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1999

EPA Superfund
Record of Decision:

Jacksonville Naval Air Station OU 2
Jacksonville, FL
3/19/1999

RECORD OF DECISION
POTENTIAL SOURCES OF CONTAMINATION 2, 3, 4, 41, 42, AND 43
OPERABLE UNIT 2

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

UNIT IDENTIFICATION CODE: N00207
CONTRACT NO.: N62467-89-D-0317/076

OCTOBER 1998

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

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

MAR 19 1999

4WD-FFB

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Commanding Officer
Naval Air Station Jacksonville
Jacksonville, Florida 32212-5000

SUBJ: Final Record of Decision
Operable Unit Two
EPA ID# FL6 170 024 412

Dear Captain Turcotte:

The United States Environmental Protection Agency (EPA) has reviewed the Department of the Navy's Final Record of Decision (ROD) for Operable Unit Two - Potential Sources of Contamination (PSCs) 2, 3, 4, 41, 42, 43 at Naval Air Station Jacksonville pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended. EPA concurs with the findings and the selected remedy presented in the ROD.

Sincerely,

Richard D. Green
Director
Waste Management Division

cc: David B. Struhs, Secretary
Florida Department of Environmental Protection

Captain William H. Lewis, USN, Commanding Officer
Southern Division Naval Facilities Engineering Command

RECORD OF DECISION

POTENTIAL SOURCES OF CONTAMINATION 2, 3, 4, 41, 42, AND 43
OPERABLE UNIT 2

NAVAL AIR STATION JACKSONVILLE
JACKSONVILLE, FLORIDA

Unit Identification Code: N00207

Contract No.: N62467-89-D-0317/076

Prepared by:

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Prepared for:

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Anthony Robinson, Code 18511, Engineer-in-Charge

October 1998

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates (formerly ABB Environmental Services, Inc.), hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/076 are complete and accurate, and they comply with all requirements of this contract.

DATE: September 16, 1998

NAME AND TITLE OF CERTIFYING OFFICIAL: Phylissa Miller
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Frederick F. Bragdon, P.G.
Project Technical Lead

(DFAR 252.227-7036)

The geologic evaluations and professional opinions rendered in this planning document that describe the evaluation for Potential Sources of Contamination 2, 3, 4, 41, 42, and 43, Naval Air Station Jacksonville, Jacksonville, Florida, were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice.

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Professional Geologist
Sate of Florida License No. 1861

Date: 9-22-98

JAX-OU2.ROD
FGW.09.98

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Naval Air Station Jacksonville
Jacksonville, Florida

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ARAR	applicable or relevant and appropriate requirement
bls	below land surface
CCWE	constituent concentrations in waste extract
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPC	contaminant of potential concern
DDE	dichlorodiphenyldichloroethene
DPT	direct-push technology
ECPC	ecological contaminant of potential concern
ELCR	excess lifetime cancer risk
ERA	ecological risk assessment
FDEP	Florida Department of Environmental Protection
FERE	focused ecological risk evaluation
FRE	focused risk evaluation
FRI	focused remedial investigation
FTA	firefighting training area
ft/day	feet per day
GGC	groundwater guidance concentration
HHCPC	human health contaminant of potential concern
HHRA	human health risk assessment
HI	hazard index
IR	installation restoration
IRA	interim remedial action
IWTP	Industrial Wastewater Treatment Plant
JP	jet propellant
LNAPL	light nonaqueous-phase liquid
LUC	land-use control
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
MOA	Memorandum of Agreement
NADEP	Naval Aviation Depot
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
OU	operable unit

GLOSSARY (Continued)

PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	preliminary remedial goal
PSC	potential source of contamination
RA	risk assessment
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation and feasibility study
ROD	Record of Decision
SCG	soil cleanup goal
STL	soil target level
SVOC	semivolatile organic compound
SWQC	surface water quality criteria
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WWTP	wastewater treatment plant

1.0 DECLARATION OF THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION. The site name is Operable Unit (OU) 2, which comprises Potential Sources of Contamination (PSCs) 2 (Former Firefighting Training Area [FTA]), 3 (Wastewater Treatment Plant [WWTP] Sludge Disposal Area), 4 (Pine Tree Planting Area), 41 (Domestic Waste Sludge Drying Beds), 42 (WWTP Polishing Pond), and 43 (Industrial Waste Sludge Drying Beds) located at the Naval Air Station (NAS) Jacksonville in Jacksonville, Florida.

1.2 STATEMENT OF BASIS AND PURPOSE. This decision document presents the selected remedial action for OU 2 at NAS Jacksonville. The selected action was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). The information supporting this remedial action decision is contained in the Administrative Record for this site, which is located at Southern Division Naval Facilities Engineering Command in North Charleston, South Carolina. The information repository, which also contains supporting documents for this remedial action decision, is located at the Charles D. Webb Wesconnett Branch of the Jacksonville Public Library.

The U.S. Environmental Protection Agency (USEPA) and the State of Florida concur with the selected remedy.

1.3 DESCRIPTION OF THE SELECTED REMEDY. This Record of Decision (ROD) is the final action for OU 2 and is based on results of the Remedial Investigation (RI) and Risk Assessment (RA) completed for OU 2. The preferred remedial action at OU 2 is No Further Action because of the following:

- Interim remedial actions (IRAs) were conducted at PSCs 2, 41, 42, and 43.
- Due to the presence of light non-aqueous phase liquids (LNAPL) and petroleum related contaminants, and based on the CERCLA petroleum exclusion, PSC 2 was transferred to the State's petroleum program.
- Although no IRA was deemed necessary for PSC 3, an area of surface soil was excavated at PSC 3 where one sample exceeded the industrial preliminary remedial goal (PRG) for lead. Results of the focused risk evaluation (FRE) for soils at PSC 3 support the No Further Action remedy selection.
- Sludge piles with elevated levels of trace metals at PSC 4 were excavated prior to completion of the Human Health Risk Assessment (HHRA). Cancer risks calculated for future residents exposed to soil and sludge at PSC 4 are within USEPA acceptable risk range.

Because PSCs 41, 42, and 43 are all classified as Resource Conservation and Recovery Act (RCRA) sites, they require a period of groundwater monitoring. The Navy, USEPA, and Florida Department of Environmental Protection (FDEP) agreed that a postclosure monitoring program of 2 to 3 years, combined with groundwater data collected over the last decade, will meet the requirements of the RCRA. The

groundwater monitoring data will be used to determine if there are significant changes in chemical levels that could potentially impact human health and the environment over time.

1.4 DECLARATION STATEMENT. It has been determined by the Navy, USEPA, and FDEP that No Further Action with a five-year review is necessary at OU 2. In addition, PSCs 41, 42, and 43 will require postclosure groundwater monitoring under the RCRA for 2 to 3 years.

By separate Memorandum of Agreement (MOA) with the USEPA and the FDEP, NAS Jacksonville, on behalf of the Department of the Navy, agreed to implement basewide certain periodic site inspection, condition certification, and agency notification procedures designed to ensure the maintenance by Station personnel of any site-specific land-use controls (LUCs) deemed necessary for future protection of human health and the environment. A fundamental premise underlying execution of that agreement was that through the Navy's substantial good-faith compliance with the procedures called for therein, reasonable assurances would be provided to the USEPA and FDEP as to the permanency of those remedies, which included the use of specific LUCs.

Although the terms and conditions of the MOA are not specifically incorporated herein by reference, it is understood and agreed by the Navy, USEPA, and FDEP that the contemplated permanence of the remedy reflected herein shall be dependent upon the Station's substantial good-faith compliance with the specific LUC maintenance commitments reflected therein. Should such compliance not occur or should the MOA be terminated, it is understood that the protectiveness of the remedy concurred in may be reconsidered and that additional measures may need to be taken to adequately ensure necessary future protection of human health and the Environment.

The "no further cleanup action" with groundwater monitoring is protective of human health and the environment under current industrial land use, complies with State and Federal applicable or relevant and appropriate requirements (ARARs), and is cost effective.

1.5 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF THE REMEDY.

S. P. Turcotte

Captain Stephen A. Turcotte
Commanding Officer, NAS Jacksonville

20 Oct 98
Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION. NAS Jacksonville is located in Duval County, Florida, on the western bank of the St. Johns River (Figure 2-1). OU 2 is located in the northern part of the installation and is bordered by the St. Johns River to the north, the Timuquana Country Club to the west, and base runways to the south and east (Figure 2-2). The official mission of NAS Jacksonville is to provide facilities, service, and managerial support for the operation and maintenance of naval weapons and aircraft to operating forces of the U.S. Navy as designated by the Chief of Naval Operations. Some of the tasks required to accomplish this mission include operation of fuel storage facilities, performance of aircraft maintenance, maintenance and operation of engine repair facilities and test cells for turbojet engines, and support of weapons systems.

OU 2 contained two WWTP systems. Industrial wastewater from the Naval Aviation Depot (NADEP) was treated in the Industrial Wastewater Treatment Plant (IWTP), and the effluent was then discharged to the WWTP prior to final discharge to polishing ponds. The IWTP was closed in 1995. Currently, domestic wastewater and pre-treated industrial wastewater from the NADEP is sent to the plant for treatment. In the past, treated wastewater was discharged to a polishing pond, chlorinated, then discharged to the St. Johns River. A former FTA is also located within OU 2.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES. Environmental studies of the six PSCs which comprise OU 2 began in 1983. A two-staged RI was developed to address the environmental concerns at OU 2. The objectives of the first stage were to identify source areas and define the extent of contamination at PSCs 2, 3, 41, 42, and 43 and, if necessary, remediate them through IRAs. Based on the results of these investigations, IRAs were implemented at PSCs 2, 41, 42, and 43 to address risks associated with site contaminants. Cleanup criteria, remedial activities, and confirmatory sampling performed during the IRAs of PSCs 41, 42, and 43 are discussed in the following documents: *Certification and Closure Report, Potential Source of Contamination 41* (ABB Environmental Services, Inc. [ABB-ES], 1997a), *Certification and Closure Report, Potential Source of Contamination 42* (ABB-ES, 1997b) and *Certification and Closure Report, Potential Source of Contamination 43* (ABB-ES, 1997c). The remedial activities performed at PSC 2 are documented in the document, *Completion Report for PSC 2 Former Firefighter Training Area, Naval Air Station Jacksonville* (Bechtel Environmental, Inc., 1996).

Results of the first stage of the RI are documented in two focused remedial investigation and feasibility study (RI/FS) documents (ABB-ES, 1995a; 1994a).

The objectives of the second stage were to

- investigate soil at PSC 4, and groundwater, surface water, and sediment throughout OU 2, because these media were not covered (except at PSC 42) during the first stage of investigation,
- determine if additional remedial actions were needed to reach a final remedy, and

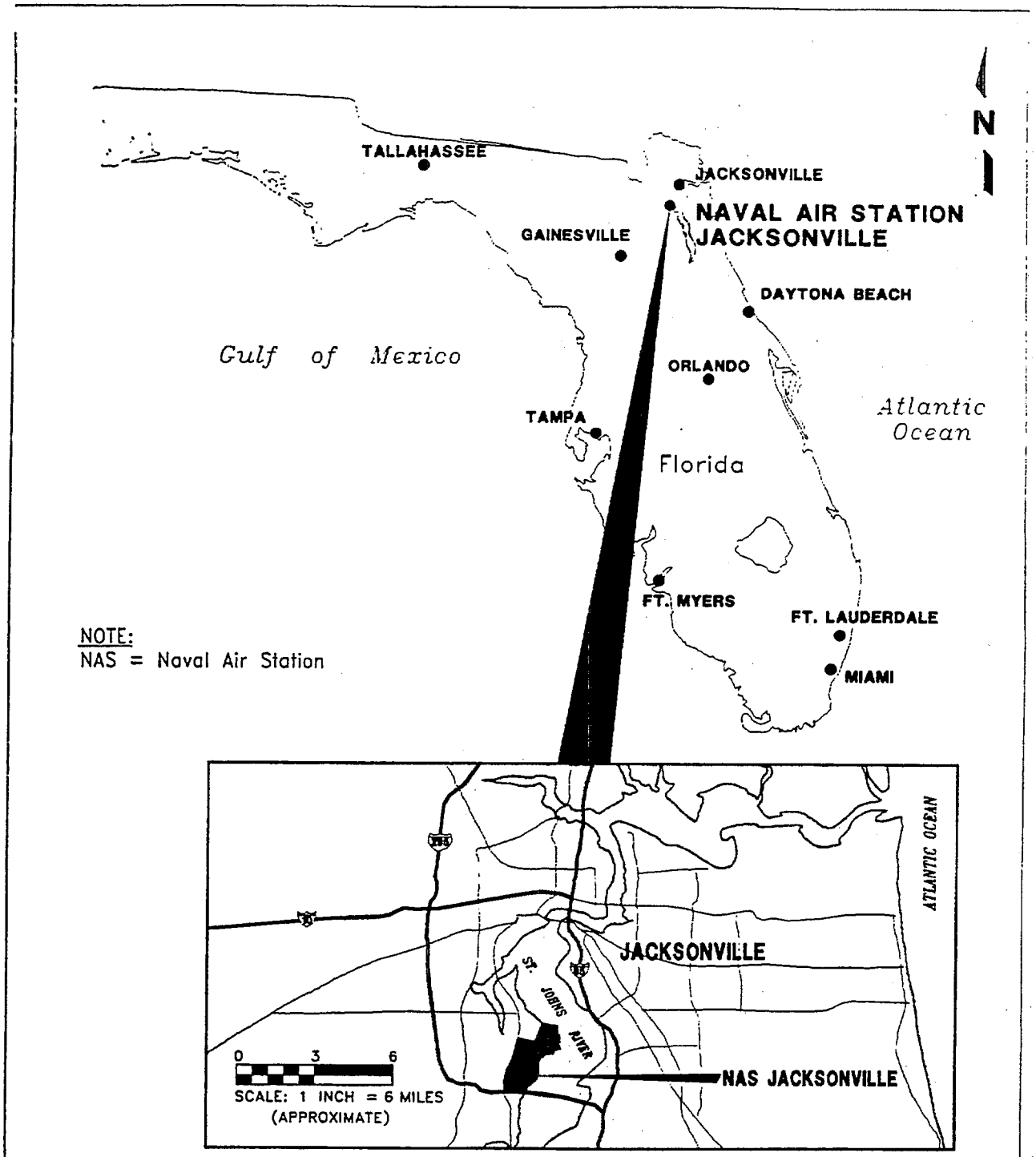

FIGURE 2-1
FACILITY LOCATION MAP

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RECORD OF DECISION
OPERABLE UNIT 2

NAVAL AIR STATION
JACKSONVILLE, FLORIDA

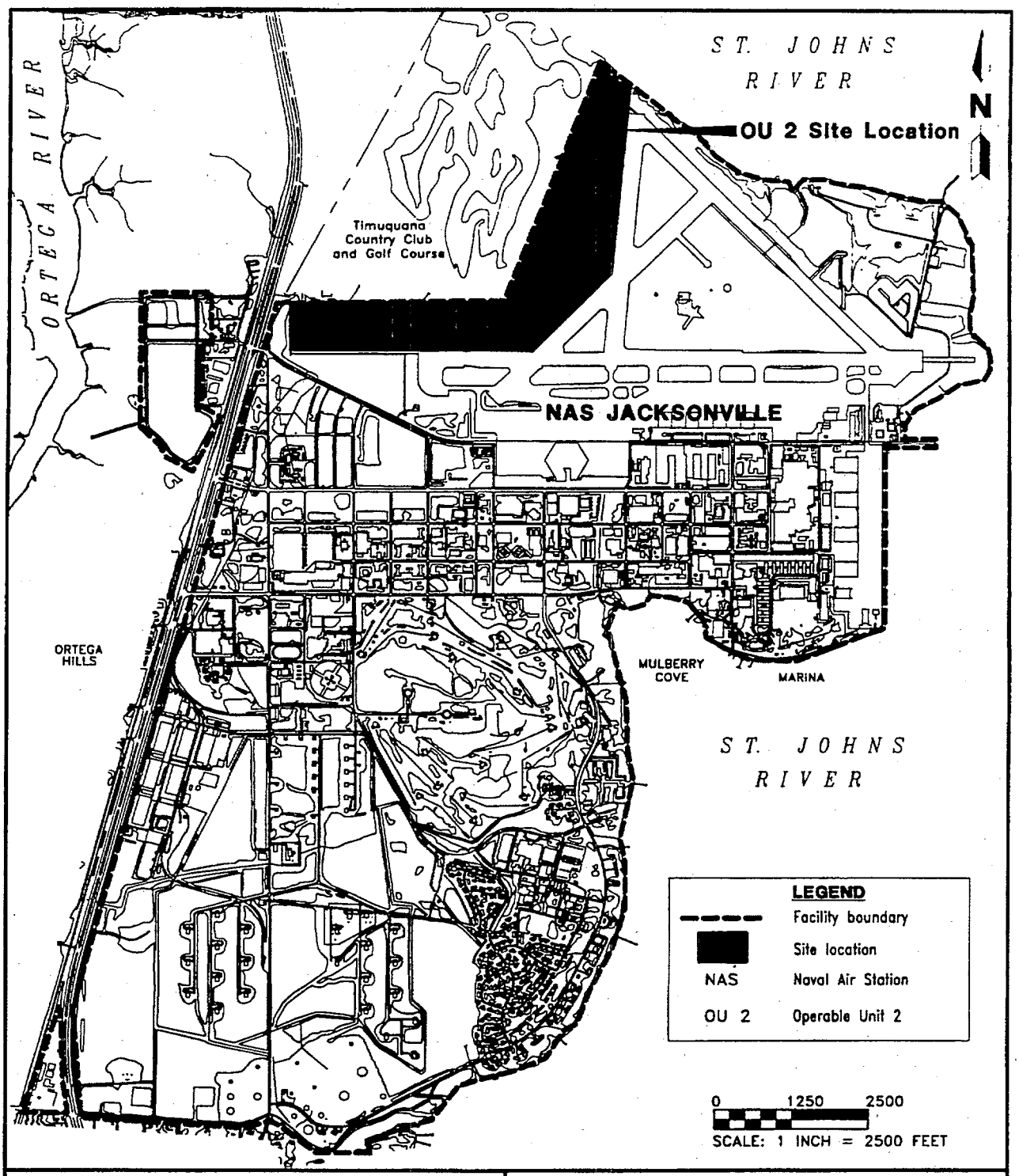

FIGURE 2-2
FACILITY MAP AND LOCATION OF OPERABLE UNIT 2

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RECORD OF DECISION
OPERABLE UNIT 2

NAVAL AIR STATION
JACKSONVILLE, FLORIDA

- if necessary, recommend remedial alternatives to achieve the final remedy.

OU 2 is composed of six PSCs (see Figure 2-3). In addition to PSC-specific site investigations, drainage areas and groundwater across OU 2 were investigated to support the OU 2 RI (ABB-ES, 1998a). Table 2-1 presents an overview of the assessments conducted to date and the associated media addressed, and Table 2-2 presents a historical summary of specific investigative activities, and associated deliverables and findings for the PSCs within OU 2. Overall results from both stages of investigation are documented in the Final RI (ABB-ES, 1998a).

The following is a description of the six PSCs contained within OU 2. Brief descriptions of the drainage areas and the groundwater coverage are presented following the PSC descriptions.

2.2.1 PSC 2: Former Firefighting Training Area PSC 2 consisted of a shallow, unlined pit, approximately 100 feet in diameter. The pit was used for firefighting training from approximately 1966 to 1991. Vehicles and parts were sprayed with jet propellant (JP)-4, JP-5, aviation gasoline, or waste oil, then ignited to simulate aircraft crashes.

Petroleum-contaminated soil and LNAPL were found at PSC 2 during the first stage of the RI. The contamination was attributed to firefighting training activities at the former FTA.

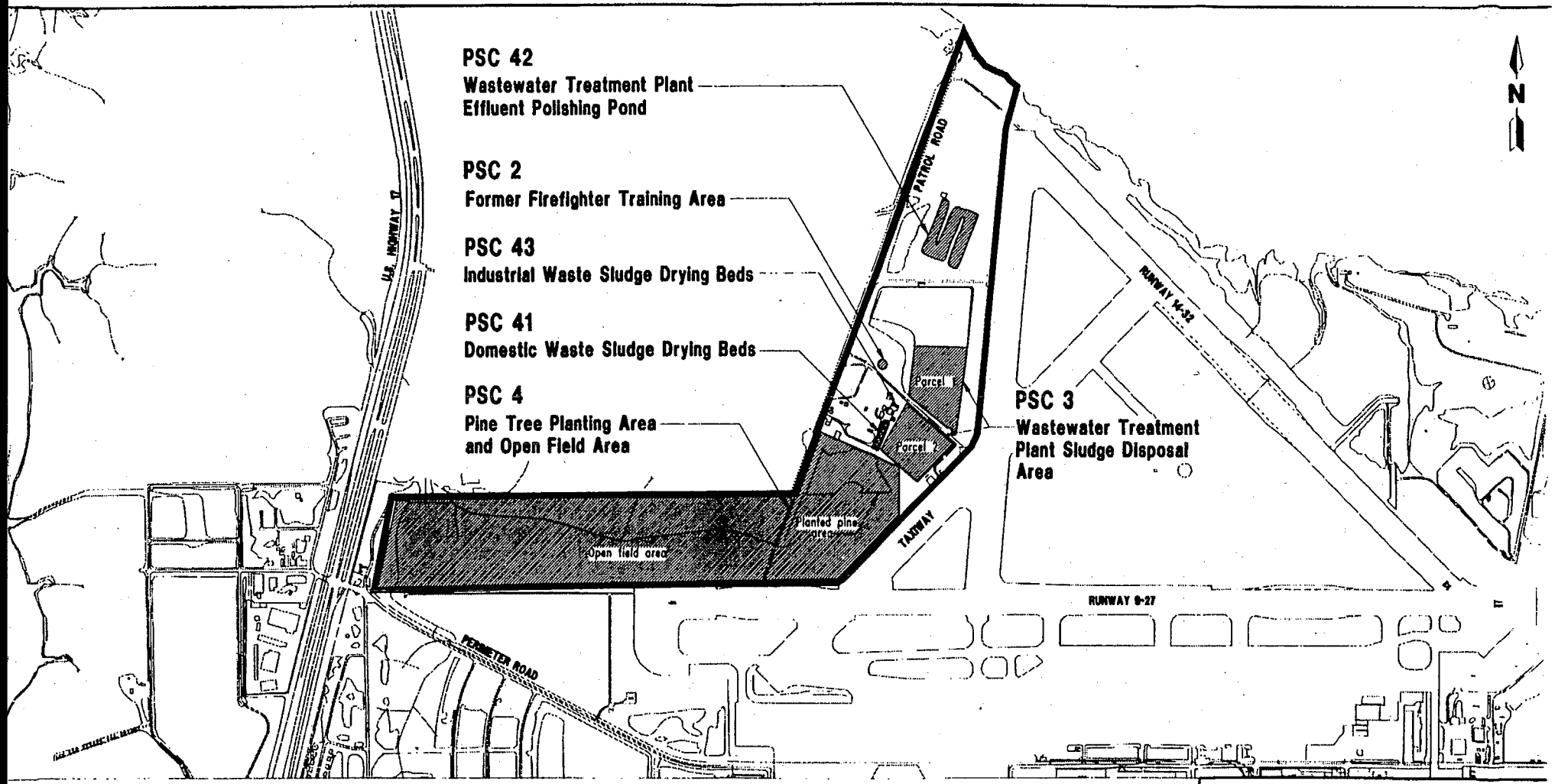
Using the Florida regulations for petroleum-contaminated soil as guidelines, the remedial action contractor excavated soil at PSC 2 with total petroleum hydrocarbon (TPH) concentrations greater than 50 milligrams per kilogram (mg/kg) and thermally treated it, and then the excavated area was backfilled. In the source area, soil was excavated down to the water table. These remedial activities were performed in 1995. LNAPL was not collected and was only encountered occasionally as small globules and as a sheen on the surface of the water.

Groundwater at PSC 2 was investigated during the second stage of the RI. LNAPL was measured in a well installed in the center of the former FTA. Additionally, a small plume of petroleum-related contaminants (primarily benzene, toluene, ethylbenzene, and xylene) was detected.

Because of the presence of LNAPL and petroleum-related contaminants in groundwater, the USEPA and FDEP have agreed to transfer jurisdiction over PSC 2 (including petroleum-contaminated groundwater) to Florida's petroleum program.

2.2.2 PSC 3: Wastewater Treatment Plant Sludge Disposal Area PSC 3 is a 15-acre tract where approximately 20,000 tons of domestic and industrial sewage sludge, reportedly containing metals and organic compounds, were disposed of between 1962 and 1980. The sludge was either dumped in piles or spread on the ground. The site was divided into two parcels of land by an access road. The land north of the road has been planted with pine trees, and the land south of the road is an open field.

Paint chips, observed in the shallow surface soil during the first phase of the RI, confirmed that sludge was disposed of at PSC 3. Of the two parcels of land



LEGEND

PSC Potential source of contamination

Operable Unit 2 boundary

0 500 1000

SCALE: 1 INCH = 1000 FEET

FIGURE 2-3
LOCATION OF POTENTIAL SOURCES OF CONTAMINATION AT OPERABLE UNIT 2

RECORD OF DECISION
OPERABLE UNIT 2

NAVAL AIR STATION
JACKSONVILLE, FLORIDA

Table 2-1
Operable Unit 2
Summary of Investigations and Media Addressed

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Area of Interest	Media	FRI	FRE	FFS	IRA	Groundwater Monitoring	RCRA Closure Report	RI	RA	Comments
PSC 2	Surface Soil	X	X	X	X					PSC 2 has been transferred to the Florida petroleum program. Five temporary wells were installed during the FRI to confirm the presence of LNAPL. Subsurface soil samples were collected during the FRI and analyzed for TPH only.
PSC 3	Surface Soil	X	X							Due to high concentrations of metals detected at one sample location during the FRI, a single "hot spot" was excavated in 1997 and incorporated into the IRA at PSC 42.
	Subsurface Soil	X	X							
PSC 4	Soil/Sludge							X	X	Five small piles of sludge material, discovered during site walkovers that preceded the RI, were removed in 1997 and incorporated into the IRA at PSC 42.
PSC 41	Surface Soil/ Filter Media	X	X	X	X		X			Soil and sludge material solidified during the IRA in 1995 were excavated and incorporated as backfill into the IRA at PSC 42 in 1997.
	Subsurface Soil/ Filter Media	X	X	X	X		X			
	Groundwater					X				
PSC 42	Sediment	X		X	X		X			
	Surface Water	X		X	X		X			
	Surface Soil	X	X							
	Groundwater					X				Groundwater was collected during the FRI of PSC 42 solely to support evaluation of remedial alternatives.

See notes at end of table.

Table 2-1 (Continued)
Operable Unit 2
Summary of Investigations and Media Addressed

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Area of Interest	Media	FRI	FRE	FFS	IRA	Groundwater Monitoring	RCRA Closure Report	RI	RA	Comments
PSC 43	Surface Soil/ Filter Media	X	X	X	X		X			Soil and sludge material solidified during the IRA in 1995 were excavated and incorporated as backfill into the IRA at PSC 42 in 1997.
	Subsurface Soil/ Filter Media	X	X	X	X		X			
	Groundwater					X				
OU 2 Drainage Areas	Surface Water							X	X	
	Sediment							X	X	
	Surface Soil							X	X	
OU 2 Groundwater								X	X	Groundwater samples collected at or immediately downgradient of PSC 2 were not included in the overall groundwater evaluation for OU 2 because PSC 2 has been transferred to the Florida petroleum program.

Notes: Groundwater monitoring was initiated at PSCs 42, and 43 in 1984. Monitoring for PSC 41 began in 1990.

PSC = potential source of contamination.
FRI = focused remedial investigation.
FRE = focused risk evaluation.
FFS = focused feasibility study.
IRA = interim remedial action.
RCRA = Resource Conservation and Recovery Act.
RI = remedial investigation.
RA = risk assessment.
LNAPL = light nonaqueous-phase liquid.
TPH = total petroleum hydrocarbons.
IRA = interim remedial action.
OU = operable unit.

Table 2-2
Operable Unit 2 Investigative History

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Date	Investigation Title	Activities	Findings
1983	*IAS, NAS Jacksonville, Jacksonville, Florida* (Fred C. Hart & Associates)	• Review of historical records and aerial photographs. • Field inspections and personal interviews.	• PSCs 2, 3, and 4 were identified as potential sources of contamination. • At PSC 2, 6,000 gallons of jet fuel and waste oil were burned annually from 1966 to 1991. • At PSC 3, 20,000 tons of sludge-containing metals were dumped between 1962 and 1980. • PSC 4 was used for disposal of paint shavings, sewage sludge, asbestos, oil, and petroleum products between 1968 and 1975.
1983	*Groundwater Monitoring Plan for RCRA Compliance, NAS Jacksonville, Jacksonville, Florida* (Geraghty & Miller)	Discussed general hydrogeologic conditions and proposed monitoring well installation and sampling.	• Three wells installed around PSC 43 in April 1994. Quarterly sampling began. • Three wells installed around PSC 42 in June 1994. Quarterly sampling began.
1985	*Verification Study, NAS Jacksonville, Jacksonville, Florida* (Geraghty & Miller)	• Monitoring wells were installed at PSCs 2 and 4. • Groundwater samples were collected. • Soil samples were collected at PSC 4.	• VOCs were found in soil at PSC 4.
1991	*Quarterly Compliance Monitoring of Polishing Pond and Domestic Sludge Drying Beds, NAS Jacksonville, Jacksonville, Florida* (IT Corporation)	Presented quarterly sampling results for 11 wells surrounding PSCs 41 and 42.	Contamination above background levels found in all shallow aquifer wells. Recommended installation of additional wells.
1994	*Focused RI/FS, PSCs 2, 41, and 43 at OU 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1994a)	• Soil sampling and analysis were completed at PSC 2. • Temporary observation wells were installed at PSC 2 and free-product samples were collected. • Sampling of the sludge drying bed material and soils surrounding the sludge drying beds was completed at PSCs 41 and 43.	• Soil samples at PSC 2 contained SVOCs and VOCs characteristic of weathered and/or burned waste petroleum products. • Trace levels of SVOCs and VOCs were found in soil and sludge material sampled at PSCs 41 and 43.
1994	*Technical Memorandum for Preferred Remedial Alternative for PSC 2, OU 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1994b)	Provided elements of the IRA: • Goals and objectives • Remedial action criteria • Description of IRA • Cost estimate	NA

See notes at end of table.

Table 2-2 (Continued)
Operable Unit 2 Investigative History

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Date	Investigation Title	Activities	Findings
1994	*Interim Record of Decision for PSCs 2, 41, and 43 at OU 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1994c)	PSC 2 • Collected free product from soil and disposed of off site. • Excavated and treated contaminated soil on site via low-thermal desorption. • Backfilled with treated soil. PSCs 41 and 43 • Removed and disposed of nonhazardous material. • Excavated and treated hazardous material on site. • Backfilled with treated materials. • Treated material was consolidated on PSC 41. • PSC 43 was backfilled with clean soil.	2 NA
1995	*Focused RI/FS, PSCs 3 and 42 at OU 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1995a)	• Soil sampling and analysis were completed at PSCs 3 and 42. • Surface water and sediment sampling were completed within the polishing pond at PSC 42.	• Soil samples at PSC 42 contained inorganics, specifically, cadmium, chromium, and lead. • Inorganics were detected in sediment and sludge deposits at PSC 42. • Inorganics were detected in the surface water at PSC 42. • Inorganics were found at levels above background in surface soil samples at PSC 3.
1995	*Interim Record of Decision for PSC 42 at OU 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1995b)	• Installed *in situ* mobile stabilization unit. • Bermed and lined pond perimeter. • *In situ* stabilization of polishing pond sludge and water.	NA
1996	*Completion Report for PSC 2 FFTA, NAS Jacksonville, Jacksonville, Florida* (Bechtel Environmental, Inc., 1996)	• Clearing and grubbing. • Soil excavation. • Free-product recovery and disposal. • Thermal desorption treatment. • Backfill. • Site restoration.	NA

See notes at end of table.

Table 2-2 (Continued)
Operable Unit 2 Investigative History

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Date	Investigation Title	Activities	Findings
1997	*Certification and Closure Report, PSC 41, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1997a)	Remedial activities were conducted in two phases: • Phase 1 included excavation and on-site stabilization of contaminated media from PSCs 41 and 43. • Phase 2 included excavation of the previously stabilized material from PSC 41, and transportation and incorporation of the stabilized material into the backfill covering cured and stabilized material at PSC 42.	NA
1997	*Certification and Closure Report, PSC 42, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1997b)	• Installation of mobile treatment unit for *in situ* stabilization. • Construction of containment berm around polishing pond. • *In situ* stabilization of sediment, sludge, and water.	NA
1997	*Certification and Closure Report, PSC 43, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1997c)	• Removed and disposed of nonhazardous material off site. • Excavated and treated hazardous material on site. • Backfilled the excavated area.	NA
1998	*RI, OU 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1998a)	OU 2-wide • Groundwater investigation. • Surface water and sediment investigation. • Soil investigation.	• Due to presence of petroleum-related compounds in groundwater, PSC 2 was transferred to Florida's petroleum program. • No further actions recommended for PSCs 3 and 4. • PSCs 41, 42, and 43 were recommended for clean closure under RCRA. • Groundwater monitoring for postclosure required for PSCs 41, 42, and 43.

Notes: IAS = initial assessment study.
NAS = Naval Air Station.
PSC = potential source of contamination.
RCRA = Resource Conservation and Recovery Act.
VOC = volatile organic compound.
RI/FS = remedial investigation and feasibility study.
OU = operable unit.
ABB-ES = ABB Environmental Services, Inc.
SVOC = semivolatile organic compound.
NA = not available.
IRA = interim remedial action.
FFTA = firefighter training area.
RI = remedial investigation.

at PSC 3, only the southern one (Parcel 2) appears to have been utilized for sludge disposal.

Although risks were not expected from exposure to soil at PSC 3, there were concerns about the exceeded guidance cleanup goals for lead detected in one surface soil sample collected at Parcel 2. Metals concentrations in this sample were also much higher than those detected in other PSC 3 samples.

Because of these concerns, soil around this sample was removed in January 1997 and incorporated into the ongoing IRA at PSC 42.

2.2.3 PSC 4: Pine Tree Planting Area PSC 4 comprises approximately 70 acres and is located southwest of the WWTP. Approximately 5 to 6 acres in the northern part of the area were planted with pine trees sometime after 1975; hence, the name of the site. The rest of the site is an open grassy field. Portions of the area were reportedly used for the disposal of wastewater sludge, asbestos, and petroleum products between 1968 and 1975. The waste was either dumped in piles or spread on the ground. Investigators found evidence of sludge disposal in the northern portion of the Pine Tree Planting Area (i.e., sludge piles and a sludge layer containing paint chips) during the first portion of the RI. Evidence of sludge disposal was not found anywhere else at PSC 4.

Samples from the piles contained high metal concentrations, which further indicated that the piles consisted of sludge from the WWTP. Because of the metal concentrations, the piles were removed in January 1997 along with soil surrounding one sampling location in the same area as the piles. The excavated sludge material and soil were incorporated into the ongoing IRA of PSC 42.

2.2.4 PSC 41: Domestic Waste Sludge Drying Beds A system of five unlined beds were constructed in 1970 to dry sludge from the domestic WWTP. After the sludge was dried, it was removed from the beds and disposed of at PSC 3, PSC 4, or a landfill. During operations between 1970 and 1980, it was reported that approximately 300 cubic yards of dried sludge were removed annually from the domestic waste sludge drying beds. In 1987, the USEPA classified the drying beds as a surface impoundment used for the treatment of listed RCRA hazardous waste. The beds were permanently removed from service in 1987. Sludge remaining in the drying beds was reported to have been removed and disposed of at an off-site, USEPA-permitted landfill.

The former domestic sludge drying beds were investigated during the first stage of the RI. High metal concentrations were detected in samples of sludge bed media and in soil beneath the former drying beds. To address the potential risks and support RCRA closure, an IRA was implemented in 1995 at PSC 41. Soil and filter media from ground surface down to the water table were excavated and stabilized. Stabilized materials from PSC 41 and PSC 43 (simultaneously undergoing an identical IRA) were used to backfill the excavation at PSC 41. In January 1997, the stabilized and solidified sludge material was excavated and incorporated as backfill into the ongoing IRA of PSC 42.

Because the source areas had been removed and treated, an RCRA closure report for PSC 41 was completed in 1997 (ABB-ES, 1997a).

2.2.5 PSC 42: Wastewater Treatment Plant Polishing Pond The polishing pond was constructed in 1970 to provide final clarification for approximately 2.3 million

gallons per day of treated wastewater from both the industrial and domestic WWTPs. After clarification, the water was chlorinated and discharged to the St. Johns River. The pond was permanently removed from service in May 1987, but contained water until 1996.

The polishing pond was investigated during the first stage of the RI. Based on high concentrations of metals detected in sediment and surface water in the pond, it was determined that an IRA was needed to support RCRA closure. Five inorganic elements (cadmium, chromium, lead, nickel, and silver) were identified as contaminants of concern to be addressed in the IRA. Remedial activities were conducted at PSC 42 from March 1996 to April 1997 to address surface water and sediment through treatment and *in situ* solidification of the sludge and underlying soil. The RCRA Closure report for PSC 42 was completed in 1997 (ABB-ES, 1997b).

The selected IRA for treatment of contaminated surface water and sediment at PSC 42 was based on results of the focused RI (FRI) for PSC 42. The selected IRA is presented in the *Interim Record of Decision for Potential Source of Contamination 42, Operable Unit 2* (ABB-ES, 1995b). The selected remediation was *in situ* stabilization of contaminated media. Cleanup criteria, remedial activities, and confirmatory sampling (for PSC 42 media) performed during the IRA of PSC 42 are discussed in the *Certification and Closure Report, Potential Source of Contamination 42* (ABB-ES, 1997b). Because the source areas at PSC 42 have been removed and treated, no further action is recommended for RCRA closure of the site. However, a period of postclosure groundwater monitoring for PSC 42 will be performed to satisfy the requirements of the RCRA.

<u>2.2.6 PSC 43: Industrial Waste Sludge Drying Beds</u> The four industrial sludge drying beds were constructed in 1980 to dry sludge generated from the wastewater treatment of plating wastes. During operations, approximately 41 cubic yards of dried sludge were excavated annually from the drying beds and disposed of by land spreading at PSC 3 and possibly PSC 4. The drying beds were removed from service in 1988, with the remaining sludge removed and taken to an off-site USEPA-permitted landfill in 1991.

PSC 43 was investigated during the first stage of the RI. High concentrations of metals were detected in the sludge bed filter media and the underlying soil. In order to reduce potential risks associated with the metals contamination and comply with RCRA closure requirements, an IRA was implemented for PSC 43 in 1995. The IRAs for PSCs 41 and 43 were performed concurrently. Contaminated filter media and soil were excavated and stabilized, and temporarily placed in the PSC 41 excavation. In 1997, the combined solidified material from PSCs 41 and 43 were excavated and incorporated as backfill into the ongoing IRA at PSC 42. The RCRA closure report for PSC 43 was completed in 1997 (ABB-ES, 1997c).

<u>2.2.7 Drainage Areas</u> There are drainage ditches and swales in several areas of OU 2 (see Figure 2-4). However, only the drainage ditch in the open field area of PSC 4 contains water on a continuous basis. During the RI, surface water and sediment samples were collected from this drainage ditch.

Samples were also collected from other drainage areas at OU 2. These drainage areas are predominantly grass-lined swales and only contain water during or immediately following rain storms. Therefore, samples obtained from these areas were evaluated as soil in the RI.

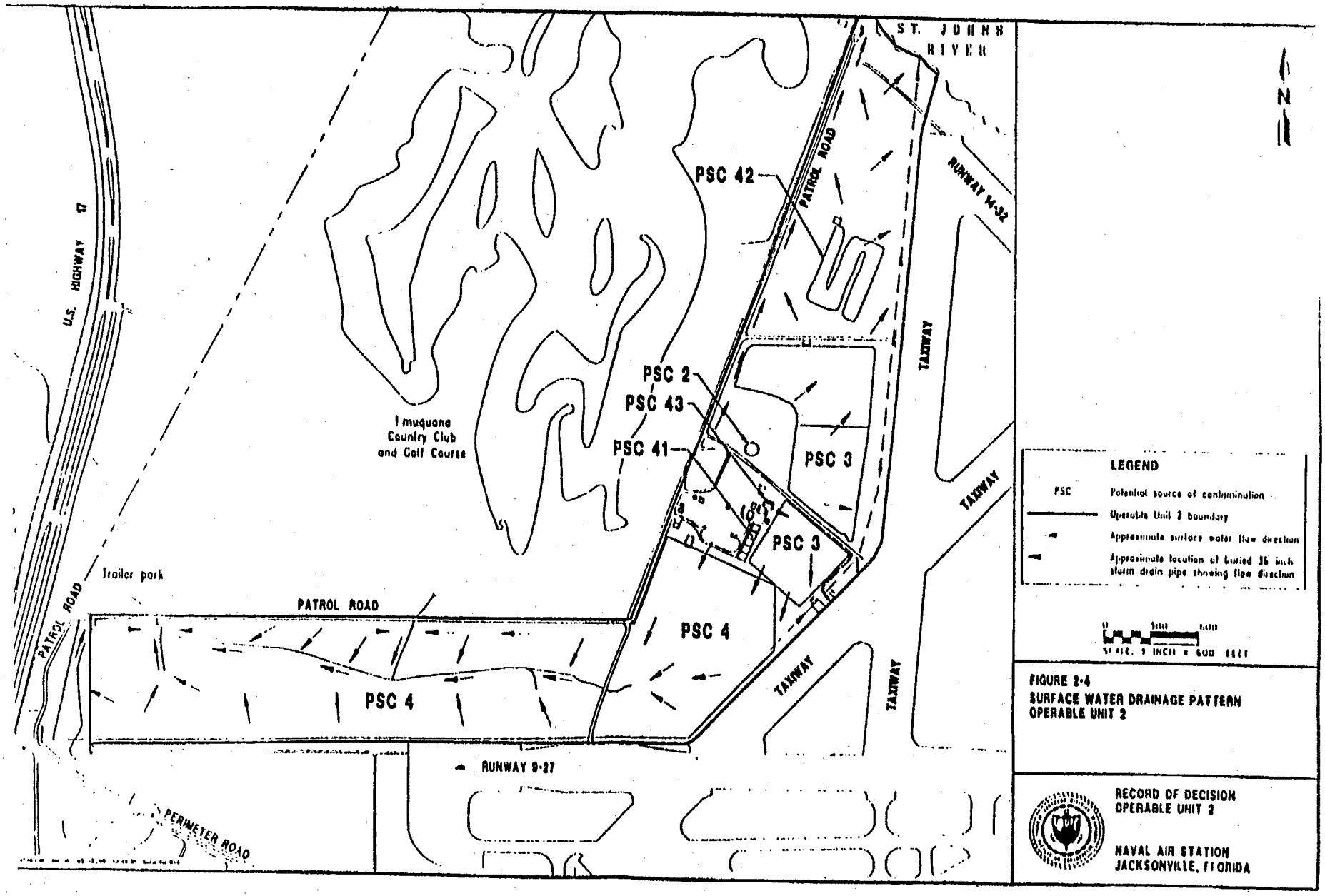


FIGURE 2-4
SURFACE WATER DRAINAGE PATTERN
OPERABLE UNIT 2

RECORD OF DECISION
OPERABLE UNIT 2

NAVAL AIR STATION
JACKSONVILLE, FLORIDA

2.2.8 Groundwater Groundwater samples have been collected from wells at OU 2 since 1984, primarily as part of the RCRA compliance monitoring for PSCs 41, 42, and 43. The results from pre-RI groundwater sampling events are summarized in the OU 2 RI Workplan (ABB-ES, 1992).

Direct-push technology (DPT) was used to collect groundwater samples during the RI. Analytical results from the DPT groundwater investigation were used in selecting locations for installing five monitoring wells. These wells were then sampled and the groundwater analyzed in support of the RI (ABB-ES, 1998a).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION. The RI report (ABB-ES, 1998a) and the Proposed Plan (ABB-ES, 1998b) for OU 2 were completed and released to the public in January 1998 and April 1998, respectively. These documents, and other Installation Restoration (IR) program information, are available for the public's review in the Information Repository and Administrative Record. The repository is maintained at the Charles D. Webb Wesconnett Branch of the Jacksonville Public Library in Jacksonville, Florida. The notice of availability of the Proposed Plan was published in the *Florida Times Union* on April 1, 1998, and in the *Clay Today* on April 1 and April 3, 1998. These local editions target the communities closest to NAS Jacksonville. The news releases presented information on the RI at OU 2 and encouraged community members to submit written comments on the Proposed Plan.

A public comment period was held from April 1, 1998, to May 15, 1998, to solicit comments on the Proposed Plan. In addition, a public meeting was held on April 21, 1998. Representatives from NAS Jacksonville, USEPA, and the FDEP, plus the Navy's environmental consultants, presented information on the results of the OU 2 RI, the RA, and the Proposed Plan, and solicited comments from the community. No comments were received during the public comment period.

2.4 SCOPE AND ROLE OF OPERABLE UNIT. Investigations at OU 2, the subject of this ROD, indicated the presence of soil, groundwater, surface water and sediment contamination resulting from past disposal practices. IRAs have been completed for PSCs 2, 41, 42, and 43. In addition, "hot spot" soil removals were completed at PSCs 3 and 4. Soil and sludge removed from PSCs 3, 4, 41, and 43 were incorporated into the ongoing IRA at PSC 42. Because of the presence of LNAPL and petroleum-related contaminants in the groundwater at PSC 2, jurisdiction over PSC 2 has been transferred to Florida's petroleum program.

The IRAs completed at OU 2 addressed soil, surface water, and sediment contamination. Because the source of contamination at OU 2 has been removed during IRAs, contamination in the groundwater is expected to decline over time.

The Navy, USEPA, and FDEP decided that the site conditions, RA results, and regulatory requirements (ARARs) do not warrant establishing remedial action objectives (RAOs) for OU 2.

2.5 SUMMARY OF SITE CHARACTERISTICS. Contaminant sources, detections, migration pathways, contaminated media, and geologic and hydraulic conditions of OU 2 are discussed in the OU 2 Focused RI/FS reports and the RI report. Site characteristic data are summarized in the subsections and paragraphs below.

2.5.1 General Site Characteristics of OU 2

Geology. A generalized geologic cross section of OU 2 is shown and described in Volume 1 of the NAS Jacksonville IR program plan (Geraghty & Miller, 1991). The surficial soil consists of post-Miocene fluvial deposits, including fine-grained sand, silty sand, clayey sand, and sandy clay overlying the Hawthorn Group. The post-Miocene deposits are up to 75 feet thick (United States Army Corps of Engineers).

Surface Hydrology. A drainage divide runs northwesterly across OU 2 in the vicinity of the access road running through PSC 3 and the sludge drying beds at PSCs 41 and 43. South of the divide, runoff flows south and west into a drainage ditch that begins 1,200 feet south of the WWTP. This ditch parallels the east-west runway for approximately 3,000 feet, then turns north and flows off base. North of the divide, runoff flows toward the St. Johns River via drainage swales on either side of the patrol road and in two 36-inch-diameter stormwater drainage pipes paralleling the taxiway on the east side of OU 2.

Hydrogeology. Groundwater flow in the surficial aquifer is generally northward toward the St. Johns River, north of the surface drainage divide and south to southwest south of the divide. Depth to groundwater generally ranges from near surface to 5 feet below land surface (bls). Hydraulic conductivity ranges from 0.23 to 9.33 feet per day (ft/day) in the shallow zone and 3.54 to 81.35 ft/day in the deep zone.

Meteorology. The meteorology of the Jacksonville area is described in detail in Volume 1 of the NAS Jacksonville IR Program Plan (Geraghty & Miller, 1991).

Contaminant Sources. OU 2 contaminant sources were addressed during IRAs. These contaminant sources and the contaminated media included the following:

Site	Media
PSC 2	soil, groundwater
PSCs 3 and 4	soil, sludge
PSCs 41 and 43	soil, sludge
PSC 42	soil, surface water, sediment

PSC-specific investigations conducted at OU 2 are documented in the Focused RI/FS and the Final RI. Soil was investigated at all PSCs, while surface water and sediment were only investigated for PSCs 4 and 42. Groundwater was investigated as a whole across OU 2, and will be discussed in this ROD as such.

2.5.2 PSC 2, Firefighting Training Area

2.5.2.1 Soil

Volatile Organic Compounds (VOCs). VOCs detected prior to the IRA included ethylbenzene, 4-methyl-2-pentanone, and 2-butanone at the center of PSC 2. These constituents are degradation products of hydrocarbon-based compounds related to fuel, including jet and diesel fuel.

Semivolatile Organic Compounds (SVOCs). SVOCs detected in surface soils consisted of polynuclear aromatic hydrocarbons (PAHs). The PAH 2-methylnaphthalene was found at the center and the northeastern edge of PSC 2. Other PAHs were detected in low concentrations at one location near the eastern edge of PSC 2. These PAHs included dibenz(a,h)anthracene, chrysene, pyrene, benzo(g,h,i)-perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and benzo(b)fluoranthene. These constituents also appear to be associated with degradation of hydrocarbon-based compounds related to fuel.

Pesticides and Polychlorinated Biphenyls (PCBs). Pesticides were found near the edge of PSC 2. These compounds included alpha-chlordane, gamma-chlordane, and dieldrin. In addition, 4,4'-dichlorodiphenyldichloroethene (DDE) was detected at one location within PSC 2. PCBs were not detected in any of the soil samples collected from PSC 2.

Total Petroleum Hydrocarbons. Horizontal TPH distribution indicated an approximately circular zone of contamination with areas of highest concentrations in and around the center of the former firefighting training pit. TPH concentrations were found to rapidly dissipate toward the edges of the pit.

Inorganics. Inorganic compounds detected at PSC 2 included lead, chromium, cadmium, and arsenic.

2.5.2.2 Groundwater

LNAPL Characterization. LNAPL was found to be present at PSC 2 and is interpreted to be a petroleum product containing no PCBs or chlorides. Further investigation activities will be handled through the petroleum program at NAS Jacksonville.

2.5.3 PSCs 3 and 4, Land Disposal from Drying Beds Sludge

2.5.3.1 Soil and Sludge

VOCs. VOC analytical results indicated that soil contamination by VOCs was not extensive at PSC 3 or PSC 4. Acetone and methylene chloride were the only two VOCs detected at PSC 4. Both compounds are common artifacts of laboratory and decontamination procedures. Carbon disulfide, xylene, and acetone were detected in one sample at PSC 3.

SVOCs. Contamination by SVOCs was not considered extensive at either PSC 3 or PSC 4. A summary of SVOCs detected is documented in the Focused RI/FSs (ABB-ES, 1994a; 1995a) and the Final RI (ABB-ES, 1998a).

Pesticides and PCBs. Organochlorine pesticides were detected at PSC 3. Dieldrin and low levels of alpha- and gamma-chlordane were detected in soils. Similar low-level detections of dieldrin, and alpha- and gamma-chlordane were present at PSC 4. The nature and extent of dieldrin contamination at PSC 3 and PSC 4 do not appear to be related to sludge disposal operations and may have been a result of past pest control practices.

Inorganics. Chromium, lead, and cadmium were the most often detected inorganics at PSC 3. The extent of soil contamination by cadmium, chromium, and lead at PSC 3 was primarily in the surface layer. Except for a small area in the

southern portion of Parcel 2 at PSC 3, metal contamination extended from the former drying beds towards the center of the parcel, and extended south and west of PSC 3.

Sludge samples obtained from PSC 4 revealed high inorganics concentrations in the sludge piles. Arsenic was detected above Florida residential soil cleanup goals (SCGs) in soil samples from across PSC 4, although there was no pattern to the distribution of arsenic in soil. Because there was no evidence of sludge disposal in the areas of soil sampling, and the arsenic concentrations were broadly distributed, it is likely that the arsenic concentrations detected in soil at PSC 4 represents naturally occurring concentrations.

2.5.4 PSC 41, Domestic Waste Sludge Drying Beds

2.5.4.1 **Soil** Pre-IRA site characteristics are described in the paragraphs below.

VOCs. Soil contamination by VOCs is not extensive at PSC 41. Acetone was the only VOC detected, and it is considered a common artifact of laboratory and decontamination procedures.

Inorganics. Sixty-nine soil samples were screened in the field for five heavy metals (arsenic, cadmium, chromium, lead, and nickel). Nine samples of sand, filter media, and soil were analyzed by an off-site laboratory for target analyte list (TAL) metals. Seventeen metals were detected in these samples. Of the five heavy metals screened in the field, lead was detected in all nine samples with concentrations in the surface (0 to 1 foot bls) higher than in the subsurface. Arsenic, cadmium, nickel, and chromium were each detected in five locations. Each of the five metals was detected in the screening samples across all sampling depths, from 0 to 4 feet bls, both within the drying beds and in the surrounding soil. Field screening data for the five heavy metals were correlated with off-site laboratory analyses.

An FRE performed for PSC 41 (discussed more thoroughly in Paragraph 2.6.1.1) identified arsenic, chromium, and nickel as site contaminants which posed a potential threat to human and ecological receptors. Based on results of the FRE, five heavy metals (arsenic, cadmium, chromium, lead, and nickel) and respective toxicity characteristic leaching procedure (TCLP) extract cleanup concentrations were selected as treatment criteria for the IRA at PSC 41. Although lead was not found to pose potential risk at PSC 41, it was a risk driver for PSC 43, and treatment criteria were based on results of the risk evaluation for both PSC 41 and 43 because the two sites were treated together and included in a single IRA. The TCLP extract concentration of cadmium detected during the FRI for PSC 41 exceeded the constituent concentrations in waste extract (CCWE) limits for land disposal, making cadmium the fifth metal in the list of treatment criteria for the IRA at PSC 41.

2.5.5 PSC 42, Wastewater Treatment Effluent Polishing Pond

2.5.5.1 **Soil** Pre-IRA site characteristics are described in the paragraphs below.

VOCs. Soil contamination by VOCs does not appear to be extensive in soil around PSC 42. Acetone, the only VOC detected, is a common artifact of laboratory decontamination procedures.

SVOCs. Contamination by SVOCs does not appear to be extensive at PSC 42. Except for the detection of bis(2-ethylhexyl)phthalate, all SVOC detections were below contract-required quantitation limits.

Pesticides and PCBs. Organochlorine pesticides were detected in soil around PSC 42. Dieldrin, gamma-chlordane, and alpha-chlordane were also detected in soils at PSC 42. No PCB compounds were detected. The nature and extent of organochlorine pesticide contamination in soil around PSC 42 does not appear to be related to PSC 42 operations and may have been a result of past basewide pest control programs.

Inorganics. Fifty-six soil samples were screened for five metals (arsenic, cadmium, chromium, lead, and nickel). Cadmium, chromium, and lead were the most often detected metals in the soil screening samples. Nickel was detected in 7 of the 56 samples, and arsenic was below detection limits in all 56 screened samples. Twelve soil samples were sent to a laboratory for confirmation of screening results. Lead (12 of 12), chromium (11 of 12), and cadmium (7 of 12) were detected in the confirmation samples, while arsenic and nickel were undetected. Laboratory results showed that concentrations of lead, chromium, and cadmium were above background levels 16, 67, and 88 percent of the time, respectively.

The FRE completed for PSC 42 (discussed further in Paragraph 2.6.1.2) concluded that unacceptable risks were not predicted for human or ecological receptors from exposure to surface soil at PSC 42. Therefore, the IRA at PSC 42 did not address soil surrounding the polishing pond.

2.5.5.2 Surface Water and Sediment Pre-IRA site characteristics are described in the paragraphs below.

VOCs. VOC screening analytical results for sediment around the polishing pond are documented in the Focused RI/FS. In the screening data, 2-butanone was detected in all of the sediment samples. Acetone, benzene, carbon disulfide, toluene, and total xylenes were detected in various sediment samples submitted for analysis. Only one surface water sample showed low-detectable levels of acetone and benzene.

SVOCs. SVOCs detected in all sediment samples include phenol and bis(2-ethylhexyl)phthalate. Butylbenzyl phthalate and di-*n*-butyl phthalate were detected in two of the four sediment samples. Di-*n*-octyl phthalate, fluoranthene, and benzo(b)fluoranthene were detected in various sediment samples. Di-*n*-octylphthalate was detected at a low level in one surface water sample.

Pesticides and PCBs. There were no detections of pesticides or PCBs in the PSC 42 sediment and surface water.

Inorganics. Seventeen sediment samples were initially screened for arsenic, cadmium, chromium, lead, and nickel. Cadmium, chromium, lead, and nickel were detected in all 17 sediment screening samples. Arsenic was not detected. Four sediment samples were sent to a laboratory and analyzed for TAL inorganics to

confirm the screening results. Fifteen TAL inorganic parameters were detected in all four sediment samples: aluminum, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, silver, vanadium, zinc, and cyanide. Eleven metals were detected in the three surface water samples analyzed for TAL inorganics: aluminum, barium, calcium, chromium, iron, lead, magnesium, manganese, nickel, potassium, and sodium.

The FRE performed for PSC 42 did not address the sediment, sludge, and water present within the polishing pond, as it was assumed those materials would be removed and/or treated as part of the IRA for the site. Five inorganic elements (cadmium, chromium, lead, nickel, and silver), present in the sediments and sludge at PSC 42 were identified in the Bench-Scale Mix Design (ABB-ES, 1995c) as contaminants to be targeted in the IRA. Most of the surface water in the pond was incorporated into the IRA stabilization process for contaminated media. Excess surface water was sampled for discharge criteria established by the Navy Public Works Center and discharged to the federally owned treatment works.

2.5.6 PSC 43, Industrial Waste Sludge Drying Beds

2.5.6.1 Soil Pre-IRA site characteristics are described in the paragraphs below.

VOCs. As in PSC 41, soil contamination by VOCs is not extensive at PSC 43. Acetone was the only positive detection, and it is a common artifact of laboratory decontamination procedures.

Inorganics. Sixty-eight soil samples were screened in the field for arsenic, cadmium, chromium, lead, and nickel. The highest screening concentrations of chromium, cadmium, lead, and nickel were detected in the upper 2-inch filter material layer of the sludge drying beds. Chromium was detected in every sample from PSC 43 screened on site. Five samples were submitted to a laboratory for TAL metals analyses. Of the five inorganics screened in the field, chromium and lead were detected in all five samples. Cadmium and nickel were in three of five samples, and arsenic was detected in two of the samples.

The FRE conducted for PSC 43 (discussed further in Paragraph 2.6.1.1) indicated that observed levels of chromium, nickel, and lead posed potential risks to human health for an industrial scenario. In addition to these three heavy metals, arsenic and cadmium were chosen as treatment criteria for an IRA performed at PSC 43. Arsenic was included because it was found to pose potential risk at PSC 41, and both PSC 41 and PSC 43 were treated together and included in the IRA. Likewise, cadmium was included because its TCLP extract concentration detected during the FRI for PSC 41 exceeded the CCWE limits for land disposal.

2.5.7 Drainage Areas Discussion of results from sampling efforts for the drainage areas have been divided into the following components:

- Surface water - all surface water samples
- Sediment samples - sediment samples collected from the PSC 4 drainage ditch
- Drainage swale soil - soil samples collected from other OU 2 drainage areas

Site characteristics, based on the above listed components, are summarized in the paragraphs below.

2.5.7.1 Surface Water

VOCs. Acetone and methylene chloride were detected in surface water samples at low concentrations. Because these compounds were also detected in some of the quality control samples and were found only at low concentrations, they may be artifacts from common laboratory and decontamination procedures.

SVOCs. Bis(2-ethylhexyl)phthalate was detected in one surface water sample at an estimated concentration slightly greater than the Florida surface water quality criteria (SWQC), but below the reporting limit.

Inorganics. Eleven metals and cyanide were detected at concentrations greater than background levels. Concentrations of beryllium, cadmium, copper, iron, lead, and mercury exceed Florida SWQC. Aluminum, barium, calcium, magnesium, manganese, potassium, and vanadium have no Florida SWQC for comparison. Although concentrations in some samples are greater than background and/or Florida SWQC, concentrations detected from the most downstream sample were all below background levels. This indicates that inorganics detected in upstream samples are not migrating downstream or off site.

2.5.7.2 Sediment

VOCs. Acetone was detected in all the sediment samples, and 2-butanone was detected in two of the samples with highest acetone concentrations. Because both of these VOCs are common artifacts of laboratory and decontamination procedures and were also detected in some of the quality control samples, it is likely that these VOCs were introduced to the samples during collection or analysis.

SVOCs. Benzo(a)pyrene, benzo(g,h,i)perylene, and fluoranthene were detected in one sediment sample at estimated concentrations below the reporting limit. TPH was also detected in this sample. The subject sample was located next to a road, and the PAHs and TPH detected likely represent paving material and/or runoff from the road.

Pesticides and PCBs. The pesticides dichlorodiphenyldichloroethane and DDE were detected in duplicate samples at estimated concentrations below the reporting limits. These low concentrations likely represent stationwide application of pesticides.

Inorganics. Fifteen metals and cyanide were detected at concentrations higher than background levels. The highest concentrations of most inorganics were detected in a sample collected closest to the PSC 4 sludge disposal area. However, soil samples collected between the sludge disposal area and the drainage ditch have lower concentrations of inorganics than those detected in the above referenced sample. This indicates that inorganics have not migrated to the ditch via overland flow.

The concentrations of calcium, magnesium, and iron detected in the referenced sediment sample suggest that dolomitic ballast from the road was in the soil sample.

2.5.7.3 Drainage Swale Soil

VOCs. No VOCs were detected at levels greater than benchmarks.

SVOCs. Benzo(a)pyrene was detected in one sample at the end of Patrol Road at a level higher than Florida SCGs for both residential and industrial scenarios. The source of the PAHs is unknown; however, roadway runoff and paving material are possible sources. Additionally, at times, security personnel temporarily park patrol cars in this area while on patrol.

Pesticides and PCBs. DDE and dichlorodiphenyltrichloroethane were detected in one sample at concentrations less than Florida residential SCGs.

Inorganics. Antimony, arsenic, beryllium, and cadmium were all detected at concentrations greater than background levels. Levels of antimony and cadmium are characteristic of treatment plant waste. Arsenic and beryllium are not metals characteristic of the treatment plant waste. It is likely that arsenic and beryllium levels are naturally occurring.

2.5.8 Groundwater Groundwater samples from compliance wells and monitoring wells, and analytical results from the DPT groundwater investigation were used to evaluate groundwater at OU 2. Samples from PSC 2 and immediately downgradient from PSC 2 were not used during this evaluation.

VOCs. Acetone and methylene chloride were detected at concentrations above benchmarks. Due to the levels found, and results of quality control samples, it is likely that acetone and methylene chloride were introduced to the samples during collection or analysis. Carbon disulfide and 1,1-dichloroethane were detected at concentrations less than Florida groundwater guidance concentrations (GGCs).

SVOCs. Phenol was detected in one groundwater sample obtained near the domestic sludge drying beds. Phenol may have migrated to groundwater from sludge deposited in the drying beds.

Inorganics. Seven inorganics were detected at concentrations greater than background levels. Of these inorganics, cadmium, manganese, sodium, and thallium were detected at concentrations greater than established Florida GGCs. Cadmium and manganese are likely related to sludge that was placed in the drying beds. Sodium was detected at one sample location at a concentration greater than background levels and Florida GGCs. Thallium was also detected in one sample slightly above Florida GGCs, and it is believed that this is not related to the sludge drying beds. It is likely that the thallium is naturally occurring.

2.6 SUMMARY OF SITE RISKS. CERCLA directs the Navy to conduct an RA to determine whether or not a site poses a current or future threat to human health and the environment in the absence of any remedial action. Both a HHRA and ecological risk assessment (ERA) were performed for OU 2. The RAs evaluated the contaminants detected in site media during the FRIs (PSCs 2, 3, 41, 42, and 43) and the RI (PSC 4, OU 2 groundwater, and OU 2 drainage areas), and provided the basis for selecting either remedial actions or a No Further Action alternative. For ease of understanding, results of the risk evaluations are presented in the same order in which they were conducted.

To assist in distinguishing inorganic contaminants from those that are present naturally, analytical results were compared to background screening concentrations for each medium sampled. These background screening concentrations are twice the mean of the concentrations detected in the background samples for each medium. The methods used to develop the background screening concentrations are presented in the OU 1 RI/FS (ABB-ES, 1996).

2.6.1 Human Health Risk Assessment HHRAs were conducted to characterize the risks associated with potential exposure to site-related contaminants at OU 2 for human receptors. Four basic components of the HHRA were performed for each area of OU 2: (1) selection of human health contaminants of potential concern (HHCPCs), (2) exposure assessment, (3) toxicity assessment, and (4) risk characterization.

HHCPCs. HHCPCs are chemicals found at levels above State and Federal risk-screening levels and levels typical of an area. These contaminants of potential concern (CPCs) are the focus of the RAs performed for each area of interest at OU 2. Table 2-3 summarizes the HHCPCs selected for media for the six PSCs, drainage areas, and groundwater at OU 2.

Exposure Assessment. An exposure assessment is performed to identify populations that might come into contact with site-related chemicals and the pathways through which exposure might occur.

Toxicity Assessment. The toxicity assessment evaluates possible harmful effects from exposure to the identified CPCs. Both carcinogenic and noncarcinogenic risks associated with each CPC are evaluated.

Risk Characterization. For risk characterization, the results of the exposure and toxicity assessments are combined to estimate the overall risk from exposure to site contamination. For carcinogens, risk is expressed as a probability of developing cancer. For noncarcinogens, the dose of a chemical for which a receptor may be exposed is estimated and compared to a reference dose. The reference dose is developed by USEPA scientists and represents the amount of a chemical a person could be exposed to over a lifetime without developing adverse effects. The measure of likelihood of adverse noncancer effects occurring in humans is called the hazard index (HI). An HI greater than 1 suggests that adverse effects are possible.

2.6.1.1 PSCs 2, 41, and 43 Based on results of the FRI, a FRE was performed for PSCs 2, 41, and 43. The FRE is included in the *Focused Remedial Investigation and Feasibility Study for PSCs 2, 41, and 43 at Operable Unit 2* (ABB-ES, 1994a). The media within each PSC addressed in the FRE are presented in Table 2-1. Groundwater across OU 2 was assessed during the overall RI; therefore, individual groundwater investigations at PSCs 2, 41, and 43 were not completed during the Focused RI/FS. The purpose of the focused human health risk evaluations for PSCs 2, 41, and 43 was to identify immediate threats to human health associated with site contamination and to evaluate the need to perform IRAs for source control.

A fifth component of the HHRA, development of PRGs, was included in the FREs for PSCs 2, 41, and 43. PRGs represent soil concentrations of CPCs that are not expected to pose an unacceptable risk to humans by the respective route of exposure. PRGs were compared with maximum detected concentrations of HHCPCs to identify CPCs that may pose an unacceptable risk.

Table 2-3
Summary of Human Health Contaminants of Potential Concern (HHCPCs)

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Area of Interest	Environmental Medium	HHCPCs
PSC 2[1]	Surface Soil	**Volatile Organics:** 2-butanone, 4-methyl-2-pentanone, acetone, ethylbenzene, xylene (total)
		Semivolatile Organics: 2-methylnaphthalene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, naphthalene, pyrene
		Pesticides/PCBs: 4,4'-DDE, dieldrin, alpha-chlordane, gamma-chlordane
		Inorganics: aluminum, arsenic, barium, cadmium, chromium, copper, lead, manganese, zinc
PSC 3[2]		
Parcel 1	Surface Soil	**Inorganics:** lead
	Subsurface Soil	**Inorganics:** lead
Parcel 2	Surface Soil	**Pesticides/PCBs:** dieldrin
		Inorganics: cadmium, chromium (trivalent), lead
	Subsurface Soil	**Inorganics:** lead
PSC 4[3]		
Outside Sludge Disposal Area		**Inorganics:** arsenic, beryllium, iron, thallium
		Other: total petroleum hydrocarbons (TPH)
Within Sludge Disposal Area		**Inorganics:** arsenic, cadmium, iron
		Other: TPH
PSC 41[1]	Surface Soil/Filter Me-	**Volatile Organics:** acetone
		Inorganics: aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, zinc
	Subsurface Soil/Filter Media	**Volatile Organics:** acetone
		Inorganics: aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, zinc
PSC 42[2]	Surface Soil	**Inorganics:** cadmium, lead

See notes at end of table.

Table 2-3 (Continued)
Summary of Human Health Contaminants of Potential Concern (HHCPCs)

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Area of Interest	Environmental Medium	HHCPCs
PSC 43[1]	Surface Soil/Filter Media	**Volatile Organics:** acetone
		Inorganics: aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, zinc
	Subsurface Soil/Filter Media	**Volatile Organics:** acetone
		Inorganics: aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, zinc
OU 2 Groundwater[3]		**Volatile Organics:** acetone, methylene chloride
		Semivolatile Organics: phenol
		Inorganics: arsenic, barium, cadmium, manganese, sodium, thallium
OU 2 Drainage Areas[3]	Surface Water	**Volatile Organics:** acetone
		Semivolatile Organics: bis(2-ethylhexyl)phthalate
		Inorganics: aluminum, arsenic, beryllium, iron, lead, manganese, mercury, vanadium, zinc
	Sediment	**Semivolatile Organics:** benzo(a)pyrene
		Inorganics: arsenic, cadmium, iron, vanadium
		Other: TPH
	Surface Soil	**Semivolatile Organics:** benzo(a)pyrene, indeno(1,2,3,-cd)pyrene
		Inorganics: antimony, arsenic, beryllium, cadmium, iron, lead, silver
		Other: TPH

[1] Reference Document: ABB Environmental Services, Inc. (ABB-ES), *Focused Remedial Investigation and Feasibility Study, PSCs 2, 41, and 43 at Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (August 1994).
[2] Reference Document: ABB-ES, *Focused Remedial Investigation and Feasibility Study for PSCs 3 and 42 at Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (April 1995).
[3] Reference Document: ABB-ES, *Remedial Investigation, Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (January 1998).

Notes: PSC = potential source of contamination.
DDE = dichlorodiphenyldichloroethene.
PCB = polychlorinated biphenyl.
OU = operable unit.
NAS = Naval Air Station.

HHCPCs selected for surface soil at PSC 2 and soil/filter media at PSCs 41 and 43 are presented in Table 2-3. Identical exposure pathways and scenarios were evaluated for PSCs 2, 41, and 43. Under current land use, adult commercial and industrial workers could be exposed to contaminants in surface soil; therefore, exposure of these receptors (through ingestion of and direct dermal contact with surface soil and inhalation of particulates and volatiles from surface soil) was evaluated in the FRE. In addition, the FRE evaluated exposure to assumed future resident adults and children via ingestion and dermal contact with surface soils.

Using contaminant-specific toxicity values, residential and industrial PRGs were calculated for carcinogenic and noncarcinogenic effects to potential receptors. The PRGs are based on a target cancer risk of 1 in 1,000,000 (10^{-6}) for carcinogens and a target HI of 1 for noncarcinogens. The risk characterization for PSCs 2, 41, and 43 was based on a qualitative estimate of the risks at each PSC. This approach adequately supports the objective of identifying whether CPCs in soil at PSCs 2, 41 and 43 may pose an unacceptable risk to human health. The maximum detected concentrations of CPCs detected in soils from each of the PSCs were compared to the PRGs and FDEP Soil Target Levels (STLs) (FDEP, 1994). Table 2-4 summarizes the results of the PRG and STL comparisons to maximum detected concentrations of CPCs for both the residential and industrial scenarios.

Exceedances of PRGs indicate that unacceptable risks for human health may be associated with exposure to the CPC. The results of the risk characterization supported implementation of IRAs at PSCs 2, 41, and 43. The need for IRAs at the PSCs was based on the comparison of CPCs to PRGs, since FDEP STLs were not specifically calculated for the exposure pathways present at the sites.

Due to the presence of LNAPL and petroleum-related contaminants detected in PSC 2 groundwater during the second stage of the RI, the USEPA and FDEP agreed to transfer jurisdiction of PSC 2 to Florida's petroleum program. No further actions are recommended for PSC 2 under the CERCLA program at OU 2. Because the source areas at PSCs 41 and 43 have been removed and treated, no further actions are recommended for RCRA closure of the sites. However, a period of postclosure groundwater monitoring (of 2 to 3 years) will be performed to satisfy the requirements of RCRA.

2.6.1.2 **PSCs 3 and 42** Following completion of the FRIs, FREs were performed for selected media at PSCs 3 and 42. Results of the FREs are included in the *Focused Remedial Investigation and Feasibility Study, PSCs 3 and 42 at Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1995a). The media within each PSC addressed in the FREs are presented in Table 2-3. Groundwater across OU 2 was assessed during the overall RI; therefore, individual groundwater investigations at PSCs 3 and 42 were not completed during the Focused RI/FS. The purpose of the focused human health risk evaluations for PSCs 3 and 42 was to identify potential threats to human health associated with site contamination and to evaluate the need to perform IRAs for soil.

As indicated in Table 2-1, a risk evaluation for surface water and sediment at PSC 42 was not performed. As a result of FRI findings for those media, and in order to satisfy RCRA closure requirements for the PSC, surface water and sediment were addressed in an IRA for PSC 42. Therefore, surface soil surrounding the polishing pond was the only media addressed in the FRE for PSC 42.

Table 2-4
Comparison Result Summary for Residential and Industrial USEPA PRGs and Florida STLs for PSCs 2, 41, and 43

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Residential PRG Comparison Result Summary		
PSC 2	Exceedances of USEPA PRGs	Exceedances of Florida STLs
	Arsenic Benzo(a)pyrene	Arsenic Benzo(a)pyrene Dieldrin
PSC 41	Exceedances of USEPA PRGs	Exceedances of Florida STLs
	Arsenic Chromium	Arsenic Chromium Nickel
PSC 43	Exceedances of USEPA PRGs	Exceedances of Florida STLs
	Arsenic Chromium Lead	Arsenic Chromium Copper Manganese Nickel
Industrial PRG Comparison Result Summary		
PSC 2	No exceedances of USEPA PRGs.	No exceedances of Florida STLs.
PSC 41	Exceedances of USEPA PRGs	Exceedances of Florida STLs
	Arsenic Chromium	Arsenic Chromium Nickel
PSC 43	Exceedances of USEPA PRGs	Exceedances of Florida STLs
	Chromium Lead	Chromium Nickel

Notes: USEPA = U.S. Environmental Protection Agency.
PRG = preliminary remedial goal.
STL = soil target level.
PSC = potential source of contamination.

PSC 3 was subdivided into two parcels for the purpose of evaluating risks: Parcel 1 and Parcel 2 (Figure 2-3). The HHCPCs selected for surface and subsurface soil at each parcel of PSC 3 and for surface soil at PSC 42 are presented in Table 2-3. The potential exposure pathways and scenarios evaluated for PSCs 3 and 42 included ingestion and inhalation of soil particulates for an industrial and general worker.

Using toxicity data for each CPC, PRGs were calculated and included in the FREs for PSCs 3 and 42, in the same manner as the FREs for PSCs 2, 41, and 43. PRGs were calculated for carcinogenic and noncarcinogenic effects to potential receptors. The PRGs were based on a target cancer risk of 10^{-6} for carcinogens and an HI of 1 for noncarcinogens. PRGs were calculated for all HHCPCs with the exception of lead. Reference values for lead were based on a proposed soil cleanup standard for lead that recommended cleanup goals be set between 500 and 1,000 mg/kg (USEPA, 1989). A concentration of 1,000 mg/kg of lead was used as the industrial PRG. PRGs and FDEP STLs were compared to maximum HHCPC concentrations to identify HHCPCs that may cause a potential risk with human contact. The comparison of maximum detected concentrations of HHCPCs in soil at PSCs 3 and 42 to PRGs was not a quantitative estimate of risk at each PSC. However, this qualitative approach adequately supported the objectives of the Focused RI/FS by identifying those areas with the highest contaminant concentrations. Results of the comparison of FDEP STLs and PRGs to maximum detected concentrations of CPCs for PSCs 3 and 42 are presented in Table 2-5.

In PSC 3 Parcel 2, the maximum detected concentration of lead (1,060 mg/kg) in a single surface soil sample just exceeded the industrial PRG value of 1,000 mg/kg. The concentration of this sample was approximately five times higher than the next highest samples, which had lead values of approximately 200 mg/kg. These five samples were randomly spaced over the site and appeared unrelated to the sample with a lead concentration of 1,060 mg/kg. No other concentrations of HHCPCs in PSC 3 Parcel 1 or Parcel 2 exceeded their respective PRGs for surface soil or subsurface soil. For PSC 42, the maximum detected concentrations of cadmium and lead in surface soil did not exceed their respective PRGs. Overall, the results of the FREs for soils at PSCs 3 and 42 did not suggest the need for IRAs. However, in 1997 an area of soil approximately 1 square meter in size was excavated around the sample at PSC 3 Parcel 2 with a lead concentration exceeding the industrial PRG. The excavated soil was incorporated into the ongoing IRA at PSC 42. No further actions are recommended at PSC 3.

2.6.1.3 PSC 4, OU 2 Drainage Areas, and OU 2 Groundwater Based on results of the RIs for PSC 4, drainage areas at OU 2, and OU 2 groundwater (conducted during the second stage of OU 2 investigations), RAs were performed for those areas. Results of the RIs are documented in the *Remedial Investigation, Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1998a).

PSC 4 was subdivided for purposes of conducting the RI. The three components are referred to hereafter as (1) sludge piles, (2) soil within the PSC 4 disposal area, and (3) soil outside the PSC 4 sludge disposal area (i.e., Open Field Area and the portion of the Pine Tree Planting Area where no paint chips were found). During site walkovers that preceded the RI, five small piles of sludge material were discovered in the Pine Tree Planting Area. Relatively high concentrations of trace metals (e.g., chromium, cadmium, mercury, and silver) were detected in samples collected from the piles. The NAS Jacksonville Partnering Team agreed to removal of the piles and inclusion of the sludge in the ongoing IRA at PSC 42. Therefore, the sludge piles were not included in the HHRA for PSC 4.

Table 2-5
Comparison of Maximum Concentration of HHCPCs at PSCs 3 and 42 with PRGs

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

HHCPC	Maximum Detected Concentration		Industrial PRG[1]	FDEP STLs for General Worker	Exceedance of PRG
PSC 3	**Parcel 1**	**Parcel 2**			
Surface Soil					
Cadmium	16.4	75.2	2,040	621	No
Chromium (trivalent)	651	12,200	2,040,000	306,000	No
Dieldrin		0.140	0.362	0.269	No
Lead[2]	29	1,060	1,000	NA	Yes
Subsurface Soil					
Lead[2]	6.2	3.2	1,000	NA	No
PSC 42	**(not subdivided)**				
Surface Soil					
Cadmium	65.6		2,040	621	No
Lead[2]	284		1,000	NA	No

[1] The PRG used for comparison is the lesser of the cancer or noncancer PRG.
[2] The PRG for lead is not based on calculation. Value used was based on a proposed soil cleanup standard that recommended cleanup goals for lead be set between 500 and 1000 milligrams per kilogram (mg/kg) (USEPA, 1989). A concentration of 1000 mg/kg of lead was used as the industrial PRG.

Notes: All values are in mg/kg.

HHCPC = human health contaminant of potential concern.
PSC = potential source of contamination.
PRG = preliminary remedial goal.
FDEP = Florida Department of Environmental Protection.
STL = soil target level.
NA = not applicable.
USEPA = U.S. Environmental Protection Agency.

The HHCPCs selected for media within each area addressed in the RI are presented in Table 2-3. Exposures of HHCPCs to potential future adult and child residents were evaluated as a conservative estimate of potential risks to other receptors. OU 2 is accessible to current Navy personnel and on-base residents; however, access is relatively limited due to the proximity of the site to NAS Jacksonville runways. Future residents could be exposed to contaminants in groundwater if the area were developed into a housing area where the shallow aquifer is used as a potable water source. This, however, is unlikely because the surrounding area uses a municipal water supply, with the exception of two private wells on adjacent properties.

The exposure scenarios, including potential receptors and routes of exposure selected for PSC 4, OU 2 drainage areas, and OU 2 groundwater, are summarized in Table 2-6. The toxicity assessment for each of the three areas included in the RI estimated excess lifetime cancer risk (ELCR) for carcinogenic HHCPCs and the HI for all HHCPCs. Risk estimates, based on an ELCR of 10^{-6} and a total HI of 1, are also presented in Table 2-6. Table 2-7 provides a summary of risk drivers (HHCPCs that contribute a risk of greater than 10^{-6} or an HI greater than 0.1 when the total HI for a receptor is greater than 1). Following is a summary of the risk characterization for each area addressed in the RI.

PSC 4. The cancer risks calculated for future residents exposed to the soil and sludge at PSC 4 are within the USEPA acceptable risk range but slightly exceed Florida's risk threshold. The cancer risk estimate for soil outside the sludge disposal area is 2×10^{-6}. The cancer risk estimate for soil and sludge within the sludge disposal area is 5×10^{-6}. However, the primary contributor to the risk in both areas is arsenic, which was detected at concentrations above Florida residential SCGs but below industrial SCGs. Based on the evaluation of samples from the PSC 4 sludge piles and PSC 3 soil, arsenic is not characteristic of the sludge at OU 2 and is likely naturally occurring.

No further actions are recommended for PSC 4.

OU 2 Drainage Areas. The cancer risk estimate for exposure of future residents to surface water is 2×10^{-5}, which is within the USEPA acceptable risk range but exceeds Florida's risk threshold. The noncancer risk estimate of 2 for children slightly exceeds the USEPA and Florida risk threshold. However, the primary risk contributors are arsenic and beryllium, which are likely naturally occurring. Arsenic and beryllium are not characteristic of the sludge at OU 2, and the highest concentrations were detected in stagnant portions of the ditch. Inorganic concentrations detected at the most downstream location were at levels below background, indicating that migration is not occurring from upstream locations. Additionally, based on the current exposure scenario (industrial), potential cancer risks are acceptable.

For sediments, the HHRA calculated a cancer risk of 6×10^{-6} for future residents. These potential risks are attributed to metals and PAHs detected in one sediment sample collected in a dry portion of the drainage ditch. Some of the metals at this location are likely naturally occurring (e.g., arsenic); however, the source of the other metals is unknown. The distribution of metals in soil at PSC 4 indicates that metals have not migrated to the ditch from the Pine Tree Planting Area. Because this sample was collected next to a roadway, the PAHs may be from roadway runoff or paving material.

Table 2-6
Human Health Risk Summary
PSC 4, OU 2 Drainage Areas, and OU 2 Groundwater

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Media	Receptor	Exposure Route	Hazard Index	Estimated Lifetime Cancer Risk
PSC 4				
Soil Outside the PSC 4 Sludge Disposal Area	Adult	Ingestion	0.03	6E-07
		Dermal Contact	0.009	4E-07
		Inhalation	NC[1]	6E-10
		Total Adult	0.04	[2]1E-06
	Child	Ingestion	0.3	1E-06
		Dermal Contact	0.01	1E-07
		Inhalation	NC[1]	5E-10
		Total Child	0.3	1E-06
Total Resident, Outside the PSC 4 Sludge Disposal Area			N/A	2E-06
Soil and Sludge within the PSC 4 Sludge Disposal Area	Adult	Ingestion	0.02	1E-06
		Dermal Contact	0.06	5E-07
		Inhalation	NC[1]	1E-09
		Total Adult	0.08	2E-06
	Child	Ingestion	0.2	2E-06
		Dermal Contact	0.09	2E-07
		Inhalation	NC[1]	9E-10
		Total Child	0.3	[2]3E-06
Total Resident, within the PSC 4 Sludge Disposal Area			N/A	5E-06
OU 2 Drainage Areas				
Surface Water	Adult	Ingestion	0.04	8E-07
		Dermal Contact	0.9	1E-05
		Total Adult	0.9	1E-05
	Child	Ingestion	0.9	5E-06
		Dermal Contact	1	5E-06
		Total Child	2	1E-05
Total Resident, Surface Water			N/A	[2]2E-05
Sediment	Adult	Ingestion	0.03	2E-06
		Dermal Contact	0.07	3E-07
		Total Adult	0.1	2E-06
	Child	Ingestion	0.3	4E-06
		Dermal Contact	0.1	1E-07
		Total Child	0.4	4E-06
Total Resident, Sediment			N/A	6E-06

See notes at end of table.

Table 2-6 (Continued)
Human Health Risk Summary
PSC 4, OU 2 Drainage Areas, and OU 2 Groundwater

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Media	Receptor	Exposure Route	Hazard Index	Estimated Lifetime Cancer Risk
OU 2 Drainage Areas (continued)				
Drainage Swale Soils	Adult	Ingestion	0.1	6E-06
		Dermal Contact	0.4	4E-06
		Inhalation	NC[1]	1E-09
		Total Adult	0.5[2]	1E-05
	Child	Ingestion	1	1E-05
		Dermal Contact	0.7	2E-06
		Inhalation	NC[1]	1E-09
		Total Child	2	1E-05
Total Resident, Drainage Swale Soils			N/A	2E-05
OU 2 Groundwater				
Groundwater	Adult	Ingestion	3	1E-04
		Total Adult[3]	3	1E-04
	Child	Ingestion	6	6E-05
		Total Child[3]	6	6E-05
Total Resident, Groundwater			N/A	2E-04

[1] Not calculated because inhalation noncancer toxicity values were not available.
[2] Total risk discrepancy with risk calculation spreadsheets is due to rounding algorithm.
[3] Total excess lifetime cancer risk is based on two times the risk from ingestion of the volatile constituents in groundwater to account for inhalation of volatiles and dermal contact with groundwater.

Notes: PSC = potential source of contamination.
OU = operable unit.
NC = not calculated.
N/A = not applicable.

Table 2-7
Human Health Summary of Risk Drivers
PSC 4, OU 2 Drainage Areas, and OU 2 Groundwater

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Medium	Total Estimated Lifetime Cancer Risk[1]	Cancer Risk Driver (Risk)	Total Hazard Index[2]	Noncancer Risk Driver (Hazard Index)
PSC 4				
Surface Soil Outside the PSC 4 Sludge Disposal Area	2E-06	Arsenic (2E-06)	0.03	N/A[3]
Surface Soil and Sludge within the PSC 4 Sludge Disposal Area	5E-06	Arsenic (3E-06)	0.3	N/A[3]
OU 2 Drainage Areas				
Surface Water	2E-05	Arsenic (5E-06) Beryllium (2E-05)	2	Iron (2)
Sediment	6E-06	Benzo(a)pyrene (1E-06) Arsenic (5E-06)	0.4	N/A[3]
Drainage Swale Soils	2E-05	Benzo(a)pyrene (2E-05) Indeno(1,2,3-cd)pyrene (1E-06) Arsenic (3E-06) Beryllium (2E-06)	2	Antimony (0.4) Cadmium (0.9) Iron (0.2) Silver (0.2)
OU 2 Groundwater				
Groundwater	2E-04	Methylene chloride[4] (1E-06) Arsenic (2E-04)	6	Arsenic (2) Barium (0.6) Cadmium (2) Manganese (0.3) Thallium (2)

[1] Total excess lifetime cancer risk is the combined adult and child risks for each pathway.
[2] Hazard Index is the highest of the adult or child total hazard indices.
[3] There are no noncarcinogenic risk drivers for the medium because the total hazard indices do not exceed the target value of 1.0.
[4] Total excess lifetime cancer risk is the sum of the ingestion risk plus two times the risk from ingestion of the volatile constituents in groundwater to account for inhalation of volatiles and dermal contact with groundwater.

Notes: PSC = potential source of contamination.
OU = operable unit.
N/A = not applicable.

A cancer risk of 2×10^{-5} and a noncancer risk of 2 (child) were calculated for future residents exposed to drainage swale soil. The primary drivers for the cancer risk are concentrations of arsenic, beryllium, and benzo(a)pyrene detected in a sample collected at the end of a paved road. Arsenic and beryllium are not characteristic of sludge at OU 2 and may be naturally occurring. The benzo(a)-pyrene may be from roadway runoff or paving material. The primary drivers for the noncancer risk are metals detected in a sample from the eastern drainage swale. Metals detected in this sample are characteristic of the sludge at OU 2 and may represent metals carried by wastewater that overflowed the berm at the polishing pond.

Based on the current use of OU 2, no further action is recommended for the drainage areas.

OU 2 Groundwater. Cadmium, manganese, sodium, and thallium were detected at concentrations greater than background and benchmarks. The one cadmium concentration greater than benchmarks was detected immediately downgradient of the industrial sludge drying beds and is likely site related. Cadmium is not migrating in groundwater.

The manganese and sodium concentration exceedances were detected in monitoring wells adjacent to the domestic sludge drying beds, and are likely site related. However, the grout used in the construction of these monitoring wells may be a source of sodium detected in these groundwater samples.

Thallium is not characteristic of the sludge at OU 2; therefore, the thallium concentration is not considered to be site related.

A cancer risk of 2×10^{-4}, which exceeds USEPA and Florida thresholds for acceptable risks, was calculated for future residents exposed to groundwater containing arsenic and methylene chloride. However, arsenic concentrations detected at OU 2 are well below Federal maximum contaminant levels (MCLs) and Florida GGCs. Additionally, methylene chloride concentrations are all below 10 micrograms per liter, and the distribution indicates that they are laboratory or field contaminants.

Noncancer risk estimates for future residents are 3 for adults and 6 for children. These estimates also exceed USEPA and Florida risk thresholds. However, of the five metals that are the primary contributors to this estimate, only cadmium and manganese are site-related. Additionally, the concentrations of the other three metals are below or only slightly exceed Federal MCLs and Florida GGCs. Based on the current exposure scenario at OU 2 (industrial), no human receptors are exposed to groundwater at OU 2. Access restrictions will be placed on the base to prevent consumption of the groundwater at OU 2 from the surficial aquifer in the affected area. These restrictions will include the maintenance of the fence constructed around the air field to prevent trespassing, and restriction of groundwater for consumption.

By separate Memorandum of Agreement (MOA) with the USEPA and the FDEP, NAS Jacksonville, on behalf of the Department of the Navy, agreed to implement basewide certain periodic site inspection, condition certification, and agency notification procedures designed to ensure the maintenance by Station personnel of any site-specific LUCs deemed necessary for future protection of human health and the environment. A fundamental premise underlying execution of that

agreement was that through the Navy's substantial good-faith compliance with the procedures called for therein, reasonable assurances would be provided to the USEPA and FDEP as to the permanency of those remedies which included the use of specific LUCs.

Although the terms and conditions of the MOA are not specifically incorporated herein by reference, it is understood and agreed by the Navy, USEPA, and FDEP that the contemplated permanence of the remedy reflected herein shall be dependent upon the Station's substantial good-faith compliance with the specific LUC maintenance commitments reflected therein. Should such compliance not occur or should the MOA be terminated, it is understood that the protectiveness of the remedy concurred in may be reconsidered and that additional measures may need to be taken to adequately ensure necessary future protection of human health and the environment.

No further action is required for groundwater at OU 2, with the exception of postclosure monitoring required for RCRA closure of PSCs 41, 42, and 43.

2.6.2 Ecological Risk Assessment The purpose of the ERA was to characterize actual or potential adverse effects to ecological receptors associated with exposures to site-related contaminants at OU 2. Basic components of the ERA performed for each area of OU 2 include the following: (1) identification of potential ecological receptors and pathways, (2) selection of ecological contaminants of potential concern (ECPCs), (3) exposure assessment, (4) ecological effects assessment, and (5) risk characterization. The following results of the ERAs performed for each area at OU 2 are presented in the same order as the HHRAs.

2.6.2.1 PSCs 2, 41, and 43 The Focused Ecological Risk Evaluation (FERE) for PSCs 2, 41, and 43 is included in the *Focused Remedial Investigation and Feasibility Study for PSCs 2, 41, and 43 at Operable Unit 2* (ABB-ES, 1994a). The CPCs selected for ecological evaluation are the same as those selected for the focused human health risk evaluation for soils 0 to 1 foot bls at PSCs 2, 41, and 43 (see Table 2-3).

An earthworm bioassay was completed for PSC 2 to determine the direct toxicity of contaminated soil to soil invertebrates. Based on the result of the toxicity testing, it was determined that an IRA at PSC 2 was necessary for the protection of ecological receptors (soil dwelling invertebrates). The testing results indicated that a conservative soil action level for an IRA for the protection of fauna to direct toxic effects would be 53 mg/kg. Soils with TPH concentrations greater than 50 mg/kg were excavated and treated during the IRA conducted at PSC 2 in 1995.

For PSCs 41 and 43, a quantitative determination of ecological risk and acceptable concentrations of CPCs in soil and filter media was determined to be unnecessary as part of the FREs, since the volume of material to be removed within the sludge drying beds would be determined by the closure requirements under RCRA. A qualitative appraisal of the metal content of material within the PSC 41 and PSC 43 drying beds suggested it presented a possible hazard. The primary ecological concern with heavy metals in soils is the potential transfer of metals from the soils to terrestrial invertebrates or plants. Results of the FREs for PSCs 41 and 43 supported implementation of IRAs at the sites. As

mentioned previously, IRAs were implemented and closure reports for both PSCs were completed in 1997.

2.6.2.2 **PSCs 3 and 42** The FERE for PSCs 3 and 42 is included in the *Focused Remedial Investigation and Feasibility Study, PSCs 3 and 42 at Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1995a).

The results of the FERE for PSC 3 indicated that none of the ECPCs selected for potential ecological receptors and exposure pathways presented unacceptable risks for terrestrial wildlife, terrestrial plants, or soil invertebrates.

An FERE for surface water and sediment at PSC 42 was not performed. Based on RI results, those media were addressed in an IRA. Therefore, surface soil surrounding the polishing pond was the only media addressed in the FERE for PSC 42.

Potential ecological receptors of contamination at PSC 42 include terrestrial wildlife, terrestrial plants, and terrestrial invertebrates. Potential exposure routes for terrestrial wildlife at PSC 42 include ingestion of soil and food items that may be contaminated as a result of accumulation of contamination from the soil. Risks for terrestrial plants and invertebrates were not evaluated because the area of surface soil contamination surrounding the polishing pond was maintained as mowed lawn. Two SVOCs, three pesticides, and ten inorganics were identified as CPCs for surface soil surrounding the polishing pond. Results of the FRE for surface soil determined that unacceptable risks were not posed to either terrestrial wildlife, plants, or soil invertebrates; therefore, the IRA for PSC 42 did not need to address surface soil surrounding the pond.

2.6.2.3 **PSC 4, OU 2 Drainage Areas, and OU 2 Groundwater** The ERAs for PSC 4, OU 2 drainage areas, and OU 2 groundwater are documented in the *Remedial Investigation, Operable Unit 2, NAS Jacksonville, Jacksonville, Florida* (ABB-ES, 1998a).

No risks were estimated for wildlife receptors, terrestrial plants, or for soil invertebrates exposed to PSC 4 surface soil outside the sludge disposal area; however, potential risks to terrestrial plants and invertebrates from exposure to chromium in soil and sludge within the PSC 4 sludge disposal area were identified. The PSC 4 sludge disposal area is in a portion of the Pine Tree Planting Area where there is virtually no understory due to the heavy pine needle litter (i.e., stressed herbaceous vegetation is not evident). Although it is unknown how chromium concentrations within the PSC 4 sludge disposal area may actually be impacting soil invertebrates, chromium concentrations are well below the Florida residential SCGs, and no further actions were recommended for PSC 4.

The primary risk contributors for surface water are aluminum, iron, and zinc. The samples with high levels of metals were in a portion of the ditch with murky, standing water that contains algae growth. Downstream, where the water is flowing, levels of the metals were lower and do not pose a risk. Therefore, the metals in the upstream portion of the ditch are probably not site-related, but are most likely related to the water conditions.

For sediment, metals and PAHs found in one sample are the primary contributors to the risk. Arsenic is naturally occurring. PAHs are typically from roadway runoff or paving material.

Chromium found in drainage swales near the polishing pond is the primary risk contributor. Cadmium and silver may also present a potential risk. However, grass is growing in the swales, so adverse effects to plants are not likely.

The ERA for OU 2 groundwater identified potential risks to aquatic receptors. Cadmium is the source of the potential risk; however, samples indicate that cadmium is not moving from the groundwater to surface water. Therefore, it is not likely that aquatic receptors would be exposed to harmful levels of cadmium.

Based on the current use of OU 2 and the limited quality of the habitats that the drainage areas provide, no further action is recommended for these areas.

2.7 DESCRIPTION OF THE NO ACTION ALTERNATIVE. Based on the RA, no unacceptable human health or ecological risks were identified at OU 2. Therefore, no action is needed and no other remedial alternatives were considered.

However, PSCs 41, 42, and 43 have all been classified as RCRA units and require postclosure monitoring of groundwater until standards are achieved. An abbreviated monitoring program of two to three years is believed to meet such requirements. Should groundwater standards not be achieved in that time frame, groundwater will continue to be monitored as per RCRA instructions.

In addition, appropriate LUCs will be implemented at the operable unit to prevent the emplacement of a residential scenario.

2.8 DOCUMENTATION OF SIGNIFICANT CHANGES. There are no significant changes in this remedial action from that described in the Proposed Plan.

2.9 STATUTORY DETERMINATIONS. The no further action alternative selected and implemented for OU 2 is consistent with CERCLA and the NCP. The IRAs conducted at the PSCs were selected based on the RAO set for each PSC. These RAOs were determined based on consideration of ARARs. Table 2-8 lists and describes the State and Federal chemical specific ARARs considered for OU 2.

Table 2-8
Synopsis of Potential Federal Chemical-Specific ARARs for OU 2

Record of Decision
Potential Sources of Contamination 2, 3, 4, 41, 42, and 43
Operable Unit 2
Naval Air Station Jacksonville
Jacksonville, Florida

Federal Standards and Requirements	Requirements Synopsis	Consideration in the Remedial Response Process
Occupational Safety and Health Act (OSHA), Occupational Health and Safety Regulations [29 CFR Part 1910, Subpart Z]	Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals.	Standards are applicable for worker exposure to OSHA hazardous chemicals during remedial activities.
Resource Conservation and Recovery Act (RCRA), Identification and Listing of Hazardous Wastes [40 CFR Part 261]	Defines those solid wastes subject to regulation as hazardous wastes under 40 CFR Parts 262-265.	These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes that should be incorporated into the characterization and remediation elements of remedial response at PSC 42.
RCRA, Releases from Solid Waste Management Units [40 CFR Part 264, Subpart F]	Establishes the requirements for solid waste management units at RCRA-regulated temporary storage and disposal facilities. The scope of the regulation encompasses groundwater protection standards (RCRA maximum contaminant levels), point of compliance, compliance period, and requirements for groundwater monitoring.	This rule is relevant and appropriate for Comprehensive Environmental Response, Compensation, and Liability Act sites contaminated with RCRA hazardous constituents, and potential applicable requirements for groundwater remediation executed under the RCRA Corrective Action Program. However, these requirements are not applicable to Superfund sites unless the action involves active placement in regulated units after July 26, 1982.

Notes: ARAR = applicable or relevant and appropriate requirement.
OU = operable unit.
PSC = potential source of contamination.
CFR = Code of Federal Regulations.

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APPENDIX A

RESPONSIVENESS SUMMARY

Appendix A: Responsiveness Summary

Note: No comments were received during the public comment period.

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