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RECORD OF DECISION FOR OPERABLE UNIT 11 (OU 11) SITE 45 FORMER STEAM
GENERATING PLANT NAS CECIL FIELD FL
10/9/2003
TETRA TECH NUS INC

**Record Of Decision
Operable Unit 11, Site 45
Former Steam Generating Plant**

**Naval Air Station
Cecil Field
Jacksonville, Florida**



**Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0078**

October 2003

**RECORD OF DECISION
OPERABLE UNIT 11, SITE 45
FORMER STEAM GENERATING PLANT**

**NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

**COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT**

**Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406**

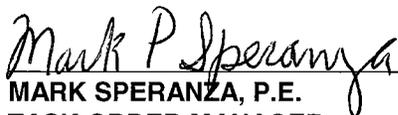
**Submitted by:
Tetra Tech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220**

**CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0078**

OCTOBER 2003

PREPARED UNDER THE SUPERVISION OF:

APPROVED FOR SUBMITTAL BY:


MARK SPERANZA, P.E.
TASK ORDER MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA


DEBBIE WROBLEWSKI
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA



This document that describes the Record of Decision for Operable Unit 11, Site 45, Former Steam Generating Plant at Naval Air Station Cecil Field, Jacksonville, Florida, has been prepared under the direction of a Florida-registered professional engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice.

Mark P. Speranza

Mark P. Speranza, P.E.
Professional Engineer No. PE0050304

Date: 10/9/03

Mark P. Speranza

MARK P. SPERANZA
PROFESSIONAL ENGINEER
STATE OF FLORIDA
NO. PE0050304

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ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
BaPEq	Benzo(a)pyrene equivalent
BCT	BRAC Cleanup Team
BRA	Baseline Risk Assessment
bgs	Below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chemical of concern
cPAH	Carcinogenic PAH
CSF	Cancer Slope Factor
DO	Dissolved oxygen
EBS	Environmental Baseline Survey
EE	Envirodyne Engineers
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FFA	Federal Facility Agreement
FS	Feasibility Study
GCTL	Groundwater Cleanup Target Level
G&M	Geraghty & Miller
HLA	Harding Lawson Associates
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IBDS	Inorganic Background Data Set
IR	Installation Restoration
JEDC	Jacksonville Economic Development Commission
KAG	Kerosene Analytical Group
LTTD	Low-temperature thermal desorption
LUC	Land use control
MCL	Maximum Contaminant Level
NAS	Naval Air Station
Navy	United States Department of the Navy

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
NPW	Net present worth
O&M	Operation and maintenance
ORP	Oxydation/reduction potential
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PRE	Preliminary Risk Evaluation
PRG	Preliminary Remedial Goal
PSC	Potential Source of Contamination
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RfD	Reference dose
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCTL	Soil Cleanup Target Level
SMCL	Secondary MCL
SPECAP	Specific capacity
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TBC	To be considered (criterion)
TCL	Target Compound List
TOC	Total organic carbon
TRPH	Total recoverable petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper confidence level
USCS	United Soil Classification System
U.S. EPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic compound

1.0 DECLARATION OF THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Operable Unit (OU) 11, Site 45 consists of the contaminated soil and groundwater identified at the Former Steam Generating Plant at Naval Air Station (NAS) Cecil Field, Jacksonville, Florida [United States Environmental Protection Agency (U.S. EPA) ID FL5 170 022 474]. Site 45 is located in the central portion of the Main Base.

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedy for contaminated soil and groundwater at OU 11, Site 45 at NAS Cecil Field. The selected remedial actions were chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) §300]. This decision document was prepared in accordance with U.S. EPA decision document guidance (U.S. EPA, 1999). This decision is based on the Administrative Record for the site. The United States Department of the Navy (Navy) and U.S. EPA Region 4 issue this ROD (jointly).

1.3 ASSESSMENT OF THE SITE

The response actions selected in this ROD are necessary to protect the public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment or of pollutants or contaminants from this site that may present an imminent and substantial endangerment to public health or welfare.

1.4 DESCRIPTION OF THE SELECTED REMEDY

OU 11, Site 45 is part of a comprehensive environmental investigation and cleanup currently being performed at NAS Cecil Field under the CERCLA program. This ROD addresses only OU 11, Site 45. The selected remedy eliminates unacceptable exposures to benzo(a)pyrene equivalents (BaPEq), arsenic, and total recoverable petroleum hydrocarbons (TRPH) in soil and vanadium in groundwater. The selected remedy for OU 11, Site 45 includes monitored natural attenuation for groundwater and soil, and land use controls (LUCs) that will limit exposure to soil, prevent any residential reuse activities, and prevent extraction or consumption of groundwater from taking place at this location. The selected remedy

was determined based on evaluation of the site conditions, site-related risks, future land use, applicable or relevant and appropriate requirements (ARARs), and Remedial Action Objectives (RAOs).

The major components of the selected remedy are as follows:

- LUCs, including institutional controls and deed restrictions, will be implemented to prevent residential development of Site 45 and to restrict the use of the surficial aquifer groundwater.
- Long-term monitoring will be performed by collecting and analyzing soil and groundwater samples to verify that no unacceptable contaminant migration is occurring and to evaluate reductions in contaminant concentrations through naturally occurring processes such as biodegradation, dispersion, and dilution.
- Site conditions will be reviewed every 5 years. If natural attenuation and LUCs are shown to be insufficient, another remedial approach will be evaluated and may be implemented. Due to the lengthy projected time frame for reaching clean-up goals for groundwater (900 to 1,300 years), periodic reviews of new technologies that may address vanadium in groundwater may be conducted in conjunction with the five-year review.

The Navy shall prepare in accordance with U.S. EPA Guidance and submit to the U.S. EPA and Florida Department of Environmental Protection (FDEP) a Remedial Design as well as all other post-ROD documents as specified in the Federal Facility Agreement (FFA) dated October 23, 1990.

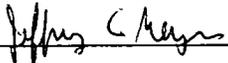
1.5 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, is cost effective, and complies with federal and State requirements that are legally applicable or relevant and appropriate to remedial action. The nature of the selected remedy for OU 11, Site 45 is such that ARARs will eventually be met through monitoring for soil and through monitored natural attenuation for groundwater. The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at this site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment. Although the selected remedy does not provide for treatment as a principal element, reduction of soil and groundwater contaminant concentrations are expected over time due to dispersion, advection, and adsorption processes. Because this remedy would result in soil and groundwater with contaminant concentrations greater than health-based levels remaining on site, a review will be conducted every 5 years to ensure that the remedy continues to provide adequate protection of human health.

1.6 DATA CERTIFICATION CHECKLIST

The information required to be included in the ROD is summarized on Table 1-1. These data are presented in Section 2.0: Decision Summary of this ROD. Additional information, if required, can be found in the Administrative Record for OU 11, Site 45.

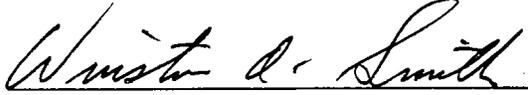
1.7 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF REMEDY



Jeffrey G. Meyers, P.E.
Base Realignment and Closure
Environmental Coordinator

10/9/2003

Date



Winston A. Smith
Director
Waste Management Division
U.S. EPA Region 4

11-13-03

Date

TABLE 1-1

**DATA CERTIFICATION CHECKLIST
OU 11, SITE 45 RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Information	ROD Reference
Chemicals of Concern (COCs) and their concentrations	Section 2.5.2, Pages 2-7 and 2-8 Tables 2-1, 2-2, 2-3, and 2-4 Figures 2-4 and 2-5
Baseline risk represented by the COCs	Section 2.6 Pages 2-9 and 2-10
Preliminary Remedial Goals (PRGs) established for the COCs	Section 2.7 Page 2-10
Disposition of source materials constituting principal threat	Section 2.2.2, 9 th bullet Page 2-4
Current and reasonably anticipated future land and groundwater use scenarios used for risk assessment	Section 2.5.3 Page 2-9
Potential land and groundwater uses available at the site as a result of the selected remedy	Section 2.10.4 Page 2-18
Estimated capital, operating and maintenance (O&M), and total present worth (NPW) costs of selected remedy. Discount rate used and timeframe over which these costs are projected	Section 2.10.3 Page 2-18 Appendix B
Key factors that lead to the selection of the remedy	Section 2.10.1 Page 2-15

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

OU 11, Site 45 is situated within the boundaries of the former NAS Cecil Field (U.S. EPA ID No. FL5 170 022 474), which is located 14 miles southwest of Jacksonville, Florida (See Figure 2-1). The majority of Cecil Field is located within Duval County, and the southernmost part of the Facility is located in Clay County. NAS Cecil Field was established in 1941 and provided facilities, services, and material support for the operation and maintenance of naval weapons, aircraft, and other units of the operation forces as designated by the Chief of Naval Operations. Since the closure of NAS Cecil Field in September 1999, most of the Facility has been transferred to the Jacksonville Port Authority (now Jacksonville Airport Authority) and the City of Jacksonville. According to the City's reuse plan, Cecil Field will have multiple uses but will be used primarily for aviation-related activities.

OU 11, Site 45 consists of the contaminated soil and groundwater identified at the Former Steam Generating Plant for NAS Cecil Field. As shown in Figures 2-2 and 2-3, Site 45 is located north of Crossover Street (formerly Second Street) and east of Authority Avenue (formerly "C" Avenue). Investigations at the site were originally focused on Buildings 7 and 11. As shown on Figure 2-3, the site included Buildings 2, 7, 11, and 12, and the adjacent area [Harding Lawson Associates (HLA), 1999c]. Three aboveground storage tanks (ASTs) and a concrete containment area are located east of Building 11. The buildings have been demolished and the ASTs have been removed from the site. An underground storage tank (UST) was located south of Building 11 but was removed in 1986 [ABB-Environmental Services, Inc. (ABB-ES), 1994].

The site is primarily unpaved and covers an area of approximately 2 acres. The southern border is Crossover Street, the western border is Authority Avenue, the northern border is Skillside Street (formerly Third Street), and the eastern border is a parking lot. There are also parking lots adjacent to the buildings along Crossover Street, Skillside Street, and Authority Avenue. The Base railroad tracks passed through the eastern side of the site, next to the current parking lot. These tracks were removed in 1986.

Building 11, constructed in 1941, was the Steam Generating Plant and included a large room for three boilers and several smaller rooms for office space, workshops, and restrooms. Building 2, constructed in 1985, was an administrative office. Building 7, constructed in 1989, was used to store flammable and hazardous materials used for operations in Building 11. This building was divided into four rooms, three for storage and one for electrical power. Building 12, constructed in 1941, was the Operations Training Building and included offices and classrooms. The building was originally built as a utility building and

hospital and was converted in 1943 to a headquarters administrative facility. In 1989, the building began being used for Operations Training activities (ABB-ES, 1994).

Soil contaminated with polynuclear aromatic hydrocarbons (PAHs), TRPH, arsenic, mercury, and vanadium was delineated during pre-Remedial Investigation (RI) sampling activities. The contaminated soil was excavated to industrial levels and disposed off site [Tetra Tech NUS, Inc. (TtNUS), 2000b; CH2M Hill, 2001). Groundwater contaminated by lead and vanadium was also identified in earlier studies and was further investigated during the RI (TtNUS, 2001a).

The name of the site has been changed over the course of the investigations. For the Environmental Baseline Survey (EBS), the site was designated as Facility 11. In January 1999, when it was determined that soil contamination was present over a large area, the site was re-designated as Potential Source of Contamination (PSC) 45. In February 2000, when the presence of groundwater contamination was confirmed, the area was again re-designated as Installation Restoration (IR) Site 45 within OU 11.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The first environmental studies for the investigation of waste handling and/or disposal sites at NAS Cecil Field were conducted between 1983 [Geraghty and Miller (G&M), 1983] and 1985 (G&M, 1985). These studies were followed in 1985 by an Initial Assessment Study (IAS) [Envirodyne Engineers (EE), 1985]. A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was completed in 1988 (HLA, 1988).

NAS Cecil Field was placed on the National Priorities List (NPL) by the U.S. EPA in December 1989. An FFA for NAS Cecil Field was signed by the FDEP, U.S. EPA, and the Navy in 1990. Following the listing of NAS Cecil Field on the NPL and the signing of the FFA, remedial response activities at the Facility have been completed under CERCLA authority. OU 11 is one of 12 OUs that have been identified. A Hazardous and Solid Waste Amendments (HSWA) permit was issued on October 13, 1996. The HSWA permit was renewed on August 25, 2000 and is still in effect.

2.2.1 Site 45 History

From the time of its construction, Building 11 was used for steam generation for the entire Base. Building 7 had always stored chemicals used in Building 11. The adjacent buildings, Buildings 2 and 12, were always used for administrative functions. The three aboveground storage tanks provided fuel to the boilers, and an UST provided fuel to Building 11 for an emergency generator (ABB-ES, 1994). Following NAS Cecil Field closure in September 1999 and transfer of the Base to civilian ownership, the Building 11 steam generating facility was deactivated.

2.2.2 Site Investigations

The following investigations and studies have been conducted in and around Site 45:

- November 1995 through February 1996 - Phase II investigation of Building 7 under the Base Realignment and Closure (BRAC) Program. One monitoring well was installed and sampled, and one soil sample was collected. Samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), and Target Analyte List (TAL) inorganic analytes (ABB-ES, 1997).
- November 1995 through September 1998 - Phase II investigation of Building 11 (BRAC Program). One monitoring well was installed and sampled, and four soil samples were collected. Samples were analyzed for TCL VOCs, SVOCs, pesticides and PCBs, and TAL inorganic compounds. An additional seven surface soil samples and two subsurface soil samples were collected and analyzed for PAHs (HLA, 1999c).
- January 1997 through August 1997 - Confirmatory sampling investigation for UST 11A. Five soil borings were installed, and samples were collected for headspace analysis. One monitoring well was installed, and one groundwater sample was analyzed for Florida Kerosene Analytical Group (KAG) parameters (HLA, 1998b).
- February 1997 through October 1998 - Confirmatory sampling investigation and site assessment investigation for aboveground storage tanks 11B, 11C, and 11D. Six soil borings for headspace analysis were advanced. One monitoring well was installed, and one groundwater sample and one subsurface soil sample were analyzed for Florida KAG parameters (HLA 1998a, 1999b, and 1999c).
- June 1998 through March 2000 - Investigation of PSC 45. Samples were collected to delineate soil and groundwater contamination. Seventy-six surface soil samples and 11 subsurface soil samples were collected. Five new monitoring wells were installed and sampled, and three existing monitoring wells were sampled. Analyses were limited to the contaminants that had been detected in previous investigations. Typically, samples were analyzed for TRPH, PAHs, arsenic, lead, mercury, and vanadium. The results were used to delineate soil contamination for excavation and disposal. The groundwater investigation identified four wells with vanadium at concentrations greater than the FDEP criteria, and two wells with lead at concentrations greater than the FDEP criteria (TtNUS, 2000a).

- April through March 2000 - Site 45 RI. Samples were collected to further delineate lead and vanadium contamination of groundwater. Seven new monitoring wells were installed and sampled, and five existing monitoring wells were sampled (TtNUS, 2001a). Groundwater samples were analyzed for lead and vanadium. In addition, specific capacity (SPECAP) tests were performed on two monitoring wells to determine site-specific hydrogeological conditions.
- December 2000 through August 2001 - Site 45 Feasibility Study (FS). Based on the results of previous investigations, groundwater COCs were identified and Preliminary Remediation Goals (PRGs) established. Groundwater remedial technologies were screened and remedial alternatives were assembled, analyzed, and compared.
- March 2001 - One post-RI round of groundwater samples was collected and analyzed from six existing monitoring wells to check for potential vanadium attenuation. Samples were analyzed for natural attenuation parameters [alkalinity, chloride, ferrous iron, dissolved oxygen (DO), hydrogen sulfide, nitrate, nitrite, orthophosphate, oxidation/reduction potential (ORP), and sulfate], general water quality parameters [pH, specific conductance, temperature, total organic carbon (TOC), and turbidity] and selected total and dissolved metals (aluminum, calcium, iron, manganese, potassium, sodium, and vanadium).
- May through June 2001 - Approximately 363 tons of soil with concentrations of BaPEq, arsenic, and vanadium greater than the FDEP Soil Cleanup Target Levels (SCTLs) for industrial land use were excavated and disposed offsite (CH2M Hill, 2001).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

A public notice of the availability of the Proposed Plan (TtNUS, 2001c) was placed in the Metro section of the *Florida Times-Union* on July 14, 2003. A 30-day comment period was held from July 14 through August 13, 2003. The results of the RI (TtNUS, 2001a) and Preliminary Risk Evaluation (PRE), the remedial alternatives of the FS (TtNUS, 2001b), and the preferred alternatives of the Proposed Plan (TtNUS, 2001c) were also presented and discussed at a Restoration Advisory Board (RAB) meeting held in July 2001, during which comments were solicited from the community. Public comments and the responses to these comments are presented in the Responsiveness Summary provided in Appendix A.

Documents pertaining to OU 11, Site 45 are available to the public at the Information Repository located at Building 907, 13357 Lake Newman Street, Cecil Commerce Center, Jacksonville, Florida 32252 [Telephone (904) 573-0336]. This ROD will become part of the Administrative Record File [NCP §300.825(a)(2)].

2.4 SCOPE AND ROLE OF OPERABLE UNIT

The environmental concerns at NAS Cecil Field are complex. As a result, work at the 24 sites in the IR Program has been organized into 12 OUs. More than 200 other areas have undergone or are undergoing evaluation in the BRAC and petroleum programs.

This ROD is the final action for OU 11, Site 45. Final RODs have been approved for OU 1 through OU 4; OU 5, Site 14; OU 6 through OU 8; OU 9, Sites 36/37; and OU 12, Sites 32, 42, 44 and Old Golf Course. An RI, Baseline Risk Assessment (BRA), and FS have also been prepared for OU 5, Site 15, but the FS is currently being re-evaluated. RI and FS reports were finalized for OU 9, Sites 57 and 58 in August and October 2002, respectively. RI reports for OU 10, Sites 21 and 25 were finalized in October 2001. The FS report in Site 21 was finalized in September 2002, and the FS for Site 25 was finalized in October 2001. An interim action has been completed for OU 12, Site 32. Decision documents are forthcoming for Sites 21, 25, and 32.

Investigations at OU 11, Site 45 indicated the presence of soil and groundwater contamination from past operating practices. This contamination could pose an unacceptable human health risk if residential development occurred at the site or if the groundwater was used as a potable water source.

The following RAOs were established for soil and groundwater at OU 11, Site 45:

- Prevent unacceptable risk from exposure to soil with concentrations of BaPEq and TRPH greater than the FDEP residential SCTLs and concentrations of arsenic greater than the background value (HLA, 1998c).
- Prevent unacceptable risk from ingestion of groundwater with concentrations of vanadium greater than the FDEP Groundwater Cleanup Target Level (GCTL).
- Reduce concentrations of vanadium in groundwater to less than the FDEP GCTL.

The remedy documented in this ROD will achieve these RAOs.

2.5 SUMMARY OF SITE CHARACTERISTICS

Contaminant sources, detected concentrations, fate and transport, contaminated media, and geologic and hydrogeologic conditions of OU 11, Site 45 are discussed in Sections 4.0, 5.0, and 6.0 of the OU 11, Site 45 RI Report (TtNUS, 2001a). These site characteristics are summarized in the following paragraphs.

2.5.1 Geology and Hydrogeology

Shallow soil to a depth of 6 feet below ground surface (bgs) at Site 45 was composed of approximately 91 percent fine sand and approximately 9 percent silt and clay, with a United Soil Classification System (USCS) classification of SW-SM. Deeper soil to a depth of 37 ft bgs was composed of approximately 98 percent fine sand and 2 percent silt and clay, with a USCS classification of SW. Specific gravity of the soil ranged from 2.58 to 2.63, and porosity ranged from 31.8 to 46.3 percent.

Three main hydrogeologic units underlie the site. These units, in ascending order, are the Floridan aquifer system, the intermediate aquifer system or confining unit, and the surficial aquifer.

Depth to groundwater at Site 45, as measured in April 2000, ranged from approximately 7 to 9 feet bgs. The surficial aquifer system in which the wells are installed is approximately 90 to 100 feet thick at NAS Cecil Field, although wells at Site 45 monitor only the shallow and intermediate zones to depths of 15 and 40 feet bgs, respectively.

Based on the water level measurements taken during the RI, groundwater flows to the southeast across the site. This direction of flow is consistent with nearby sites such as Sites 36 and 37. The groundwater gradient at the site is approximately 0.003, similar to the gradients measured at Sites 36 and 37 (0.001 to 0.007).

The velocity of groundwater flow can be calculated from a modified form of Darcy's equation:

$$V_h = K_h \times i/n_e$$

Where,

V_h is horizontal velocity, ft/day

K_h is horizontal hydraulic conductivity, ft/day

i is hydraulic gradient, dimensionless

n_e is effective porosity, dimensionless (assumed at 0.15 for fine sands)

Because the contamination is limited to the shallow zone of the surficial aquifer, groundwater velocity was evaluated only in that zone. The K_h value used was the average of the values derived from the SPECAP test data for wells CEF-P45-4S and CEF-P45-5S.

$K_h = 3.8$ feet/day

$i = 0.003$

$n_e = 0.15$.

The resulting V_h is 0.08 feet/day or 28 feet/year.

2.5.2 Nature and Extent of Contamination

2.5.2.1 Soil

During the RI, carcinogenic PAHs (cPAHs), TRPH, arsenic, and mercury were detected in soil at concentrations in excess of the FDEP SCTLs for direct industrial and residential exposure. Vanadium was detected in soil at concentrations greater than its FDEP residential SCTL based on acute toxicity, but at concentrations less than the SCTL for direct industrial exposure. The presence of these contaminants in the soil is probably due to emissions fall-out from the combustion of fossil fuels used in the generation of steam. A statistical evaluation was conducted to determine the areas of soil requiring removal so that the site-wide 95-percent upper confidence level (UCL) of the remaining concentrations of each contaminant was equal to or less than the SCTLs for direct industrial exposure. The results of this statistical evaluation are presented in the Action Memorandum for PSC 45 (TtNUS, 2000b).

A removal action was conducted in May and June 2001 (CH2M Hill, 2001). During this removal action, approximately 363 tons of soil were excavated and disposed off site so that the 95-percent UCLs of the residual concentrations of cPAHs, TRPH, arsenic, and mercury in soil were equal to or less than the SCTLs for direct industrial exposure.

Because benzo(a)pyrene was the principal cPAH detected in the Site 45 soil, the BRAC Cleanup Team (BCT) agreed that cPAHs detected in the soil of that site should be regarded as a family of compounds and that their concentrations should be expressed in terms of BaPEq. For a given soil sample, a total BaPEq concentration was derived using detected concentrations of individual cPAHs and toxicity equivalent factors (U.S. EPA, 1995). If a cPAH was not detected in a particular sample, a concentration of one-half of the analytical detection limit for that cPAH was used to compute the total BaPEq concentration of that sample.

Table 2-1 presents a summary of soil analytical data including minimum and maximum detected concentrations, arithmetic means of detected concentrations, and 95-percent UCL concentrations for BaPEq, TRPH, arsenic, mercury, and vanadium detected in the Site 45 soil following the removal action. Table 2-1 also compares these analytical data to the FDEP SCTLs for direct industrial exposure, direct residential exposure, and leachability to groundwater and, for inorganic analytes, to the NAS Cecil Field

site-specific Inorganic Background Data Set (IBDS) (HLA, 1998c). As can be seen from Table 2-1, the site-wide 95-percent UCL concentrations of BaPEq and TRPH remaining in soil following the removal action still considerably exceed the SCTLs for direct residential exposure. Table 2-1 also shows that concentrations of arsenic remaining in soil exceed the NAS Cecil Field site-specific IBDS value.

Accordingly, BaPEq, TRPH, and arsenic were retained as soil chemicals of concern (COCs) for Site 45. Post-removal action exceedances of residential SCTLs or IBDS values in soil are illustrated on Figure 2-4.

2.5.2.2 Groundwater

Lead and vanadium were detected in groundwater at concentrations greater than their respective FDEP GCTLs of 15 and 49 micrograms per liter ($\mu\text{g/L}$) (FDEP, 1999a). Tables 2-2, 2-3, and 2-4 present a summary of lead and vanadium detections in groundwater during the pre-RI, RI, and post-RI sampling events, respectively.

As shown on Table 2-2, lead was detected slightly in excess of its GCTL at two locations during pre-RI sampling (16.8 $\mu\text{g/L}$ at CEF-P45-01S and 17.3 $\mu\text{g/L}$ at CEF-P45-04S). However, as shown on Table 2-3, neither of these exceedances was confirmed by the results of the RI sampling. Lead was in fact detected in excess of its GCTL at one location (34.6 $\mu\text{g/L}$ at CEF-P45-08S) during the first round of RI sampling, but this exceedance was not confirmed by the results of the second round.

Accordingly, vanadium was retained as the only groundwater COC in the surficial aquifer at Site 45. As shown on Table 2-2, vanadium was detected significantly in excess of its GCTL at several locations during pre-RI sampling. The maximum detected concentration of vanadium was 740 $\mu\text{g/L}$ in well CEF-011-01Sa. As shown on Tables 2-3 and 2-4, these exceedances were confirmed with maximum detected vanadium concentrations of 240 $\mu\text{g/L}$ and 284 $\mu\text{g/L}$ in well CEF-007-01Sa during RI and post-RI sampling, respectively. Monitoring wells were used to delineate the horizontal and vertical extent of the vanadium plume. This plume, as defined by the GCTL for vanadium, is approximately 260 feet in length by 110 feet in width, as illustrated on Figure 2-5.

Vanadium was detected at concentrations in excess of its GCTL in the samples collected only in monitoring wells screened in the shallow zone of the surficial aquifer, at approximately 15 feet bgs. Vanadium was also detected at concentrations less than its GCTL in samples collected from the monitoring well (CEF-P45-10I) screened in the intermediate zone of the surficial aquifer (35 to 40 feet bgs).

The source of the vanadium detected in groundwater at Site 45 appears to be from the soil in the unsaturated zone. Vanadium was detected in soil samples but only at concentrations less than the FDEP SCTL for leachability to groundwater. The origin of this metal is assumed to be from the combustion of fuel in the Building 11 steam boilers.

2.5.3 Current and Potential Future Site Uses

Site 45 is currently located within the aviation-related maintenance activities portion of the Jacksonville Economic Development Commission (JEDC) Parcel. The JEDC Reuse Plan provides for continued aviation- and industrial-related uses of the site. Site RAOs support industrial risk exposure; therefore, potential future uses for Site 45 are limited to commercial or industrial land use.

2.6 SUMMARY OF SITE RISKS

2.6.1 Human Health Risk Assessment

The PRE performed as part of the RI indicated that, although the concentrations of vanadium detected in groundwater were greater than the FDEP GCTL, detected concentrations did not exceed U.S. EPA Region 9 risk-based PRGs (U.S. EPA, 2001), and no elevated concentrations of vanadium remain in soil at concentrations greater than FDEP industrial or leachability to groundwater SCTLs following the soil excavation.

The 95-percent UCLs of all soil COCs remaining at the site following the removal action are less than their respective industrial FDEP SCTLs and have concentrations less than their respective leachability criteria. Overall, for industrial exposure, the cumulative hazard index for the post-removal is significantly less than 1.0. The cumulative cancer risk is approximately 1×10^{-6} , with arsenic at a UCL concentration approximately equal to its Cecil Field IBDS value.

The post-removal UCLs of mercury, vanadium, and TRPH are less than their respective residential PRGs. The post-removal UCL for arsenic exceeds its residential PRG, but is approximately equal to its Cecil Field IBDS value. The post-removal UCL for BaPEq exceeds its residential PRG. Overall, for residential exposure, the cumulative hazard index for the post-removal soil is less than 1.0. The cumulative cancer risk is 9.3×10^{-6} . The carcinogenic risk value is within U.S. EPA's target risk range but greater than FDEP's target risk of 10^{-6} .

The PRE is a screening-level evaluation of potential risks from site constituents to human receptors at the site. The risks calculated in a PRE are derived by a comparison of exposure concentrations to SCTLs or PRGs. These SCTLs and PRGs are derived using default exposure assumptions established by the

FDEP and U.S. EPA, respectively. Because there are no deviations between the Navy and the regulatory agencies regarding those exposure assumptions or pathways defined by the regulatory agencies for residential and industrial exposures, this approach was used to streamline the evaluation of risk.

2.6.2 Ecological Risk Assessment

The ecological risk assessment performed as part of the RI established that Site 45 consists primarily of buildings and parking lots that provide an ecological habitat of marginal quality and of little use to terrestrial wildlife. The developed nature of the site renders exposure to soil by terrestrial receptors insignificant. Therefore, the RI concluded that Site 45 does not present a significant ecological risk.

2.7 PRELIMINARY REMEDIAL GOALS

A PRG is the target concentration to which a COC must be reduced within a particular medium of concern to achieve one or more of the established RAOs. PRGs are developed to ensure that contaminant concentration levels left on site are protective of human and ecological receptors. For Site 45, PRGs were established based on the following criteria:

- Protection of human health from direct exposure to contaminated soil and groundwater
- Compliance with ARARs and, to the extent practicable, To Be Considered criteria (TBCs)

2.7.1 Soil PRGs

The following soil PRGs were established for Site 45 soil:

COC	PRG
BaPEq	100 µg/kg ⁽¹⁾
Arsenic	2.04 mg/kg ⁽²⁾
TRPH	340 mg/kg ⁽¹⁾

1 FDEP SCTL for direct residential exposure (FDEP, 1999a)

2 NAS Cecil Field site-specific IBDS value (HLA, 1998c)

2.7.2 Groundwater PRG

The vanadium PRG for the Site 45 groundwater was established as 49 µg/L, the FDEP GCTL.

2.8 DESCRIPTION OF REMEDIAL ALTERNATIVES

This section provides a narrative of each alternative evaluated for the remediation of soil and groundwater at OU 11, Site 45. For further information on the remedial alternatives, refer to the FS (TtNUS, 2001b) and the Proposed Plan (TtNUS, 2001c). Summaries of the treatment alternatives evaluated in the FS are described in the following sections. The remedy selected for this ROD is presented in Section 2.10. As part of the FS, each of the following alternatives was evaluated for compliance with related ARARs; Section 2.0 of the FS presents a complete list of these ARARs. It should be noted that the ARARs presented in Section 2.11 of this ROD are specific to the selected remedy.

2.8.1 Soil Remedial Alternatives

Three remedial alternatives were analyzed for OU 11, Site 45 soil. This ROD has selected Soil Alternative 2: LUCs and Monitoring to address contaminants remaining in soil following excavation activities. The alternatives evaluated, as described in the FS and summarized in Table 2-6, are as follows.

Soil Alternative 1: No Action:

Evaluation of the No Action alternative is required by law to provide a baseline for comparison with other alternatives. Under this alternative, no remedial activities would occur to remove soil contamination, and no controls would be implemented to reduce exposure by human receptors. Although BaPEq and TRPH would attenuate naturally, arsenic probably would not, and no periodic monitoring would be performed to evaluate contamination reduction or to verify that no contaminant migration is occurring.

This alternative would not protect human health because risks from exposure to contaminated soil would continue to exist. Table 2-1 presents contaminant concentrations compared to applicable residential, industrial, and leachability criteria. This alternative would not achieve the soil RAO or comply with ARARs. There would be no reduction of contaminant mobility, and reductions in toxicity and volume would occur only through long-term natural attenuation and would not be monitored. Because no remedial action would take place, this alternative would not result in any short-term risks and would be very easy to implement. There would be no cost associated with this alternative.

Soil Alternative 2: Institutional Controls and Monitoring:

LUCs would consist of preventing future residential development. Monitoring would consist of long-term soil and groundwater sampling and analysis to verify that no contaminants are migrating from soil to groundwater and to evaluate natural attenuation of contaminants in soils. Regular site inspections would

be conducted to verify the continued application of LUCs, and site reviews would be performed every 5 years to verify the continued adequacy of this alternative.

This alternative would protect human health because it would prevent the potential for unacceptable risk from direct exposure to contaminated soil by preventing residential development. Exposure to soil would result in residential risks that exceed Florida's target risk level of 10^{-6} . This alternative would achieve the soil RAO but would not comply with chemical-specific ARARs or TBCs because the 95-percent UCL for BaPEq exceeds the residential PRG and SCTL. However, for the intended future land use (industrial), the site would be protective as long as LUCs are maintained. There would be no reduction of contaminant toxicity, mobility, or volume through active treatment, but contaminant toxicity and volume would be reduced through long-term natural attenuation. There would be minimal short-term risks associated with the performance of monitoring activities that would be addressed through appropriate health and safety procedures. The activities for this alternative would be easy to implement. The capital, O&M, and 30-/50-/100-year net present worth (NPW) of this alternative are estimated at \$5,000, \$47,000, and \$52,000/\$57,000/\$58,000, respectively.

Soil Alternative 3: Excavation and Off-Base Disposal:

This alternative would consist of excavating approximately 7,800 cubic yards of contaminated soil to reduce the site-wide 95-percent UCL of remaining concentrations of BaPEq and TRPH to less than the FDEP residential SCTL and the site-wide 95-percent UCL of remaining concentrations of arsenic to less than the IBDS value. Excavated areas would be backfilled with clean soil. The excavated soil would be transported off base to a permitted facility for disposal by secure landfilling. Prior to landfilling, the excavated material might be treated, if required, by such technologies as chemical fixation/solidification and/or low-temperature thermal desorption (LTTD). However, based on the experience of recent soil removal actions at similar NAS Cecil Field sites, it is not anticipated that such treatment would be required.

This alternative would protect human health because it would permanently remove contaminated soil from the site and thus prevent unacceptable risk from exposure under any current or future land use scenario. This alternative would achieve the soil RAO and comply with ARARs through removal, treatment, and disposal. There would be a significant reduction of contaminant toxicity, mobility, or volume through treatment, and an estimated 7,800 cubic yards of soil containing 1,604 pounds of COCs (5 pounds BaPEq, 39 pounds arsenic, and 1,560 pounds TRPH) would be irreversibly and permanently removed from the site. There would be significant short-term risks associated with excavation of the contaminated soil and the off-base transportation of the excavated soil. However, these risks would be addressed through appropriate engineering controls and health and safety procedures. This alternative would achieve the soil PRGs within an estimated 6 months. The activities for this alternative would be

easy to implement. The capital and NPW costs of this alternative are estimated at \$3,900,000. There are no O&M costs associated with this alternative.

2.8.2 Groundwater Remedial Alternatives

Three remedial alternatives were analyzed for OU 11, Site 45 groundwater. This ROD has selected Groundwater Alternative 2: Natural Attenuation, LUCs, and Monitoring to address contaminants in groundwater. The alternatives evaluated in the FS are summarized as follows.

Groundwater Alternative 1: No Action:

Under this alternative, no remedial activities would occur to remove groundwater contamination, and no controls would be implemented to reduce exposure by human receptors. Although vanadium would attenuate naturally, no periodic monitoring would be performed to evaluate the effectiveness of the No Action alternative in meeting the vanadium PRG and preventing the potential downgradient migration of vanadium.

This alternative would not protect human health because risks from direct exposure to contaminated groundwater would continue to exist. This alternative would not achieve the groundwater RAO or comply with ARARs. There would be no reduction of contaminant mobility, and reduction in toxicity and volume would occur only through long-term natural attenuation and would not be monitored. Because no remedial action would take place, this alternative would not result in any short-term risks and would be very easy to implement. There would be no cost associated with this alternative.

Groundwater Alternative 2: Natural Attenuation, LUCs, and Monitoring:

Natural processes such as dispersion, advection, and adsorption would eventually reduce the groundwater concentrations of vanadium to its PRG. A long-term groundwater monitoring program would be implemented to evaluate the decrease of vanadium concentrations in groundwater. Groundwater monitoring would also be used to detect the potential downgradient migration of vanadium. LUCs would consist of preventing the use of groundwater. Regular site inspections would be conducted to verify the continued application of LUCs, and site reviews would be performed every 5 years to verify the adequacy of this alternative for as long as groundwater contaminant concentrations exceed cleanup goals.

This alternative would protect human health because it would reduce the risk from direct exposure to contaminated groundwater. This alternative would achieve the groundwater RAO, and monitoring would establish eventual compliance with ARARs through natural attenuation. There would be no reduction of contaminant toxicity, mobility, or volume through active treatment, but contaminant toxicity and volume

would be reduced through long-term natural attenuation. There would be minimal short-term risks associated with the performance of groundwater monitoring activities that would be addressed through appropriate health and safety procedures. Based on modeling results, the vanadium PRG would be attained within 900 to 1,300 years. The activities for this alternative would be easy to implement. The capital, O&M, and 30-/50-/100-year NPW costs of this alternative are estimated at \$25,000, \$97,000, and \$122,000/\$133,000/\$137,000, respectively.

Groundwater Alternative 3: Extraction, On-Site Treatment, Surface Water Discharge, LUCs, and Monitoring:

This alternative would consist of extracting the contaminated groundwater through four new extraction wells pumping at a combined rate of 20 gallons per minute. The extracted groundwater would be treated by filtration to remove suspended solids and by ion exchange to remove dissolved vanadium prior to discharge to surface water. Institutional controls and monitoring would be the same as for Groundwater Alternative 2.

This alternative would protect human health because it would actively remove vanadium-contaminated groundwater from the surficial aquifer and thus reduce the risk from direct exposure to contaminated groundwater. This alternative would achieve the groundwater RAO and comply with ARARs through treatment. There would be a significant reduction of contaminant toxicity, mobility, or volume through treatment, and an estimated 3.1 pounds of vanadium would be irreversibly and permanently removed from the groundwater. There would be minimal short-term risks associated with operation of the groundwater extraction and treatment system and performance of groundwater monitoring activities. These risks would be addressed through appropriate health and safety procedures. Based on modeling results, the vanadium PRG would be attained within approximately 18 years. The activities for this alternative would be easy to implement. The capital, O&M, and 18-year NPW of this alternative are estimated at \$303,000, \$393,000, and \$696,000, respectively.

2.9 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

This section evaluates and compares each of the soil and groundwater remedial alternatives with respect to the nine criteria outlined in Section 300.430(e) of the NCP. These criteria are categorized as threshold, primary balancing, and modifying and are further explained in Table 2-5. A detailed analysis was performed for each alternative using the nine criteria to select a site remedy. Tables 2-6 and 2-7 present a summary comparison of these analyses for soil and groundwater, respectively.

2.10 SELECTED REMEDY

2.10.1 Summary of Rationale For Remedy Selection

The goals of the selected soil and groundwater remedies are to protect human health and the environment by eliminating, reducing, or controlling hazards posed by the site and to meet ARARs. Based on consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives, and U.S. EPA, FDEP, and public comments, Soil Alternative 2 and Groundwater Alternative 2 were selected to address contamination at OU 11, Site 45.

This remedy was selected for the following reasons:

- Although concentrations of COCs remaining in soil exceed the FDEP residential SCTLs or background values, they do not present an unacceptable threat to human health or the environment assuming only future commercial or industrial uses are permitted at Site 45.
- Although vanadium is present in groundwater at concentrations greater than the FDEP GCTL, detected concentrations are lower than the U.S. EPA Region 9 risk-based PRG and do not present an unacceptable threat to human health or the environment under the groundwater use restrictions to be implemented as part of the selected remedy. There are no federal Maximum Contaminant Levels (MCLs) established for vanadium. Vanadium contamination concentrations exceed Florida GCTLs, but the maximum concentration is less than the State's Natural Attenuation Default Concentration.
- The vanadium contaminant plume is small and stable and confined to the shallow aquifer, and there is no evidence of ongoing contaminant migration. Additionally, viability of currently available technologies for remediation of vanadium in groundwater is limited. Therefore, so long as exposure to groundwater is prohibited, Alternative 2 is considered to be adequately protective at a much more reasonable cost than active treatment. New technologies may become available in the future that may provide a practical, cost-effective, and reliable alternative.

2.10.2 Remedy Description

The remedy is illustrated on Figure 2-6 and consists of three major components: (1) LUCs, (2) long-term monitoring of soil and groundwater, and (3) contingency remedy.

Component 1: Land Use Controls

Soil and groundwater contamination remains at Site 45 at concentrations that preclude unrestricted reuse; therefore, the remedy includes LUCs to prevent unacceptable risk. These LUCs will be

implemented to prohibit both residential development at Site 45 and usage of the surficial aquifer beneath the site and will thereby preclude unacceptable risks from exposure to contaminated soil and/or groundwater. The boundaries of OU 11, Site 45 and the area to be covered by the LUCs are shown in Figure 2-7. The LUCs cover both soil and groundwater. The following are the LUC performance objectives for OU 11, Site 45, and these objectives will also be incorporated into the deed and other LUC mechanisms:

- Prohibit residential reuse of the site.
- Prohibit the excavation and uncontrolled removal of soil with contaminant concentrations greater than FDEP residential SCTLs unless prior written approval is obtained from the Navy, U.S. EPA, and FDEP.
- Prohibit the consumption of groundwater that exceeds federal MCLs or State GCTLs.
- Prohibit all other uses of the groundwater from the surficial aquifer underlying the site (including, but not limited to, dewatering, irrigation, heating/cooling purposes, and other industrial processes) without prior written approval from the Navy, U.S. EPA, and FDEP.
- Maintain the integrity of any existing or future monitoring or remediation system(s).

The LUCs shall be maintained for as long as they are required to prevent unacceptable exposures to contaminated soil and groundwater or to preserve the integrity of the remedy. The Navy or any subsequent owners shall not modify, delete, or terminate any LUC without U.S. EPA and FDEP concurrence. The LUCs shall be maintained until the concentrations of hazardous substances in the soils and groundwater beneath have been reduced to levels that allow for unlimited exposure and unrestricted reuse.

The Navy will be responsible for implementing, inspecting, reporting, and enforcing the LUCs described in this ROD in accordance with the approved LUC Remedial Design. Although the Navy may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity. Should this LUC remedy fail, the Navy will ensure that appropriate actions are taken to reestablish its protectiveness and may initiate legal action to either compel action by a third party(ies) and/or to recover the Navy's costs for remedying any discovered LUC violation(s).

The LUC Remedial Design will be prepared as the LUC component of the Remedial Design. Within 90 days of ROD signature, the Navy shall prepare and submit to U.S. EPA and FDEP for review and approval a LUC Remedial Design that shall contain implementation and maintenance actions, including periodic inspections. The Navy will implement, maintain, monitor, and enforce the LUCs according to the Remedial Design.

Component 2: Long-Term Monitoring

Long-term monitoring will consist of the periodic collection and analysis of soil and groundwater samples to verify that no contaminant migration is occurring either from soil to groundwater or within the surficial aquifer, as determined by sentinel well sample results. Long-term monitoring will also be used to assess natural attenuation of soil and groundwater contamination.

Six soil samples will be collected and analyzed for PAHs, arsenic, and TRPH. Groundwater samples will be collected from 11 existing monitoring wells and analyzed for vanadium. Sampling frequency will be annually for groundwater and every 5 years, at a minimum, for soils. As agreed by the BCT, if the results of two consecutive groundwater sampling events indicate that the vanadium PRG has been met, the site will be considered as remediated for vanadium in groundwater.

Component 3: Contingency Remedy

If the results of any Five-Year Review show that (1) the implemented LUCs have failed to prevent unacceptable risks from exposure to on-site soil and/or groundwater contamination; (2) contaminated groundwater has migrated to an unacceptable degree as determined by sentinel well sampling results; or (3) the vanadium contamination in groundwater is not attenuating as expected, then additional active remedial measures would need to be evaluated and possibly implemented. Potential contingency remedial measures could include additional excavation and off-base disposal of contaminated soil and the extraction, on-site treatment, and surface discharge of contaminated groundwater.

In addition to the aforementioned, due to the lengthy projected time frame for reaching clean-up goals for vanadium in groundwater (900 to 1,300 years), U.S. EPA, FDEP, and the Navy agree that the Navy will conduct periodic reviews of new remedial technology(ies) that could potentially remediate such contamination in a more cost-effective manner and in a significantly shorter period of time. Such reviews could be conducted as part of any required Five-Year Review in the event that either U.S. EPA, FDEP, or the Navy becomes aware of any such new technology(ies). Should the parties agree that a particular new technology(ies) shows the potential for significantly reducing the remediation time for residual vanadium in groundwater on a cost-effective basis, then the parties shall evaluate whether the Navy

should proceed to undertake a focused FS to evaluate the practicality of implementing such a new developed remedial technology(ies).

2.10.3 Summary of Estimated Remedy Costs

The estimated capital, O&M, and NPW costs of the selected remedy are as follows:

- Capital Cost: \$25,000
- 30-/50-/100-Year NPW of Capital, LUC, and O&M Costs: \$129,000/\$140,000/\$144,000

The above cost figures have been rounded to the nearest \$1,000 to reflect the preliminary nature of the estimates. Because the duration of the remedy extends far into the future, an NPW comparison of 50 and 100 years is included. The NPW costs are based on an annual discount rate of 7 percent. A detailed breakdown of the above estimates is provided in Appendix B.

2.10.4 Expected Outcomes of the Selected Remedy

The expected outcomes of the selected remedy may be summarized as follows:

- Immediately upon implementation of the remedy, Site 45 will be environmentally safe for its intended use as a commercial/industrial facility, so long as the institutional controls are in place and observed.
- Eventually, the groundwater GCTLs will be attained, and the surficial aquifer will become available for unrestricted use. It is expected that the GCTLs will be attained in a period between 900 and 1,300 years.
- Soil will require LUCs to prevent residential development of Site 45. These controls will be required for as long as soil contaminant concentrations preclude unrestricted reuse.
- Site 45 is currently an empty lot located within the industrial complex. The JEDC Reuse Plan prescribes commercial aviation-related reuse for this area, although a specific activity has not yet been identified. It is anticipated that the reuse of NAS Cecil Field, including Site 45, will be beneficial to the Jacksonville area and expand the tax base of Duval County.

2.11 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the selected remedy must be protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), be cost effective, and utilize

permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following sections discuss how the selected remedy meets these statutory requirements.

2.11.1 Protection of Human Health and the Environment

The selected remedy, Soil Alternative 2 and Groundwater Alternative 2, will protect human health and the environment. LUCs will prevent the future residential development of the site. Consequently, the reduced frequency of exposure associated with industrial exposure results in a reduced intake of constituents of concern and consequently, a reduced risk. LUCs will also prohibit use of groundwater from the surficial aquifer beneath the site.

The PRE indicates that exposure to soil and groundwater associated with Site 45 results in incremental cancer risks that fall within U.S. EPA's target risk range of 10^{-4} to 10^{-6} and hazard indices less than 1.0 for both industrial and residential exposures. Moreover, concentrations of all COCs are less than FDEP SCTLs for leachability to groundwater. Therefore, soil is unlikely to pose any significant impact to groundwater. However, the incremental cancer risk for the residential exposure exceeds FDEP's target risk level of 10^{-6} . Additionally, the concentrations of vanadium in groundwater are less than U.S. EPA's tap water PRG but exceed the FDEP GCTL. Although this results in a hazard index less than 1.0, the exceedance of the GCTL still triggers the need for monitoring.

2.11.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy, Soil Alternative 2 and Groundwater Alternative 2, will comply with all ARARs. The ARARs that the selected remedy complies with are presented below and in more detail in Table 2-8 through Table 2-13. There are no Location-Specific ARARs.

The Chemical- and Action-Specific ARARs include the following:

- Safe Drinking Water Act MCLs (40 CFR Part 141), This is a Chemical-Specific ARAR that specifies acceptable concentration levels in groundwater that serves as a potential drinking water aquifer.
- Groundwater Classes, Standards, and Exemptions [Florida Administrative Code (FAC) Chapter 62-520]. This is a Chemical-Specific ARAR that designates the groundwater of the State into five classes and establishes minimum "free from" criteria (i.e., what contaminants are prohibited from being present in a particular class of aquifer).

- Occupational Safety and Health Act (OSHA), General Industry Standards (29 CFR Part 1910). This is an Action-Specific ARAR that requires the establishment of programs to assure worker health and safety at hazardous waste sites.
- OSHA Occupational Safety and Health Regulations (29 CFR Part 1910, Subpart Z). This is an Action-Specific ARAR that establishes permissible exposure limits for workplace exposure to specific chemicals.
- OSHA Recordkeeping, Reporting, and Related Regulations (29 CFR Part 1904). This is an Action-Specific ARAR that dictates recordkeeping and reporting requirement for remedial activities.
- OSHA, Health and Safety Standards (29 CFR Part 1926). This is an Action-Specific ARAR that specifies the type of safety training, equipment, and procedures to be used during remediation.
- Florida Water Well Permitting and Construction Requirement - March 1992. This is an Action-Specific ARAR that establishes minimum standards for location, construction, repair, and abandonment of water wells.
- Florida Rules on Hazardous Waste Warning Signs - July 1991. This is an Action-Specific ARAR that requires appropriate warning signs for public protection at NPL and FDEP hazardous waste sites.
- Drinking Water Criteria (FAC Chapter 62-550). This Chemical-Specific ARAR provides primary and secondary drinking water quality criteria.

2.11.3 Other Criteria, Advisories, or Guidance To Be Considered for This Remedial Action

In implementing the selected remedy, The Navy, U.S. EPA and the State have agreed to consider a number of non-binding criteria that are TBCs. These include:

- SDWA Regulations, National Secondary Drinking Water Standards (SMCLs), (40 CFR 143). This Chemical-Specific TBC establishes welfare-based standards for public water systems.
- Cancer Slope Factors (Integrated Risk Information System). This Chemical-Specific TBC provides guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.

- Reference Dose Factors (Integrated Risk Information System). This Chemical-Specific TBC provides guidance values used to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants.
- Contaminant Cleanup Target Levels Rule (FAC Chapter 62-777). This Chemical-Specific TBC provides values for soil, groundwater, and surface water cleanup.
- U.S. EPA Monitored Natural Attenuation Guidance. This provides guidance on evaluation of monitored natural attenuation.

2.11.4 Cost-Effectiveness

The selected remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: “A remedy shall be cost-effective if its costs are proportional to its overall effectiveness.” [NCP §300.430(f)(1)(ii)(D)]. This was accomplished by evaluating the “overall effectiveness” of those alternatives that satisfied the threshold criteria (i.e., both were protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money spent.

The estimated 30/50/100-year NPW costs of the selected remedy are \$129,000/\$140,000/\$144,000.

2.11.5 Utilization of Permanent Solutions and Alternative Treatment Technologies

The Navy and U.S. EPA, in conjunction with FDEP, have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at Site 45. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy and U.S. EPA, in conjunction with FDEP, have determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principle element and bias against off-site treatment and disposal and considering State and Community acceptance.

2.11.6 Preference for Treatment as a Principal Element

Although the selected remedy does not provide for treatment as a principal element, reduction of soil and groundwater contaminant concentrations are expected over time due to dispersion, advection, and adsorption processes.

2.11.7 Five-Year Review Requirement

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.12 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for OU 11, Site 45 (TtNUS, 2001c) was released for public comment on July 14, 2003. The Proposed Plan identified soil Alternative 2 and Groundwater Alternative 2 as the preferred alternatives. The public was invited to comment during a 30-day period extending from July 14 to August 13, 2003. No changes to the proposed remedy, as originally identified in the Proposed Plan, have been made as a result of public comments.

TABLE 2-1

SUMMARY OF POST-REMOVAL ACTION SOIL ANALYTICAL DATA
 OPERABLE UNIT 11, SITE 45
 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

Analyte	Unit	Minimum Detected Concentration	Maximum Detected Concentration	Mean	UCL	FDEP Direct Exposure Industrial SCTL ⁽¹⁾	FDEP Direct Exposure Residential SCTL ⁽¹⁾	FDEP Leachability to Groundwater SCTL ⁽¹⁾	IBDS Value
BaPEq	µg/kg	4	2,478	247	258	500	100	8,000	NA
Arsenic	mg/kg	0.1	9.6	1.9	2.0	3.7	0.8	29	2.04
Mercury	mg/kg	0.02	0.07	0.05	0.05	8.7	3.4	2.1	0.16
Vanadium	mg/kg	1.8	49	11	12	7,400	15	980	6.3
TRPH	mg/kg	10	439	79	83	2,500	340	340	NA

1 Florida Department of Environmental Protection (FDEP) Soil Cleanup Target Levels (SCTLs) (FDEP, 1999a).

BaPEq = Benzo(a)pyrene equivalents.

IBDS = NAS Cecil Field site-specific Inorganic Background Data Set (HLA, 1998c).

Mean = Arithmetic mean of analytical data.

NA = Not available.

TRPH = Total recoverable petroleum hydrocarbons.

UCL = 95-percent upper confidence limit of the mean.

TABLE 2-2

**SUMMARY OF GROUNDWATER LEAD AND VANADIUM DETECTIONS
PRE-RI SAMPLING
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Analyte	Detected Concentration (total/filtered)							FDEP GCTL ⁽¹⁾	U.S. EPA MCL ⁽²⁾	IBDS Value ⁽³⁾	U.S. EPA PRG ⁽⁴⁾
	CEF- 007-01Sa	CEF- 011-01Sa	CEF- P45-01S	CEF- P45-02S	CEF- P45-03S	CEF- P45-04S	CEF- P45-05S				
February 1996											
Lead	2 U / NA	9.7 / NA	NS	NS	NS	NS	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
Vanadium	147 / NA	195 / NA	NS	NS	NS	NS	NS	49	NC	20.2	260
October 1998											
Lead	NS	NA / NA	NS	NS	NS	NS	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
Vanadium	NS	740 / 720	NS	NS	NS	NS	NS	49	NC	20.2	260
July 1999											
Lead	3.9 U / 3.2 U	NS	5 U / 16.8	8.4 2.3 U	5.7 U / 1.8 U	NS	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
Vanadium	695 / 744	NS	31.4 / 30	280 / 235	33 / 250	NS	NS	49	NC	20.2	260
September 1999											
Lead	NS	NS	NS	NS	NS	17.3 / NA	2.5 U / NA	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
Vanadium	NS	NS	NS	NS	NS	54.2 / NA	4.1 / NA	49	NC	20.2	260

All concentrations in µg/L.

Bolded values indicate an exceedance of the Florida Department of Environmental Protection(FDEP) Groundwater Cleanup Target Level (GCTL).

- | | | | |
|---|---|----|--|
| 1 | FDEP GCTLs (1999a). | NA | Not analyzed. |
| 2 | U.S. EPA Maximum Contaminant Levels (MCLs) (1998). | NC | No criterion. |
| 3 | NAS Cecil Field site-specific Inorganic Background Data Set (HLA, 1998c). | NS | Not sampled. |
| 4 | U.S. EPA Region 9 risk-based Preliminary Remediation Goals (PRGs) (2002). | U | Not detected at the indicated detection limit. |
| 5 | Action level. | | |

TABLE 2-3

**SUMMARY OF GROUNDWATER LEAD AND VANADIUM DETECTIONS
RI SAMPLING
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Sampling Location	Analyte	April 2000	August 2000	FDEP GCTL ⁽¹⁾	U.S. EPA MCL ⁽²⁾	IBDS Value ⁽³⁾	U.S. EPA PRG ⁽⁴⁾
CEF-007-01Sa	Lead	1.6U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	240 / 233	NS	49	NC	20.2	260
CEF-P45-01S	Lead	3.6U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	13.3 / 5.5	NS	49	NC	20.2	260
CEF-P45-02S	Lead	1.6U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	74.9 / 85	NS	49	NC	20.2	260
CEF-P45-03S	Lead	5.8U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	49 / 40.4	NS	49	NC	20.2	260
CEF-P45-04S	Lead	5.4U / 3.1U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	68.2 / 53.6	NS	49	NC	20.2	260
CEF-P45-06S	Lead	1.6U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	3 / 1.7	NS	49	NC	20.2	260
CEF-P45-07S	Lead	1.8U / 1.7U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	5 / 3.6	NS	49	NC	20.2	260
CEF-P45-08S	Lead	34.6 / 10.2	5.3 / 2.9	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	5.4 / 3.7	NA	49	NC	20.2	260
CEF-P45-09S	Lead	1.6U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	0.7U / 0.7U	NS	49	NC	20.2	260
CEF-P45-10I	Lead	12.6 / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	26.5 / 3.9	NS	49	NC	20.2	260
CEF-P45-11S	Lead	1.6 / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	4.3 / 3.9	NS	49	NC	20.2	260
CEF-P45-12S	Lead	1.6U / 1.6U	NS	15	15 ⁽⁵⁾	5.35	15 ⁽⁵⁾
	Vanadium	2 / 2.1	NS	49	NC	20.2	260

All concentrations in µg/L.

Bolded values indicate an exceedance of the Florida Department of Environmental Protection (FDEP) Groundwater Cleanup Target Level (GCTL).

- 1 FDEP GCTLs (1999a).
- 2 U.S. EPA MCLs (1998).
- 3 NAS Cecil Field site-specific Inorganic Background Data Set (HLA, 1998c).
- 4 U.S. EPA Region 9 risk-based Preliminary Remediation Goals (PRGs) (2002).
- 5 Action level.
- NA Not analyzed.
- NC No criterion.
- NS Not sampled.
- U Not detected at the indicated detection limit.

TABLE 2-4

**SUMMARY OF GROUNDWATER ANALYTICAL DATA
POST-RI SAMPLING
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Parameter	Units	Monitoring Well					
		CEF-P45-2S	CEF-P45-3S	CEF-P45-4S	CEF-P45-7S	CEF-F11-1Sa	CEF-007-1Sa
Alkalinity	mg/L	135	17.2	25.8	60.1	127	67.6
Alkalinity, field	mg/L	265	48	134	117	5110	169
Chloride	mg/L	4.5	6	35.5	8	165	5
Ferrous iron, field	mg/L	0.02	0.14	0.36	0.39	0.86	0.01
Dissolved oxygen, field	mg/L	3	2.5	3	1	NM*	6
Dissolved oxygen, Horiba	mg/L	3.7	1.2	1.9	0.7	2.3	6.4
Dissolved sulfide	mg/L	2.0 U	2.0 U	3.7	3.3	2.0 U	2.0 U
Hydrogen sulfide, field	mg/L	0	0	5	5	1	0
Sulfide, field	mg/L	0.01	0.13	0.78	0.29	0.67	0.04
Nitrate	mg/L	1.6	1.4	0.10 U	0.19	0.28	2.4
Nitrite	mg/L	0.18	0.010 U	0.010 U	0.010 U	0.050 U	0.010 U
Orthophosphate	mg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
pH, field	St. units	6.3	6.2	5.4	6.0	6.2	6.7
ORP, field	mV	117	100	-78	-162	-169	177
Specific conductance, field	mS/cm	0.519	0.110	0.301	0.334	1.08	0.298
Sulfate	mg/L	41.7	32.6	10 U	32.4	72.3	24.4
Temperature	°C	21.1	19.1	22.7	22.5	19.0	19.7
TOC	mg/L	13.9	11.4	214	51.2	285	18.9
Turbidity	NTU	6.2	55	78	62.7	20.7	11.7
Turbidity, field	NTU	4.5	62	140	72	21	0
Total Aluminum	ug/L	281	3280	14500	1670	8760	545
Filtered Aluminum	ug/L	280	1140	11100	1130	7510	233
Total Calcium	ug/L	92600	11600	8030	42600	32500	58500
Filtered Calcium	ug/L	83400	10900	8310	39000	31000	57800
Total Iron	ug/L	20.9	220	392	411	840	9.4
Filtered Iron	ug/L	30	96.3	377	331	691	9.02 U
Total Magnesium	ug/L	4720	1020	314	2010	1780	664
Filtered Magnesium	ug/L	4210	1010	387	1850	1720	653
Total Manganese	ug/L	1	0.32	1.8	19.4	30.4	.26 U
Filtered Manganese	ug/L	0.79	0.87	5.2	17.6	28.4	.26 U
Total Potassium	ug/L	4520	889	2380	6660	1920	1500
Filtered Potassium	ug/L	4240	892	2740	5940	1910	1590
Total Sodium	ug/L	20500	7540	62800	5530	203000	2480
Filtered Sodium	ug/L	30300	7290	56000	5090	197000	2600
Total Vanadium	ug/L	211	66	85	5.9	281	284
Filtered Vanadium	ug/L	221	60.9	78.3	5	259	262

U = Not detected at or above indicated detection limit.

J = Estimated concentration.

NA = Not analyzed.

ORP = Oxidation-reduction potential.

mS/Cm = microSiemens/centimeter.

NTU = Nephelometric turbidity units.

TOC = Total organic carbon.

°C = degrees Celsius.

NM* = Not measured. Color interference.

Well P45-2S was duplicated and the greater of the two values is shown.

TABLE 2-5

EXPLANATION OF DETAILED ANALYSIS CRITERIA
 OPERABLE UNIT 11, SITE 45 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

Criterion	Description
Threshold	<p>Overall Protection of Human Health and the Environment. This criterion evaluates the degree to which each alternative eliminates, reduces, or controls threats to human health and the environment through treatment, engineering methods, or institutional controls (e.g., access restrictions).</p> <p>Compliance with State and Federal Regulations. The alternatives are evaluated for compliance with environmental protection regulations determined to be applicable or relevant and appropriate to the site conditions.</p>
Primary Balancing	<p>Long-Term Effectiveness and Permanence. The alternatives are evaluated based on their ability to maintain reliable protection of human health and the environment after implementation.</p> <p>Reduction of Contaminant Toxicity, Mobility, and Volume Through Treatment. Each alternative is evaluated based on how it reduces the harmful nature of the contaminants, their ability to move through the environment, and the amount of contamination.</p> <p>Short-Term Effectiveness. The risks that implementation of a particular remedy may pose to workers and nearby residents (e.g., whether or not contaminated dust will be produced during excavation), as well as the reduction in risks that results by controlling the contaminants, are assessed. The length of time needed to implement each alternative is also considered.</p> <p>Implementability. Both the technical feasibility and administrative ease (e.g., the amount of coordination with other government agencies needed) of a remedy, including availability of necessary goods and services, are assessed.</p> <p>Cost. The benefits of implementing a particular alternative are weighted against the cost of implementation.</p>
Modifying	<p>U.S. EPA and FDEP Acceptance. The final Feasibility Study and the Proposed Plan, which are placed in the Administrative Record, represent a consensus by the Navy, U.S. EPA, and FDEP.</p> <p>Community Acceptance. The Navy assesses community acceptance of the preferred alternative by giving the public an opportunity to comment on the remedy selection process and the preferred alternative and then responds to those comments.</p>

TABLE 2-6

**SUMMARY OF COMPARATIVE ANALYSIS OF SOIL REMEDIAL ALTERNATIVES
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 1 OF 2**

Evaluation Criteria	Soil Alternative 1: No Action	Soil Alternative 2: LUCs and Monitoring	Soil Alternative 3: Excavation and Off-Base Disposal
Overall Protection of Human Health and Environment	Would not be protective because residential development could occur that would result in unacceptable risks to human and ecological receptors. The threat of soil COCs migrating to the groundwater would remain.	Would be protective of the environment by preventing residential development and detecting the migration of soil COCs.	Would be most protective by eliminating the risk of exposure to soil contaminated above SCTLs for direct residential exposure or background values and minimizing the potential for migration of COCs to groundwater.
Compliance with ARARs and TBCs: Chemical-Specific Location-Specific Action-Specific	Would not comply Would not comply Not applicable	Would not comply in the short-term Would comply Would comply	Would comply Would comply Would comply
Long-Term Effectiveness and Permanence	Would have very limited long-term effectiveness and permanence because contaminants would remain on-site. Any long-term effectiveness would not be known since monitoring would not occur.	Would be long-term effective and permanent. The prevention of residential development through deed restrictions and the monitoring of contaminants to evaluate their migration would provide long-term effectiveness and permanence.	Would provide the most long-term effectiveness and permanence. Risks from exposure to contaminated soil under any land use scenario and from potential contaminants migration would be effectively and permanently eliminated through removal and disposal.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	Would not achieve reduction of toxicity, mobility, or volume of contaminants through treatment but may achieve some reduction through natural processes.	Would not achieve reduction of toxicity, mobility, or volume of contaminants through treatment but may achieve some reduction through natural processes.	Approximately 7,800 yd ³ of contaminated soil containing an estimated 1,604 pounds of COCs would be permanently removed from the site. Disposal would reduce mobility.

TABLE 2-6

**SUMMARY OF COMPARATIVE ANALYSIS OF SOIL REMEDIAL ALTERNATIVES
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 2 OF 2**

Evaluation Criteria	Soil Alternative 1: No Action	Soil Alternative 2: LUCs and Monitoring	Soil Alternative 3: Excavation and Off-Base Disposal
Short-Term Effectiveness	Would not result in short-term risks to site workers or adversely impact the surrounding community but would also not achieve the soil RAO and PRGs.	Would result in slight risk to site workers during sampling of the soil and groundwater. This risk would be reduced through the wearing of appropriate personal protection equipment (PPE) and the compliance with site-specific health and safety procedures. The soil RAO would be achieved immediately upon implementation. Eventual compliance with the soil PRGs would be determined through monitoring.	Would result in a significant risk of exposure to site workers to contaminated soil during the excavation and off-base disposal activities. This risk would be reduced through the wearing of appropriate PPE and compliance with site-specific health and safety procedures. The soil RAO would be achieved immediately upon implementation. Soil PRGs would be attained within 6 months.
Implementability	Would be simple to implement because no action would occur.	Would be easy to implement because the resources, materials, and equipment are readily available. Provisions will be incorporated into the property transfer documents to ensure the continuation of the LUCs and monitoring when ownership of the site is transferred to the private sector.	Would be the most difficult to implement because contaminated soil would have to be excavated and transported off-base for disposal. No LUCs or monitoring would be required. A construction permit and manifesting would also be required.
Costs: Capital NPW of O&M (30-year) NPW (30-/50-/100-year)	\$0 \$0 \$0	\$5,000 \$47,000 \$52,000/\$57,000/\$58,000	\$3,900,000 \$0 \$3,900,000

TABLE 2-7

**SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER REMEDIAL ALTERNATIVES
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 1 OF 2**

Evaluation Criteria	Groundwater Alternative 1: No Action	Groundwater Alternative 2: Natural Attenuation, LUCs, and Monitoring	Groundwater Alternative 3: Extraction, On-Site Treatment, Surface Discharge, LUCs, and Monitoring
Overall Protection of Human Health and Environment	Would not be protective because there would be a continued risk from human exposure to contaminated groundwater. Also, potential contaminant migration would remain unchecked.	Would be protective by preventing risk from exposure to contaminated groundwater through LUCs and monitoring.	Would be more protective than Alternative 2 by providing the same protective components plus elimination of risk from exposure to vanadium in groundwater through extraction and treatment of the contaminant plume.
Compliance with ARARs and TBCs: Chemical-Specific Location-Specific Action-Specific	Would not comply Would not comply Not applicable	Would eventually comply Would comply Would comply	Would eventually comply Would comply Would comply
Long-Term Effectiveness and Permanence	Would not be effective and permanent in the long term because contaminants would remain on site. Any long-term effectiveness would not be known because monitoring would not occur.	Would be effective and permanent in the long term. Groundwater use restrictions and monitoring would effectively prevent unacceptable risk from exposure to contaminated groundwater.	Would be effective and permanent in the long term. Groundwater use restrictions and monitoring would effectively prevent unacceptable risk from exposure to contaminated groundwater.
Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment	Would not achieve reduction of toxicity, mobility, or volume of contaminants through treatment but might achieve some reduction through natural processes.	Would not achieve reduction of toxicity, mobility, or volume of contaminants through treatment but would achieve reduction through natural processes.	Would achieve reduction of contaminant toxicity, mobility, and volume through treatment. An estimated 3.1 pounds of vanadium would be irreversibly and permanently removed from the groundwater.

TABLE 2-7

**SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER REMEDIAL ALTERNATIVES
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
PAGE 2 OF 2**

Evaluation Criteria	Groundwater Alternative 1: No Action	Groundwater Alternative 2: Natural Attenuation, LUCs, and Monitoring	Groundwater Alternative 3: Extraction, On-Site Treatment, Surface Discharge, LUCs, and Monitoring
Short-Term Effectiveness	Would not result in short-term risks to site workers or adversely impact the surrounding community but would also not achieve the groundwater RAO and PRG.	Would result in slight risk of exposure to site workers during sampling of groundwater. This risk would be reduced through the wearing of appropriate PPE and the compliance with site-specific health and safety procedures. The groundwater RAO would be achieved immediately upon implementation. The vanadium PRG would be attained within approximately 900 to 1,300 years.	Would result in slight risk of exposure to site workers during the installation and operation of the groundwater extraction and treatment system and the sampling of groundwater. This risk would be reduced through the wearing of appropriate PPE and the compliance with site-specific health and safety procedures. The groundwater RAO would be achieved immediately upon implementation. The vanadium PRG would be attained within approximately 18 years.
Implementability	Would be simple to implement because no action would occur.	Would be easy to implement. Resources, materials, and equipment are readily available. Provisions will be incorporated into the property transfer documents to ensure the continuation of the LUCs and monitoring.	Would be more difficult to implement than Alternative 2 because, in addition to LUCs and monitoring, a groundwater extraction and treatment system would have to be installed, operated, and maintained. Provisions will be incorporated into the property transfer documents to ensure the continuation of the LUCs and monitoring. A construction permit would be required.
Costs:			
Capital	\$0	\$25,000	\$303,000
NPW of O&M (30-year)	\$0	\$97,000	\$393,000
NPW (30-/50-/100-year)	\$0	\$122,000/\$133,000/\$137,000	\$696,000

TABLE 2-8

FEDERAL CHEMICAL-SPECIFIC ARARs FOR SELECTED REMEDY
 OPERABLE UNIT 11, SITE 45
 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
Federal Regulatory Requirement	Groundwater	Safe Drinking Water Act (SDWA) Regulations, Maximum Contaminant Levels (MCLs)	40 CFR Part 141	Relevant and Appropriate	Establishes enforceable standards for potable water for specific contaminants that have been determined to adversely affect human health.	Will be used to establish protective levels for groundwater that are current or potential drinking water sources.
Federal Regulatory Requirement	Groundwater	SDWA Regulations, National Secondary Drinking Water Standards (SMCLs)	40 CFR Part 143	To Be Considered (TBC)	Establishes welfare-based standards for public water systems for specific contaminants or water characteristics that may affect the aesthetic qualities of drinking water.	Will be considered to establish protective levels for groundwater that are current or potential drinking water sources.
Federal Advisory	Soil and Water	Cancer Slope Factors (CSFs)		TBC	Guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Were considered for development of human health protection PRGs for soil and groundwater at this site.
Federal Advisory	Soil and Water	Reference Doses (RfDs)		TBC	Guidance values used to evaluate the potential noncarcinogenic hazard caused by exposure to contaminants.	Were considered for development of human health protection PRGs for soil and groundwater at this site.
Federal Guidance	Groundwater	U.S. EPA Monitored Natural Attenuation Guidance		TBC	Provides guidance on the evaluation of monitored natural attenuation.	Was considered in site evaluation.

TABLE 2-9

STATE CHEMICAL-SPECIFIC ARARs OF SELECTED REMEDY
 OPERABLE UNIT 11, SITE 45
 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
State Regulatory Requirement	Groundwater	Groundwater Classes, Standards and Exemptions	FAC Chapter 62-520	Applicable	This rule designates the groundwater of the state into five classes and establishes minimum "free from" criteria. This rule also specifies that Classes I and II must meet the primary and secondary drinking water standards listed in Chapter 62-550.	This rule was used to establish PRGs for groundwater that is a potential source of drinking water.
State Regulatory Requirement	Groundwater	Drinking Water Criteria	FAC Chapter 62-550	Applicable	Provides primary and secondary drinking water quality criteria.	This rule was used to establish PRGs for groundwater that is a potential source of drinking water.
State Regulatory Requirement	Soil and Groundwater	Contaminant Cleanup Target Levels Rule	FAC Chapter 62-777	TBC	This rule provides guidance for soil, groundwater, and surface water cleanup levels that can be developed on a site-by-site basis.	This rule was considered for the development of soil and groundwater PRGs at this site.

TABLE 2-10

**FEDERAL LOCATION-SPECIFIC ARARs FOR SELECTED REMEDY
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
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There are no Federal Location-Specific ARARs

TABLE 2-11

**STATE LOCATION-SPECIFIC ARARs FOR SELECTED REMEDY
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
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There are no State Location-Specific ARARs

TABLE 2-12

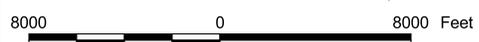
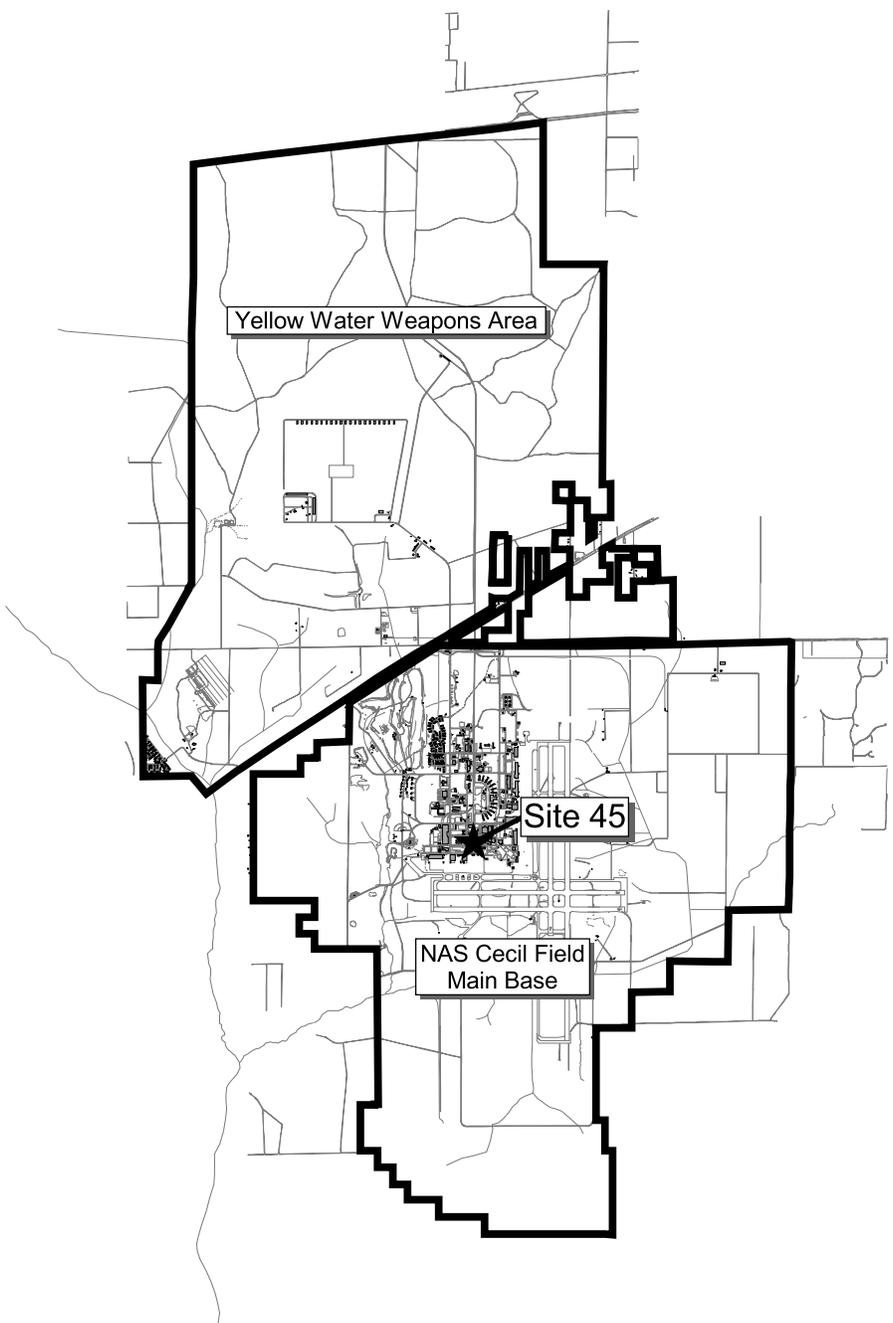
FEDERAL ACTION-SPECIFIC ARARs FOR SELECTED REMEDY
 OPERABLE UNIT 11, SITE 45
 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action To Be Taken to Attain Requirement
Federal Regulatory Requirement	All	Occupational Safety and Health Act (OSHA), General Industry Standards	29 CFR Part 1910	Applicable	Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee-training requirements.	These regulations will apply to all soil and groundwater remedial activities.
Federal Regulatory Requirement	All	OSHA, Occupational Health and Safety Regulations	29 CFR Part 1910, Subpart Z	Applicable	Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals.	Will be applied to control worker exposure to OSHA hazardous chemicals during remedial activities.
Federal Regulatory Requirement	All	OSHA, Recordkeeping, Reporting, and Related Regulations	29 CFR Part 1904	Applicable	Provides recordkeeping and reporting requirements applicable to remedial activities.	These requirements will apply to all site contractors and subcontractors and will be followed during all site work.
Federal Regulatory Requirement	All	OSHA, Health and Safety Standards	29 CFR Part 1926	Applicable	Specifies the type of safety training, equipment, and procedures to be used during the site investigation and remediation.	All phases of the remedial response project will be executed in compliance with these standards.

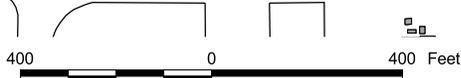
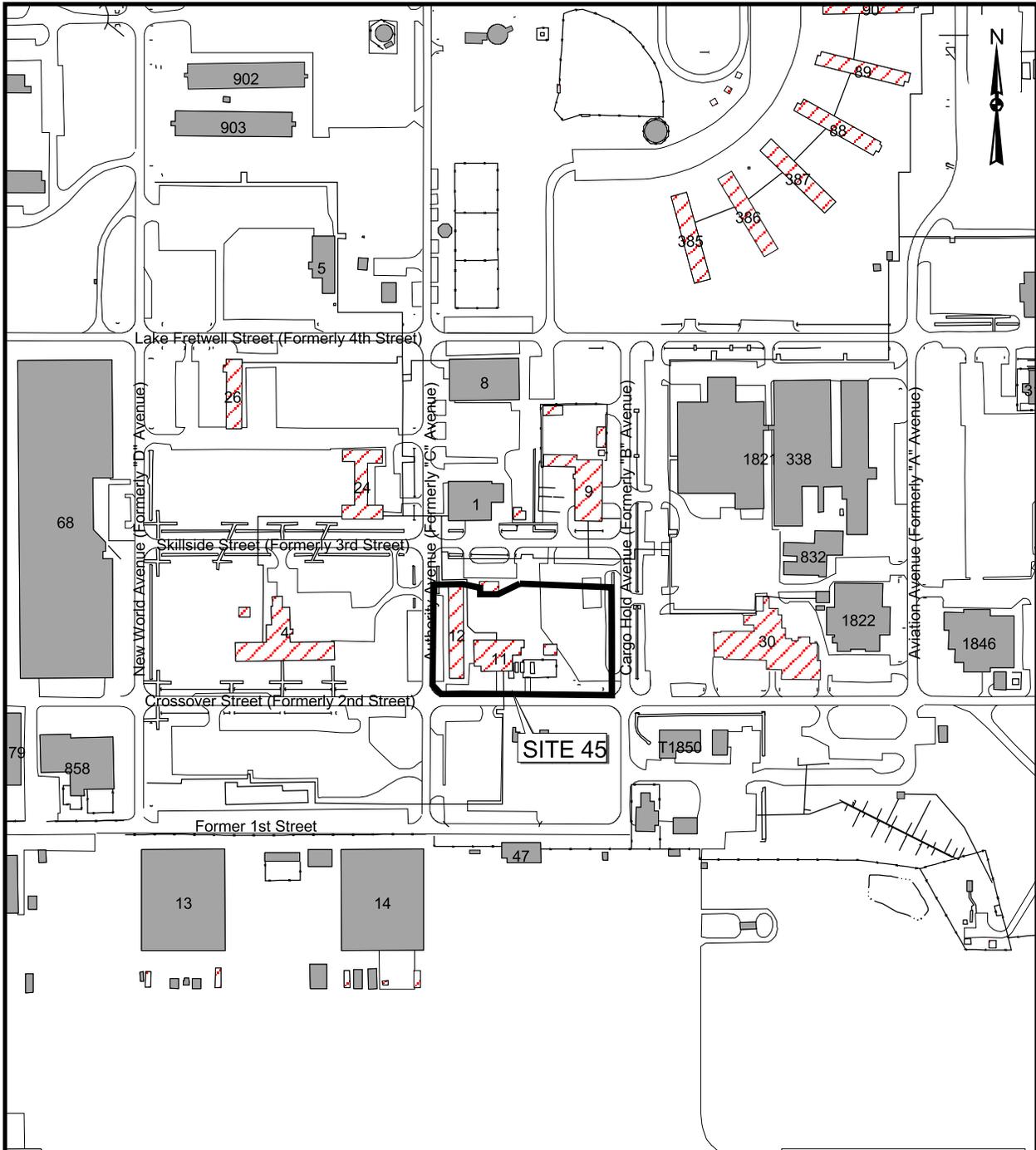
TABLE 2-13

**STATE ACTION-SPECIFIC ARARs FOR SELECTED REMEDY
OPERABLE UNIT 11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

Authority	Medium	Requirement	Citation	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
State Regulatory Requirement	Groundwater	Florida Water Well Permitting and Construction Requirements – March 1992	FAC Chapter 62-532	Applicable	Establishes minimum standards for the location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established.	The substantive requirements for permitting will be met for the construction, repair, or abandonment of monitoring wells.
State Regulatory Requirement	All	Florida Rules on Hazardous Waste Warning Signs – July 1991	FAC Chapter 62-736	Applicable	Requires warning signs at NPL and FDEP - identified hazardous waste sites to inform the public of the presence of potentially harmful conditions.	This requirement will be met.



DRAWN BY MJJ	DATE 30Jun00		GENERAL LOCATION MAP OU11, SITE 45 RECORD OF DECISION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA		CONTRACT NUMBER 0039	
CHECKED BY	DATE		APPROVED BY	DATE		
COST/SCHEDULE-AREA			APPROVED BY	DATE		
SCALE AS NOTED			DRAWING NO. FIGURE 2-1	REV 1		



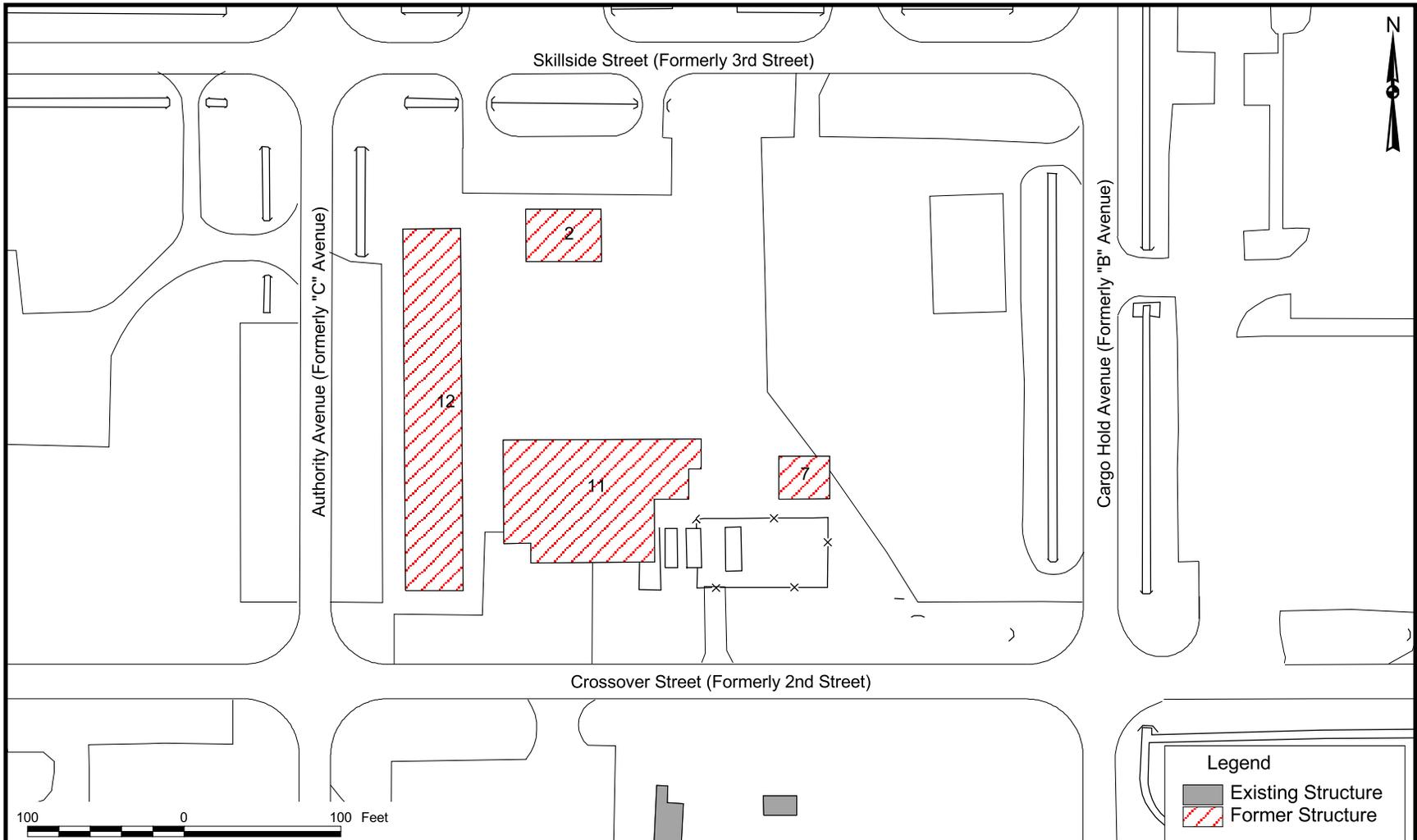
Legend	
	Existing Structure
	Former Structure

DRAWN BY MJJ	DATE 08May00
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE AS NOTED	



SITE VICINITY MAP
 OU11, SITE 45
 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

CONTRACT NUMBER 0039	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 2-2	REV 1



Legend

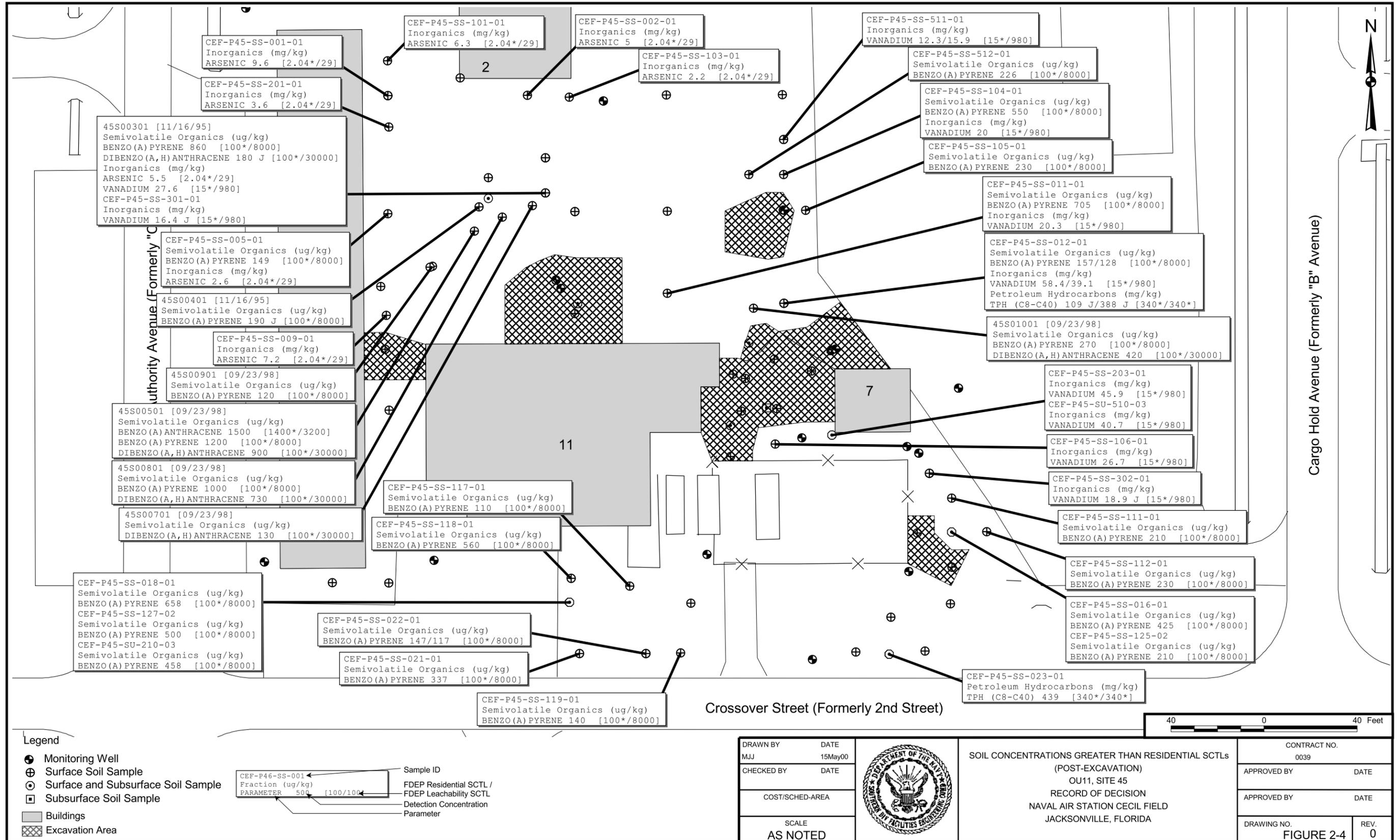
-  Existing Structure
-  Former Structure

DRAWN BY	DATE
MJJ	30Jun00
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE AS NOTED	

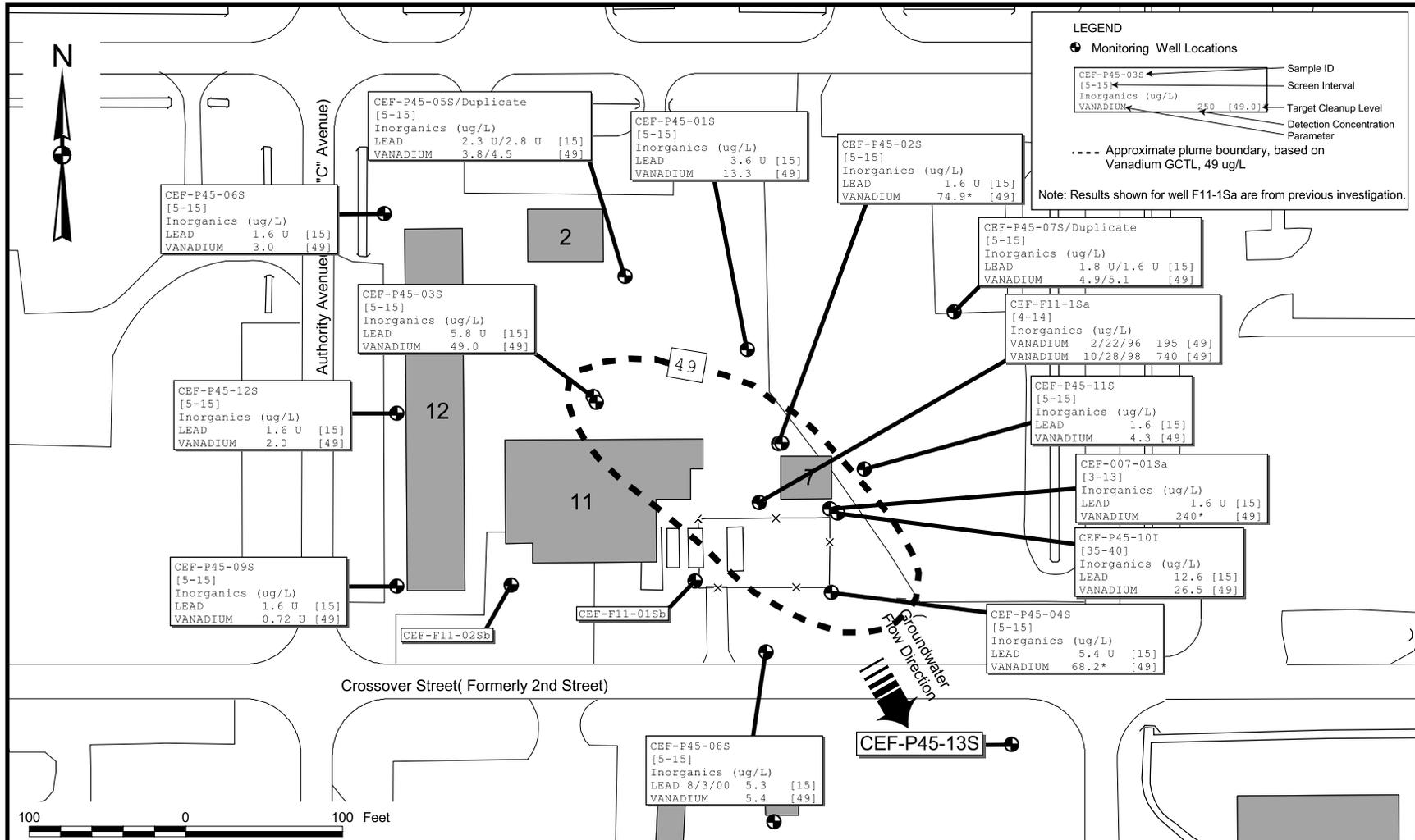


GENERAL ARRANGEMENT
 OU11, SITE 45
 RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

CONTRACT NUMBER 0039	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 2-3	REV 1



DRAWN BY MJJ	DATE 15May00		SOIL CONCENTRATIONS GREATER THAN RESIDENTIAL SCTLs (POST-EXCAVATION) OU11, SITE 45 RECORD OF DECISION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NO. 0039	
CHECKED BY	DATE			APPROVED BY	DATE
COST/SCHED-AREA				APPROVED BY	DATE
SCALE AS NOTED				DRAWING NO. FIGURE 2-4	REV. 0



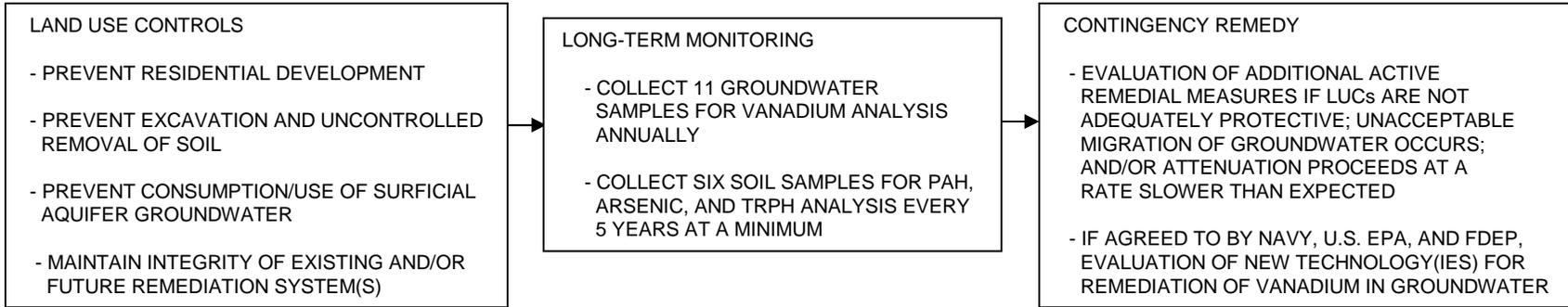
DRAWN BY	DATE
MJJ	02Oct00
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE	
AS NOTED	



GROUNDWATER RESULTS - RI
OU11, SITE 45
RECORD OF DECISION
NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA

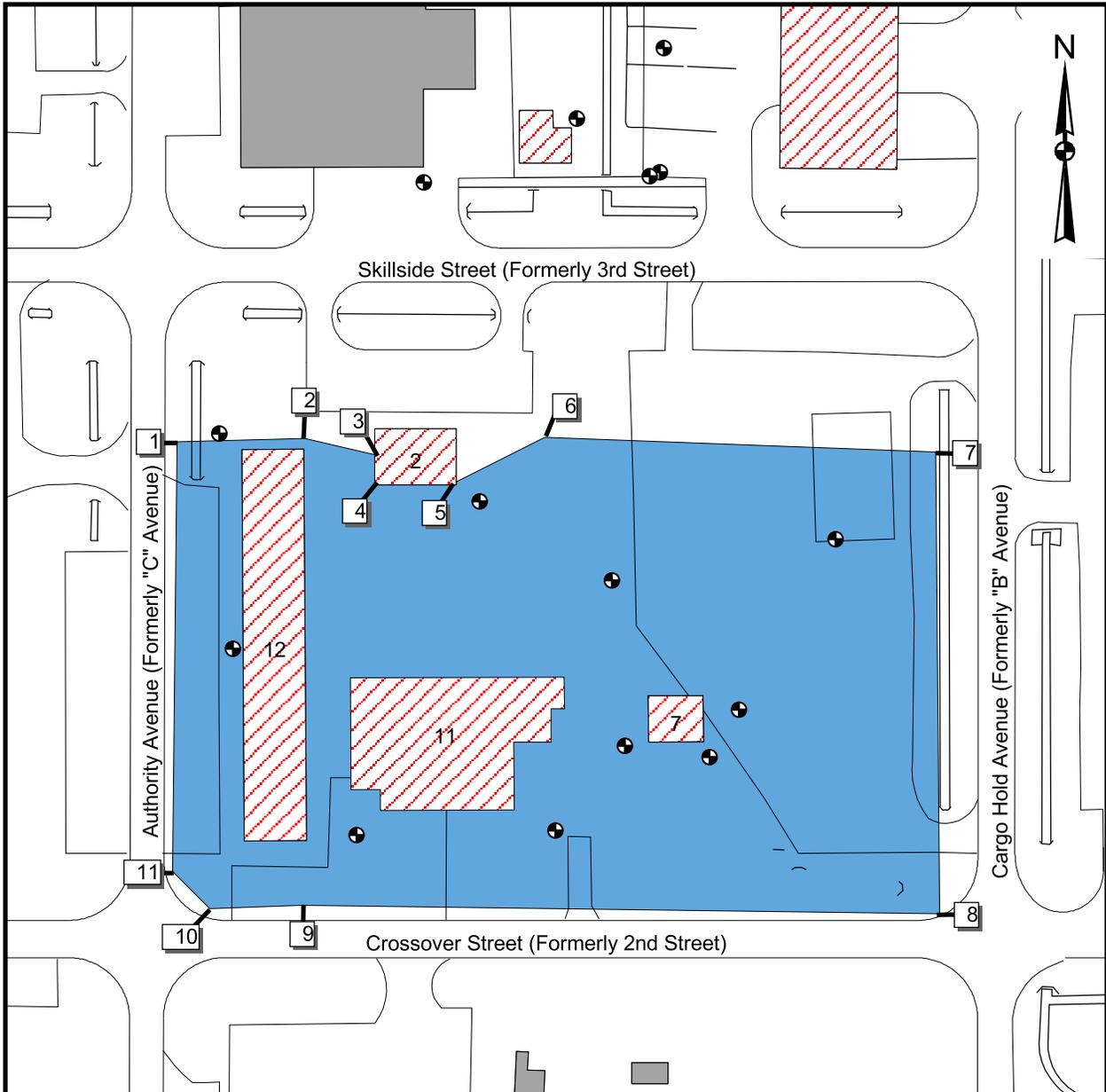
CONTRACT NUMBER	
0039	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO.	REV
FIGURE 2-5	0

LAND USE CONTROLS, MONITORING, AND CONTINGENCY REMEDY



PAHs = Polynuclear aromatic hydrocarbons.
 TRPH = Total recoverable petroleum hydrocarbons.
 LUCs = Land use controls.

DRAWN BY MJJ	DATE 02/28/03		BLOCK FLOW DIAGRAM OU11, SITE 45 RECORD OF DECISION NAVAL AIR STATION CECIL FIELD JACKSONVILLE, FLORIDA	CONTRACT NUMBER 0039
CHECKED BY 	DATE 		APPROVED BY 	DATE
COST/SCHEDULE-AREA 			APPROVED BY 	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-6	REV 0



Legend

- Monitoring Wells
- Controlled land use parcel
- Existing Structure
- ▨ Former Structure

Notes: Controlled land use parcel has groundwater and soil restrictions.

LABEL	EASTING	NORTHING
1	375956.35	2142425.49
2	376030.76	2142428.01
3	376074.24	2142417.56
4	376074.15	2142401.93
5	376119.05	2142401.39
6	376173.59	2142429.20
7	376403.62	2142419.40
8	376404.36	2142146.72
9	376030.49	2142152.75
10	375975.21	2142149.73
11	375953.86	2142171.35



DRAWN BY MJJ	DATE 10Feb03
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE AS NOTED	



LAND USE CONTROL IMPLEMENTATION PLAN
 OU11, SITE 45
RECORD OF DECISION
 NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA

CONTRACT NUMBER 0039	
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE 2-7	REV 1

REFERENCES

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APPENDIX A
RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

Public notice of the availability of the Proposed Plan was placed in the Metro edition of the *Florida-Times Union* on July 14, 2003. This local edition targets the communities closest to NAS Cecil field. A 30-day public comment period was held from July 14 to August 13, 2003. Provisions for the public to request a public meeting to discuss the Revised Proposed Plan were also described in the public notice. No comments were received during the 30-day comment period.

APPENDIX B
ESTIMATED COSTS OF SELECTED REMEDY

NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA
 SITE 45

SELECTED REMEDY: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	100	hr			\$35.00		\$0	\$0	\$3,500	\$0	\$3,500
2 MOBILIZATION/DEMOBILIZATION											
2.1 Mobilize/Demobilize Drill Rig	1	ls	\$2,495.00				\$2,495	\$0	\$0	\$0	\$2,495
3 DECONTAMINATION											
3.1 Decontamination of Drill Rig	1	ls	\$500.00				\$500	\$0	\$0	\$0	\$500
4 MONITORING WELL INSTALLATION											
4.1 Install Monitoring Well	15	lf	\$24.00				\$360	\$0	\$0	\$0	\$360
4.2 Well Development	2	hr	\$35.00				\$70	\$0	\$0	\$0	\$70
4.3 Collect/Containerize IDW	1	ea	\$50.00				\$50	\$0	\$0	\$0	\$50
4.4 Transport/Dispose IDW Off Site	1	drum	\$150.00				\$150	\$0	\$0	\$0	\$150
5 INSTITUTIONAL CONTROLS											
5.1 Prepare Deed Restrictions & LUCIPs	100	hr			\$35.00		\$0	\$0	\$3,500	\$0	\$3,500
Subtotal							\$3,625	\$0	\$7,000	\$0	\$10,625
Local Area Adjustments							100.0%	120.5%	88.0%	88.0%	
							\$3,625	\$0	\$6,160	\$0	\$9,785
Overhead on Labor Cost @ 30%									\$1,848		\$1,848
G & A on Labor Cost @ 10%									\$616		\$616
G & A on Material Cost @ 10%								\$0			\$0
G & A on Subcontract Cost @ 10%							\$363				\$363
Total Direct Cost							\$3,988	\$0	\$8,624	\$0	\$12,612
Indirects on Total Direct Cost @ 35%											\$4,414
Profit on Total Direct Cost @ 10%											\$1,261
Subtotal											\$18,287
Health & Safety Monitoring @ 5%											\$914
Total Field Cost											\$19,201
Contingency on Total Field Costs @ 20%											\$3,840
Engineering on Total Field Cost @ 10%											\$1,920
TOTAL COST											\$24,961

**NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA
 SITE 45
 SELECTED REMEDY: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING
 Annual Cost**

Item	Item Cost Year 1 - X ⁽¹⁾	Item Cost Every 5 Years	Notes
Groundwater Sampling	\$4,360		Labor, Field Supplies
Analysis/Water	\$240		Analyze samples from 11 wells plus one QA sample for vanadium. Annually for years 1 - 30, 50 or 100.
Soil Sampling		\$1,090	Labor, Field Supplies
Analysis/Soil		\$2,065	Analyze 6 surface (0-2 ft) soil samples and one QA sample for PAHs, TRPHs, and arsenic. Once every 5 years for 100 years.
Report	\$1,000		Document sampling events and results
Site Inspection	\$1,000		One day annual inspection to verify continued implementation of institutional controls
Site Review		<u>\$7,000</u>	
TOTALS	\$6,600	\$10,155	

(1) Sampling would occur annually for years 1 - 30, 50 or 100.

**NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
SITE 45**

**SELECTED REMEDY: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING
Thirty Year Present Worth Analysis**

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$24,961		\$24,961	1.000	\$24,961
1		\$6,600	\$6,600	0.935	\$6,171
2		\$6,600	\$6,600	0.873	\$5,762
3		\$6,600	\$6,600	0.816	\$5,386
4		\$6,600	\$6,600	0.763	\$5,036
5		\$16,755	\$16,755	0.713	\$11,946
6		\$6,600	\$6,600	0.666	\$4,396
7		\$6,600	\$6,600	0.623	\$4,112
8		\$6,600	\$6,600	0.582	\$3,841
9		\$6,600	\$6,600	0.544	\$3,590
10		\$16,755	\$16,755	0.508	\$8,512
11		\$6,600	\$6,600	0.475	\$3,135
12		\$6,600	\$6,600	0.444	\$2,930
13		\$6,600	\$6,600	0.415	\$2,739
14		\$6,600	\$6,600	0.388	\$2,561
15		\$16,755	\$16,755	0.362	\$6,065
16		\$6,600	\$6,600	0.339	\$2,237
17		\$6,600	\$6,600	0.317	\$2,092
18		\$6,600	\$6,600	0.296	\$1,954
19		\$6,600	\$6,600	0.277	\$1,828
20		\$16,755	\$16,755	0.258	\$4,323
21		\$6,600	\$6,600	0.242	\$1,597
22		\$6,600	\$6,600	0.226	\$1,492
23		\$6,600	\$6,600	0.211	\$1,393
24		\$6,600	\$6,600	0.197	\$1,300
25		\$16,755	\$16,755	0.184	\$3,083
26		\$6,600	\$6,600	0.172	\$1,135
27		\$6,600	\$6,600	0.161	\$1,063
28		\$6,600	\$6,600	0.150	\$990
29		\$6,600	\$6,600	0.141	\$931
30		\$16,755	\$16,755	0.131	\$2,195
TOTAL PRESENT WORTH					\$128,755

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

SELECTED REMEDY: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

Fifty Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$24,961		\$24,961	1.000	\$24,961
1		\$6,600	\$6,600	0.935	\$6,171
2		\$6,600	\$6,600	0.873	\$5,762
3		\$6,600	\$6,600	0.816	\$5,386
4		\$6,600	\$6,600	0.763	\$5,036
5		\$16,755	\$16,755	0.713	\$11,946
6		\$6,600	\$6,600	0.666	\$4,396
7		\$6,600	\$6,600	0.623	\$4,112
8		\$6,600	\$6,600	0.582	\$3,841
9		\$6,600	\$6,600	0.544	\$3,590
10		\$16,755	\$16,755	0.508	\$8,512
11		\$6,600	\$6,600	0.475	\$3,135
12		\$6,600	\$6,600	0.444	\$2,930
13		\$6,600	\$6,600	0.415	\$2,739
14		\$6,600	\$6,600	0.388	\$2,561
15		\$16,755	\$16,755	0.362	\$6,065
16		\$6,600	\$6,600	0.339	\$2,237
17		\$6,600	\$6,600	0.317	\$2,092
18		\$6,600	\$6,600	0.296	\$1,954
19		\$6,600	\$6,600	0.277	\$1,828
20		\$16,755	\$16,755	0.258	\$4,323
21		\$6,600	\$6,600	0.242	\$1,597
22		\$6,600	\$6,600	0.226	\$1,492
23		\$6,600	\$6,600	0.211	\$1,393
24		\$6,600	\$6,600	0.197	\$1,300
25		\$16,755	\$16,755	0.184	\$3,083
26		\$6,600	\$6,600	0.172	\$1,135
27		\$6,600	\$6,600	0.161	\$1,063
28		\$6,600	\$6,600	0.150	\$990
29		\$6,600	\$6,600	0.141	\$931
30		\$16,755	\$16,755	0.131	\$2,195
31		\$6,600	\$6,600	0.123	\$812
32		\$6,600	\$6,600	0.115	\$759
33		\$6,600	\$6,600	0.107	\$706
34		\$6,600	\$6,600	0.100	\$660
35		\$16,755	\$16,755	0.0937	\$1,570
36		\$6,600	\$6,600	0.0875	\$578
37		\$6,600	\$6,600	0.0818	\$540
38		\$6,600	\$6,600	0.0765	\$505
39		\$6,600	\$6,600	0.0715	\$472
40		\$16,755	\$16,755	0.0668	\$1,119
41		\$6,600	\$6,600	0.0624	\$412
42		\$6,600	\$6,600	0.0583	\$385
43		\$6,600	\$6,600	0.0545	\$360
44		\$6,600	\$6,600	0.0509	\$336
45		\$16,755	\$16,755	0.0476	\$798
46		\$6,600	\$6,600	0.0445	\$294
47		\$6,600	\$6,600	0.0416	\$275
48		\$6,600	\$6,600	0.0389	\$257
49		\$6,600	\$6,600	0.0363	\$240
50		\$16,755	\$16,755	0.0339	\$568

TOTAL PRESENT WORTH \$140,398

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

SELECTED REMEDY: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

One Hundred Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$24,961		\$24,961	1.000	\$24,961
1		\$6,600	\$6,600	0.935	\$6,171
2		\$6,600	\$6,600	0.873	\$5,762
3		\$6,600	\$6,600	0.816	\$5,386
4		\$6,600	\$6,600	0.763	\$5,036
5		\$16,755	\$16,755	0.713	\$11,946
6		\$6,600	\$6,600	0.666	\$4,396
7		\$6,600	\$6,600	0.623	\$4,112
8		\$6,600	\$6,600	0.582	\$3,841
9		\$6,600	\$6,600	0.544	\$3,590
10		\$16,755	\$16,755	0.508	\$8,512
11		\$6,600	\$6,600	0.475	\$3,135
12		\$6,600	\$6,600	0.444	\$2,930
13		\$6,600	\$6,600	0.415	\$2,739
14		\$6,600	\$6,600	0.388	\$2,561
15		\$16,755	\$16,755	0.362	\$6,065
16		\$6,600	\$6,600	0.339	\$2,237
17		\$6,600	\$6,600	0.317	\$2,092
18		\$6,600	\$6,600	0.296	\$1,954
19		\$6,600	\$6,600	0.277	\$1,828
20		\$16,755	\$16,755	0.258	\$4,323
21		\$6,600	\$6,600	0.242	\$1,597
22		\$6,600	\$6,600	0.226	\$1,492
23		\$6,600	\$6,600	0.211	\$1,393
24		\$6,600	\$6,600	0.197	\$1,300
25		\$16,755	\$16,755	0.184	\$3,083
26		\$6,600	\$6,600	0.172	\$1,135
27		\$6,600	\$6,600	0.161	\$1,063
28		\$6,600	\$6,600	0.150	\$990
29		\$6,600	\$6,600	0.141	\$931
30		\$16,755	\$16,755	0.131	\$2,195
31		\$6,600	\$6,600	0.123	\$812
32		\$6,600	\$6,600	0.115	\$759
33		\$6,600	\$6,600	0.107	\$706
34		\$6,600	\$6,600	0.100	\$660
35		\$16,755	\$16,755	0.0937	\$1,570
36		\$6,600	\$6,600	0.0875	\$578
37		\$6,600	\$6,600	0.0818	\$540
38		\$6,600	\$6,600	0.0765	\$505
39		\$6,600	\$6,600	0.0715	\$472
40		\$16,755	\$16,755	0.0668	\$1,119
41		\$6,600	\$6,600	0.0624	\$412
42		\$6,600	\$6,600	0.0583	\$385
43		\$6,600	\$6,600	0.0545	\$360
44		\$6,600	\$6,600	0.0509	\$336
45		\$16,755	\$16,755	0.0476	\$798
46		\$6,600	\$6,600	0.0445	\$294
47		\$6,600	\$6,600	0.0416	\$275
48		\$6,600	\$6,600	0.0389	\$257
49		\$6,600	\$6,600	0.0363	\$240
50		\$16,755	\$16,755	0.0339	\$568

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

SELECTED REMEDY: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

One Hundred Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
51		\$6,600	\$6,600	0.0317	\$209
52		\$6,600	\$6,600	0.0297	\$196
53		\$6,600	\$6,600	0.0277	\$183
54		\$6,600	\$6,600	0.0259	\$171
55		\$16,755	\$16,755	0.0242	\$405
56		\$6,600	\$6,600	0.0226	\$149
57		\$6,600	\$6,600	0.0211	\$139
58		\$6,600	\$6,600	0.0198	\$131
59		\$6,600	\$6,600	0.0185	\$122
60		\$16,755	\$16,755	0.0173	\$290
61		\$6,600	\$6,600	0.0161	\$106
62		\$6,600	\$6,600	0.0151	\$100
63		\$6,600	\$6,600	0.0141	\$93
64		\$6,600	\$6,600	0.0132	\$87
65		\$16,755	\$16,755	0.0123	\$206
66		\$6,600	\$6,600	0.0115	\$76
67		\$6,600	\$6,600	0.0107	\$71
68		\$6,600	\$6,600	0.0100	\$66
69		\$6,600	\$6,600	0.00939	\$62
70		\$16,755	\$16,755	0.00877	\$147
71		\$6,600	\$6,600	0.00820	\$54
72		\$6,600	\$6,600	0.00766	\$51
73		\$6,600	\$6,600	0.00716	\$47
74		\$6,600	\$6,600	0.00669	\$44
75		\$16,755	\$16,755	0.00625	\$105
76		\$6,600	\$6,600	0.00585	\$39
77		\$6,600	\$6,600	0.00546	\$36
78		\$6,600	\$6,600	0.00511	\$34
79		\$6,600	\$6,600	0.00477	\$31
80		\$16,755	\$16,755	0.00446	\$75
81		\$6,600	\$6,600	0.00417	\$28
82		\$6,600	\$6,600	0.00390	\$26
83		\$6,600	\$6,600	0.00364	\$24
84		\$6,600	\$6,600	0.00340	\$22
85		\$16,755	\$16,755	0.00318	\$53
86		\$6,600	\$6,600	0.00297	\$20
87		\$6,600	\$6,600	0.00278	\$18
88		\$6,600	\$6,600	0.00260	\$17
89		\$6,600	\$6,600	0.00243	\$16
90		\$16,755	\$16,755	0.00227	\$38
91		\$6,600	\$6,600	0.00212	\$14
92		\$6,600	\$6,600	0.00198	\$13
93		\$6,600	\$6,600	0.00185	\$12
94		\$6,600	\$6,600	0.00173	\$11
95		\$16,755	\$16,755	0.00162	\$27
96		\$6,600	\$6,600	0.00151	\$10
97		\$6,600	\$6,600	0.00141	\$9
98		\$6,600	\$6,600	0.00132	\$9
99		\$6,600	\$6,600	0.00123	\$8
100		\$16,755	\$16,755	0.00115	\$19

TOTAL PRESENT WORTH \$144,318

NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA
 SITE 45

SOIL ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 INSTITUTIONAL CONTROLS											
1.1 Prepare Deed Restrictions & LUCIPs	100	hr			\$35.00		\$0	\$0	\$3,500	\$0	\$3,500
Subtotal							\$0	\$0	\$3,500	\$0	\$3,500
Local Area Adjustments							100.0%	120.5%	88.0%	88.0%	
							\$0	\$0	\$3,080	\$0	\$3,080
Overhead on Labor Cost @ 30%									\$924		\$924
G & A on Labor Cost @ 10%									\$308		\$308
G & A on Material Cost @ 10%							\$0	\$0			\$0
G & A on Subcontract Cost @ 10%							\$0	\$0			\$0
Total Direct Cost							\$0	\$0	\$4,312	\$0	\$4,312
Indirects on Total Direct Cost @ 0%											\$0
Profit on Total Direct Cost @ 10%											\$431
Subtotal											\$4,743
Health & Safety Monitoring @ 0%											\$0
Total Field Cost											\$4,743
Contingency on Total Field Costs @ 0%											\$0
Engineering on Total Field Cost @ 0%											\$0
TOTAL COST											\$4,743

NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
SITE 45
SOIL ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING
Annual Cost

Item	Item Cost Year 1 - X ⁽¹⁾	Item Cost Every 5 Years	Notes
Soil Sampling		\$1,090	Labor, Field Supplies
Analysis/Soil		\$2,065	Analyze 6 surface (0-2 ft) soil samples and one QA sample for PAHs, TRPHs, and arsenic. Once every 5 years for 100 years.
Report	\$1,000		Document sampling events and results
Site Inspection	\$1,000		One day annual inspection to verify continued implementation of institutional controls
Site Review		\$7,000	
TOTALS	\$2,000	\$10,155	

(1) Sampling would occur annually for years 1 - 30, 50 or 100.

NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA
 SITE 45

SOIL ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING
 Thirty Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$4,743		\$4,743	1.000	\$4,743
1		\$2,000	\$2,000	0.935	\$1,870
2		\$2,000	\$2,000	0.873	\$1,746
3		\$2,000	\$2,000	0.816	\$1,632
4		\$2,000	\$2,000	0.763	\$1,526
5		\$12,155	\$12,155	0.713	\$8,667
6		\$2,000	\$2,000	0.666	\$1,332
7		\$2,000	\$2,000	0.623	\$1,246
8		\$2,000	\$2,000	0.582	\$1,164
9		\$2,000	\$2,000	0.544	\$1,088
10		\$12,155	\$12,155	0.508	\$6,175
11		\$2,000	\$2,000	0.475	\$950
12		\$2,000	\$2,000	0.444	\$888
13		\$2,000	\$2,000	0.415	\$830
14		\$2,000	\$2,000	0.388	\$776
15		\$12,155	\$12,155	0.362	\$4,400
16		\$2,000	\$2,000	0.339	\$678
17		\$2,000	\$2,000	0.317	\$634
18		\$2,000	\$2,000	0.296	\$592
19		\$2,000	\$2,000	0.277	\$554
20		\$12,155	\$12,155	0.258	\$3,136
21		\$2,000	\$2,000	0.242	\$484
22		\$2,000	\$2,000	0.226	\$452
23		\$2,000	\$2,000	0.211	\$422
24		\$2,000	\$2,000	0.197	\$394
25		\$12,155	\$12,155	0.184	\$2,237
26		\$2,000	\$2,000	0.172	\$344
27		\$2,000	\$2,000	0.161	\$322
28		\$2,000	\$2,000	0.150	\$300
29		\$2,000	\$2,000	0.141	\$282
30		\$12,155	\$12,155	0.131	\$1,592
TOTAL PRESENT WORTH					\$51,455

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

SOIL ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

Fifty Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$4,743		\$4,743	1.000	\$4,743
1		\$2,000	\$2,000	0.935	\$1,870
2		\$2,000	\$2,000	0.873	\$1,746
3		\$2,000	\$2,000	0.816	\$1,632
4		\$2,000	\$2,000	0.763	\$1,526
5		\$12,155	\$12,155	0.713	\$8,667
6		\$2,000	\$2,000	0.666	\$1,332
7		\$2,000	\$2,000	0.623	\$1,246
8		\$2,000	\$2,000	0.582	\$1,164
9		\$2,000	\$2,000	0.544	\$1,088
10		\$12,155	\$12,155	0.508	\$6,175
11		\$2,000	\$2,000	0.475	\$950
12		\$2,000	\$2,000	0.444	\$888
13		\$2,000	\$2,000	0.415	\$830
14		\$2,000	\$2,000	0.388	\$776
15		\$12,155	\$12,155	0.362	\$4,400
16		\$2,000	\$2,000	0.339	\$678
17		\$2,000	\$2,000	0.317	\$634
18		\$2,000	\$2,000	0.296	\$592
19		\$2,000	\$2,000	0.277	\$554
20		\$12,155	\$12,155	0.258	\$3,136
21		\$2,000	\$2,000	0.242	\$484
22		\$2,000	\$2,000	0.226	\$452
23		\$2,000	\$2,000	0.211	\$422
24		\$2,000	\$2,000	0.197	\$394
25		\$12,155	\$12,155	0.184	\$2,237
26		\$2,000	\$2,000	0.172	\$344
27		\$2,000	\$2,000	0.161	\$322
28		\$2,000	\$2,000	0.150	\$300
29		\$2,000	\$2,000	0.141	\$282
30		\$12,155	\$12,155	0.131	\$1,592
31		\$2,000	\$2,000	0.123	\$246
32		\$2,000	\$2,000	0.115	\$230
33		\$2,000	\$2,000	0.107	\$214
34		\$2,000	\$2,000	0.100	\$200
35		\$12,155	\$12,155	0.0937	\$1,139
36		\$2,000	\$2,000	0.0875	\$175
37		\$2,000	\$2,000	0.0818	\$164
38		\$2,000	\$2,000	0.0765	\$153
39		\$2,000	\$2,000	0.0715	\$143
40		\$12,155	\$12,155	0.0668	\$812
41		\$2,000	\$2,000	0.0624	\$125
42		\$2,000	\$2,000	0.0583	\$117
43		\$2,000	\$2,000	0.0545	\$109
44		\$2,000	\$2,000	0.0509	\$102
45		\$12,155	\$12,155	0.0476	\$579
46		\$2,000	\$2,000	0.0445	\$89
47		\$2,000	\$2,000	0.0416	\$83
48		\$2,000	\$2,000	0.0389	\$78
49		\$2,000	\$2,000	0.0363	\$73
50		\$12,155	\$12,155	0.0339	\$412
TOTAL PRESENT WORTH					\$56,696

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

SOIL ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

One Hundred Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$4,743		\$4,743	1.000	\$4,743
1		\$2,000	\$2,000	0.935	\$1,870
2		\$2,000	\$2,000	0.873	\$1,746
3		\$2,000	\$2,000	0.816	\$1,632
4		\$2,000	\$2,000	0.763	\$1,526
5		\$12,155	\$12,155	0.713	\$8,667
6		\$2,000	\$2,000	0.666	\$1,332
7		\$2,000	\$2,000	0.623	\$1,246
8		\$2,000	\$2,000	0.582	\$1,164
9		\$2,000	\$2,000	0.544	\$1,088
10		\$12,155	\$12,155	0.508	\$6,175
11		\$2,000	\$2,000	0.475	\$950
12		\$2,000	\$2,000	0.444	\$888
13		\$2,000	\$2,000	0.415	\$830
14		\$2,000	\$2,000	0.388	\$776
15		\$12,155	\$12,155	0.362	\$4,400
16		\$2,000	\$2,000	0.339	\$678
17		\$2,000	\$2,000	0.317	\$634
18		\$2,000	\$2,000	0.296	\$592
19		\$2,000	\$2,000	0.277	\$554
20		\$12,155	\$12,155	0.258	\$3,136
21		\$2,000	\$2,000	0.242	\$484
22		\$2,000	\$2,000	0.226	\$452
23		\$2,000	\$2,000	0.211	\$422
24		\$2,000	\$2,000	0.197	\$394
25		\$12,155	\$12,155	0.184	\$2,237
26		\$2,000	\$2,000	0.172	\$344
27		\$2,000	\$2,000	0.161	\$322
28		\$2,000	\$2,000	0.150	\$300
29		\$2,000	\$2,000	0.141	\$282
30		\$12,155	\$12,155	0.131	\$1,592
31		\$2,000	\$2,000	0.123	\$246
32		\$2,000	\$2,000	0.115	\$230
33		\$2,000	\$2,000	0.107	\$214
34		\$2,000	\$2,000	0.100	\$200
35		\$12,155	\$12,155	0.0937	\$1,139
36		\$2,000	\$2,000	0.0875	\$175
37		\$2,000	\$2,000	0.0818	\$164
38		\$2,000	\$2,000	0.0765	\$153
39		\$2,000	\$2,000	0.0715	\$143
40		\$12,155	\$12,155	0.0668	\$812
41		\$2,000	\$2,000	0.0624	\$125
42		\$2,000	\$2,000	0.0583	\$117
43		\$2,000	\$2,000	0.0545	\$109
44		\$2,000	\$2,000	0.0509	\$102
45		\$12,155	\$12,155	0.0476	\$579
46		\$2,000	\$2,000	0.0445	\$89
47		\$2,000	\$2,000	0.0416	\$83
48		\$2,000	\$2,000	0.0389	\$78
49		\$2,000	\$2,000	0.0363	\$73
50		\$12,155	\$12,155	0.0339	\$412

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

SOIL ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

One Hundred Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
51		\$2,000	\$2,000	0.0317	\$63
52		\$2,000	\$2,000	0.0297	\$59
53		\$2,000	\$2,000	0.0277	\$55
54		\$2,000	\$2,000	0.0259	\$52
55		\$12,155	\$12,155	0.0242	\$294
56		\$2,000	\$2,000	0.0226	\$45
57		\$2,000	\$2,000	0.0211	\$42
58		\$2,000	\$2,000	0.0198	\$40
59		\$2,000	\$2,000	0.0185	\$37
60		\$12,155	\$12,155	0.0173	\$210
61		\$2,000	\$2,000	0.0161	\$32
62		\$2,000	\$2,000	0.0151	\$30
63		\$2,000	\$2,000	0.0141	\$28
64		\$2,000	\$2,000	0.0132	\$26
65		\$12,155	\$12,155	0.0123	\$150
66		\$2,000	\$2,000	0.0115	\$23
67		\$2,000	\$2,000	0.0107	\$21
68		\$2,000	\$2,000	0.0100	\$20
69		\$2,000	\$2,000	0.00939	\$19
70		\$12,155	\$12,155	0.00877	\$107
71		\$2,000	\$2,000	0.00820	\$16
72		\$2,000	\$2,000	0.00766	\$15
73		\$2,000	\$2,000	0.00716	\$14
74		\$2,000	\$2,000	0.00669	\$13
75		\$12,155	\$12,155	0.00625	\$76
76		\$2,000	\$2,000	0.00585	\$12
77		\$2,000	\$2,000	0.00546	\$11
78		\$2,000	\$2,000	0.00511	\$10
79		\$2,000	\$2,000	0.00477	\$10
80		\$12,155	\$12,155	0.00446	\$54
81		\$2,000	\$2,000	0.00417	\$8
82		\$2,000	\$2,000	0.00390	\$8
83		\$2,000	\$2,000	0.00364	\$7
84		\$2,000	\$2,000	0.00340	\$7
85		\$12,155	\$12,155	0.00318	\$39
86		\$2,000	\$2,000	0.00297	\$6
87		\$2,000	\$2,000	0.00278	\$6
88		\$2,000	\$2,000	0.00260	\$5
89		\$2,000	\$2,000	0.00243	\$5
90		\$12,155	\$12,155	0.00227	\$28
91		\$2,000	\$2,000	0.00212	\$4
92		\$2,000	\$2,000	0.00198	\$4
93		\$2,000	\$2,000	0.00185	\$4
94		\$2,000	\$2,000	0.00173	\$3
95		\$12,155	\$12,155	0.00162	\$20
96		\$2,000	\$2,000	0.00151	\$3
97		\$2,000	\$2,000	0.00141	\$3
98		\$2,000	\$2,000	0.00132	\$3
99		\$2,000	\$2,000	0.00123	\$2
100		\$12,155	\$12,155	0.00115	\$14

TOTAL PRESENT WORTH \$58,461

NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA
 SITE 45
 GROUNDWATER ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

Item	Quantity	Unit	Subcontract	Unit Cost			Subcontract	Extended Cost			Subtotal
				Material	Labor	Equipment		Material	Labor	Equipment	
1 PROJECT PLANNING											
1.1 Prepare Remedial Action Plan	100	hr			\$35.00		\$0	\$0	\$3,500	\$0	\$3,500
2 MOBILIZATION/DEMobilIZATION											
2.1 Mobilize/Demobilize Drill Rig	1	ls	\$2,495.00				\$2,495	\$0	\$0	\$0	\$2,495
3 DECONTAMINATION											
3.1 Decontamination of Drill Rig	1	ls	\$500.00				\$500	\$0	\$0	\$0	\$500
4 MONITORING WELL INSTALLATION											
4.1 Install Monitoring Well	15	lf	\$24.00				\$360	\$0	\$0	\$0	\$360
4.2 Well Development	2	hr	\$35.00				\$70	\$0	\$0	\$0	\$70
4.3 Collect/Conatinerize IDW	1	ea	\$50.00				\$50	\$0	\$0	\$0	\$50
4.4 Transport/Dispose IDW Off Site	1	drum	\$150.00				\$150	\$0	\$0	\$0	\$150
5 INSTITUTIONAL CONTROLS											
5.1 Prepare Deed Restrictions & LUCIPs	100	hr			\$35.00		\$0	\$0	\$3,500	\$0	\$3,500
Subtotal							\$3,625	\$0	\$7,000	\$0	\$10,625
Local Area Adjustments							100.0%	120.5%	88.0%	88.0%	
							\$3,625	\$0	\$6,160	\$0	\$9,785
Overhead on Labor Cost @ 30%									\$1,848		\$1,848
G & A on Labor Cost @ 10%									\$616		\$616
G & A on Material Cost @ 10%								\$0			\$0
G & A on Subcontract Cost @ 10%							\$363				\$363
Total Direct Cost							\$3,988	\$0	\$8,624	\$0	\$12,612
Indirects on Total Direct Cost @ 35%											\$4,414
Profit on Total Direct Cost @ 10%											\$1,261
Subtotal											\$18,287
Health & Safety Monitoring @ 5%											\$914
Total Field Cost											\$19,201
Contingency on Total Field Costs @ 20%											\$3,840
Engineering on Total Field Cost @ 10%											\$1,920
TOTAL COST											\$24,961

**NAVAL AIR STATION CECIL FIELD
 JACKSONVILLE, FLORIDA
 SITE 45
 GROUNDWATER ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING
 Annual Cost**

Item	Item Cost Year 1 - X ⁽¹⁾	Item Cost Every 5 Years	Notes
Groundwater Sampling	\$4,360		Labor, Field Supplies
Analysis/Water	\$240		Analyze samples from 11 wells plus one QA sample for vanadium. Annually for years 1 - 30, 50 or 100.
Report	\$1,000		Document sampling events and results
Site Inspection	\$1,000		One day annual inspection to verify continued implementation of institutional controls
Site Review		<u>\$7,000</u>	
TOTALS	\$6,600	\$7,000	

(1) Sampling would occur annually for years 1 - 30, 50 or 100.

**NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA
SITE 45**

**GROUNDWATER ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING
Thirty Year Present Worth Analysis**

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$24,961		\$24,961	1.000	\$24,961
1		\$6,600	\$6,600	0.935	\$6,171
2		\$6,600	\$6,600	0.873	\$5,762
3		\$6,600	\$6,600	0.816	\$5,386
4		\$6,600	\$6,600	0.763	\$5,036
5		\$13,600	\$13,600	0.713	\$9,697
6		\$6,600	\$6,600	0.666	\$4,396
7		\$6,600	\$6,600	0.623	\$4,112
8		\$6,600	\$6,600	0.582	\$3,841
9		\$6,600	\$6,600	0.544	\$3,590
10		\$13,600	\$13,600	0.508	\$6,909
11		\$6,600	\$6,600	0.475	\$3,135
12		\$6,600	\$6,600	0.444	\$2,930
13		\$6,600	\$6,600	0.415	\$2,739
14		\$6,600	\$6,600	0.388	\$2,561
15		\$13,600	\$13,600	0.362	\$4,923
16		\$6,600	\$6,600	0.339	\$2,237
17		\$6,600	\$6,600	0.317	\$2,092
18		\$6,600	\$6,600	0.296	\$1,954
19		\$6,600	\$6,600	0.277	\$1,828
20		\$13,600	\$13,600	0.258	\$3,509
21		\$6,600	\$6,600	0.242	\$1,597
22		\$6,600	\$6,600	0.226	\$1,492
23		\$6,600	\$6,600	0.211	\$1,393
24		\$6,600	\$6,600	0.197	\$1,300
25		\$13,600	\$13,600	0.184	\$2,502
26		\$6,600	\$6,600	0.172	\$1,135
27		\$6,600	\$6,600	0.161	\$1,063
28		\$6,600	\$6,600	0.150	\$990
29		\$6,600	\$6,600	0.141	\$931
30		\$13,600	\$13,600	0.131	\$1,782
TOTAL PRESENT WORTH					\$121,953

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

GROUNDWATER ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

Fifty Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$24,961		\$24,961	1.000	\$24,961
1		\$6,600	\$6,600	0.935	\$6,171
2		\$6,600	\$6,600	0.873	\$5,762
3		\$6,600	\$6,600	0.816	\$5,386
4		\$6,600	\$6,600	0.763	\$5,036
5		\$13,600	\$13,600	0.713	\$9,697
6		\$6,600	\$6,600	0.666	\$4,396
7		\$6,600	\$6,600	0.623	\$4,112
8		\$6,600	\$6,600	0.582	\$3,841
9		\$6,600	\$6,600	0.544	\$3,590
10		\$13,600	\$13,600	0.508	\$6,909
11		\$6,600	\$6,600	0.475	\$3,135
12		\$6,600	\$6,600	0.444	\$2,930
13		\$6,600	\$6,600	0.415	\$2,739
14		\$6,600	\$6,600	0.388	\$2,561
15		\$13,600	\$13,600	0.362	\$4,923
16		\$6,600	\$6,600	0.339	\$2,237
17		\$6,600	\$6,600	0.317	\$2,092
18		\$6,600	\$6,600	0.296	\$1,954
19		\$6,600	\$6,600	0.277	\$1,828
20		\$13,600	\$13,600	0.258	\$3,509
21		\$6,600	\$6,600	0.242	\$1,597
22		\$6,600	\$6,600	0.226	\$1,492
23		\$6,600	\$6,600	0.211	\$1,393
24		\$6,600	\$6,600	0.197	\$1,300
25		\$13,600	\$13,600	0.184	\$2,502
26		\$6,600	\$6,600	0.172	\$1,135
27		\$6,600	\$6,600	0.161	\$1,063
28		\$6,600	\$6,600	0.150	\$990
29		\$6,600	\$6,600	0.141	\$931
30		\$13,600	\$13,600	0.131	\$1,782
31		\$6,600	\$6,600	0.123	\$812
32		\$6,600	\$6,600	0.115	\$759
33		\$6,600	\$6,600	0.107	\$706
34		\$6,600	\$6,600	0.100	\$660
35		\$13,600	\$13,600	0.0937	\$1,274
36		\$6,600	\$6,600	0.0875	\$578
37		\$6,600	\$6,600	0.0818	\$540
38		\$6,600	\$6,600	0.0765	\$505
39		\$6,600	\$6,600	0.0715	\$472
40		\$13,600	\$13,600	0.0668	\$908
41		\$6,600	\$6,600	0.0624	\$412
42		\$6,600	\$6,600	0.0583	\$385
43		\$6,600	\$6,600	0.0545	\$360
44		\$6,600	\$6,600	0.0509	\$336
45		\$13,600	\$13,600	0.0476	\$647
46		\$6,600	\$6,600	0.0445	\$294
47		\$6,600	\$6,600	0.0416	\$275
48		\$6,600	\$6,600	0.0389	\$257
49		\$6,600	\$6,600	0.0363	\$240
50		\$13,600	\$13,600	0.0339	\$461
TOTAL PRESENT WORTH					\$132,832

**NAVAL AIR STATION CECIL FIELD
JACKSONVILLE, FLORIDA**

SITE 45

GROUNDWATER ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

One Hundred Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	\$24,961		\$24,961	1.000	\$24,961
1		\$6,600	\$6,600	0.935	\$6,171
2		\$6,600	\$6,600	0.873	\$5,762
3		\$6,600	\$6,600	0.816	\$5,386
4		\$6,600	\$6,600	0.763	\$5,036
5		\$13,600	\$13,600	0.713	\$9,697
6		\$6,600	\$6,600	0.666	\$4,396
7		\$6,600	\$6,600	0.623	\$4,112
8		\$6,600	\$6,600	0.582	\$3,841
9		\$6,600	\$6,600	0.544	\$3,590
10		\$13,600	\$13,600	0.508	\$6,909
11		\$6,600	\$6,600	0.475	\$3,135
12		\$6,600	\$6,600	0.444	\$2,930
13		\$6,600	\$6,600	0.415	\$2,739
14		\$6,600	\$6,600	0.388	\$2,561
15		\$13,600	\$13,600	0.362	\$4,923
16		\$6,600	\$6,600	0.339	\$2,237
17		\$6,600	\$6,600	0.317	\$2,092
18		\$6,600	\$6,600	0.296	\$1,954
19		\$6,600	\$6,600	0.277	\$1,828
20		\$13,600	\$13,600	0.258	\$3,509
21		\$6,600	\$6,600	0.242	\$1,597
22		\$6,600	\$6,600	0.226	\$1,492
23		\$6,600	\$6,600	0.211	\$1,393
24		\$6,600	\$6,600	0.197	\$1,300
25		\$13,600	\$13,600	0.184	\$2,502
26		\$6,600	\$6,600	0.172	\$1,135
27		\$6,600	\$6,600	0.161	\$1,063
28		\$6,600	\$6,600	0.150	\$990
29		\$6,600	\$6,600	0.141	\$931
30		\$13,600	\$13,600	0.131	\$1,782
31		\$6,600	\$6,600	0.123	\$812
32		\$6,600	\$6,600	0.115	\$759
33		\$6,600	\$6,600	0.107	\$706
34		\$6,600	\$6,600	0.100	\$660
35		\$13,600	\$13,600	0.0937	\$1,274
36		\$6,600	\$6,600	0.0875	\$578
37		\$6,600	\$6,600	0.0818	\$540
38		\$6,600	\$6,600	0.0765	\$505
39		\$6,600	\$6,600	0.0715	\$472
40		\$13,600	\$13,600	0.0668	\$908
41		\$6,600	\$6,600	0.0624	\$412
42		\$6,600	\$6,600	0.0583	\$385
43		\$6,600	\$6,600	0.0545	\$360
44		\$6,600	\$6,600	0.0509	\$336
45		\$13,600	\$13,600	0.0476	\$647
46		\$6,600	\$6,600	0.0445	\$294
47		\$6,600	\$6,600	0.0416	\$275
48		\$6,600	\$6,600	0.0389	\$257
49		\$6,600	\$6,600	0.0363	\$240
50		\$13,600	\$13,600	0.0339	\$461

NAVAL AIR STATION CECIL FIELD

JACKSONVILLE, FLORIDA

SITE 45

GROUNDWATER ALTERNATIVE 2: NATURAL ATTENUATION, INSTITUTIONAL CONTROLS, AND MONITORING

One Hundred Year Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
51		\$6,600	\$6,600	0.0317	\$209
52		\$6,600	\$6,600	0.0297	\$196
53		\$6,600	\$6,600	0.0277	\$183
54		\$6,600	\$6,600	0.0259	\$171
55		\$13,600	\$13,600	0.0242	\$329
56		\$6,600	\$6,600	0.0226	\$149
57		\$6,600	\$6,600	0.0211	\$139
58		\$6,600	\$6,600	0.0198	\$131
59		\$6,600	\$6,600	0.0185	\$122
60		\$13,600	\$13,600	0.0173	\$235
61		\$6,600	\$6,600	0.0161	\$106
62		\$6,600	\$6,600	0.0151	\$100
63		\$6,600	\$6,600	0.0141	\$93
64		\$6,600	\$6,600	0.0132	\$87
65		\$13,600	\$13,600	0.0123	\$167
66		\$6,600	\$6,600	0.0115	\$76
67		\$6,600	\$6,600	0.0107	\$71
68		\$6,600	\$6,600	0.0100	\$66
69		\$6,600	\$6,600	0.00939	\$62
70		\$13,600	\$13,600	0.00877	\$119
71		\$6,600	\$6,600	0.00820	\$54
72		\$6,600	\$6,600	0.00766	\$51
73		\$6,600	\$6,600	0.00716	\$47
74		\$6,600	\$6,600	0.00669	\$44
75		\$13,600	\$13,600	0.00625	\$85
76		\$6,600	\$6,600	0.00585	\$39
77		\$6,600	\$6,600	0.00546	\$36
78		\$6,600	\$6,600	0.00511	\$34
79		\$6,600	\$6,600	0.00477	\$31
80		\$13,600	\$13,600	0.00446	\$61
81		\$6,600	\$6,600	0.00417	\$28
82		\$6,600	\$6,600	0.00390	\$26
83		\$6,600	\$6,600	0.00364	\$24
84		\$6,600	\$6,600	0.00340	\$22
85		\$13,600	\$13,600	0.00318	\$43
86		\$6,600	\$6,600	0.00297	\$20
87		\$6,600	\$6,600	0.00278	\$18
88		\$6,600	\$6,600	0.00260	\$17
89		\$6,600	\$6,600	0.00243	\$16
90		\$13,600	\$13,600	0.00227	\$31
91		\$6,600	\$6,600	0.00212	\$14
92		\$6,600	\$6,600	0.00198	\$13
93		\$6,600	\$6,600	0.00185	\$12
94		\$6,600	\$6,600	0.00173	\$11
95		\$13,600	\$13,600	0.00162	\$22
96		\$6,600	\$6,600	0.00151	\$10
97		\$6,600	\$6,600	0.00141	\$9
98		\$6,600	\$6,600	0.00132	\$9
99		\$6,600	\$6,600	0.00123	\$8
100		\$13,600	\$13,600	0.00115	\$16

TOTAL PRESENT WORTH \$136,495