge of the 1,1-DCE plume to reach the unnamed tributary at Site 8 (Figure 4-2). The travel time estimate was based on using the 1995 USGS groundwater flow model, partitioning coefficients, retardation factor, and seepage velocity of Site 8 groundwater. During this travel time, natural environmental degradation would be expected to significantly reduce the concentrations of 1,1-DCE that actually reach the stream. The expected concentration of 1,1-DCE at the stream would be lower than current surface water standards.

Review of data from the RI suggested that decreasing concentrations of 1,1-DCE from the source area to the unnamed tributary represents the cumulative effect of fate and transport mechanisms at Site 8. As shown on Figure 4-2, the highest concentration of 1,1-DCE in the source area is 96 $\mu g/\ell$, but decreased to 15 $\mu g/\ell$ approximately 400 feet downgradient and 2 $\mu g/\ell$ approximately 500 feet further downgradient. Further evaluation and measurement of Site 8 groundwater conditions demonstrate that reductions in 1,1-DCE are well defined and predictable based on geochemical and microbial conditions and processes (USGS, 1996).

Natural biological and chemical processes occurring at Site 8 include oxidation-reduction (redox) conditions such as methanogenisis (methane producing), sulfate reduction, iron reduction, and oxygen reduction (USGS, 1996). According to this report, a methanogenic zone is present near the contaminant source, surrounded by sulfate-reducing and iron-reducing zones further downgradient. This redox zonation suggests that the natural attenuation of chlorinated ethenes (i.e., 1,1-DCE) will be rapid and efficient at this site. Near the contaminant source, methanogenic and sulfate-reducing zones favor dechlorination of tetrachloroethene, DCE, and trichloroethene. In the downgradient iron-reducing zone, anoxic oxidation of vinyl chloride (VC) to carbon dioxide can occur (USGS, 1996). Anaerobic conditions, which occur naturally at Site 8, are particularly favorable for degradation of DCE. Nitrogen, carbon, and phosphorus also present at Site 8 would support the degradation process.

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

- groundwater use restrictions
- 5-year site reviews,
- groundwater monitoring, and
- modeling of groundwater flow and degradation processes.

The groundwater monitoring component of Site 8, Alternative 8GW2, is necessary to assess rates of degradation and reduction of organics within the aquifer, thus allowing an evaluation of the effectiveness of natural attenuation as a treatment technology. Since the estimated travel time of the 1,1-DCE plume is approximately 44 to 78 years, the administrative O&M cost estimate was capped at a duration of 30 years, in accordance with CERCLA guidance (USEPA, 1988). However, the anticipated effectiveness of the natural degradation processes are expected to shorten the period to achieve the RAO in less than 10 years. As groundwater monitoring data are collected over time, the rates of natural degradation processes can be estimated specifically for Site 8 conditions. Based on the technical literature, a period as short as 3 to 8 years may be expected before the RAO is achieved. Groundwater use restrictions, monitoring, and evaluation of degradation rates and processes will continue until the RAO is achieved.

Five-Year Site Reviews. Because contaminated media would remain onsite, the Navy, USEPA Region IV, and FDEP must review site conditions (as required under SARA) to assess if a more aggressive alternative (i.e., *in situ* or *ex situ* treatment) should be considered. Site reviews would occur every 5 years until concentrations of 1,1-DCE in groundwater are below MCLs. Site reviews would consist of (1) evaluating monitoring data and analytical results, (2) assessing changes in site conditions (e.g., construction, demolition, receptors, migration pathways, and qualitative risks) and groundwater use, and (3) assessing the effectiveness of natural attenuation as a treatment technology.

Groundwater Monitoring. Monitoring of the groundwater would be implemented to determine the effectiveness of natural attenuation as a treatment for the surficial aquifer at Site 8. Monitoring would occur on a quarterly basis for the first year, and annually every year thereafter. Samples would be collected from the nine existing monitoring wells shown on Figure 5-1. These wells were selected because their spatial locations are useful for monitoring the size, constituent concentrations, and movement of the groundwater plume.

Groundwater at Site 8 was analyzed during the RI for target compound list and target analyte list analytical parameters. Analytical results showed detections of a select number of compounds. However, the RA concluded that 1,1-DCE (a VOC) is the major risk contributor, while naphthalene and bis(2-ethylhexyl)phthalate (SVOCs) are minor risk contributors. Therefore, the annual monitoring program for Site 8, Alternative 8GW2, would include groundwater sampling and analysis for VOCs and SVOCs. In addition, sampling and analysis of microbial and geochemical parameters will be conducted to more accurately measure the rate of natural degradation of contaminants, particularly the effectiveness of reducing concentrations of 1,1-DCE.

Figure 5-1 shows 13 wells. A total of 13 samples would be collected for analysis during each round of sampling (1 sample per well and 1 quality control sample) and analyzed for the following parameters:

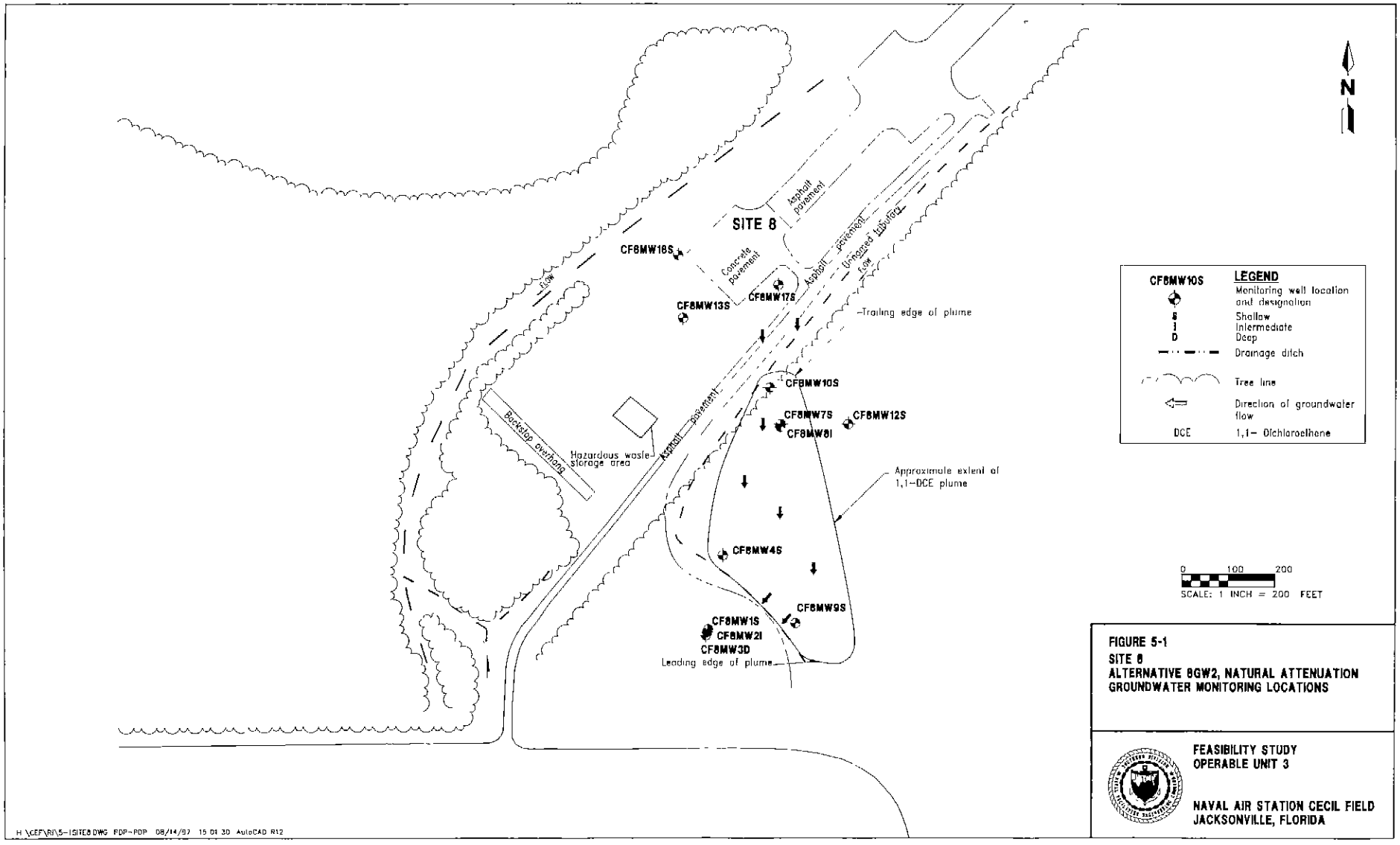


FIGURE 5-1
SITE 8
ALTERNATIVE 8GW2, NATURAL ATTENUATION
GROUNDWATER MONITORING LOCATIONS

FEASIBILITY STUDY
OPERABLE UNIT 3

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

H:\CEF\RI\5-1SITE8.DWG FDP-FDP 08/14/97 15:01:30 AutoCAD R12

- VOCs, in particular 1,1-DCE and VC (a byproduct of 1,1-DCE in the biotransformation process);
- SVOCs, in particular naphthalene and bis(2-ethylhexyl)phthalate;
- biochemical oxygen demand;
- sulfate, chloride, and nitrate;
- total and dissolved (field-filtered) iron;
- dissolved organic carbon; and
- field measurements of redox potential, pH, dissolved oxygen alkalinity, and temperature.

Measurements of these parameters over time at Site 8 will assist in evaluating the extent of natural biodegradation, the overall conditions within the aquifer, and the relative migration of contaminants. The data will help determine whether or not natural attenuation is effective in reducing contaminant concentrations and ultimately reducing risks to human receptors. Based on an evaluation of the data, additional measurements to reduce contaminant concentrations may be implemented. Land use would also be observed to identify the presence of possible receptors and compliance with administrative groundwater use restrictions.

If natural attenuation is sufficiently reducing contaminant concentrations at Site 8 after the first 5-year review, groundwater sample collection and analysis would continue to be performed once per year until the RAO is achieved. During this time, the data from sample analyses will be evaluated annually to verify that natural degradation processes are still occurring within the aquifer.

Groundwater Modeling. Modeling will be performed to simulate plume movement and degradation over time. During the first year of groundwater monitoring, analytical results from the quarterly sampling will be input into the model to serve as the baseline for establishing biodegradation rates and plume movement. The groundwater model will be updated annually, at a minimum, based on the results of annual groundwater sampling or other pertinent data or site changes. The modeling will be used to estimate the duration of the remedial treatment as well as to evaluate contaminant degradation and distribution.

Groundwater Use Restrictions. During the period of natural attenuation treatment of Site 8 groundwater contaminants, the use of groundwater in the surficial aquifer at the site will be restricted. Once the RAO is achieved, the restrictions will be removed. This may be done administratively while Site 8 is still owned by the Navy. Alternatively, property deeds could be modified to indicate that consumption of untreated groundwater from the surficial aquifer may pose an increased risk to human health. This annotation would reference the RI (which includes the RA), FS, Proposed Plan, and Record of Decision. The agency currently responsible for administering the well installation permit program would be formally requested to prohibit permits for installing potable wells in the surficial aquifer at Site 8.

Owners of property affected by the Site 8 plume would be reminded annually of the groundwater use restrictions. These restrictions would be removed after groundwater monitoring results from two consecutive annual sampling events indicate that the groundwater RAO is achieved and groundwater from the surficial aquifer is fit for consumption.

5.4.2 Technical Assessment of Site 8, Groundwater, Alternative 8GW2 This subsection provides the technical assessment of Site 8, Alternative 8GW2.

Overall Protection of Human Health and the Environment. This alternative would provide protection to future human receptors who may use Site 8 groundwater as a potable water supply. During the treatment period, exposure to contaminated groundwater would be prohibited by implementing groundwater use restrictions. Under groundwater use restrictions, installing production wells within the surficial aquifer at Site 8 would be prevented.

No adverse short-term or cross-media effects are anticipated as a result of implementing natural attenuation. Furthermore, groundwater contamination is expected to decrease significantly (to below MCLs) prior to discharge to the unnamed tributary and ultimately Sal Taylor Creek.

Compliance with ARARs. ARARs for this alternative are identified and discussed in Table 5-5.

In the short term, this alternative would not comply with chemical-specific ARARs (e.g., MCLs) for 1,1-DCE. However, data from the RI suggest that contaminant concentrations downgradient of the higher concentrations of 1,1-DCE are below the MCL (7 $\mu g/\ell$) and FDEP guidance concentration (2.2 $\mu g/\ell$).

In the long term, compliance with ARARs would be achieved when natural processes within the aquifer reduce contaminant concentrations over time. In addition, natural attenuation does not trigger location-specific or action-specific ARARs.

Long-Term Effectiveness and Permanence. Naturally occurring processes are expected to reduce contaminant concentrations in the aquifer over the long term. However, human risks due to ingestion of groundwater from the surficial aquifer would not be addressed via active treatment and would remain until concentrations are reduced by natural processes.

Groundwater monitoring would provide a means of evaluating the concentrations of contaminants in groundwater and assessing the degradation rate of contaminants. In addition, monitoring of indicator parameters within the aquifer would help to evaluate the effectiveness of natural attenuation in reducing contaminant concentrations. Administrative actions proposed in this alternative would provide a means of exposure control, but would not provide a permanent, irreversible remedy for risks posed by groundwater contaminants. Groundwater monitoring and administrative actions are considered reliable controls.

Reduction of Toxicity, Mobility, and Volume through Treatment. Although no active treatment is included in this alternative, contaminant toxicity of VOCs and SVOCs will be reduced over time through natural degradation processes. According to a study of redox conditions at Site 8 (USGS, 1996), natural attenuation would be rapid and efficient for reducing the toxicity of chlorinated VOCs including 1,1-DCE at Site 8.

Table 5-5
Synopsis of Federal and State Regulatory Requirements for Site 8

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Federal Safe Drinking Water Act (SDWA) Regulations, National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) (40 Code of Federal Regulations Part 141, subpart B)	The SWDA MCLs are legally enforceable Federal drinking water standards. MCLs are commonly identified as applicable or relevant and appropriate requirements for existing or potential drinking water sources.	MCLs can be used as protection levels for surface waters or groundwater that are potential sources of drinking water.	Chemical-specific
Florida Groundwater Classes, Standards and Exemptions (Florida Administrative Code [FAC], 62-520)	The rule designates the groundwater of the State into five classes and establishes minimum "free from" criteria. Rule also specifies that classes I and II must meet the primary and secondary drinking water standards listed in FAC, Chapter 62-550 (see next entry).	The groundwater at this site is considered class II; therefore, the primary and secondary standards would apply.	Chemical-specific
Florida Drinking Water Standards, Monitoring and Reporting (FAC, 62-550)	The regulations implement the Federal SDWA by adopting primary and secondary drinking water standards.	The primary drinking water standard for 1,1 dichloroethylene is 7 micrograms per liter ($\mu g/\ell$).	Chemical-specific
Groundwater Guidance, Florida Bureau of Groundwater Protection, June 1994.	The document provides maximum concentration levels for groundwater contaminants in the State of Florida. Groundwater with concentrations less than the listed values are considered "free from" contamination.	The values in this guidance may be used as groundwater monitoring levels for monitoring at Site 8. The guidance concentration for 1,1-dichloroethylene is 7 $\mu g/\ell$.	Chemical-specific

This alternative would not provide a reduction in contaminant mobility or volume; however, it was estimated in the RI report that it will take approximately 44 to 78 years for the trailing edge of the plume to reach the Sal Taylor Creek. During this 44- to 78-year travel time, natural attenuation would be expected to significantly reduce the 1,1-DCE concentrations before they can actually reach the stream.

This alternative would not increase the rate of natural transformation processes that reduce the toxicity, mobility, or volume of contaminants in groundwater; however, groundwater monitoring will allow an assessment of the effectiveness and rate of natural degradation processes.

Human health toxicity posed by ingestion of groundwater contaminants would remain until concentrations are reduced by natural processes. No treatment residuals would be produced if this alternative were implemented.

Short-Term Effectiveness. This alternative would not comply with RAOs or treatment levels in the short term because the only means of contaminant reduction posed by this alternative is natural attenuation. Based on the results of the baseline RA, this alternative does not pose a threat to workers through exposure to contaminated groundwater. Human health risks posed by contaminants in groundwater exist only if the water is used as a potable water supply.

Implementability. This alternative does not require any construction for implementation. Other activities, such as groundwater monitoring, groundwater modeling, groundwater use restrictions, and 5-year site reviews, are easily implemented, although administratively burdensome. Several vendors provide these services in the Jacksonville area.

State Acceptance. Natural attenuation of 1,1-DCE in groundwater at Site 8 is considered a viable and acceptable solution by the BCT. As a result, natural attenuation of the 1,1-DCE plume at Site 8 is acceptable to the State.

Cost. The cost estimate for Site 8, Alternative 8GW2, is presented in Table 5-6. Direct costs for Site 8, Alternative 8GW2, include quarterly groundwater sampling and groundwater modeling for the first year. Direct costs are estimated to be $50,000, and indirect costs (preparation of health and safety plan, sampling and analysis plan, direct cost contingency) are estimated to be $30,000. Annual O&M includes groundwater monitoring, groundwater modeling, and 5-year reviews for a duration of 30 years. Annual O&M costs are estimated at $28,000 per year with a present worth of $385,000 (30-year period using a discount rate of 6 percent).

5.5 DETAILED ANALYSIS FOR SITE 8, SEDIMENT, ALTERNATIVE 8SD1. This alternative is a "no action" alternative. The "no action" alternative provides a baseline against which other alternatives can be compared. This alternative does not involve remedial actions to treat contaminated sediment.

5.6 DETAILED ANALYSES OF SITE 8, SEDIMENT, ALTERNATIVE 8SD2. Under this alternative, sediment in the vicinity of two sediment sample locations (refer to Chapter 3.0), or focus areas, would be dredged to a depth of approximately 2 feet below the bottom of the ditch and transported to an appropriate off-site land disposal facility. As described in the RI (ABB-ES, 1997), Aroclor-1260 in these

Table 5-6
Site 8, Alternative 8GW2: Natural Attenuation Cost

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Cost Item	Cost
Direct Costs	
Groundwater Monitoring (Quarterly - 1st year)	$38,000
Groundwater Modeling (1st year)	$12,000
Total Direct Cost	$50,000
Indirect Costs	
Preparation of Health and Safety Plan	$7,500
Preparation of Sampling and Analysis Plan	$12,500
Direct Cost Contingency (20%)	$10,000
Total Indirect Cost	$30,000
Operation and Maintenance (O&M) Cost	
O&M (30-year period)	
Annual Groundwater Monitoring	$17,000
Five-year Reviews (annualized)	$4,800
Annual Groundwater Modelling	$6,400
Total Annual O&M Cost	$28,000
Present Worth of O&M (30-year period)	$385,000
Total Cost (Direct + Indirect + PW O&M)	$465,000

Note: Totals are rounded to the nearest $1,000.

sediment samples posed a probable ecological risk to microinvertebrates exposed to these concentrations that exceeded the risk management criteria. The two sample locations, CF7SD7 and CF7SD8, were shown on Figure 4-3.

5.6.1 Description of Site 8, Sediment, Alternative 8SD2 Major components of this alternative include the following:

- delineation of boundaries of dredging
- site preparation
- dredging sediment
- waste characterization
- transportation and disposal of dredged sediment
- backfilling the dredged area
- site restoration

These activities are discussed in the following sections. A site layout for this alternative is provided on Figure 4-3, which shows the focus areas of sediment to be dredged.

Delineation of Boundaries of Dredging. Currently the excavation boundaries are identified as the mid points between sampling locations. However, more accurate boundaries of dredging will be established based on additional sediment samples around the focus area within the ditch.

Site Preparation. Site preparation would include all activities necessary prior to excavation of surface soil.

Fluorescent-yellow caution tape would be used around the areas to be excavated to define the exclusion zone at the site during removal activities.

A temporary decontamination area would be constructed at the site for cleaning of equipment and personnel. The decontamination area would consist of two layers of 6-millimeter thick plastic sheeting and DOT-approved 55-gallon drums to containerize any liquids generated during cleaning. The decontamination area would be bermed using a temporary wood frame for collection of decontamination fluid. A backhoe and minor equipment (power washer, tools, etc.) would be mobilized to the site to dredge the sediment from the focus areas in the ditch.

Dredging of Sediment. Sediment will be dredged using a backhoe from an area surrounding each sample location to a depth of approximately 2 foot bls. The human health risk assessment did not identify unacceptable risk based on exposure to sediment at the site. Therefore, the depth of excavation is 1 foot deeper than the depth of sediment sampled during the RI (i.e., 0 to 1 foot), thus ensuring that the "hot spots" are adequately removed. Excavated sediment (approximately 700 yd^3) would be transferred directly into DOT-approved 55-gallon drums for waste characterization and disposal. Approximately 14 to 16 drums would be needed to containerize 100 cubic feet of soil.

Waste Characterization. Prior to transportation of the dredged sediment off-site, two composite samples of the excavated material (one per focus area) would be collected and analyzed as required by FDEP and RCRA disposal regulations. The samples would be submitted for full RCRA characteristics, including ignitability, corrosivity, reactivity, TCLP metals, pesticides, herbicides, and PPL VOCs and SVOCs. In addition, one sample of the decontamination fluid from each focus area

would be collected and submitted for full RCRA characteristics. The analytical results from the dredged sediment and decontamination fluid would be forwarded to the off-site disposal facility for review and approval. Disposal of the dredged sediment and decontamination fluid will be in conformance with Navy, USEPA, and FDEP standards and regulations.

Transportation and Disposal of Dredged Sediment. Upon disposal approval from the Navy, the drummed sediment would be transported to a preapproved disposal facility. The drums will be labeled in accordance with DOT regulations and loaded onto fully placarded and DOT-approved transport vehicles.

Depending on the results of the waste characterization, dredged sediment may be eligible for disposal in a Subtitle D RCRA (solid waste) landfill. If the sediment is not eligible for disposal in a Subtitle D RCRA (solid waste) facility, then it would be transported to a Subtitle C RCRA (hazardous waste) land disposal facility. The costs for both disposal options are presented in the detailed analysis. These two options represent the lowest and highest cost scenarios for off-site disposal.

Backfilling the Excavation. Once contaminated sediment has been removed, the excavation area would be backfilled using Unified Soil Classification System-certified clean topsoil. The topsoil would be transported from a nearby off-site source to Site 8. The topsoil would be backfilled directly into the open excavation areas and spread and graded.

Site Restoration. Once the areas have been backfilled, seed and fertilizer would be added to promote vegetative growth. Hay would be used to protect the seed and fertilizer during initial development.

Decontamination pad materials would be removed and disposed of properly. Decontamination water would be sampled for full RCRA characteristics described previously. Depending on the waste characterization results, the decontamination fluid would be discharged to the ground surface at Site 8, transported to the onsite wastewater treatment plant, or disposed of off-site (if necessary). Equipment and vehicles used during construction would be demobilized.

5.6.2 Technical Assessment of Site 8, Sediment, Alternative 8SD2 This subsection provides the technical assessment of Site 8, Alternative 8SD2.

Overall Protection of Human Health and the Environment. This alternative would eliminate ecological receptor exposure to chemicals of concern in Site 8 sediment because the sediment would be dredged and disposed of off-site. Furthermore, the excavation would be backfilled using clean topsoil. As a result, risks posed to ecological receptors by potential exposure to sediment would be eliminated.

According to the RI (ABB-ES, 1997), ecological risks for exposure to the Site 8 focus area sediments exceed the FDEP TEL. Under this alternative, focus area sediment at Site 8 would be excavated and disposed of off-site.

Site restoration activities, such as grading, would promote uninterrupted surface water flow within the ditch and promote ecological rehabilitation and improve environmental quality.

Compliance with ARARs. This alternative would comply with both chemical-specific and action-specific ARARs, as waste characterization of the surface soil and decontamination fluid would be performed prior to off-site disposal. Table 5-7 is a summary of ARARs for Site 8 sediment. The analytical results of the waste characterization for excavated soil will determine which ARARs apply (i.e., whether or not hazardous waste regulations would apply) and the types of off-site facilities that can accept the waste.

Comparison of the concentrations of chemicals detected in Site 8 sediment to Universal Treatment Standards indicates that treatment of sediment prior to disposal would not be required. However, waste characterization results will determine whether the sediment can be disposed of in an RCRA Subtitle D (nonhazardous) disposal facility or RCRA Subtitle C (hazardous) disposal facility. Documentation, such as waste profile sheets and waste manifests, would be prepared in accordance with ARARs, as necessary.

Long-Term Effectiveness and Permanence. Under this alternative, sediment would be removed and transported off-site for disposal. In this manner, this alternative is effective in preventing further exposure by ecological receptors to focus area sediment at Site 8, as it is removed from the site.

Reduction of Toxicity, Mobility, and Volume through Treatment. Based on the small quantity of sediment to be dredged (approximately 560 yd^3), onsite treatment alternatives were not considered. As a result, the toxicity, mobility, and volume of waste would be reduced *onsite* for Site 8 focus area sediment because the waste would be transported and disposed of off-site.

Depending on the waste characterization results, off-site treatment may be required prior to land disposal in accordance with RCRA land disposal restrictions stated in Table 5-7. However, based on sampling data from the RI (ABB-ES, 1997), off-site treatment of focus area sediment prior to disposal does not seem likely. Furthermore, the chemical of concern at Site 8 (Aroclor-1260) is not land-ban restricted, and, therefore, is not subject to applicable treatment standards prior to land disposal.

If treatment is required, the toxicity, mobility, and volume would be reduced. If no treatment is required, the sediment would be disposed of in an appropriate disposal facility, and the toxicity, mobility, or volume of the waste would not be reduced.

Other off-site sediment disposal options exist, such as thermal desorption and sediment stabilization; however, these costs would most likely be between the low and high disposal costs presented in Table 5-8.

Short-Term Effectiveness. Through implementation of this alternative, there would be a total destruction of the ecological habitat in the dredged area; however, rapid restoration is anticipated. During dredging and sediment handling activities, site workers would wear personal protection equipment to address potential exposure to site-related contaminants. Because Site 8 is in a primarily industrial area, activities proposed under this alternative would not affect the surrounding community.

Implementability. This alternative is relatively easy to implement. This alternative involves mobilizing a backhoe and minor equipment to Site 8 to remove

Table 5-7
Synopsis of Federal and State Regulatory Requirements for Site 8

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Wastes (40 Code of Federal Regulations [CFR] Part 261)	Defines the listed and characteristic hazardous wastes subject to RCRA. Appendix II contains the Toxicity Characteristic Leaching Procedure (TCLP) used for testing contaminated sediments.	These regulations would apply when determining whether waste onsite is listed as hazardous, as defined in the regulations, or exhibits a hazardous characteristic based on the TCLP. Disposal option would also be determined based on the TCLP.	Chemical-specific Action-specific
RCRA, Regulations for Transporters of Hazardous Waste (40 CFR Part 263)	Establishes the responsibilities of transporters for handling, transporting, and managing hazardous wastes. To avoid duplicative regulation with Department of Transportation (DOT), U.S. Environmental Protection Agency (USEPA) has expressly adopted certain DOT regulations governing the transportation of hazardous materials (see entry directly below).	These regulations would apply if sediments from Site 8 needs to be deposited in an off-site hazardous waste disposal area.	Action-specific
Hazardous Materials Transportation Act Regulations (49 CFR Parts 171-179)	Establishes the procedures for packaging, labeling, and transporting of hazardous materials.	Same as above.	Action-specific
RCRA Regulations, Land Disposal Restrictions (40 CFR Part 268)	Identifies those wastes that are restricted from land disposal and defines those limited circumstances in which a prohibited waste may continue to be disposed of on land.	If a remedial action involves the thermal treatment of sediments, the treated sediments would have to meet the land disposal restriction for metals before being redeposited on the ground.	Action-specific
Florida Hazardous Waste Rules (Florida Administrative Code [FAC], 62-730)	Adopts by reference sections of the Federal hazardous waste regulations and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes.	These regulations would apply if sediments at Site 8 must be disposed of in a hazardous waste disposal area.	Action-specific Chemical-specific
Florida Petroleum Contaminated Site Cleanup Criteria (FAC, 62-770)	Establishes a cleanup process to be followed at all petroleum-contaminated sites.	Since this is a petroleum-contaminated site, the procedures for cleanup in this rule would apply.	Chemical-specific Action-specific
Florida Soil Thermal Treatment Facilities Regulations (FAC, 62-775)	Establishes criteria for the thermal treatment of petroleum or petroleum product-contaminated sediments. The rule outlines procedures for excavating, receiving, handling, and stockpiling contaminated sediments prior to thermal treatment in both stationary and mobile facilities.	If the contaminated sediment is sent to a thermal treatment facility, these regulations would apply.	Chemical-specific Action-specific
Soil Cleanup Standards for Florida, September 1995	The document provides guidance for determining sediment cleanup levels that can be developed on a site-by-site basis, using the calculations found in Table 1 of the document.	After thermal treatment is performed, the sediment would have to meet the goals in this guidance before it could be redeposited.	Chemical-specific Action-specific

Table 5-8
Site 8, Alternative 8SD2: Dredging and Off-Site Disposal of Sediment Cost

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Cost Item	Cost: RCRA Subtitle D Disposal (Solid Waste)	Cost: RCRA Subtitle C Disposal (Hazardous Waste)
DIRECT COST		
Site Preparation and Mobilization	$3,500	$3,500
Dredging of Sediment	$5,000	$5,000
Waste Characterization	$7,700	$7,700
Contaminant Delineation	$17,000	$17,000
Off-site Transportation and Land Disposal	$29,150	$339,500
Backfill Excavation Area	$2,300	$2,300
Site Restoration and Demobilization	$1,400	$1,400
Total Direct Cost	$66,050	$376,400
INDIRECT COST		
Health and Safety Plan	$7,500	$7,500
Preparation of a Workplan	$12,500	$12,500
Administration and Permitting Fees	$1,000	$2,000
Direct Cost Contingency (@ 20%)	$13,210	$75,280
Total Indirect Cost	$34,210	$97,280
TOTAL CAPITAL COST **(Direct Cost plus Indirect Cost)**	$100,300	$473,700
Operation and Maintenance Cost	$0	$0
TOTAL COST	$100,300	$473,700

Notes: RCRA = Resource Conservation and Recovery Act
% = percent.
@ = at.

focus area sediment. It is estimated that it would take approximately 1 to 3 days to conduct mobilization, site preparation, dredging, transportation and disposal, backfilling, and site restoration activities.

Furthermore, disposal of sediment is easy to implement. Several solid waste landfills exist in the Jacksonville area that accept nonhazardous soil. In addition, FDEP has an approved list of thermal treatment facilities, if off-site treatment is required. Finally, TSDFs exist in Alabama, if the soil is determined hazardous by waste characterization.

The implementation of this alternative may temporarily alter the natural surface water runoff through the ditch at Site 8, if any.

State Acceptance. Based on BCT meetings between the Navy, FDEP, and USEPA, removal of the focus area sediment from Site 8 was considered a viable solution. As a result, dredging and off-site disposal of the focus area sediment at Site 8 is an acceptable alternative for this FS.

Cost. The estimated present worth cost of Alternative 8SD2 is $100,300 to $473,700 and is presented in Table 5-8. A range of total costs is given based on disposal of soil and decontamination fluid as solid waste (RCRA Subtitle D) or hazardous waste (RCRA Subtitle C). Direct costs include site preparation and mobilization, excavation of focus area soil, waste characterization, off-site transportation and disposal, backfilling, site restoration, and demobilization. Indirect costs include preparation of a health and safety plan, workplan, administrative and permitting fees, and direct costs contingency. Because this alternative involves immediate removal action, long-term monitoring or O&M costs are not associated with this alternative.

CHAPTER 6.0

6.0 SUMMARY OF FS FOR OU 3

The remedial alternatives evaluated in Chapter 5.0 for Site 7 surface soil and Site 8 groundwater and sediment would accomplish the RAOs identified in Chapter 3.0. The RAOs were based on protection of humans from exposure, under current industrial and assumed future residential land use, to surface soil at Site 7 and groundwater consumption (assumed future land use) at Site 8, and protection of ecological receptors from exposure to Site 8 sediments.

For Site 7, excavation and off-site disposal of surface soil would eliminate human receptor exposure to soil because the surface soil would be excavated and disposed of off-site. Furthermore, the excavation would be backfilled using clean topsoil. As a result, risks posed to human receptors by potential exposure to surface soil would be eliminated.

For Site 8 groundwater, naturally occurring biological, physical, and chemical processes within the surficial aquifer would be relied on to reduce the concentrations of VOCs (in particular 1,1-DCE) in groundwater over time (i.e., natural attenuation). This alternative addresses the risk posed via ingestion of groundwater from the surficial aquifer by imposing institutional controls. Groundwater monitoring and modeling would provide a means of assessing the degradation rate of contaminants and duration of the alternative.

For Site 8 sediment, dredging and off-site disposal of sediment would eliminate ecological receptor exposure to sediment because the sediment would be dredged and disposed of off-site. Furthermore, the excavation would be backfilled using clean topsoil. As a result, risks posed to ecological receptors by potential exposure to sediment would be eliminated.

These remedial alternatives for Sites 7 and 8 were evaluated in Chapter 5.0 using the technical criteria recommended by the NCP. Upon completion of this evaluation, the CERCLA RI/FS guidance manual indicates that a comparative analysis of the identified alternatives should be completed. This comparison typically provides the technical information required to support the selection of a preferred alternative. Table 6-1 presents a summary of detailed analysis and comparison of alternatives for OU 3, Site 7 and Site 8.

Table 6-1
Comparative Analyses of Remedial Alternatives

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Alternative	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection to Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume of Contaminants	Short-Term Effectiveness	Implementability	Cost
Alternative 7SS1 Site 7, Surface Soils-No Action	Protects by means of property deed restrictions.	Does not comply with the chemical-specific ARARs.	Not effective over the long term.	Natural transformation processes (physical, chemical, and biological) are anticipated to reduce the toxicity, mobility, and volume of contaminants.	Contaminated soil is left onsite. Not effective over the short term.	Does not require any resources to implement "no action."	$0
Alternative 7SS2 Site 7, Surface Soils-Excavation and Off-site Disposal	Provides overall protection to human health and the environment.	Complies with the ARARs.	Provides long-term effectiveness.	Reduces the toxicity, mobility, and volume of contaminants.	Provides short-term effectiveness.	Excavation and off-site disposal are implementable.	Residential land use $530,100 to $5,422,900. Industrial land use $221,300 to $2,025,200
Alternative 8GW1 Site 8, Groundwater-No Action	Does not protect human health. No threat for the environment.	Eventually complies with the chemical-specific ARARs. Anticipated to take 20 to 30 years, however, may not be verified.	Anticipated to be effective over the long term, however, may not be verifiable.	Natural transformation processes (physical, chemical, and biological) are anticipated to reduce the toxicity, mobility, and volume of contaminants.	Contaminated groundwater is left onsite. Not effective over the short term.	Easy to implement.	$ 0
Alternative 8GW2 Site 8, Groundwater-Natural Attenuation	Use of groundwater models to implement the groundwater use restrictions and provide protection to human health.	Eventually complies with the chemical specific ARARs. Anticipated to take 20 to 30 years.	Anticipated to be effective over the long term.	Natural transformation processes (physical, chemical, and biological) are anticipated to reduce the toxicity, mobility, and volume of contaminants.	Contaminated groundwater is left onsite. Not effective over the short term.	Easy to implement.	$465,000

See notes at end of table.

Table 6-1 (Continued)
Comparative Analyses of Remedial Alternatives

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Alternative	Threshold Criteria		Primary Balancing Criteria				
	Overall Protection to Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume of Contaminants	Short-Term Effectiveness	Implementability	Cost
Alternative 8SD1 Site 8, Sediment No Action	No threat to human health at Site 8 sediments. No protection to ecological receptors is provided.	Will not meet chemical-specific ARARs.	Not effective over the long term.	Will not reduce the toxicity, mobility, and volume of the contaminants.	Contaminated sediments are left onsite. Not effective over the short term.	Does not require any resources to implement "no action."	$ 0
Alternative 8SD2 Site 8, Sediment-Dredging and Off-Site Disposal	Provides overall protection to human health and the environment.	Complies with the ARARs.	Provides long-term effectiveness.	Reduces the toxicity, mobility, and volume of contaminants.	Provides short-term effectiveness.	Excavation and off-site disposal are implementable.	$100,300 to $473,700

Note: ARAR = applicable or relevant and appropriate requirement.

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APPENDIX A

APPENDIX A

LIST OF HHCPCs AND ECPCs AT SITE 7 AND SITE 8 MEDIA OF CONCERN

Table A-1
Human Health Contaminants of Potential Concern in Surface Soil Associated with Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analytical Parameter	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations[2]	Mean[3]	Background Screening Concentration[4]	Risk-Based Concentration[5]	FDEP Soil Cleanup Goals[6]	HHCPC? (Yes/No)	Reason[7]
Volatile Organic Compounds (mg/kg)									
Acetone	13/20	0.011 to 0.013	0.002 to 0.011	0.0043	NA	780	260	No	S, G
Semivolatile Organic Compounds (mg/kg)									
2-Methylnaphthalene	1/46	0 35 to 7.2	0.2	0.2	NA	310	960	No	S, G
4-Nitroaniline	1/20	0.86 to 1.1	0.11 to 0.11	0.11	NA	23	230	No	S, G
Acenaphthene	7/46	0.35 to 7.2	0 029 to 2.1	0.46	NA	470	2,800	No	S, G
Acenaphthylene	3/46	0.35 to 7.2	0.022 to 0.088	0.047	NA	230	670	No	S, G
Anthracene	13/46	0.35 to 7.2	0.029 to 5.6	0.69	NA	2,300	20,000	No	S, G
Benzo(a)anthracene	29/46	0.35 to 7.2	0.021 to 32	2.1	NA	0.88	1.40	Yes	
Benzo(a)pyrene	30/46	0.35 to 7.2	0.031 to 29	2.1	NA	0.088	0.10	Yes	
Benzo(b)fluoranthene	31/46	0.35 to 7.2	0.022 to 45	3.2	NA	0.88	1.4	Yes	
Benzo(g,h,i)perylene	28/46	0.35 to 7.2	0.025 to 9.4	0.95	NA	230	14	No	S, G
Benzo(k)fluoranthene	30/46	0.35 to 7.2	0.023 to 16	1.1	NA	8.8	14	Yes	
Butylbenzylphthalate	5/20	0.35 to 0.44	0.084* to 1.1	0.33	NA	1,600	15,000	No	S, G
Carbazole	6/20	0.35 to 0.44	0.047 to 0.86	0.21	NA	32	42	No	S, G
Chrysene	30/46	0.35 to 7.2	0.024 to 33	2	NA	88	140	Yes	C
Di-n-butylphthalate	18/20	0.35 to 0.44	0.049* to 3.4	0.32	NA	780	7,300	No	S, G
Di-n-octylphthalate	2/20	0.35 to 0.44	0.020 to 0.14	0.08	NA	160	1,500	No	S, G
Dibenz(a,h)anthracene	20/46	0.35 to 7.2	0.018 to 3.5	0.43	NA	0.088	0.10	Yes	
Dibenzofuran	2/20	0.35 to 0.44	0.024 to 0.12	0.072	NA	31	240	No	S, G
Dimethylphthalate	1/20	0.35 to 0.44	0.14	0.14	NA	78,000	630,000	No	S, G
Fluoranthene	30/46	0.35 to 7.2	0.032 to 59	3.4	NA	310	2,900	No	S, G

See notes at end of table.

Table A-1 (Continued)
Human Health Contaminants of Potential Concern in Surface Soil Associated with Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analytical Parameter	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations[2]	Mean[3]	Background Screening Concentration[4]	Risk-Based Concentration[5]	FDEP Soil Cleanup Goals[6]	HHCPC? (Yes/No)	Reason[7]
Semivolatile Organic Compounds (mg/kg) (Continued)									
Fluorene	4/46	0.35 to 7.2	0.038 to 0.36	0.14	NA	310	2,400	No	S, G
Indeno(1,2,3-cd)pyrene	28/46	0.35 to 7.2	0.022 to 14	1.2	NA	0.88	1.4	Yes	
Naphthalene	1/46	0.35 to 7.2	0.047	0.047	NA	310	0.1[8]	No	S, G
Phenanthrene	17/46	0.35 to 7.2	0.026 to 30	2.8	NA	230	1,700	No	S, G
Phenol	1/22	0.35 to 1.4	0.023	0.023	NA	4,700	34,000	No	S, G
Pyrene	30/46	0.35 to 7.2	0.022 to 51	3	NA	230	2,200	No	S, G
bis(2-Ethylhexyl)phthalate	14/20	0.35 to 0.44	0.022 to 0.88	0.16	NA	46	48	No	S, G
Pesticides and PCBs (mg/kg)									
4,4'-DDD	3/19	0.0035 to 0.019	0.00058* to 0.0058	0.0026	NA	2.7	4.5	No	S, G
4,4'-DDE	13/19	0.0035 to 0.019	0.00026 to 0.026	0.0044	NA	1.9	3.00	No	S, G
4,4'-DDT	9/19	0.0035 to 0.019	0.001 to 0.041	0.01	NA	1.9	3.10	No	S, G
Aroclor-1260	2/19	0.035 to 0.19	0.024 to 0.03	0.027	NA	0.319	0.90	No	S, G
gamma-Chlordane	1/19	0.0018 to 0.010	0.00051	0.00051	NA	[8]0.49	[8]0.80	No	S, G
Inorganic Analytes (mg/kg)									
Aluminum	20/20	40	1,120 to 3,170	1,890	29,086	7,800	75,000	No	S, G, B
Antimony	3/34	12	0.67 to 37.5	13	ND	3.1	26	Yes	
Arsenic	6/41	2 to 20	0.53 to 7.5	2.6	3.4	[9]0.43	0.8	Yes	
Barium	20/20	40	3.4 to 177	35.6	21	550	5,200	No	S, G
Cadmium	11/20	1	0.29 to 14.5	2.1	ND	3.9	37	Yes	
Calcium	20/20	1,000	900* to 44,700	12,400	ND	1,000,000	NSC	No	S
Chromium	20/20	2	1.7* to 35.4	6.1	31.2	[10]39	[10]290	No	S, G
Cobalt	7/20	10	0.33 to 2.8*	1.2	ND	470	4,700	No	S, G
Copper	20/20	5	0.51 to 90	9.7	ND	310	NSC	No	S
Iron	20/20	20	372 to 12,100	1,600	8060	2,300	NSC	Yes	
Lead	26/26	0.6 to 30	4.5 to 178,000	6,895	15.6	[11]400	500	Yes	
Magnesium	19/20	1,000	82 to 2,500	539	474	460,468	NSC	No	S

See notes at end of table.

Table A-1 (Continued)
Human Health Contaminants of Potential Concern in Surface Soil Associated with Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analyte	Frequency of Detection[1]	Range of Reporting Limits	Range of Detected Concentrations[2]	Mean[3]	Background Screening Concentration[4]	Risk-Based Concentration[5]	FDEP Soil Cleanup Goals[6]	HHCPC? (Yes/No)	Reason[7]
Inorganic Analytes (mg/kg) (Continued)									
Manganese	20/20	3	10.9 to 118	43.1	17	180	370	No	S, G
Mercury	1/20	0.1	0.19	0.19	ND	2.3	23	No	S, G
Nickel	18/20	8	0.65 to 10	2.2	7.2	160	1,500	No	S, G
Potassium	12/20	1,000	25.8 to 672	200	310	1,000,000	NSC	No	S
Silver	1/20	2	2.4	2.4	ND	39	390	No	S, G
Sodium	18/20	1,000	176* to 251	210	ND	1,000,000	NSC	No	S
Thallium	1/20	2	5.2	5.2	ND	[12]0.63	NSC	Yes	
Vanadium	20/20	10	1.6 to 7.4	3.6	34.2	55	490	No	B, S, G
Zinc	13/20	4	16 4 to 107	45.2	40.4	2,300	23,000	No	S, G
Total Recoverable Petroleum Hydrocarbons (TRPH) (mg/kg)									
TRPH	19/20	10 to 100	13 to 1,400	280	NA	NSC	380	Yes	

See notes at end of table

Table A-1 (Continued)
Human Health Contaminants of Potential Concern in Surface Soil Associated with Site 7

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Frequency of detection is the number of samples in which the analyte was detected over the total number of samples analyzed (excluding rejected values).
[2] The value indicated by an asterisk is the average of a sample and its duplicate. For duplicate samples having one nondetect value, 1/2 the contract-required quantitation limit/contract-required detection limit is used as a surrogate.
[3] Per U.S. Environmental Protection Agency (USEPA) Region IV Guidance, the mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples with "R", "U", or "UJ" validation qualifiers.
[4] The background screening value is twice the average of detected concentrations for inorganics in background samples.
[5] For all chemicals except the essential nutrients (calcium, magnesium, potassium, and sodium). USEPA Region III Risk-Based Concentration (RBC) table for residential surface soil exposure per January 1993 guidance (Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening, EPA/903/R-93-001) was used for screening. Actual values are taken from the USEPA Region III RBC Tables dated January 1997, which are based on a cancer risk of 10^{-6} and an adjusted hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (see General Information Report).
[6] FDEP memoranda "Soil Cleanup Goals for Florida," dated September 29, 1995, and "Applicability of Soil Cleanup Goals for Florida," dated January 19, 1996. # = value is based on leaching value because analyte was selected as an HHCPC in groundwater. TRPH cleanup target levels are from draft technical report dated February, 1997.
[7] Analyte was included or excluded from the risk assessment for the following reasons:

B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations and will not be considered further.
S = the maximum detected concentration did not exceed the risk-based screening concentration and will not be considered further.
G = the maximum detected concentration did not exceed the Florida Guidance concentration and will not be considered further.
C = Per USEPA Region IV guidance, the analyte is a member of carcinogenic polycyclic aromatic hydrocarbons that have other members selected as HHCPC and should be retained for evaluation.

[8] The value is based on a mixture of Chlordane isomers.
[9] The value is based on arsenic as a carcinogen.
[10] The value is based on hexavalent chromium form.
[11] The value for lead is based on the USEPA Office of Solid Waste and Emergency Response Directive No. 9355.4-12 "Revised Interim Soil Lead Guidance for Comprehensive Environmental Response, Compensation, and Liability Act Sites and Resource Conservation and Recovery Act Corrective Action Facilities" (USEPA, 1994).
[12] The value is based on thallium sulfate.

Notes: The average of a sample and its duplicate is used for all table calculations.
Sample locations include CF7SS1 through CF7SS20, CF7SS21 through CF7SS26 (lead only), and CF7SS27 through CF7SS40 (polynuclear aromatic hydrocarbons [PAHs], arsenic and antimony only), CF7SS41 through CF7SS47 (PAHs and arsenic), and CF7SS48 through CF7SS52 (PAHs only).
Duplicate sample locations include CF7SS10D, CF7SS19D, and CF7SS34D.
Background sample locations include CEFBSS01, CEFBSS02, CEFBSS02D(Duplicate), CEFBSS03, and CEFBSS04.
Boldface analytical parameters were selected as HHCPCs.

FDEP = Florida Department of Environmental Protection.
HHCPC = human health chemical of potential concern.
mg/kg = milligrams per kilogram.
* = average of a sample and its duplicate.
NA = not appropriate.
NSC = no screening concentration available.
PCB = polychlorinated biphenyl.
DDD = dichlorodiphenyldichloroethane.
DDE = dichlorodiphenyldichloroethene.
DDT = dichlorodiphenyltrichloroethane.
ND = not detected in any background samples.

Table A-2
Human Health Contaminants of Potential Concern in Site 8 Unfiltered Groundwater

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analytical Parameter	Frequency of Detection[1]	Range of Lower Reporting Limits	Range of Detected Concentrations[2]	Mean[3]	Background Screening Concentration[4]	Risk-Based Concentration[5]	FDEP Guidance Concentration[6]	HHCPC? (Yes/No)	Reason[7]
Volatile Organic Compounds (µg/ℓ)									
1,1,1-Trichloroethane	1/20	1 to 33	57*	57	NA	79	200	No	S, G
1,1-Dichloroethane	4/20	1 to 33	2 to 370*	110	NA	81	700	Yes	
1,1-Dichloroethene	4/20	1 to 33	2 to 95*	31.5	NA	0.044	7	Yes	
2-Butanone	1/20	2 to 33	7.5*	7.5	NA	190	4,200	No	S, G
4-Methyl-2-pentanone	2/20	2 to 33	2 to 3.5*	2.8	NA	290	350	No	S, G
Benzene	2/20	1 to 17	1*	1	NA	0.36	1	Yes	
Ethylbenzene	2/20	1 to 17	3* to 4	3.5	NA	130	30	No	S, G
Toluene	3/20	1 to 33	3.5 * to 48*	19.5	NA	75	40	Yes	
Xylenes (total)	3/20	1 to 33	10* to 23	15.3	NA	1,200	20	Yes	
Semivolatile Organic Compounds (µg/ℓ)									
2-Methylnaphthalene	4/20	10	0.7 to 25*	15.6	NA	*150	NS	No	S
4-Methylphenol	1/20	10	44*	44	NA	18	35	No	F
Anthracene	1/20	10	2.75*	2.8	NA	1,100	2,100	No	S, G
Naphthalene	5/20	10	0.5 to 36.5*	18.3	NA	150	6.8	Yes	
Phenol	1/20	10	0.6	0.6	NA	2,200	10	No	S, G
***bis*(2-Ethylhexyl)phthalate**	12/20	10	0.9 to 12	4.6	NA	4.8	6	Yes	
Pesticides and PCBs (µg/ℓ)									
4,4-DDD	1/19	0 1 to 500.25	0.17*	0.17	NA	0.28	0.1	Yes	
4,4-DDT	1/19	0.1 to 500.25	0.19*	0.19	NA	0.2	0.1	Yes	
Aldrin	1/18	0.01 to 0.25	0.003	0.003	NA	0.004	0.05	No	S, G

See notes at end of table.

Table A-2 (Continued)
Human Health Contaminants of Potential Concern in Site 8 Unfiltered Groundwater

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analytical Parameter	Frequency of Detection[1]	Range of Lower Reporting Limits	Range of Detected Concentrations[2]	Mean[3]	Background Screening Concentration[4]	Risk-Based Concentration[5]	FDEP Guidance Concentration[6]	HHCPC? (Yes/No)	Reason[7]
Pesticides and PCBs (µg/ℓ) (Continued)									
Endosulfan II	1/18	0.1 to 500.25	0.14*	0.14	NA	[9]22	[8]0.35	No	S, G
Endosulfan sulfate	1/19	0.1 to 1,000	250*	250	NA	[9]22	0.3	Yes	
Methoxychlor	1/19	0.5 to 2,501.25	0.96*	0.96	NA	18	40	No	S, G
Inorganic Analytes (µg/ℓ)									
Aluminum	6/20	200	415 to 15,300	4,140	776	3,700	200	Yes	
Arsenic	1/20	10	3.6	3.6	9.8	[10]0.045	50	No	B,G
Barium	14/20	200	16.8 to 42.4	27.3	41.2	260	2,000	No	S, G
Calcium	19/20	5,000	396 to 52,500	14,500	380	1,000,000	NS	No	S
Chromium	3/20	10	2.6* to 26.2	11.5	70	[11]18	[12]100	No	B
Copper	2/20	25	6.55* to 12.1*	9.3	113.6	150	1,000	No	B
Cyanide	3/20	10	2 to 2.1	2	ND	73	200	No	S, G
Iron	20/20	100	222 to 3,270	1,230	450	1,100	300	Yes	
Magnesium	20/20	5,000	264 to 12,800	2,480	1,290	119,000	NS	No	S
Manganese	17/20	15	2.1 to 48.7	25.5	9.8	84	50	No	S, G
Nickel	3/20	40	5 to 12.5*	9.7	32	73	100	No	B
Potassium	19/20	5,000	166 to 7,980	1,360	1,576	297,000	NS	No	S
Selenium	3/20	5	3.7* to 6.05*	4.6	ND	18	50	No	S, G
Sodium	20/20	5,000	1,220 to 13,100	5,430	1,150	396,000	160,000	No	S, G
Vanadium	8/20	50	1.1 to 23.8	7.6	96	26	49	No	B
Zinc	2/20	20	44.5 to 96.2	70.4	4.8	1,100	5,000	No	S, G
Total Recoverable Petroleum Hydrocarbons (TRPH) (µg/ℓ)									
TRPH	3/20	500 to 1,00	600 to 2,250*	1,500	NA	NS	[13]5,000	No	G

See notes at end of table.

Table A-2 (Continued)
Human Health Contaminants of Potential Concern in Site 8 Unfiltered Groundwater

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

[1] Frequency of detection is the number of samples in which the analyte was detected over the total number of samples analyzed (excluding rejected values).
[2] The value indicated by an asterisk is the average of a sample and its duplicate. For duplicate samples having one nondetect value, 1/2 the contract-required quantitation limit/contract-required detection limit is used as a surrogate.
[3] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples with "R", "U", or "UJ" validation qualifiers.
[4] The background screening value is twice the average of detected concentrations for inorganics in background samples.
[5] For all chemicals except the essential nutrients (calcium, magnesium, potassium, and sodium). U.S. Environmental Protection Agency (USEPA) Region III Risk-Based Concentration (RBC) table for tap water exposure per January 1993 guidance (Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening, EPA/903/R-93-001) was used for screening Actual values are taken from the USEPA Region III RBC Tables dated January 1997, which are based on a cancer risk of 10- and an adjusted hazard quotient of 0.1. For the essential nutrients, screening values were derived based on recommended daily allowances (see the General Information Report).
[6] The values are from FDEP "Groundwater Water Guidance Concentrations," dated June 1994. When both primary and secondary standard is available for a parameter, the more stringent standard is used.
[7] Analyte was included or excluded from the risk assessment for the following reasons:

B = the maximum detected concentration did not exceed twice the arithmetic mean of detected concentrations at background locations and will not be considered further.
S = the maximum detected concentration did not exceed the risk-based screening concentration and will not be considered further.
G = the maximum detected concentration did not exceed the Florida guidance concentration and will not be considered further.
F = frequency of detection was equal to 5 percent and was not an HHCPC in other media.
R = no risk-based screening value is available; therefore, the analyte was retained as an HHCPC.

[8] The RBC value for this polynuclear aromatic hydrocarbon is not available; the RBC value for naphthalene is used as a surrogate.
[9] The value is based on a mixture of endosulfan isomers.
[10] The value is based on arsenic as a carcinogen.
[11] The value is based on hexavalent chromium form.
[12] The value is based on trivalent chromium form.
[13] The value is based on criteria established by FDEP in the document 62-770 titled "Petroleum Contamination Site Cleanup Criteria," dated February 21, 1990.

Notes: The average of a sample and its duplicate is used for all table calculations.
Sample locations include CF8MW1S, CF8MW2I, CF8MW3D, CF8MW4S, CF8MW5S, CF8MW6S, CF8MW7S, CF8MW8I, CF8MW9S, CF8MW10S, CF8MW11D, CF8MW12S, CF8MW13S, CF8MW14I, CF8MW15D, CF8MW16S, CF8MW17S, CF8MW18S, CF8MW19I, and CF8MW20D.
Duplicate sample locations include CF8MW4SD, CF8MW10SD, and CF8MW13SD.
Background sample locations include CFBKMW1S, CFBKMW2S, CFBKMW4S, CFBKMW5S, CFBKMW7S, and CFBKMW8S.
Background duplicate sample location is CFBKMW4SD.
Boldface analytical parameter was selected as an HHCPC.

FDEP = Florida Department of Environmental Protection.
HHCPC = human health chemicals of potential concern.
$\mu g/\ell$ = micrograms per liter.
* = average of a sample and its duplicate.
NA = not applicable.
PCB = polychlorinated biphenyl.
DDD = dichlorodiphenyldichloroethane.
DDT = dichlorodiphenyltrichloroethane.
ND = not detected in any background samples.
NS = no standard available.

Table A-3
Ecological Contaminants of Potential Concern in Site 8 Sediment[1]

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analytical Parameter	Frequency of Detection[2]	Range of Lower Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[3]	Region IV Chronic Sediment Screening Value[4]	Background Sediment Concentration[5]	Contaminant of Ecological Concern?[6]	Average of All Concentrations[7]	Exposure Point Concentrations	
									Maximum[8]	Average[8]
Volatile Organic Compounds (mg/kg)										
Acetone	1/4	0.013 to 0.025	0.055	0.055	NA	NA	Yes A/W	0.021	0.055	0.021
2-Butanone	1/4	0.013 to 0.015	0.0030	0.0030	NA	0.021	Yes A/W	0.0060	0.0030	0.0030
Semivolatile Organic Compounds (mg/kg)										
Di-n-butylphthalate	3/4	0.42 to 0.50	0.029 to [10]0.13 (0.43U/0.035)	0.062	NA	0.13	Yes A/W	0.10	0.13	0.10
Pesticides and PCBs (mg/kg)										
Aroclor-1260	1/4	0.042 to 0.050	0.038	0.038	0.033	NA	Yes A/W	0.027	0.038	0.027
Inorganic Analytes (mg/kg)										
Aluminum	4/4	40	566 to 13,200	5,090	NA	19,700	No[11]			
Barium	3/4	40	2.7 to 5.6	3.7	NA	12	No[11]			
Chromium	4/4	2	2.8 to 17	7.6	52	20	No[11,12]			
Copper	2/4	5	1.2 to 3.1	2.2	18.7	3.2	No[11,12]			
Iron	4/4	20	176 to 526 [10](491/560)	323	NA	1,500	No[11]			
Lead	1/4	0.6	8	8	30.2	14	No[11,12]			
Magnesium	2/4	1,000	[10]53 (49.2/56) to 65.4	59	NA	176	No[11,13]			
Manganese	3/4	3	[10]1.6 (3U/1.7) to 2.3	2	NA	5.6	No[11]			
Nickel	4/4	8	0.66 to 2.6	1.2	15.9	5.2	No[11,12]			
Potassium	1/4	1,000	65.4	65.4	NA	65	No[13]			
Sodium	3/4	1,000	132 to 171	153	NA	338	No[11,13]			
Vanadium	4/4	10	0.83 to 9.3	5.6	NA	9.6	No[11]			
Zinc	1/4	4	32.1	32.1	124	NA	Yes W[12]	9.5	32.1	9.5

See notes at end of table.

Table A-3 (Continued)
Ecological Contaminants of Potential Concern in Site 8 Sediment[1]

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Analytical Parameter	Frequency of Detection[2]	Range of Lower Detection Limits	Range of Detected Concentrations	Average of Detected Concentrations[3]	Region IV Chronic Sediment Screening Value[4]	Background Sediment Concentration[5]	Contaminant of Ecological Concern?[6]	Average of All Concentrations[7]	Exposure Point Concentrations	
									Maximum[8]	Average[9]
General Chemistry (mg/kg)										
Total organic carbon	4/4	130 to 760	5,100 to 17,000	8,900	NA	NA	NA	8,900	NA	NA
Total recoverable petroleum hydrocarbons	4/4	13 to 72	31 [10](22/39) to 85	58	NA	54	Yes A/W	58	85	58

[1] Sample locations include CF8SD3, CF8SD4, CF8SD6, CF8SD7, and CF8SD7D.
[2] Frequency of detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.
[3] Arithmetic mean of all samples in which analyte was detected.
[4] U.S. Environmental Protection Agency (USEPA) Region IV Waste Management Division Sediment Screening Values (USEPA, 1995b).
[5] Background sample locations include CF8SD2 and CF8SD5.
[6] A = Ecological Contaminant of Potential Concern (ECPC) for aquatic receptors. W = ECPC for wildlife receptors.
[7] The average of all concentrations assigns a value of one-half the sample quantitation limit to all nondetects.
[8] Maximum exposure point concentrations (EPCs) are equal to the maximum detected concentration. The 95th percent upper confidence limit was not calculated because there are fewer than 10 samples in the data set.
[9] Average EPCs are equal to the arithmetic mean of all concentrations. If the arithmetic mean of all concentrations was greater than the maximum EPC, then the maximum EPC was used instead.
[10] This value was obtained after averaging a duplicate pair.
[11] Maximum analyte concentration is below the arithmetic mean background sediment concentration.
[12] Maximum analyte concentration is below the Region IV chronic surface water screening value.
[13] Analyte is an essential nutrient, and is not considered toxic except at high concentrations.

Note: mg/kg = milligrams per kilogram.
NA = not available.
U = not detected.
PCB = polychlorinated biphenyl.

Table A-4
Risk Characterization for Aquatic Receptors at Site 8

Feasibility Study, Operable Unit 3
Naval Air Station Cecil Field
Jacksonville, Florida

Sample Location	Biological Parameters		ECPCs			Interpretation of Weight-of-Evidence
	Sediment Laboratory Toxicity Testing	Benthic Community[1]	Surface Water	Sediments	Ground-water	
CF-8-SW/SD1	No toxicity	Expected condition	NE	NE[2]	NE	Not a suitable reference location; therefore, not used in the Site 8 ERA.
CF-8-SW/SD2	No toxicity	Less than expected condition	NE	NE	NE	Used as an upstream reference location in the Site 8 ERA. Less than expected benthic community composition likely caused by poor physical habitat quality.
CF-8-SW/SD3	52% midge mortality, and reduced midge growth, 46% amphipod mortality	NE	No risk	Aroclor-1260, TRPH	No risk	Sediment toxic to certain benthic receptors. Toxicity may be associated with exposure to TRPH and Aroclor-1260.
CF-8-SW/SD4[3]	52% midge mortality, 90% amphipod mortality, and reduced midge and amphipod growth	NE	No risk	Aroclor-1260, TRPH	No risk	Sediment toxic to certain benthic receptors. Toxicity may be associated with exposure to TRPH and Aroclor-1260.
CF-8-SW/SD5	NE	NE	NE	NE	NE	Used as an upstream reference location in the Site 8 ERA.
CF-8-SW/SD6	NE	NE	No risk	TRPH	No risk	No significant risks estimated; however, TRPH in sediment may cause risk to certain benthic in fauna.
CF-8-SW/SD7	67% midge mortality, and reduced midge growth	NE	No risk	No risk	No risk	No significant risks estimated or attributable to a particular chemical.

[1] Macroinvertebrate and sediment toxicity data interpretation confounded by lack of suitable reference location and overall poor habitat quality.
[2] Aroclor-1260 detected at 110 micrograms per kilogram.
[3] Adverse effects observed in sediment toxicity test associated with TRPH detected at 660 milligrams per kilogram from the February 1995 sample.

Notes: ECPC = ecological contaminant of potential concern.
NE = not evaluated.
ERA = ecological risk assessment.
% = percent.
TRPH = total recoverable petroleum hydrocarbons.

PROJECT	COMP. BY	JOB NO.
OU3, Site 7 Surface Soil, Alternative 7SS2 NAS Cecil Field, Jacksonville, Florida	KGK	8544-75
	CHK. BY BSS	DATE 8/15/97

Residential Land Use Scenario:

Volume (inplace) of the Surface Soil to be excavated

$= 66{,}640\ ft^2 \times 2\ ft$

$= 133280\ ft^3$

$= 4936\ CY$

Assume Bulking factor for Sand + silty sand $= 1.5$

Hence Volume to be transported $= 4936 \times 1.5\ CY = \underline{\underline{7404\ CY}}$

COST ESTIMATE

	Qty	Unit	Cost
1. Site Preparation			
Mobe - Backhoe, tools, etc	1	L.S	$ 1,000
Decon Pad Materials			
6 mil Plastic	4 rolls	$ 100	$ 400
Wood framing	1	L.S	$ 200
Power Washer (Rental)	2 wks.	$ 500/wk	$ 1,000
Labor Mobe & Setup			
3 men @ 6 hrs @ $40/hr	18 hrs.	$ 40/hr	$ 720
Perdiem (3 men @ 2 days)	6 days	$ 100/d	$ 600
Car Rental (2 wks)	2 wks.	$ 300/wk	$ 600
Miscellaneous tools, tape, supplies	1	L.S.	$ 1,000
	Subtotal		$ 5,520

ABB Environmental Services, Inc.

PROJECT	COMP. BY	JOB NO.
Soil Alternative 7552 – Residential Landuse Scenario	KGK	8544-75
	CHK. BY BJS	DATE 8/15/97.

	QTY	Unit	Cost
2. Excavate Soil			
Backhoe Eq operator	2 wks	$ 1500/wk	$ 3,000
Conveyor Equipment	2 wks	$ 3000/wk	$ 6,000
Decon Equipment	72 hrs	$ 40/hr.	$ 2,880
Labor @ 3 men @ 24 hrs.			
			$ 11,880
3. Waste Characterization			
Soil Full RCRA Chemicals			
5 per first 1000 cy then 1 per 500 cy.			
5 + (7404 − 1000)/500 = 18 samples.		$ 1200/sample	$ 21,600
1 DW 12 Drums. (1 Drum/day)	2 samples	$ 1200/sample	$ 2,400
ODC – orders, Fedex, Supplies, etc	1	L.S.	$ 1,000
			$ 25,000
4. Transportation and Disposal			
Pickup charge	1	L.S.	$ 1000
Approval Fee	1	L.S.	$ 200
(a) Non-Haz Soil	7404 cy	$ 50/cy	$ 370,200
Non-Haz IDW	12 Drums	$ 40/Drum	$ 480
(b) Haz Soil	7404 cy	$ 600/cy	$ 4,442,400
Haz IDW	12 Drums	$ 400/Drum	$ 4800
			$ 371,880 – $ 4,448,400

ABB Environmental Services, Inc.

PROJECT	COMP. BY	JOB NO.
Soil Alternative - 7552 Residential Land	KGR	8544-75
	CHK. BY BJF	DATE

	Qty	Unit	Cost
5. Backfill			
Top Soil Furnished & Delivered	1	LS	$ 1000
Labor 5 men @ 25 hrs.	125 hrs.	$ 40/hr.	$ 5,000
			$ 6,000
6. Site Restoration & Demob.			
Vegitative Cover	1	LS	$ 2000
Decon pad Removal	1	LS	$ 400
Demob	1	LS	$ 1000
			3,900
Total Direct Cost	$ 424,180	—	$ 4,500,700

PROJECT	COMP. BY	JOB NO.
OU3 Site 7 Surface Soil, Alternative 7SS2 NAS Cecil Field Jacksonville, Florida	KGK	8544-75
	CHK. BY BJF	DATE 8/15/97

Industrial Land Use Scenario.

Volume (in place) of the Surface Soil to be excavated

$= 24,577 \text{ ft}^2 \times 2 \text{ ft}$

$= 49,\cancel{514}\ 154 \text{ ft}^3$

$= 49,\cancel{514}\ 154 \text{ ft}^3 \times \frac{\text{yd}^3}{27 \text{ ft}^3}$

$= 1820 \text{ yd}^3$

Bulking factor $= 1.5$

Bulk volume to be transported $= 1820 \times 1.5 = \underline{2730 \text{ CY}}$

COST ESTIMATE

1. Site Preparation.	Qty	Unit	Cost
Mobe = Backhoe, tools etc	1	LS.	$ 1000
Decontpd Materials 6 mil Plastic	2 rolls	$ 100/r	$ 200
Wood framing	1	LS.	$ 200
Labor, Mobe & Setup 2 men @ 4 hrs. @ $40/hr.	8 hrs.	$ 40/hr.	$ 320
Perdiem (2 men @ 2 days.)	4 days.	$ 100/d.	$ 400
Car Rental 1 wk.	1 wk.	$ 300/wk	$ 300.
Misullenous, Tools, Tape & Supplies	1	LS.	$ 500
			$ 2920

2. Excavate Soil			
Backhoe + operator	1 wk	$ 1500/wk	$ 1500
Conveying Equipment	1 wk	$ 3000/wk	$ 3000
Decon (Labor 2 men @ 16 hrs)	32 hrs.	$ 40/hr.	$ 1280
			$ 5780

ABB Environmental Services, Inc.

R 4

PROJECT	COMP. BY	JOB NO.
Site 7, Surface Soil Alternative 7552 Industrial Land use Scenario	KGK	8544-75
	CHK. BY BBS	DATE 8/15/97

	Qty	Unit	Cost
3. Waste Characterization			
Soil Full RCRA chemicals			
5 samples first 1000 cy, 1 per 500 cy.			
5 + (2731-1000)/500 = 9 samples.			
	9 Smp	$1200/s	$10,800
1DW 1 Drum.	2 Smp	$1200/s	$2,400
ODC	1	LS.	$1000
			$14,200
4. Transportation and Disposal.			
Pickup charge	1	LS	$1000
Approval Fee	1	LS	$200
(a) Non Haz - Soil	2731 cy	$50/cy	$136,550
Non Haz - 1DW.	1 Drm.	$40/Dr	$40
(b) Haz Soil	2731 cy	$600/cy.	$1,638,600
Haz - 1DW	1 Drm.	$400	$400
		$137,790 =	$1,640,200
5. Backfill			
Top Soil Furnished.	1	LS.	$1000
Labor @ 2 men @ 25 hrs	50 hrs.	$41/hr.	$2,000
			$3,000

ABB Environmental Services, Inc.

PROJECT	COMP. BY	JOB NO.
OU3 site 7 Surfacesil Alternative 7SS2 Industrial Land Use Scenario.	KGK	8544-75
	CHK. BY BJS	DATE 8/15/97

6. Site Preparation:

Vegitative Cover	1	LS	$ 1000
DeConPad Cover	1	LS	$ 1200
Demob.	1	LS.	$ 1000
			$ 3,200

Total Direct Cost $ 166,890 – $ 1,669,300

ABB Environmental Services, Inc.

PROJECT CECIL FIELD OU3 FS SITE 8 COST Estimate	COMP. BY MTR CHK. BY MBE	JOB NO. 08 DATE 11/27/96

Description	Qty	Unit Cost	Total Cost
1. DIRECT COSTS			
A) QUARTERLY GW MONITORING (1st Year)			
Labor (2 PZs @ 16 hrs/event x 4 events/yr)	128 hrs	$50/hr	$6,400
Analytical (See Attached Quote)			
– Parameters [VOCs, SVOCs, BOD, sulfate/chloride/nitrate, Fe, DOC]			
(10 samples/event x 4 events/yr)	40 samples	$650/sample	$26,000
ODCs			
• Per Diem (2 PZs @ 2 days/event x 4 events)	16 days	$100/day	$1,600
• Travel (Vehicle)	8 days	$100/day	$800
• Field Equipment (Multimeter, DO meter, water quality)	8 days	$160/day	$1,280
• Coolers, FedEx, Supplies (Hrs.) etc.	4 events	$400/event	$1,600
(A)			$37,700
(B) GW Modelling (1st Year)			
Labor (Report, Modeling) (1 P2 Scientist @ 50 hr/event x 4 events)	200 hrs	$60/hr	$12,000
TOTAL DIRECT COSTS			$49,700

ABB Environmental Services, Inc.

FORM 00.01 REV. 4/81

PROJECT	COMP. BY	JOB NO.
Site 8 Cost Estimate	CHK. BY MBC	DATE

Indirect Costs

HASP	1 L.S.	$7,500
SAP	1 L.S.	$12,500
		20,000

O&M Costs

(A) GW Monitoring

Labor, Analytical, ODCs

(see Direct Cost (A) divided by 4) $9,000

$36,000/4 = $9,000

Report/Consulting/Meetings, etc.			
(1 P2 @ 80 hrs)	80 hrs	$60/hr	$4,800
(1 P3 @ 40 hrs)	40 hrs	$80/hr	$3,200
(A)			$17,000

(B) Five-Year Reviews (Annualized)

1 P2 @ 48 hrs	48 hrs	$60/hr	$2,880
1 P3 @ 24 hrs	24 hrs	$80/hr	$1,920
			$4,800

(C) Annual GW Modeling

1 P3 @ 120 hrs	80 hrs	$80/hr	$6,400

TOTAL Annual O&M $28,200

Present Worth (P) = $A\left(P/A\right)_{n=30\text{ yrs}}^{i=6\%}$

= $28,200(13.765) = $388,000

TOTAL COST = (DIRECT + INDIRECT + PW O&M) = $458,000

Project: NAS Cecil Field OU3 Site 8 Sediment - Dredging & Off Site Disposal - 8SD2.	Comp By: KGK	Job# 8544-75
	CHK By: BJS	Date 8/18/97

Areal Extent of Dredging $= (750\ ft + 200\ ft) \times 8\ ft$

$= 7600\ ft^2$

Volume of Sediment to be dredged

$= 7600\ ft^2 \times 2\ ft$

$= 15{,}200\ ft^3$

$= 15{,}200\ ft^3 \times \frac{1}{27\ ft^3/yd^3}$

$= 563\ yd^3$

Cost Estimate.

1. Site Preparation	Qty	Unit	Cost
Mobe - Backhoe, tools etc	1	L.S.	$1,000
Decompad Materials			
6 mil Plastic	4 rolls	$100/roll	$400
Wood framing	1	L.S.	$100
Power washer (rental)	1 wk	$500/wk.	$500
Labor, Mobe and Setup.			
2 men @ 4 hrs. @ $40/hr.	8 hr	$40/hr.	$320
Perdiem (2 men @ 2 days)	4 days.	$100/hr.	$400
Car Rental (1 wk)	1 wk	$300/wk	$300
Miscellaneous tools, tape, Supplies etc	1	L.S.	$500
			$3520

	Qty	Unit	Cost
2. Dredging of Sediment.			
Backhoe and operator	1 wk	$1500/wk	$1500
Conveying and Dredging Equipment	1 wk	$1500/wk	$1500
Miscellaneous	1 wk	$1000/wk	$1000
Labor (2 men @ 8 hrs @ $40/hr)			$1000
			$5,000

3. WASTE CHARACTERIZATION.

Soil Full RCRA Chemicals			
- 4 Composite Samples	4 samples	$1200/s	$48
- IDW 2 Drums/one per Area	2 samples	$1200/s.	$24
- ODC, orders, Fedex, Supplies	1	LS.	$50
			$7,[illegible]

DIRECT COSTS

4. DELINIATION OF EXTENT of CONTAMINATION.

Sediment Samples	10 samples	$1200/s.	$12,000
original 7			
Duplicate 1			
QA/QC 2			
ODC Fedex, Supplies etc	1	LS	$1000
Reporting, Data Evaluation			
P2 = 40 hrs	40 hrs	$60/hr	$2,400
P3 = 20 hrs.	20 hrs.	$80/hr.	$1,600
			~~$17,300~~ $17,000

5. TRANSPORTATION & DISPOSAL.

Pickup Charge	1	LS.	$ 500
Approval Fee	1	LS.	$ 200
(a) Non-Hazardous Sediment	563 cy	$50/cy	$ 28,150
1DW	2 Drums	$ 150/Drum.	$ 300
(b) Hazardous Sediment	563 cy	$ 600	$ 337,800
1DW 2 Drums.	2 Drums.	$ 500	$ 1000
		$ 29,150 –	$ 339,500

6. BACKFILL

Top Soil, Furnished and Delivered ($563 yd^3$ = 684 Tons)	1	LS	$ 100
Labor 2 men @ 16 hrs.	32 hrs	$40/hr.	$128
			$ 2,280

7. SITE RESTORATION & DEMOB.

Decon Pad Removal	1	LS	$ 400
Demob	1	LS	$ 1000
			$1,400

Total Direct Cost $ 66,050 – $376,400

Mr. Mike Renga
EA Engineering, Science and Technology
ABB Environmental
2120 Washington Blvd, Suite 300
Arlington, Virginia 22204

Phone: 703-769-8167 **Fax:** 703-769-8182

Quotation Number.....: 97110079
Project/Client Number: 70046.02
Effective Date.....: 11/27/96
Valid Through.....: 01/27/97
Project Manager.....: Mary E. Asper

ABB Superfund Site

Catalog #	Parameters	Method	Matrix	Price	Quantity	Extended Cost
VO006-2	Halogenated Volatile Organics by GC (VOCS)	SW 8010	Water	$120.00	10	$1,200.00
IC005-3	Nitrate by IC	EPA 300.0	Water	$20.00	10	$200.00
IC007-3	Sulfate by IC	EPA 300.0	Water	$20.00	10	$0.00
IC003-3	Chloride by IC	EPA 300.0	Water	$20.00	10	$200.00
WC032-1	Dissolved Organic Carbon by Oxidation IR	EPA 415.1	Water	$30.00	10	$300.00
MI059-1	Total, Iron by ICP	EPA 200.7	Water	$13.00	10	$130.00
MI059-2	Dissolved, Iron by ICP	EPA 200.7	Water	$13.00	10	$130.00
SM001-2	Base/Neutral-Extractable Organics by GC/MS (SVOCs	EPA 625	Water	$275.00	10	$2,750.00
					Total:	$4,910.00

+ BOD_5 $25 10