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FINAL RECORD OF DECISION OPERABLE UNIT 10 NAS PENSACOLA FL
6/16/1997
ENSAFE/ALLEN AND HOSHALL

# FINAL RECORD OF DECISION
# OPERABLE UNIT 10
# NAS PENSACOLA
# PENSACOLA, FLORIDA

**SOUTHNAVFACENGCOM**
**Contract Number:**
**N62467-89-D-0318**
**CTO-083**

**Prepared for:**

**Comprehensive Long-Term Environmental Action Navy**
**(CLEAN)**
**Naval Air Station**
**Pensacola, Florida**

**Prepared by:**

**EnSafe/Allen & Hoshall**
**5720 Summer Trees Drive, Suite 8**
**Memphis, Tennessee 38134**
**(901) 383-9115**

**June 16, 1997**

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# Report Documentation Page

Form approved
OMB No. 0704-0188

| | |
|---|---|
| 1a. Report Security Classification<br>Unclassified | 1b. Restrictive Marking<br>N/A |
| 2a. Security Classification Authority<br>N/A | 3. Distribution/Availability of Report<br>See Cover Letters |
| 2b. Declassification/Downgrading Schedule<br>N/A | |
| 4. Performing Organization Report Number(s)<br>N/A | 5. Monitoring Organization Report Number(s)<br>N/A |
| 6a. Name of Performing Organization<br>EnSafe/Allen & Hoshall — 6b. Office symbol *(if applicable)* E/A&H | 7a. Name of Monitoring Organization<br>Naval Air Station Pensacola |
| 6c. Address *(City, State, and ZIP Code)*<br>5720 Summer Trees Drive, Suite 8<br>Memphis, Tennessee 38134 | 7b. Address *(City, State and Zip Code)*<br>Pensacola, Florida |
| 8a. Name of Funding/ Sponsoring Organization<br>SOUTHNAVFACENGCOM — 8b. Office symbol (if applicable) N/A | 9. Procurement Instrument Identification Number<br>N62467-89-D0318/083 |
| 8c. Address *(City, State and ZIP code)*<br>2155 Eagle Drive<br>P.O. Box 10068<br>Charleston, South Carolina 29411 | 10. Source of Funding Numbers<br>Program Element No. / Project No. / Task No. / Work Unit Accession No. |

11. Title *(Include Security Classification)*

Record of Decision Operable Unit 10, NAS Pensacola, Pensacola, Florida

12. Personal Author(s)

Dennen, Allison L.

| 13a. Type of Report | 13b. Time Covered | 14. Date of Report *(Year, Month, Day)* | 15. Page Count |
|---|---|---|---|
| Final | From 9/92 To 06/16/97 | 1997, June 16 | 120 |

16. Supplementary Notation
N/A

| 17. COSATI Codes | | | 18. Subject Terms *(Continue on reverse if necessary and identify by block number)* |
|---|---|---|---|
| Field | Group | Sub-Group | |
| | | | |
| | | | |

19. Abstract
A record of decision has been prepared from the remedial investigation (RI) report, focused feasibility study (FFS) report, and proposed remedial action plan for Operable Unit (OU) 10 at the Naval Air Station (NAS) Pensacola. The purpose of this Record of Decision is to describe the alternative that the U.S. Navy has selected to address potential groundwater and soil contamination onsite. The following summarizes the record of decision.

OU 10 occupies approximately 26 acres on Magazine Point at NAS Pensacola, in Escambia County, Florida. OU 10 comprises three sources of contamination: the former Industrial Sludge Drying Beds at Site 32, the former Wastewater Treatment Plant Ponds at Site 33, and miscellaneous Industrial Wastewater Treatment Plant (IWTP)-related sites at Site 35. Various facilities at Magazine Point have treated wastewater since 1941. The current wastewater treatment plant was constructed in 1948 to process primarily domestic wastewater. It was upgraded in 1971 to treat both industrial and domestic wastewater separately. Site 32, the drying beds, operated from 1971 until 1984 and was closed in 1989. Site 33, the three ponds, makes up the southern half of OU 10. These ponds operated from 1971 until 1988, when they were cleaned up and closed under the existing Resource Conservation and Recovery Act (RCRA) permit. Both Sites 32 and 33 are known sources of soil and groundwater contamination at OU 10. A groundwater treatment system installation began in 1986 to comply with conditions in the Temporary Operating Permit (No. HT17-68087) issued by the Florida Department of Environmental Regulation (now FDEP). The system installed in the shallowest portions of the underlying aquifer began operating in February 1987. Seven recovery wells along the north-south axis of Magazine Point capture chemical compounds from the former Surge Pond. Extracted groundwater is pretreated, then disposed at the domestic treatment plant.

Between December 1992 and October 1995, an environmental investigation was conducted. The final report identified soil contaminants. Areas with contaminants at higher concentrations appear to be isolated "hot spots" near the former IWTP units. The final report also identified contaminants in the site's groundwater. The RI indicates that the main area of groundwater contamination beneath Site 32 is outside the area of cleanup of the existing groundwater treatment system.

In the OU 10 baseline risk assessment, the human health risk associated with exposure to contaminants in surface soil, groundwater, and sediments was assessed for current and future site workers under industrial land use, as well as for future site residents. This study can be found in the *Final Remedial Investigation Report*. Under industrial land use, estimated exposure for current and potential future workers does not result in unacceptable risk. Under residential land use, which is unlikely for this site, two materials in the surface soil present an unacceptable risk above $10^{-6}$ to a future potential resident child. Several chemicals in site soil exceed Florida cleanup goals that protect groundwater. These concentrations were used to develop performance standards for the site. There is a potential unacceptable risk from exposure to groundwater for future site residents. The risk estimated for unlikely potential residential use exceeds the acceptable risk threshold of $10^{-6}$ and the hazard quotient of 1.

Ecological risk also was assessed for the actual or potential effects of contamination at OU 10 to ecological receptors such as plants and animals. This assessment focused on both land at OU 10, and contamination in groundwater that travels to nearby surface water bodies. Potential impacts to wetlands near OU 10 and the southern drainage ditch will be evaluated during the Site 41, NAS Pensacola Wetlands RI. Potential impacts to Pensacola Bay (Site 42) and Bayou Grande (Site 40) from groundwater contaminants will be assessed during RIs at those sites.

If OU 10 remains industrial, no further action for soil is required to protect human health. However, to address an unlikely potential residential land use at OU 10, performance standards for soil have been established to protect future residents. Performance standards representing contaminant concentrations in soil that protect groundwater and performance standards for groundwater also have been established.

Four remedial alternatives were identified in the OU 10 FFS for cleaning up soil and groundwater onsite. Alternative 1 is a "no-action" alternative. In the no-action alternative, no remedial actions will be taken to contain, remove, or treat soil. The RCRA groundwater treatment system is operating and will continue to operate in accordance with the RCRA permit. No cost is associated with this alternative.

Alternative 2 will maintain the OU 10 area for industrial use and limit exposure to contaminated groundwater. A leachability study will be conducted to demonstrate whether contaminants in soil above Florida cleanup goals are contributing significantly to groundwater contamination onsite. This alternative eliminates the risk to potential child residents by not allowing the site to be residential. If the leachability study demonstrates that groundwater is being impacted by contaminants in soil, Alternative 4 will be the contingency remedy. In addition, the Navy will meet the groundwater performance standards. Modification of the RCRA corrective action groundwater treatment system will include groundwater performance standards as a permit requirement. Attainment will be confirmed through groundwater monitoring. Because the RCRA system is operating and can be modified to meet the remedial goals for groundwater onsite, no other alternatives for groundwater are evaluated. Costs for groundwater treatment, therefore, are not included in this estimate. The cost of this alternative is estimated at $100,000. Assuming a 30% contingency, total direct and indirect costs are $130,000.

In Alternative 3, capping, all four areas will be capped with asphalt. The caps will reduce the risk of contact with contaminated soil and reduce the quantity of leachate generated when rainwater filters through contaminated soil. The present worth cost of this alternative is estimated at $185,000, assuming 30 years of maintenance.

In Alternative 4, the excavation and offsite disposal alternative, soil exceeding performance standards will be removed from OU 10 and disposed at an approved Subtitle D landfill to remove threats to human health and the environment posed by soil contamination. Soil will be sampled at the extent of the excavation to verify that soil remaining meets the performance standards. This alternative will result in unrestricted land use.

The excavation will be backfilled with clean fill. The present worth cost of this alternative is estimated at $90,000, excluding dewatering, which will cost approximately $10,000 per week. Indirect costs, including engineering services/report preparation cost, and contingencies (30%), are expected to increase the Alternative 4 total project cost to $247,000. Operating, maintenance, and sampling costs will not be required under this alternative.

The Navy evaluated each alternative by the nine criteria shown below to determine which will best reduce risk posed by OU 10.

- Overall Protection of Human Health and the Environment
- Compliance with Federal/State Applicable and Relevant or Appropriate Requirements
- Long-Term Effectiveness and Permanence
- Treatment to Reduce Toxicity, Mobility, or Volume
- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

The final remedy combines two components of the preferred alternative (e.g., leachability study on Areas B-D with excavation as a contingency and groundwater treatment under RCRA) and a component of a different alternative (e.g., excavation of Area A) presented in the FS report and proposed plan. Monitoring will verify compliance with performance standards contained in this ROD. This alternative will be protective, cost-effective, and will attain all federal and state requirements. The groundwater monitoring program will continue until a five-year review concludes that the alternative has achieved the performance standards and remains protective of human health and the environment.

The U.S. Navy's preferred alternative represents consensus opinion that is fully accepted by the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection. The U.S. Navy relied on public comments to ensure that the remedial alternatives being evaluated and selected for its sites are fully understood and that the concerns of the local community have been considered. The U.S. Navy held a public comment period from February 19 to April 4, 1996, to encourage public participation in the selection process. Comments received are summarized along with their responses in the Responsiveness Summary.

| | | |
|---|---|---|
| 20. Distribution/Availability of Abstract<br>☒ Unclassified/Unlimited ☐ Same as Rept ☐ DTIC Users | 21. Abstract Security Classification<br>N/A | |
| 22a. Name of Responsible Individual<br>William Hill | 22b. Telephone *(Include Area Code)* (803) 820-7324 | 22c. Office Symbol |

**DD Form 1473, JUN 86** *Previous editions are obsolete.*
S/N 0102-LF-014-6603

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## List of Abbreviations

The following list contains many of the abbreviations, acronyms, and symbols used in this document. A glossary of technical terms is provided in Appendix A.

| | |
|---|---|
| AOC | Area of concern |
| ARAR | Applicable or Relevant and Appropriate Requirements |
| BEHP | Bis(2-ethylhexyl)phthalate |
| bls | Below land surface |
| BRA | Baseline Risk Assessment |
| CDI | Chronic Daily Intake |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CNET | Chief of Naval Education and Training |
| COC | Chemical of Concern |
| COPC | Chemical of Potential Concern |
| CFR | Code of Federal Regulations |
| CSF | Cancer Slope Factor |
| cy | Cubic yard |
| FDER | Florida Department of Environmental Regulation (since renamed Florida Department of Environmental Protection [FDEP]) |
| FFA | Federal Facilities Agreement |
| FFS | Focused Feasibility Study |
| FS | Feasibility Study |
| HEAST | Health Effects Assessment Summary Tables |
| HI | Hazard Index |
| HQ | Hazard Quotient |
| HRS | Hazard Ranking System |
| ILCR | Incremental Lifetime Cancer Risk |
| IRIS | Integrated Risk Information System |
| ISDB | Industrial Sludge Drying Bed |
| IWTP | Industrial Wastewater Treatment Plant |
| lwa | Lifetime Weighted Average |
| MCL | Maximum Contaminant Level |
| NAS | Naval Air Station |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |

## List of Abbreviations (Continued)

| | |
|---|---|
| O&M | Operation and Maintenance |
| OU | Operable Unit |
| PAH | Polyaromatic Hydrocarbon |
| PCB | Polychlorinated Biphenyl |
| ppb | Part per billion |
| PRG | Preliminary Remediation Goal |
| PWC | Public Works Center |
| RAB | Restoration Advisory Board |
| RCRA | Resource Conservation and Recovery Act |
| RD/RA | Remedial Design/Remedial Action |
| RfD | Reference Dose |
| RGO | Remedial Goal Option |
| RME | Reasonable Maximum Exposure |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SVOC | Semivolatile Organic Compound |
| SWMU | Solid Waste Management Unit |
| TBC | To Be Considered |
| TEF | Toxicity Equivalency Factor |
| TRC | Technical Review Committee |
| USC | U.S. Code |
| USEPA | U.S. Environmental Protection Agency |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compound |

## DECLARATION OF THE RECORD OF DECISION

### Site Name and Location

Operable Unit 10, Industrial Wastewater Treatment Plant
Naval Air Station Pensacola
Pensacola, Florida

### Statement of Purpose

This decision document (Record of Decision), presents the selected remedy for Operable Unit 10 at Naval Air Station Pensacola, Pensacola, Florida, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. § 9601 *et seq.*, and to the extent practicable, the National Contingency Plan (NCP), 40 Code of Federal Regulations Part 300.

This decision is based on the administrative record for Operable Unit 10 at the Naval Air Station Pensacola.

The U.S. Environmental Protection Agency and the Florida Department of Environmental Protection concur with the selected remedy.

### Assessment of the Operable Unit

Actual or threatened releases of hazardous substances from Operable Unit 10, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health or the environment.

### Description of the Selected Remedy

This action is the first and final action planned for the operable unit. This alternative calls for the design and implementation of response measures that will protect human health and the environment. The action addresses the sources of contamination as well as soil and groundwater contamination.

The major components of the remedy are:

- Excavation and disposal of soil above residential soil preliminary remediation goals (Area A);
- Leachability study on Areas B, C, and D to verify that contaminants remaining in soil are not leaching to groundwater;

- Contingency remedial action of Areas B, C, and D to include excavation and disposal of soil that the leachability study verifies as a source of groundwater contamination;

- The remedial design for groundwater treatment will be developed in the Corrective Action Plan for the Resource Conservation and Recovery Act (RCRA) permit modification.

- Groundwater monitoring program to ensure the groundwater treatment system will be effective and that contaminants will not migrate;

- Continued groundwater monitoring at sampling intervals to be determined during the remedial design for groundwater treatment developed in the Corrective Action Plan for the RCRA permit modification. The groundwater monitoring program will continue until a five-year review concludes that the alternative has achieved the performance standards and remains protective of human health and the environment.

**Statutory Determinations**

The selected remedy with an active soil removal contingency for Areas B, C, and D is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. Modification of the RCRA corrective action groundwater treatment system will include the groundwater performance standards as a permit requirement. Attainment of standards will be confirmed through groundwater monitoring. This remedy with contingency satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Finally, this remedy uses a permanent solution and treatment technology to the maximum extent practicable.

Because this remedy may result in hazardous substances remaining onsite, a review will be conducted within five years after it commences to ensure that it continues to adequately protect human health and the environment.

CAPT, USN ______________________ 16 JUN 97

Signature (Commanding Officer, NAS Pensacola) Date

## 1.0 SITE LOCATION AND DESCRIPTION

Operable Unit (OU) 10 is on Magazine Point at the Naval Air Station (NAS) Pensacola, in Escambia County, Florida, as shown on Figure 1-1. Ordnance and munitions are stored there. In addition, domestic wastewater generated on station is treated on Magazine Point, which is bounded to the north and west by Bayou Grande and east by Pensacola Bay. South of Magazine Point is the former Chevalier Field, which is currently being converted to Chief of Naval Education and Training (CNET) facilities. Except for the Industrial Wastewater Treatment Plant (IWTP) conversion to domestic wastewater treatment only in October 1995, no other use changes are expected for Magazine Point.

OU 10 comprises three sites which are shown on Figure 1-2: the former Industrial Sludge Drying Beds (ISDBs; Site 32); the former Wastewater Treatment Plant Ponds including the former surge pond, stabilization pond, and polishing pond (Site 33); and miscellaneous IWTP Solid Waste Management Units (SWMUs; Site 35) which are listed below.

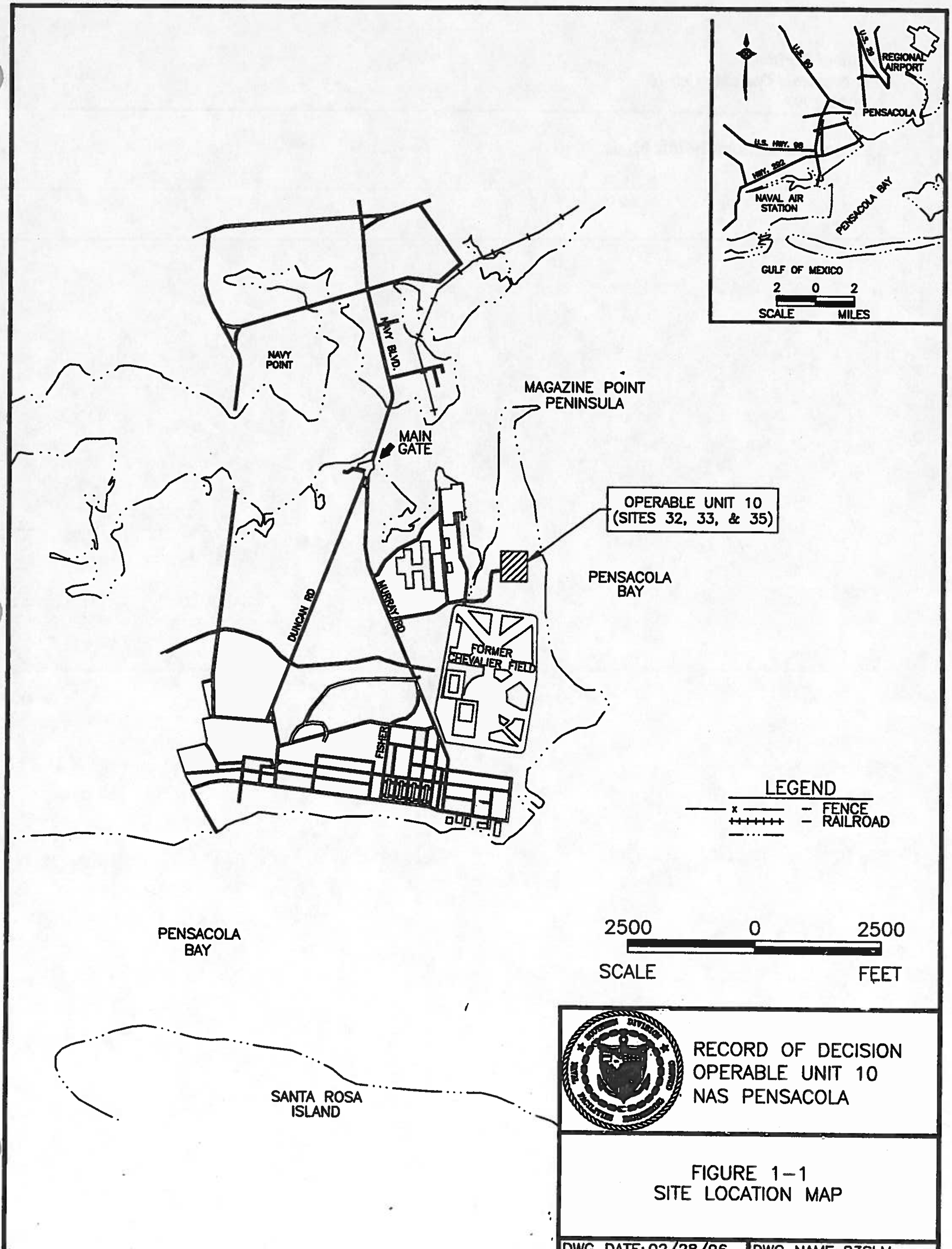
- Industrial grit chamber
- Industrial comminutor
- Industrial sludge thickener
- Industrial sludge presses
- Waste oil storage tanks
- Acid storage tanks
- Sludge bed pumping station
- Pump dock
- Ancillary piping, pumps, junction boxes, etc.
- Industrial primary clarifier and oil/water separator
- Aerobic sludge digester
- Aeration (activated sludge) tank
- Surge tank
- Sludge truck loading station
- Parallel flocculators
- Parallel final clarifiers
- Chlorine contact chamber

OU 10 occupies approximately 26 acres in an industrialized section of NAS Pensacola. The former Chevalier Field area being converted to Naval Recruit Training Facilities will contain barracks. Other residential areas are approximately 0.8 to 1.2 miles north and northwest of OU 10 across Bayou Grande.

The facility's main area is topographically higher than the surrounding areas and is dominated by fill and development. Large amounts of fill are mounded into berms 4 to 7 feet high around the closed stabilization and polishing ponds. An extensive plateau of fill 5 to 6 feet high is at the former surge pond and associated berms. Vegetation is limited to grasses within the fenced IWTP, and in several areas grass is absent, exposing a loose organic-poor sand. Marsh vegetation has colonized the closed stabilization and polishing ponds. The area south of the IWTP is a low-lying, heavily wooded swampy area. The area north of OU 10 is a wooded peninsula with thick underbrush bounded on the east by Pensacola Bay and on the west by Bayou Grande.

Depth to groundwater ranges from 0 to 4 feet below land surface (bls), depending on tidal influence and ground surface elevation. Most runoff does not flow from the site but infiltrates into the subsurface rapidly through the sandy surface soil; however, a channelized ditch drains water toward the south. Erosional channels in the steeply sloped berms and flanks of the three former ponds indicate surface runoff down these structures. Standing water was observed in the Resource Conservation and Recovery Act (RCRA) clean-closed, cement-lined stabilization and polishing ponds at depths of approximately 6 to 8 inches. The asphalt cap of the closed ISDBs slopes southward, resulting in a southerly surface runoff from the asphalt area toward a sump intake to the wastewater treatment system near the chemical storage area.

Groundwater flow generally mimics the peninsular topography (with flow to the northwest, north, northeast, east, and southeast) and discharges to Pensacola Bay and Bayou Grande. Groundwater is not currently used as a potable water source at OU 10 nor at NAS Pensacola.




RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 1-1
SITE LOCATION MAP

DWG DATE: 02/28/96 | DWG NAME: 83SLM

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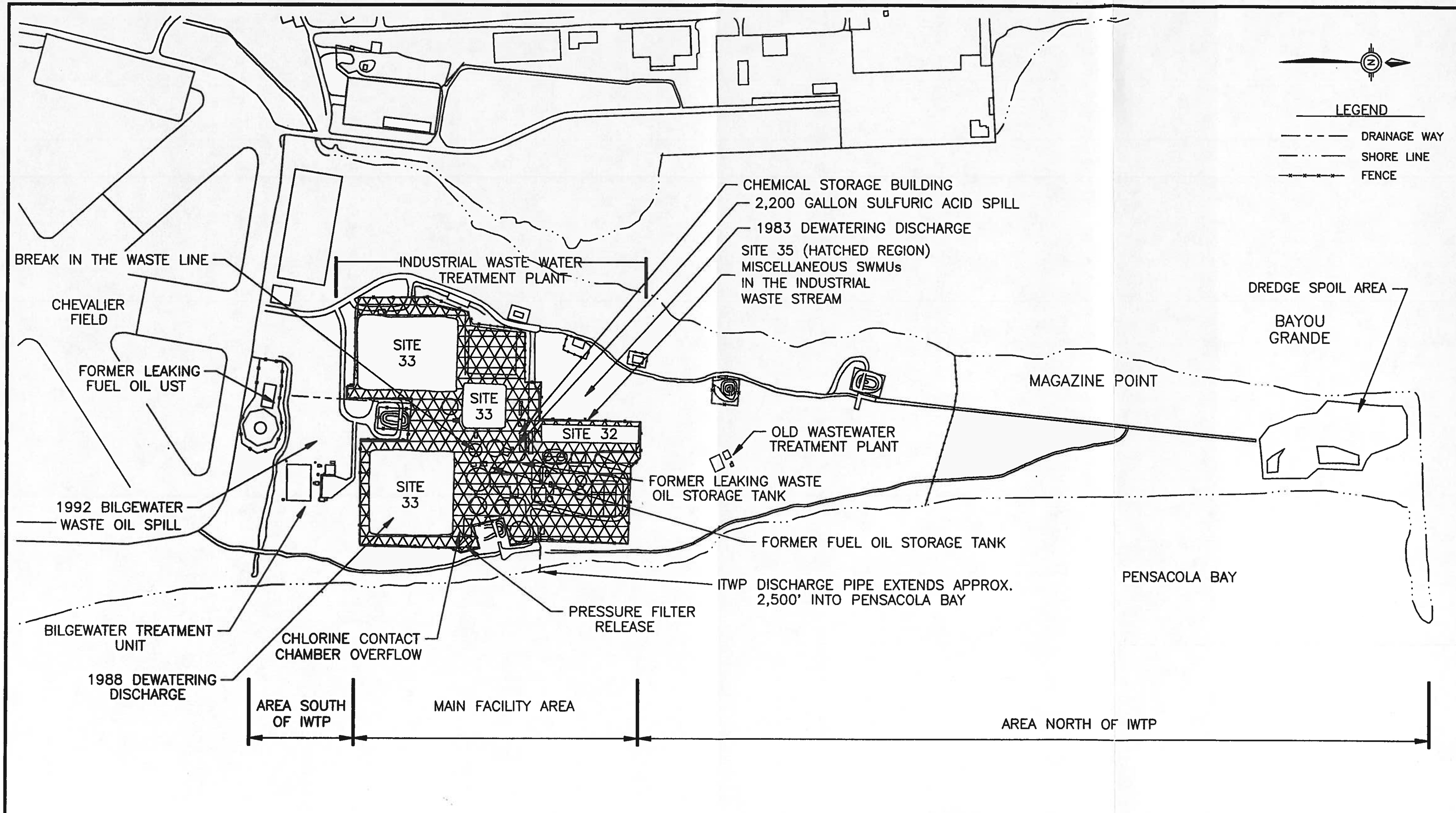


RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 1-2
OPERABLE UNIT 10
SITE MAP

DWG DATE:02/28/96 | DWG NAME:83OU10

Potable water for NAS Pensacola is received from Corry Station approximately 4 miles north. An NAS Pensacola supply well, which is screened between 105 and 160 feet bls, is approximately 0.75 miles west-southwest of OU 10. The well is used for backup supplies only during periods of peak demand. The zone in which the supply well is screened is protected by the presence of a 12- to 15-foot-thick, low-permeability clay layer. Groundwater contamination has not been detected in this zone at OU 10 nor in the supply well.

Access to the IWTP proper is limited by a fence. In addition, OU 10 is bounded by thick vegetation and trees to the north and south. To the east and west, Pensacola Bay and Bayou Grande limit site access. Groundwater is not currently being used onsite for any purpose. In addition, contaminated groundwater is not expected to transport to a drinking water supply due to the proximity of Pensacola Bay and Bayou Grande.

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## 2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

### 2.1 General Site History

NAS Pensacola was ranked using the Hazard Ranking System (HRS) in 1988 and given an HRS score of 42.4, based on groundwater and surface water pathway scores. In December 1989, the base was placed on the U.S. Environmental Protection Agency's (USEPA) National Priorities List (NPL).

The Federal Facilities Agreement (FFA), signed in October 1990, outlined the regulatory path to be followed at NAS Pensacola. NAS Pensacola must complete not only the regulatory obligations associated with its NPL listing, but it also must satisfy the ongoing requirements of a RCRA permit issued in 1988. That permit addresses the treatment, storage, and disposal of hazardous materials and waste and also the investigation and remediation of any releases of hazardous waste and/or constituents from SWMUs. RCRA governs ongoing use of hazardous materials, and the rules of the operating permit. RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) investigations and actions are coordinated through the FFA, streamlining the cleanup process.

### 2.2 Site-Specific History

Wastewater has been treated on Magazine Point since 1941 at various treatment facilities. In 1941, an Imhoff tank was installed north of the present IWTP. The tank treated only Magazine Point area sewage. The current facility was constructed in 1948 to process primarily domestic wastewater. The Imhoff tank north of the facility was abandoned subsequently. The facility was upgraded in 1971 to treat both industrial and domestic wastewater separately. Before 1971, the facility was receiving industrial waste from paint and plating operations at the Building 709 complex. Industrial waste was received via the sanitary sewer line and processed with domestic sewage.

In 1978, the domestic sludge generated at the IWTP was found to be hazardous by the Florida Department of Environmental Regulation (FDER; since renamed Florida Department of Environmental Protection [FDEP]) due to chromium concentrations, requiring it to be disposed of in the same manner as industrial sludge. After chromium concentrations decreased, FDER allowed the domestic sludge to be disposed as a nonhazardous waste.

In 1981, FDER designated the IWTP surge pond as a hazardous waste surface impoundment; it received an average of 880,000 gallons of waste per day. The wastewater contained high concentrations of organic solvents, phenols, chromium electroplating wastes (including cyanide and other heavy metals), and wastes from a chemical conversion coating process for aluminum. As a result of the hazardous waste designation, a RCRA detection groundwater monitoring program was implemented. Leakage from the surge pond was estimated to be as high as 5,800 gallons per day.

In 1984, the ISDBs were removed from service. RCRA detection monitoring identified groundwater contamination attributable to the surge pond. As a result, a RCRA assessment monitoring program was implemented to determine the extent of contamination.

In 1985, FDER issued a temporary RCRA operation permit (No. HT17-68087) to the U.S. Navy Public Works Center (PWC) for the surge pond. A new permit (No. H017-127026) was issued in September 1987.

In 1986, a RCRA Corrective Action Program was implemented at the IWTP to comply with conditions in the FDER Temporary Operating Permit No. HT17-68087. Based on results of the RCRA assessment monitoring program, a groundwater recovery system was designed and installed to remediate contaminated groundwater.

In January 1987, a comprehensive groundwater monitoring evaluation was conducted by the USEPA. Groundwater samples were collected from seven shallow wells (0 to 15 feet) and one deep monitoring well. In February 1987, the groundwater recovery system was placed in operation.

In September 1987, FDER issued RCRA Permit No. H017-127026 to the U.S. Navy PWC to operate the surge pond. The permit stipulated the continued operation of the corrective action system (the recovery wells) and the implementation of two quarterly groundwater monitoring programs: (1) point-of-compliance monitoring at the surge pond and (2) corrective action monitoring to determine the effectiveness of ongoing groundwater remediation. Well sets and parameters for analysis were separately defined for each monitoring program. The first quarterly groundwater sampling for corrective action and point-of-compliance programs was initiated in November 1987.

In January 1988, FDER issued closure permits to the U.S. Navy PWC for the polishing pond, stabilization pond, and the ISDBs (No. HF17-134657). Liquids removed from the impoundments were processed through the IWTP. Sludge was removed and transported to a hazardous waste disposal facility. Upon closure, the clay liner and/or subsurface soil of each impoundment were sampled and analyzed. The subsequent laboratory report indicated only low concentrations of phenol in liners or soil beneath the stabilization and polishing ponds; and hence, FDER granted clean closure status to these impoundments. Samples from the liner or soil beneath the ISDBs, however, indicated several contaminants.

A closure permit for the surge pond (No. HF17-148989) was issued in November 1988 to the U.S. Navy PWC. Upon closure, the clay liner and/or subsurface soil were sampled and analyzed. As with the ISDBs, several contaminants were identified. Consequently, both the surge pond and ISDBs were capped with low-permeability covers (clay and asphalt, respectively) as a condition of closure in 1989. A groundwater monitoring program was developed to ensure the effectiveness of the caps.

In September 1991, FDER issued permit No. HF17-170951, changing the monitoring requirement for each monitoring program from quarterly to semiannually.

In 1992, regulatory focus of environmental investigation at the IWTP shifted from RCRA to CERCLA. A Remedial Investigation/Feasibility Study (RI/FS) work plan for OU 10 (formerly called Group O) was submitted to meet CERCLA requirements. A Sampling and Analysis Plan was submitted in October 1992 for the present study.

Between December 1992 and October 1995, EnSafe/Allen & Hoshall performed an RI at OU 10 on behalf of the Navy. The RI was designed to assess the nature and extent of contamination to support a remedy selection. Fieldwork for the RI included installing monitoring wells and sampling soil, sediment, surface water, and groundwater.

In 1994 and 1995, a time-critical removal action was performed on the Imhoff tank north of the IWTP. Approximately 148 tons of hazardous waste were removed from the tank. In addition, 619 tons of nonhazardous soil, gravel, and construction debris were removed and landfilled. Confirmatory samples collected at the extent of the excavation did not detect volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) or polychlorinated biphenyls (PCBs). Metals and pesticide concentrations detected were below preliminary remedial goals (PRGs).

## 3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Throughout the site's history, the community has been kept abreast of activities in accordance with CERCLA Sections 113(k)(2)(B)(i-v) and 117. In January 1989, a Technical Review Committee (TRC) was formed to review recommendations for and monitor progress of the investigation and remediation efforts at NAS Pensacola. The TRC was made up of representatives of the Navy, USEPA, FDER, and the local community. In addition, a mailing list of interested community members and organizations was established and maintained by the NAS Pensacola Public Affairs Office. In July 1995, a Restoration Advisory Board (RAB) was established as a forum for communication between the community and decision-makers. The RAB absorbed the TRC and added members from the community and local organizations. The RAB members work together to monitor progress of the investigation and to review remediation activities and recommendations at NAS Pensacola. RAB meetings are held regularly, advertised, and are open to the public.

Before the removal action at Site 32, an article and a public notice were published in the *Pensacola News Journal* on July 26, 1994, and August 31, 1994. Site-related documents were made available to the public in the administrative record at information repositories maintained at the NAS Pensacola Library, the West Florida Regional Library, and the John C. Pace Library of the University of West Florida.

After finalizing the RI and Focused Feasibility Study (FFS) reports, the preferred alternative for OU 10 was presented in the Proposed Remedial Action Plan, also called the Proposed Plan. Everyone on the NAS Pensacola mailing list was sent a copy of the Proposed Plan. The notice of availability of the Proposed Plan, RI, and FFS documents was published in the *Pensacola News Journal* on February 15, 1996. A public comment period was held from February 19 to April 4, 1996, to encourage public participation in the remedy-selection process. In addition, a public meeting was held on February 27, 1996, at Pensacola Junior College, Warrington Campus, Building 3000, for the Navy to present its preferred remedy for OU 10. The public meeting

**minutes have been transcribed, and a copy of the transcript is available to the public at the aforementioned repositories. Responses to comments received during the comment period are contained in Appendix B.**

## 4.0 SCOPE AND ROLE OF THE OPERABLE UNIT

This selected remedy is the first and final remedial action for the site. The function of this remedy is to reduce the risk to human health and environment associated with exposure to contaminated groundwater and soil.

The selected remedial alternative will address conditions which pose a threat to human health and the environment including:

- Contaminated groundwater (may impact drinking water supplies or nearby ecological receptors); and

- Contaminated soil (presents a continuing source of contamination to groundwater and a potential excess risk to a future child resident).

Pathways of exposure include:

- Dermal contact and ingestion of contaminated soil.
- Ingestion and inhalation of contaminated groundwater.
- Aquatic exposure to groundwater discharging to surface waters.

The major components of the remedy are:

- Excavation and disposal of soil above residential soil PRGs (Area A);

- Leachability study on Areas B, C, and D to verify that contaminants remaining in soil are not leaching to groundwater;

- Contingency remedial action of Areas B, C, and D to include excavation and disposal of soil that the leachability study verifies as a source of groundwater contamination;

- The remedial design for groundwater treatment will be developed in the Corrective Action Plan for the Resource Conservation and Recovery Act (RCRA) permit modification;

- Groundwater monitoring program to ensure the groundwater treatment system will be effective and that contaminants will not migrate; and

- Continued groundwater monitoring at sampling intervals to be determined during the remedial design for groundwater treatment developed in the Corrective Action Plan for the RCRA permit modification. The groundwater monitoring program will continue until a five-year review concludes that the alternative has continually attained the performance standards and remains protective of human health and the environment.

This remedy addresses the first and final cleanup action planned for OU 10, where groundwater contains elevated concentrations of contaminants similar to those in site soil. Although this water-bearing zone is affected, the contamination is not affecting the public drinking water supply. The purpose of this proposed action is to prevent current or future unacceptable exposure to contaminated soil and groundwater, and to reduce the contaminant migration. The remedy will allow for unrestricted land use.

This is the only Record of Decision (ROD) contemplated for OU 10. Separate investigations and assessments are being conducted for the other sites at NAS Pensacola in accordance with CERCLA. Therefore, this ROD applies only to OU 10.

## 5.0 SITE CHARACTERISTICS

This section of the ROD presents an overview of the nature and extent of contamination at OU 10 with respect to known or suspected sources of contamination, types of contamination, and affected media. Known or potential routes of migration of contaminants also are discussed.

### 5.1 Nature and Extent of Soil Contamination

**Site 32**

Contamination by organic compounds in Site 32 soil consists primarily of dichlorobenzene isomers (predominantly 1,4-dichlorobenzene), polyaromatic hydrocarbons (PAHs), cyanide, and localized pesticide and PCB concentrations. Inorganic contamination consists of heavy metals including cadmium, chromium, and lead. Organic contaminants are concentrated primarily in the relict drainage swale area east/northeast of the former ISDBs. Secondary organic soil contamination occurs in a horizon above the water table at the southeast edge of the former ISDBs, in the domestic sludge drying beds, and near-surface soil at the northwest slope from the ISDBs. Metals concentrations are elevated in the swale (especially in the northeast portion). The spatial distribution of these contaminants suggests the sources are related to past operation of the three sludge drying units, with most environmental contamination related to the former ISDBs and their historical surface overflow drainage into the adjoining swale and potential wetlands.

The only PRG exceedances were for benzo(a)pyrene and dibenz(a,h)anthracene in Area A, as Figure 5-1 shows. A volume of 185 cubic yards (CYs) was estimated for Area A based on assumed dimensions of 50 feet by 50 feet by 2 feet deep. The actual volume may differ and will be refined during confirmation sampling.

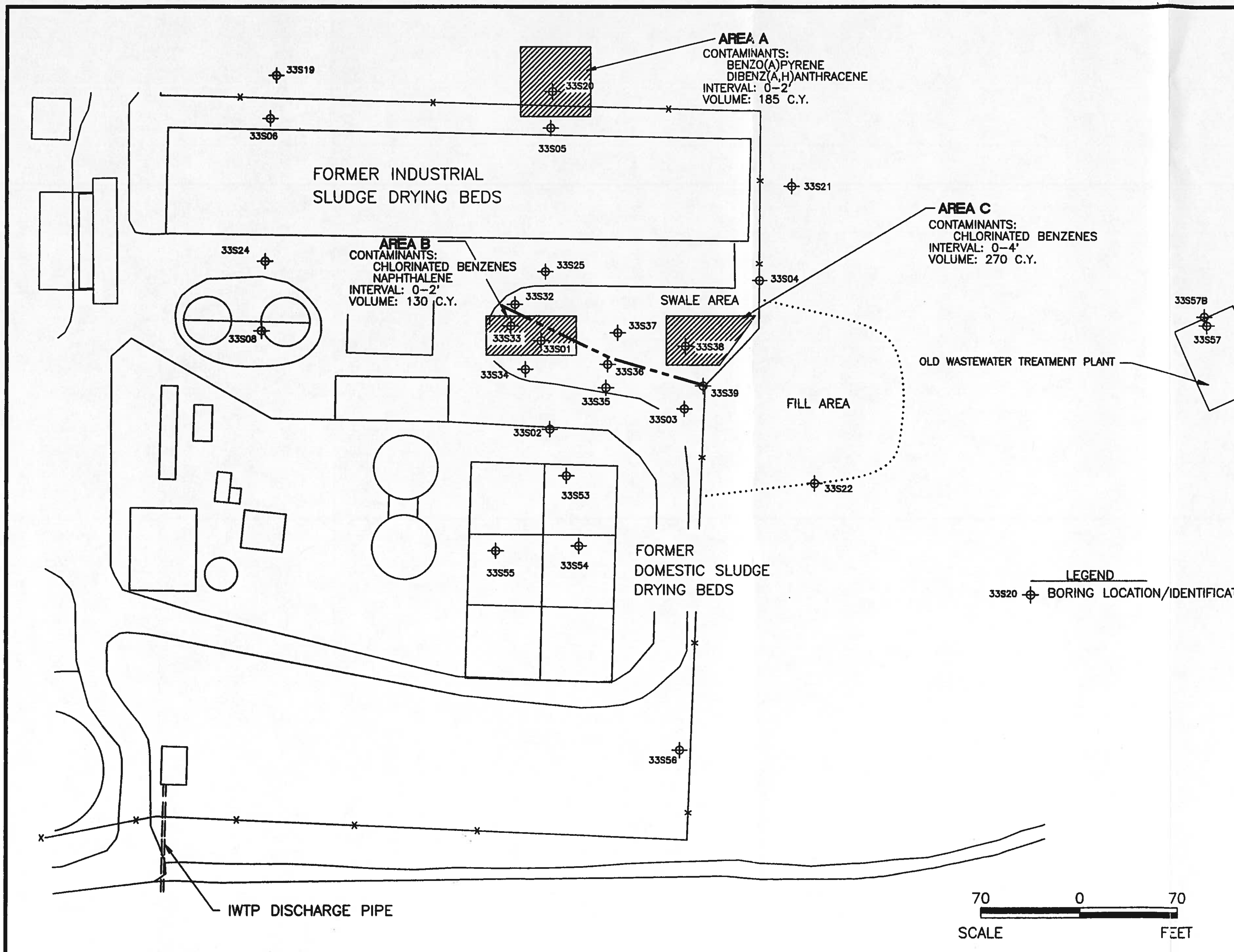
Areas B and C contained benzene and naphthalene exceeding their Florida leachability guidance concentrations. Estimated volumes were 120 and 270 CYs, respectively, based on outer sampling locations.

**Sites 33 and 35**

Two general types of organic contamination were detected in Sites 33 and 35 soil. The most pervasive contaminants are PAHs, pesticides, and PCBs. In general, concentrations are lower in magnitude than those detected at Site 32. The irregular and poorly delineated distribution of contaminants suggests that historically documented source areas (surge pond and stabilization pond) and several potential localized sources (i.e., miscellaneous spills, leaks, and/or line breaks) may have contributed to soil contamination. The spatial distribution of the contaminants indicates impacted soil at the southeastern corner of the former surge pond and around the surge tank. In addition, the spatial distribution indicates impacted soil from an undefined source near the chlorine contact chamber.

A second type of soil contamination appears restricted to the oily horizon at the water table around the area of the former waste oil underground storage tank (UST). Organic contamination includes dichlorobenzenes and other PAHs, 2-butanone, xylenes, and PCBs. Heavy metals also were detected. The contaminant source is thought to be leakage from the former waste oil tank. In conclusion, the boring coverage and analytical results indicate multiple sources of localized soil contamination.

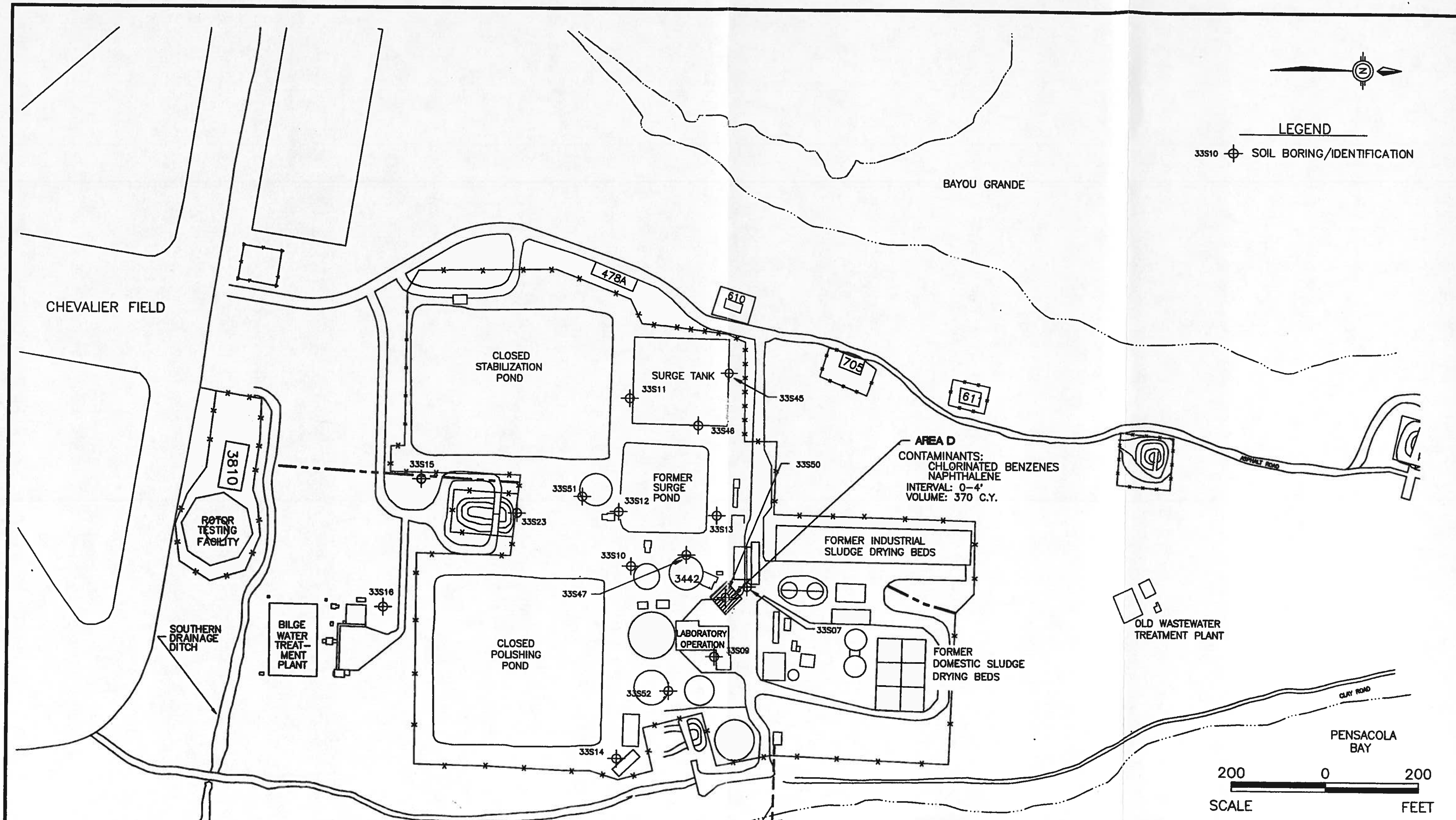
As shown in Figure 5-2, Area D exceeded the Florida leachability standards for chlorinated benzenes and naphthalene. The extent of contamination was estimated to be 50 feet wide by 50 feet long by 4 feet deep for an estimated volume of 370 CYs. No other PRG exceedance for soil was noted at Sites 33 and 35.




RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 5-1
SITE 32
PAH AND CHLORINATED BENZENE
HOT SPOTS

DWG DATE: 02/28/96 | DWG NAME: 48FSPAHS




RECORD OF DECISION
OPERABLE UNIT 10
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FIGURE 5-2
SITES 35
CHLORINATED BENZENE
HOT SPOT

DWG DATE:02/28/96 | DWG NAME:83CBHS

## 5.2 Nature and Extent of Sediment Contamination

Sediment was collected from the drainage ditch forming the southern boundary of the study area south of the bilge water facility. Sediment sampling locations are shown in Figure 5-3. Contaminants in the sediment include fluoranthene, pesticides, PCBs, cadmium, chromium, and lead. The overall distribution of contaminants indicates sources from direct surface drainage into the ditch from the former north end of Chevalier Field, drainage into the ditch from the southern part of the IWTP, and probable site pesticide application. The metals distribution increases toward the bay, probably representing hydrodynamic accumulation of finer-grained sediment containing adsorbed metals. Storms put the ditch in direct contact with the bay. The Southern Drainage Ditch and other wetlands will be investigated further during the Site 41 RI. Impacts to Pensacola Bay from the Southern Drainage Ditch will be evaluated during the Site 42 RI.

Sediment samples were not collected from the north-south ditch draining the IWTP yard. This drainage ditch connects with the southern ditch between Stations 33M01 and 33M02. Soil sample 33S15 was collected adjacent to, but not directly in, this north-south feeder ditch. This soil sample had some of the lowest detected concentrations at the IWTP. The north-south feeder ditch will be further evaluated during the Site 41 RI.

## 5.3 Nature and Extent of Surface Water Contamination

Surface water samples were collected from the southern drainage ditch at the same locations as the sediment sampling stations (Figure 5-3). Contamination detected in these samples consisted of nonchlorinated aromatics, pesticides, cadmium, chromium, and lead. The nature and distribution of these contaminants suggest the sources are most likely related to the bilge water plant spill and normal pesticide application around the plant area. Cadmium (5.2 parts per billion [ppb]) and lead (2.4 ppb) exceeded their surface water standards of 0.72 ppb and 1.5 ppb at location 33W01.

The bilge water plant spill is separate from the RI and will be investigated under the auspices of the FDEP petroleum program. The wetlands will be investigated further in the Site 41 RI.

## 5.4 Nature and Extent of Groundwater Contamination

### Shallow Groundwater

Organic contamination present in shallow groundwater consists of volatiles (chlorobenzene and toluene), semivolatiles (dichlorobenzene isomers), and pesticides. The approximate extent of groundwater contamination is shown in Figure 5-4. Inorganic contamination consists of heavy metals (cadmium, chromium, and lead) and major metals (iron and manganese) for which federal and state standards have been established. Chlorobenzene and 1,2- and 1,4-dichlorobenzene standards were not exceeded. However, the standards for cadmium (5 ppb) and lead (15 ppb) were exceeded in one CERCLA-sampled well (GM-71 and 13GS07) each, and the standards for iron and manganese were consistently exceeded. Metals concentrations were below all applicable standards in filtered aliquots.

Overall, the distribution of chlorinated aromatics in the shallow groundwater suggests the contaminant source is associated with the closed ISDBs, the drainage swale area, and the former waste oil UST. The distribution of metals in the shallow groundwater suggests the closed ISDBs, the swale area, the closed surge pond, and the former acid spill area as likely sources.

### Intermediate Groundwater

Intermediate groundwater shows significant contaminant increases over those identified in shallow groundwater. Contaminants include chlorinated aliphatics, 2-butanone, chlorinated aromatics, major metals, and comparatively lower concentrations of nonchlorinated VOCs, phenols, pesticides, and heavy metals. Of the chlorinated aliphatics detected, standards for tetrachloroethylene were met or exceeded in four CERCLA-sampled wells. For trichloroethene, standards were met or exceeded in three CERCLA-sampled wells, and for vinyl chloride, standards were exceeded in one well.

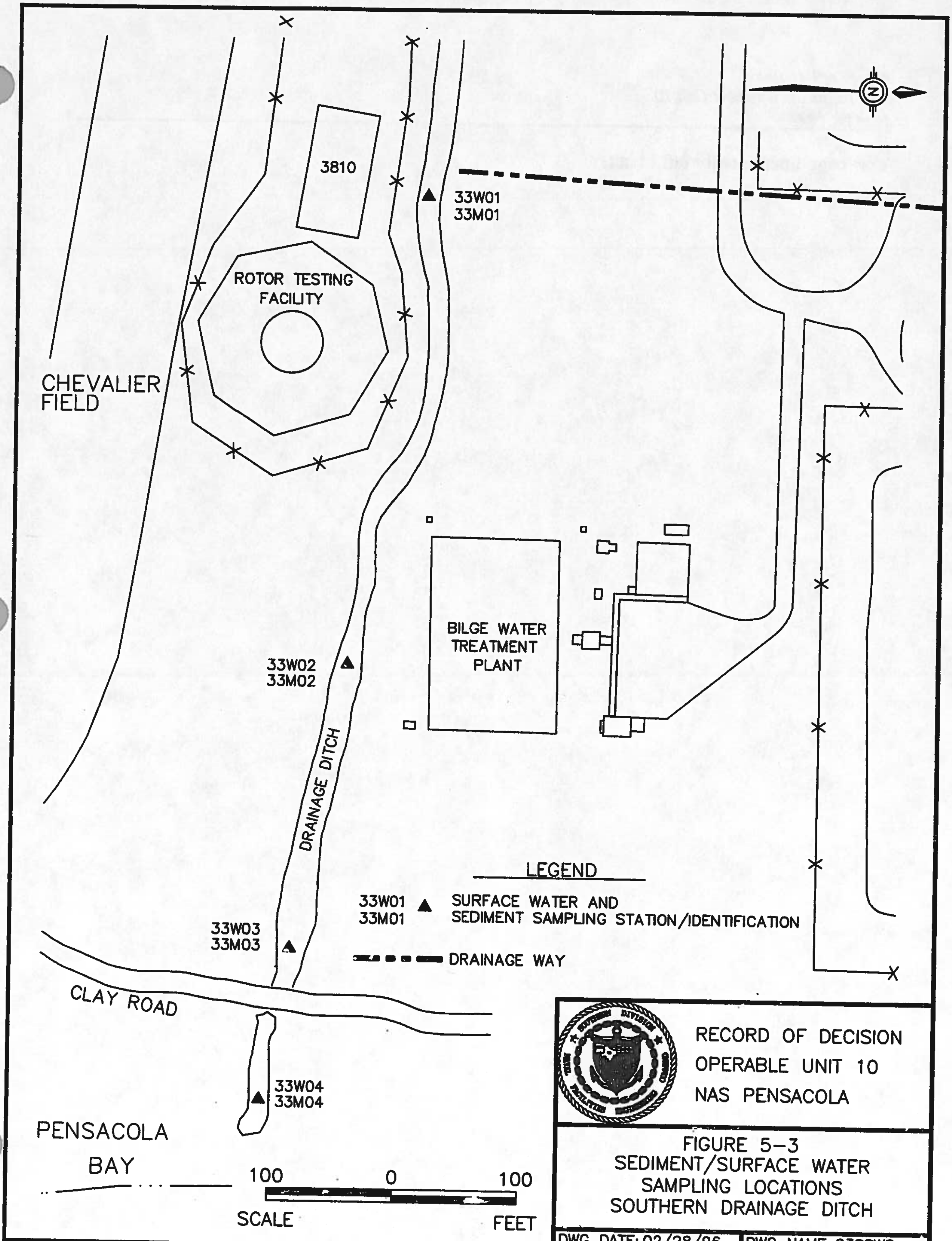


FIGURE 5-3
SEDIMENT/SURFACE WATER
SAMPLING LOCATIONS
SOUTHERN DRAINAGE DITCH

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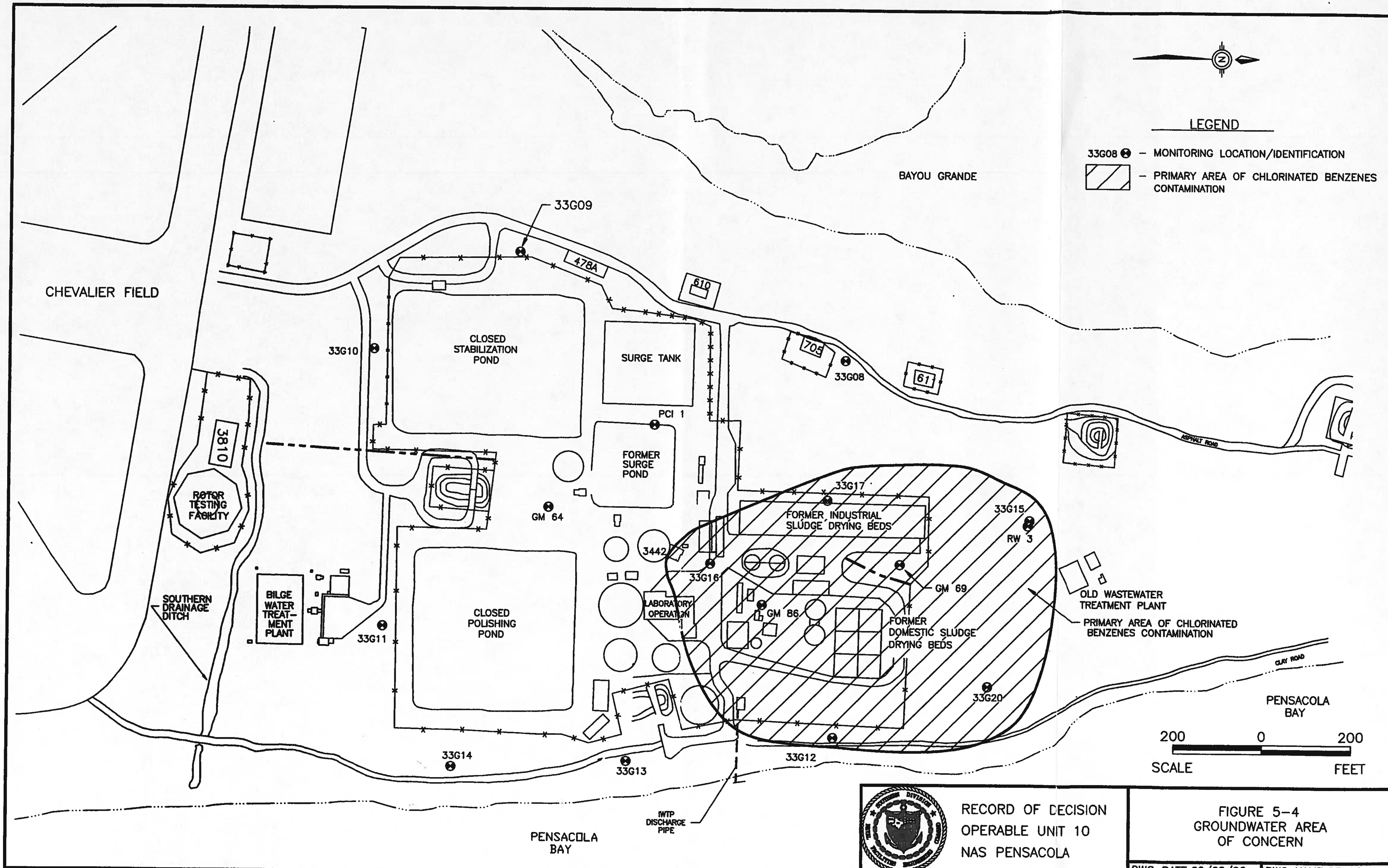


RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 5-4
GROUNDWATER AREA OF CONCERN

DWG DATE:02/28/96 | DWG NAME:83GAC

Of the chlorinated aromatics, the standards for chlorobenzene were exceeded in three CERCLA-sampled wells (33G12, 33G16, and 33G20); for 1,2-dichlorobenzene in three wells (33G12, 33G16, and 33G20), and for 1,4-dichlorobenzene in four CERCLA-sampled wells (33G12, 33G16, 33G20, and RW-3).

For the metals, the standards for cadmium, chromium, and beryllium were exceeded in one CERCLA-sampled well (GM-66). Of the major metals, the standards for iron and manganese were consistently exceeded, and the standard for sodium was exceeded in several wells. Again, metals concentrations were below applicable standards for filtered aliquots.

The overall distribution of contamination is consistent with the ISDBs, the swale area, the former waste oil UST, the surge pond, and the former acid spill as sources. Pesticide concentrations indicate either widespread leaching, downward migration through the shallow zone, or sediment carrydown in drilling.

The in-place recovery system at the site has little apparent influence on the shallow groundwater, but has had a pronounced effect on the intermediate depth. Evaluation of the data indicates flow in the intermediate depth in the southern part of the site is influenced by RW-7 and, in the northern part by RW-3. Flow in the central part of the site, however, remains to the east toward the bay, and may allow offsite contaminant migration.

**Deep Groundwater**

Heavy metals and major metals concentrations in the deep well sampled were similar to those of intermediate depth. The standard for sodium was exceeded, reflecting saltwater influence.

## 5.5 Fate and Transport

### 5.5.1 Sources of Contamination

Areas of soil contamination were identified at the former ISDBs, the swale area, and at the former waste oil UST. SVOCs, including chlorinated benzenes and PAHs, as well as PCBs and metals, were detected in this area, with lesser phenol, pesticide, and cyanide concentrations. A second area of elevated contamination relative to surrounding areas can be found in a broad and ill-defined region including the former surge pond (boring 33S12), the present surge tank (33S11), and the former waste line breach area (33S10). The principal soil contaminants in this area include PAHs, pesticides, and PCBs. The potential for contaminant migration is expected to be greatest in these areas.

Soil pesticide concentrations average less than 20 ppb and do not exceed 1,000 ppb at any location; therefore, based on soil-phase partitioning, it is expected little pesticide mass is available for leaching. Soil SVOC concentrations were nondetect to less than 500 ppb over 90% of the study area, based on sample data. However, SVOC concentrations were detected in excess of 1 part per million (ppm) in the former ISDBs and swale area, at the former waste oil UST, and around the former surge pond, present surge tank, and historic waste line breach. In these limited areas, leaching of SVOCs may threaten underlying water-bearing zones. Metals concentrations in soil were generally low except in the swale area, as well as in some isolated areas with lower (but significant) concentrations. The greatest threat to underlying water-bearing zones is in these areas.

### 5.5.2 Contaminant Migration

#### Leaching from Soil to Groundwater

Contamination identified in soil of the former ISDBs, swale area, former waste oil UST, former surge pond, surge tank, and waste line breach area may enter groundwater by three mechanisms: 1) contaminants may be leached from the soil by downward percolation of rainwater toward the water table, 2) into groundwater through direct continual contact with groundwater either from contaminant horizons identified at normal water table, or 3) from seasonally submerged soil during periods of elevated water table. Soil at the IWTP in general is very permeable, resulting in quick infiltration and minimal contact time between percolating water and soil above the water table. Soil in the swale area, however, is fill material of sands and appreciable silts with discontinuous zones of clayey material. Permeability of this soil would be substantially lower than elsewhere at the study area, resulting in longer contact time with percolating water. Shallow monitoring wells around and downgradient of the former ISDBs and swale area exhibited relatively low to nondetect concentrations of metals and most organics, except chlorinated benzenes. The swale area including 33G01 is in the area of highest soil contamination. These high contaminant concentrations were recorded during an unusually wet season with percolation of rainwater through the contaminated soil. The resultant concentrations in shallow groundwater suggest the contaminated soil is releasing chlorinated benzenes at rates substantial enough to cause a detectable impact on groundwater, but other contaminants may be more tightly retained.

Soil contamination at the water table exists as black oily horizons around the site of the former waste oil UST and around the southern portion of the former ISDBs and as a darkened horizon around the surge tank and former surge pond. Detected concentrations in Areas A, B, C, and D exceed Florida leachability values protective of groundwater. The contaminated soil may be continuously or seasonally in contact with shallow groundwater, allowing for maximum contact time for leaching. Low to nondetect concentrations in RCRA-sampled wells, downgradient of and adjacent to the former surge pond, and GM-8, downgradient and near the black oily horizon around the southern portion of the ISDBs, do not indicate any appreciable leaching of contaminants from their respective horizons at the water table. CERCLA well 33G02 shows chlorinated benzenes, suggesting groundwater and/or rainwater percolation may be leaching contaminants from the black oily horizon around the former waste oil UST.

The compound classes of PAH semivolatiles, pesticides, and PCBs are generally considered to have limited to very limited potential for migration due to their low solubility and high affinity for soil particles and organic carbon. Physical analyses on soil samples from the swale area and near the former surge pond indicate total organic carbon contents of 480 and 470 milligrams per kilogram (mg/kg) dry weight, respectively. The potential for metals migration depends highly on pH, redox potential, and cation exchange capacity of the bearing soil. Cation exchange capacities measured on soil from the two contaminant sources in question are at 3.9 meq/100g in the swale area and 5.2 meq/100g near the former surge pond. The very low metal and PAH concentrations, extremely low pesticide concentrations, and nondetected concentrations of PCBs suggest soil across the site, and possibly the oily organic-rich material in the swale area, is retaining these compounds by sorption processes.

**Surface Water Transport**

The generally high soil permeabilities around the IWTP limit any substantial transfer of contamination via surface water flow. Although the site was investigated during an unusually wet winter, overland flow was not observed. The southern drainage ditch surface waters seem to collect by seepage or storm water culvert discharge from the surrounding industrially used land, including the IWTP, the bilge water treatment plant, the helicopter rotor-testing facility, and the former Chevalier Field. Although water was not flowing in these ditches, it is possible that accelerated seepage during heavy rains may produce some surface water movement. Contaminants transfer from soil to surface water by the same leaching processes discussed above under soil-to-groundwater pathways, mediated by groundwater quality characteristics.

Contaminant transport within the drainage ditch surface water has been investigated by the hydrologic study and southern drainage ditch sampling. The ditch surface waters were determined to be more a surface expression of groundwater than a conduit for surface water transport; any migration of water and contaminants within the ditch is probably related to groundwater flow velocities. The impact of OU 10 on the Southern Drainage Ditch and area wetlands will be further evaluated during the Site 41, NAS Pensacola Wetlands, RI.

**Groundwater Transport**

Groundwater analytical results indicate contaminants are migrating with groundwater flow. Contaminant concentrations are evaluated around and hydraulically downgradient of the former ISDBs, downgradient of the surge tank, by the former waste oil UST, and at 33G15. Based on potentiometric measurements, groundwater contamination is migrating laterally east from the former ISDBs/swale area and the former waste oil UST, and north/northwest from the present surge tank. Two recovery wells at the heart of the former ISDBs and the swale area contamination apparently have not prevented or reversed the eastward migration of contaminated groundwater from the area. However, they are influencing flow in the southern and northern portions of the IWTP yard. Downward vertical hydraulic gradients between shallow and intermediate groundwater depths, equivalent in magnitude to lateral gradients, indicate a strong tendency for downward contaminant migration in conjunction with lateral movement. Elevated contaminant concentrations at intermediate depth may be a consequence of this downward flow component. Upward vertical hydraulic gradients between deep and intermediate groundwater depths, together with the presence of a 12- to 15-foot-thick, low-permeability clay layer between the two, may preclude any downward contaminant migration into the deep groundwater. Contaminant concentrations, historically found in deep wells soon after installation and nondetect later, indicate these trace contaminants were introduced while installing deep wells.

The groundwater contaminant migration rate is conservatively estimated to equal groundwater velocity. Based on groundwater velocities, the rate of contaminant movement from the former ISDBs and swale area toward well pair 33G05 and 33G12 (east of the ISDBs) is expected to average approximately 0.54 feet/day in shallow groundwater, and approximately 0.017 ft/day in intermediate groundwater. Groundwater contamination at well pair 33G03 and 33G08 (west of the ISDBs) is expected to flow north, away from the surge tank. Contaminated groundwater movement at 33G15 (north of the ISDBs) is likely influenced by nearby recovery well RW-3.

Analytical results of filtered and unfiltered sample aliquots indicate that metals in groundwater are strongly partitioned onto particulate matter. Therefore, movement of metals contamination depends on the ability of the particulate matter to move with groundwater. High hydrogen sulfide concentrations in groundwater may favor precipitation of metals from the dissolved phase, further associating metal constituents with particulates or as colloidal suspension.

**Potential Receptors and Impacted Media**

The primary medium impacted by site activity has been the surficial zone of the Surficial/Sand-and-Gravel Aquifer. Shallow and intermediate monitoring wells for this zone presently and historically have yielded impacted groundwater. Organic contaminant concentrations are lower than when the former surge pond and ISDBs operated. The greatest impacts have been observed around and downgradient of the former ISDBs and swale area, downgradient of the surge tank, and at 33G15. Several chlorinated aliphatic compounds and 1,4-dichlorobenzene exceed standards in area wells. Both impacted and unimpacted groundwater in this aquifer has been shown to be highly turbid and contains natural iron, manganese, and sodium concentrations exceeding standards. A large portion of the aquifer yields dark brown, highly organic pore water with an acrid hydrogen sulfide odor. Groundwater from the surficial zone is not used nor anticipated to be used as a potable water supply.

The surface water and sediment of Pensacola Bay and Bayou Grande are media that could potentially be impacted by contaminated groundwater migrating from the IWTP. These coastal waters have been classified by the FDEP as Class III waters, indicating their use for recreation and maintaining a well-balanced fish and wildlife population. Potential impacts on these water bodies will be addressed in upcoming RI/FSs for Bayou Grande (Site 40) and Pensacola Bay (Site 42).

## 6.0 SUMMARY OF SITE RISKS

A baseline risk assessment (BRA) has been conducted for OU 10, and the results are presented in Section 10 of the RI report. The BRA was based on contaminated environmental site media as identified in the RI. It was conducted to assess the resulting impact to human health and environment if contaminated soil and groundwater onsite were not remediated. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health or the environment.

### 6.1 Chemicals of Potential Concern

Substances detected at OU 10 were screened against available information to develop a list or group of chemicals referred to as chemicals of potential concern (COPCs). The information consists of both federal and State of Florida cleanup criteria, soil and groundwater standards, and reference concentrations. COPCs are selected after comparison to screening concentrations (risk-based and reference), intrinsic toxicological properties, persistence, fate and transport characteristics, and cross-media transfer potential. Any COPC that is carried through the risk assessment process and found to contribute to a pathway that exceeds a $10^6$ risk or hazard index (HI) greater than 1 for any of the exposure scenarios evaluated in this risk assessment and has an incremental lifetime cancer risk (ILCR) greater than $10^6$ or hazard quotient (HQ) greater than 0.1 is referred to as a chemical of concern (COC). Table 6-1 summarizes COPCs for these pathways. Surface water, sediment, and deep groundwater pathways did not produce any significant risk levels.

Essential elements may be screened out of a risk assessment if it is shown that concentrations detected are not associated with adverse health effects. Therefore, the following nutrients were eliminated: calcium, iron, magnesium, potassium, and sodium.

**Table 6-1**
**Chemicals of Potential Concern (ppm)**

| COPC | Soil | Groundwater: Shallow and Intermediate | Groundwater: Deep | Surface Water | Sediment |
|---|---|---|---|---|---|
| 1,1-Dichloroethane | - | 0.002 - 0.2 | | - | - |
| 1,2-Dichlorobenzene | - | 0.001 - 1.2 | | - | - |
| 1,2-Dichloroethene (total) | - | 0.003 - 0.012 | | - | - |
| 1,3-Dichlorobenzene | - | 0.001 - 0.7 | | - | - |
| 1,4-Dichlorobenzene | - | 0.001 - 0.7 | | - | - |
| 2,4-Dichlorophenol | - | 0.002 - 0.012 | | - | - |
| 4,4'-DDD | - | - | | 0.000041 - 0.00011 | - |
| Acenaphthene | 0.001 - 0.026 | - | | - | - |
| Aluminum | 193 - 17500 | 0.359 - 33.6 | 11.8 | 0.696 - 1.28 | 1100 - 4150 |
| Arsenic | 0.94 - 3.5 | 0.0031 - 0.0187 | 0.005 | - | 0.82 - 6.2 |
| Benzene | - | 0.003 - 0.003 | | - | - |
| Benzo(a)anthracene | 7.5 - 7.5 | - | | - | - |
| Benzo(a)pyrene | 6.2 - 6.2 | - | | - | - |
| Benzo(b)fluoranthene | 0.028 - 7 | - | | - | - |
| Benzo(k)fluoranthene | 0.028 - 7 | - | | - | - |
| Beryllium | - | - | | - | - |
| Bis(2-chloroethyl)ether | 0.83 - 0.83 | - | | - | - |
| Bis(2-ethylhexyl)phthalate | - | 0.088 - 0.088 | | - | - |
| Cadmium | 1.4 - 23 | 0.0202 - 0.0202 | | 0.0052 - 0.0052 | 2.8 - 34.6 |
| Carbon disulfide | - | 0.003 - 0.007 | | - | - |
| Chlorobenzene | - | 0.001 - 0.34 | | - | - |
| Chromium | 1.8 - 910 | 0.0107 - 0.0757 | | - | 9.3 - 1180 |
| Copper | - | - | | - | - |
| Dibenz(a,h)anthracene | 1.4 - 1.4 | - | | - | - |
| Dieldrin | - | 0.000003 - 0.000042 | | - | - |
| Heptachlor epoxide | - | - | | 0.0000013 - 0.0000013 | - |
| Hexachloroethane | - | 0.003 - 0.003 | | | |
| Indeno(1,2,3-cd)pyrene | 0.04 - 4.8 | - | | - | - |
| Lead | - | 0.0021 - 0.0182 | | - | - |
| Manganese | 1 - 537 | 0.0082 - 0.5 | | 0.0113 - 0.28 | - |
| Mercury | - | 0.00021 - 0.0016 | | - | - |
| Naphthalene | - | 0.026 - 0.038 | | | |

**Table 6-1**
**Chemicals of Potential Concern (ppm)**

| COPC | Soil | Groundwater: Shallow and Intermediate | Groundwater: Deep | Surface Water | Sediment |
|---|---|---|---|---|---|
| PCB Aroclor-1260 | 0.006 - 0.405 | - | | - | - |
| Tetrachloroethene | - | 0.006 - 0.19 | | - | - |
| Thallium | - | - | | - | - |
| Titanium | 23 - 53 | - | | - | - |
| Trichloroethene | - | 0.002 - 0.007 | | - | - |
| Vanadium | - | 0.0159 - 0.076 | | - | - |
| Vinyl chloride | - | 0.015 - 0.015 | | - | - |
| Yttrium | 1.3 - 1.85 | - | | - | - |
| trans-Nonachlor | 0.006 - 0.006 | - | | - | - |

*Notes:*
The table presents the range of concentrations detected for all COPCs.
Essential nutrients (calcium, iron, magnesium, potassium, and sodium) were not considered COPCs in any medium.

Site operations have been converted to domestic treatment only, and there is no indication the domestic treatment operations will be discontinued. Onsite groundwater is not being used at present; however, it is considered a viable source of groundwater for future consumption.

## 6.2 Exposure Assessment

Whether a chemical is actually a concern to human health depends upon the likelihood of exposure, i.e., whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- Source and mechanism of release;
- Transport medium (e.g., surface water, air) and mechanisms of migration through the medium;

- Presence or potential presence of a receptor at the exposure point; and

- Route of exposure (ingestion, inhalation, dermal absorption).

If all four elements are present, the pathway is considered complete.

All potential exposure pathways that could connect chemical sources at OU 10 with potential receptors were evaluated. All possible pathways were first hypothesized and evaluated for completeness using the above criteria. Current pathways represent exposure pathways that could exist under current conditions while future pathways represent exposure pathways that could exist, in the future, if current exposure conditions change.

### 6.2.1 Current Exposure

Under current land use conditions at OU 10, access to areas of concern is restricted to authorized personnel only. The plant has been converted to domestic treatment only; however, there are no reported plans to decommission the facility. As a result, current exposure scenarios will continue unaltered for the foreseeable future. Potential exposures under present land use are summarized below:

**Potential Exposure Scenarios – Current Conditions**

| **Media** | **Exposure Pathway** | **Receptor** |
|---|---|---|
| Soil | Incidental Inhalation<br>Dermal Contact | Onsite Worker<br>Trespasser |
| Surface Water | Incidental Ingestion | Trespasser |
| Sediment | Incidental Ingestion<br>Dermal Contact | Trespasser |

### 6.2.2 Future Exposure

Complete exposure pathways could exist when based on an estimate of the reasonable maximum exposure (RME) expected to occur under future conditions. Although unlikely, it is assumed that OU 10 may be developed as a residential area, which could also provide reasonable opportunities for recreational activities. If so, future residents could be exposed to soil via incidental ingestion and dermal contact routes of exposure associated with living in the area. Potential exposures for future land use are summarized below:

**Potential Exposure Scenarios – Future Conditions**

| **Media** | **Pathway** | **Receptors** |
|---|---|---|
| Soil | Incidental Ingestion<br>Dermal Contact | Site Resident |
| Groundwater | Ingestion<br>Inhalation | Site Resident |
| Surface Water | Incidental Ingestion | Site Resident<br>(Recreational Use) |
| Sediment | Incidental Ingestion<br>Dermal Contact | Site Resident<br>(Recreational Use) |

**Exposure Point Concentration**

Exposure point concentrations for each COC and exposure assumptions for each pathway were used to estimate chronic daily intakes (CDIs) for potentially complete pathways. CDIs were then used in conjunction with cancer potency factors and noncarcinogenic reference doses to evaluate risk.

The 95th percentile for reported concentrations of COCs in each media evaluated were calculated as exposure point concentrations for the RME in each exposure scenario. Exposure point concentrations are summarized in Table 6-2.

**Table 6-2**
**Exposure Point Concentrations**

| Media and Chemical | Frequency of Detection | Exposure Point Concentrations RME | Exposure Point Concentrations Background |
|---|---|---|---|
| **Soil (mg/kg)** | | | |
| Aluminum | 17/18 | 17500 | 3833 |
| Arsenic | 3/18 | 3.5 | 1.6 |
| Cadmium | 7/18 | 23 | N/A |
| Chromium | 17/18 | 910 | 6.2 |
| Manganese | 18/18 | 537 | 21.4 |
| Titanium | 9/9 | 53 | N/A |
| Yttrium | 4/9 | 1.85 | N/A |
| PCB-1260 | 5/17 | 0.405 | N/A |
| trans-Nonachlor | 1/9 | 0.0062 | N/A |
| Benzo(a)anthracene | 1/18 | 7.5 | N/A |
| Benzo(a)pyrene | 1/18 | 6.2 | N/A |
| Benzo(b,k)fluoranthene | 4/18 | 7 | N/A |
| Dibenzo(a,h)anthracene | 1/18 | 1.4 | N/A |
| Indeno(1,2,3-cd)pyrene | 2/18 | 4.8 | N/A |
| Bis(2-chloroethyl)ether | 1/18 | 0.83 | N/A |
| **Shallow/Intermediate Groundwater (mg/L)** | | | |
| 1,1-Dichloroethane | 10/27 | 0.065 | N/A |
| 1,2-Dichlorobenzene | 11/27 | 1.17 | N/A |
| 1,2-Dichloroethene (total) | Chromium | 0.00276 | N/A |
| 1,3-Dichlorobenzene | 7/27 | 0.274 | N/A |
| 1,4-Dichlorobenzene | 11/27 | 0.442 | N/A |
| 2,4-Dichlorophenol | 2/27 | 0.00153 | N/A |
| Acenaphthene | 3/27 | 0.00187 | N/A |

**Table 6-2**
**Exposure Point Concentrations**

| Media and Chemical | Frequency of Detection | Exposure Point Concentrations: RME | Exposure Point Concentrations: Background |
|---|---|---|---|
| Aluminum | 27/27 | 8.66 | 3.82 |
| Arsenic | 13/27 | 0.0077 | N/A |
| Benzene | 1/27 | 0.0016 | N/A |
| Bis(2-ethylhexyl)phthalate | 1/27 | 0.00804 | N/A |
| Cadmium | 1/27 | 0.01094 | 0.0096 |
| Carbon disulfide | 4/27 | 0.0023 | N/A |
| Chlorobenzene | 15/27 | 0.3208 | N/A |
| Chromium | 14/27 | 0.01905 | 0.0325 |
| Dieldrin | 4/27 | 0.000003 | N/A |
| Hexachloroethane | 1/27 | 0.001083 | N/A |
| Lead | 13/27 | 0.006352 | N/A |
| Manganese | 27/27 | 0.19341 | 0.022 |
| Mercury | 16/27 | 0.000624 | N/A |
| Naphthalene | 2/27 | 0.00781 | N/A |
| Tetrachloroethene | 3/27 | 0.00731 | N/A |
| Trichloroethene | 4/27 | 0.0017 | N/A |
| Vanadium | 8/27 | 0.02172 | 0.007 |
| Vinyl chloride | 1/27 | 0.00321 | N/A |
| **Deep Groundwater (mg/L)** | | | |
| Aluminum | 1/1 | 11.8 | N/A |
| Arsenic | 1/1 | 0.0048 | N/A |
| **Surface Water (mg/L)** | | | |
| Aluminum | 4/4 | 1.28 | N/A |
| Cadmium | 1/4 | 0.0052 | N/A |

**Table 6-2**
**Exposure Point Concentrations**

| Media and Chemical | Frequency of Detection | Exposure Point Concentrations RME | Background |
|---|---|---|---|
| Manganese | 4/4 | 0.28 | N/A |
| 4,4'-DDD | 2/4 | 0.00011 | N/A |
| Heptachlor epoxide | 1/4 | 0.0000013 | N/A |
| **Sediment (mg/kg)** | | | |
| Aluminum | 4/4 | 4150 | N/A |
| Arsenic | 3/4 | 6.2 | N/A |
| Cadmium | 2/4 | 34.6 | N/A |
| Chromium | 4/4 | 1180 | N/A |

***Notes:***
RME – Reasonable Maximum Exposure
The number of samples for three non-TCL/TAL COPCs is nine rather than 18 due to the analyte list used by USEPA Region IV ESD during supplemental sampling for OU 10 surface soil.
All results are in parts per million (ppm).

Potential future exposure scenarios included all exposures examined under current conditions. The same exposure assumptions used to evaluate future conditions were used for current conditions. Assumptions are listed in Table 6-3 for current land use and Table 6-4 for future land use.

**Table 6-3**
**Parameters Used to Estimate Potential Exposures for Current Land Use Receptors**

| Pathway Parameters | Trespassing Child Age 7-16 | Onsite Worker | Units |
|---|---|---|---|
| **Incidental Ingestion of Sediment/Soil** | | | |
| Ingestion Rate | 100[a] | 50[b] | mg/day |
| Exposure Frequency | 52[c] | 250[b] | days/year |
| Exposure Duration | 10[c] | 25[b] | years |

**Table 6-3**
**Parameters Used to Estimate Potential Exposures**
**for Current Land Use Receptors**

| Pathway Parameters | Trespassing Child Age 7-16 | Onsite Worker | Units |
|---|---|---|---|
| Body Weight | 45[d] | 70[b] | kg |
| Averaging Time-Noncancer | 3,650[e] | 9,125[e] | days |
| Averaging Time-Cancer | 25,550[f] | 25,550[f] | days |
| **Dermal Contact with Sediment/Soil** | | | |
| Skin Surface Area | 3,950[g] | 4,100[g] | $cm^2$ |
| Adherence Factor | 1[h] | 1[h] | $mg/cm^2$ |
| Absorption Factor | CSV | CSV | unitless |
| Exposure Frequency | 52[c] | 250[b] | days/year |
| **Dermal Contact with Sediment/Soil** | | | |
| Exposure Duration | 10[c] | 25[b] | years |
| Body Weight | 45[d] | 70[b] | kg |
| Averaging Time-Noncancer | 3,650[e] | 9,125[e] | days |
| Averaging Time-Cancer | 25,550[f] | 25,550[f] | days |
| **Incidental Ingestion of Surface Water** | | | |
| Ingestion Rate | 0.05[a] | NA | liters/hour |
| Exposure Time | 2.6[a] | NA | hours/day |
| Exposure Frequency | 52[c] | NA | days/year |
| Exposure Duration | 10[c] | NA | years |
| Body Weight | 45[d] | NA | kg |
| Averaging Time-Noncancer | 3,650[e] | NA | days |
| Averaging Time-Cancer | 25,550[f] | NA | days |

*Notes:*

a — USEPA (1989) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A).*

b — USEPA (1991) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual Supplemental Guidance, "Standard Default Exposure Factors,"* Interim Final, Office of Solid Waste and Emergency Response (OSWER) Directive: 9285.6-03.

c — Assumes a trespass scenario of an adolescent age 7-16 with an exposure duration of 10 years and a exposure frequency of 52 days per year.

d — Adolescent body weight is the average value for the range of body weights for boys and girls ages 7-16 taken from USEPA (1990) *Exposure Factors Handbook*, USEPA/600/8-89/043.

| | | |
|---|---|---|
| e | — | Calculated as the product of ED (years) x 365 days/year. |
| f | — | Calculated as the product of 70 years (assumed lifetime) x 365 days per year. |
| g | — | Skin surface area (i.e., worker – head, forearms and hands) provided by USEPA Region 4. For trespassing children, skin surface area was computed as 25% of the age group mean total body surface per Dermal Guidance. |
| h | — | Specific guidance from USEPA Region 4 (February 11, 1992 New Interim Region 4 Guidance). |
| NA | — | Not applicable |
| CSV | — | Chemical-specific value |

**Table 6-4**
**Parameters Used to Estimate Potential Exposures for Future Land Use Receptors**

| Pathway Parameters | Resident Adult | Resident Child | Units |
|---|---|---|---|
| **Incidental Ingestion of Soil** | | | |
| Ingestion Rate | 100[a] | 200[a] | mg/day |
| Exposure Frequency | 350[b] | 350[b] | days/year |
| Exposure Duration | 24[c] | 6[a] | years |
| Exposure Duration$_{LWA}$ | 24[c] | 6[a] | years |
| Body Weight | 70[a] | 15[a] | kg |
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |
| **Dermal Contact with Soil** | | | |
| Skin Surface Area | 4,100[f] | 2,000[f] | $cm^2$ |
| Adherence Factor | 1[g] | 1[g] | $mg/cm^2$ |
| Absorption Factor | CSV | CSV | unitless |
| Exposure Frequency | 350[b] | 350[b] | days/year |
| Exposure Duration | 24[c] | 6[a] | years |
| Exposure Duration$_{LWA}$ | 24[c] | 6[a] | years |
| Body Weight | 70[a] | 15[a] | kg |
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |
| **Drinking Water Ingestion** | | | |
| Ingestion Rate | 2[a] | 1[a] | liters/day |
| Exposure Frequency | 350[b] | 350[b] | days/year |
| Exposure Duration | 24[c] | 6[a] | years |

**Table 6-4**
**Parameters Used to Estimate Potential Exposures for Future Land Use Receptors**

| Pathway Parameters | Resident Adult | Resident Child | Units |
|---|---|---|---|
| Exposure Duration$_{LWA}$ | 24[c] | 6[a] | years |
| Body Weight | 70[a] | 15[a] | kg |
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |
| **Inhalation of Volatilized Groundwater Constituents** | | | |
| Ingestion Rate | 2[a] | 1[a] | $m^3$/day |
| Exposure Frequency | 350[b] | 350[b] | days/year |
| Exposure Duration | 24[c] | 6[c] | years |
| Exposure Duration$_{LWA}$ | 24[c] | 6[c] | years |
| Body Weight | 70[a] | 15[a] | kg |
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |
| **Incidental Ingestion of Sediment** | | | |
| Ingestion Rate | 17[h] | 34[h] | mg/day |
| Exposure Frequency | 104[i] | 140[i] | days/year |
| Exposure Duration | 24[c] | 6[c] | years |
| Exposure Duration$_{LWA}$ | 24[c] | 6[c] | years |
| Body Weight | 70[a] | 15[a] | kg |
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |
| **Dermal Contact with Sediment** | | | |
| Skin Surface Area | 4,100[f] | 2,000[f] | $cm^2$ |
| Adherence Factor | 1[g] | 1[g] | mg/$cm^2$ |
| Absorption Factor | CSV | CSV | unitless |
| Exposure Frequency | 104[i] | 140[i] | days/year |
| Exposure Duration | 24[c] | 6[c] | years |
| Exposure Duration$_{LWA}$ | 24[c] | 6[c] | years |
| Body Weight | 70[a] | 15[a] | kg |

**Table 6-4**
**Parameters Used to Estimate Potential Exposures for Future Land Use Receptors**

| Pathway Parameters | Resident Adult | Resident Child | Units |
|---|---|---|---|
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |
| **Incidental Ingestion of Surface Water** | | | |
| Ingestion Rate | 0.05[a] | 0.05[a] | liters/hour |
| Exposure Time | 2.6[a] | 2.6[a] | hours/day |
| Exposure Frequency | 104[i] | 140[i] | days/year |
| Exposure Duration | 24[c] | 6[c] | years |
| Exposure Duration$_{LWA}$ | 24[c] | 6[c] | years |
| Body Weight | 70[a] | 15[a] | kg |
| Averaging Time-Noncancer | 8,760[d] | 2,190[d] | days |
| Averaging Time-Cancer | 25,550[e] | 25,550[e] | days |

*Notes:*

a — USEPA (1989) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A)*.
b — Assumes a residential exposure frequency of 365 days per year with one two-week vacation.
c — USEPA (1991), *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)*, OSWER Directive 9285.7-01B.
d — Calculated as the product of ED (years) x 365 days/year.
e — Calculated as the product of 70 years (assumed lifetime) x 365 days per year.
f — Skin surface area (i.e., adult resident – head, forearms and hands; child resident – head, arms, hands, and legs) provided by USEPA Region 4.
g — Specific guidance from USEPA Region 4 (February 11, 1992 New Interim Region 4 Guidance).
h — Values for sediment ingestion rate are based on a soil ingestion rates of 100 milligrams per day for adults and 200 milligrams per day for children and a recreational exposure time of 2.6 hours per day (over a 16-waking hour day.)
i — Recreational exposure frequency assumed to be 104 days per year for adults and 140 days per year for children.
NA — Not applicable.
CSV — Chemical-specific value.
LWA — Lifetime Weighted Average

## 6.3 Toxicity Assessment

A cancer slope factor (CSF) and a reference dose (RfD) are applied to estimate risk of cancer from an exposure and the potential for noncarcinogenic effects to occur from exposure. CSFs have been developed by USEPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risk associated with exposure to potentially carcinogenic contaminants of concern. CSFs which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by estimated intake of a potential carcinogen in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of risk calculated from the CSF. Use of this approach makes underestimation of actual cancer risk highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

This increased cancer risk is expressed by terms such as 1E-6. To state that a chemical exposure causes a 1E-6 added upper limit risk of cancer means that if 1,000,000 people are exposed, one additional incident of cancer is expected to occur. The calculations and assumptions yield an upper limit estimate which assures that no more than one case is expected and, in fact, there may be no additional cases of cancer. USEPA policy has established that an upper limit cancer risk falling below or within the range of 1E-6 to 1E-4 is acceptable.

RfDs have been developed by USEPA for indicating the potential for adverse health effects from exposure to COCs exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are likely to be without risk of an adverse affect. Estimated intakes of COCs from environmental media (e.g., amount of COCs ingested from contaminated groundwater) can be compared to the RfD. RfDs are derived from results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g., to account for use of animal data to predict effects on humans). If the estimated exposure to a chemical expressed as mg/kg/day is less than the RfD, exposure is not expected to cause any noncarcinogenic effects, even if exposure is continued for a lifetime. In other words, if the estimated dose divided by the RfD is less than 1.0, there is no concern for adverse noncarcinogenic effects.

Exposure point concentrations and toxicity potency factors used to calculate human health risk are summarized in Table 6-5.

**Table 6-5**
**Toxicological Database Information for Chemicals of Potential Concern**

| Chemical | Oral Reference Dose (mg/kg/day) | Inhalation Reference Dose (mg/kg/day) | TEF | Cancer Classification |
|---|---|---|---|---|
| Acenaphthene | 0.06[a] | ND | NA | NA |
| Aluminum | 1[d] | ND | NA | ND |
| Arsenic | 0.0003[a] | ND | NA | A |
| Benzene | ND | 0.00171[c] | NA | A |
| Benzo(a)anthracene[g] | ND | ND | 0.1 | B2 |
| Benzo(a)pyrene[g] | ND | ND | 1 | Oral Reference Dose(mg/kg/day) |
| Benzo(b)fluoranthene[g] | ND | ND | 0.1 | Oral Reference Dose (mg/kg/day) |
| Benzo(k)fluoranthene[g] | ND | ND | 0.01 | Oral Reference Dose (mg/kg/day) |
| Beryllium | 0.005[a] | ND | NA | Oral Reference Dose (mg/kg/day) |
| Bis(2-chloroethyl)ether | ND | ND | NA | Oral Reference Dose (mg/kg/day) |
| Bis(2-ethylhexyl)phthalate | 0.02[a] | ND | NA | Oral Reference Dose (mg/kg/day) |
| Cadmium (food) | 0.001[a] | ND | NA | D/B1 |
| Cadmium (water) | 0.0005[a] | ND | NA | D/B1 |
| Carbon disulfide | 0.1[a] | 0.0029[b] | NA | D |
| Chlorobenzene | 0.02[a] | 0.00571[c] | NA | C |
| Chromium | 0.005[a] | ND | NA | A(inh) |
| Copper | 0.0371[b] | ND | NA | D |
| 1,1-Dichloroethane | 0.1[b] | 0.143[c] | NA | D |
| 1,2-Dichlorobenzene | 0.09[a] | 0.04[c] | NA | ND |
| 1,2-Dichloroethene (total) | 0.009[b] | ND | NA | ND |
| 1,3-Dichlorobenzene | 0.089[d] | ND | NA | ND |

**Table 6-5**
**Toxicological Database Information for Chemicals of Potential Concern**

| Chemical | Oral Reference Dose (mg/kg/day) | Inhalation Reference Dose (mg/kg/day) | TEF | Cancer Classification |
|---|---|---|---|---|
| 1,4-Dichlorobenzene | ND | 0.229[a] | NA | Oral Reference Dose (mg/kg/day) |
| 2,4-Dichlorophenol | 0.003[a] | ND | NA | D |
| 4,4'-DDD | ND | ND | NA | Oral Reference Dose (mg/kg/day) |
| Dibenz(a,h)anthracene[d] | ND | ND | 1 | Oral Reference Dose (mg/kg/day) |
| Dieldrin | 0.00005[a] | ND | NA | Oral Reference Dose (mg/kg/day) |
| Heptachlor epoxide | 0.000013[a] | ND | NA | B2 |
| Hexachloroethane | 0.001[a] | ND | NA | C |
| Indeno(1,2,3-cd)pyrene[d] | ND | ND | 0.1 | B2 |
| Lead | ND | ND | NA | B1 |
| Magnesium | 0.014 | ND | NA | ND |
| Manganese | 0.005[a] | 0.0000143[a] | NA | D |
| Mercury | 0.0003[b] | 0.0000857[b] | NA | D |
| Naphthalene | ND | ND | NA | D |
| PCB Aroclor-1260 | 0.00007[a] | ND | NA | B2 |
| Tetrachloroethene | 0.01[a] | ND | NA | C |
| Thallium[a] | 0.00008[a] | ND | NA | ND |
| Titanium | ND | ND | NA | ND |
| Trichloroethene | 0.006[e] | ND | NA | B2 |
| Vanadium | 0.007[b] | ND | NA | D |
| Vinyl chloride | ND | ND | NA | A |
| Yttrium | ND | ND | NA | ND |
| trans-Nonachlor | ND | ND | NA | ND |

***Notes:***
a — Integrated Risk Information System (IRIS)
b — Health Effects Assessment Summary Tables (HEAST).
c — HEAST alternative method
d — Other USEPA documents including USEPA, Region 3's "Risk-based Screening Concentrations Table, Third Quarter 1994, July 1994."
e — USEPA Environmental Criteria and Assessment Office – Cincinnati

| | | |
|---|---|---|
| g | — | The oral and inhalation cancer potency factors of 7.3 and 6.1 [(mg/kg/day)-1], for benzo(a)pyrene, respectively, were used for all other PAHs. As reported in the Exposure Assessment Section of the risk assessment, toxicity equivalency factors (TEFs) were applied to carcinogenic PAHs to convert their concentrations to an equivalent concentration of benzo(a)pyrene. |
| h | — | The oral reference dose for thallium carbonate was substituted for thallium. |
| ND | — | Not determined due to lack of information in available toxicological databases. |
| NA | — | Not applicable or available. |
| A | – | Sufficient evidence in epidemiologic studies to support casual association between exposure and cancer |
| B1 | – | Limited evidence in epidemiological studies |
| B2 | – | Sufficient evidence from animal studies |
| C | – | Limited evidence from animal studies and inadequate or no data in humans |
| D | – | Inadequate or no human and animal evidence of carcinogenicity |
| E | – | No evidence of carcinogenicity in at least two adequate animal tests in different species or in adequate epidemiologic and animal studies |

## 6.4 Risk Characterization

For carcinogens, risk is estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess life time cancer risk is calculated from the following equation:

$$\text{RISK} = \text{CDI X CSF}$$

where:

risk = a unit less probability (e.g., 2 x $10^{-5}$) of an individual developing cancer

CDI = chronic daily intake averaged over 70 years (mg/kg-day)

CSF = slope factor, expressed as $(\text{mg/kg-day})^{-1}$

These risks are probabilities that are generally expressed in scientific notation (e.g., $1X10^{-6}$ or $1E^{-6}$). An excess lifetime cancer risk of 1 X $10^{-6}$ indicates that, as a reasonable maximum estimate, an individual has a one in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under specific exposure conditions at OU 10.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time (e.g., lifetime) with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called an HQ. By adding the HQs for all COCs that affect the same target organ within a medium or across all media to which a given population may reasonably be exposed, the HI can be generated.

The HQ is calculated as follows:

**Noncancer HQ** = **CDI/RfD**

where:

CDI = Chronic Daily Intake

RfD = Reference Dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

To evaluate estimated cancer risks, a risk level lower than $1x10^{6}$ is considered a minimal or *de minimis* risk. The USEPA accepts a risk range of $1x10^{6}$ to $1x10^{-4}$ before a response action is required. However, the State of Florida does not accept risk greater than $1x10^{6}$. A risk level greater than $1x10^{-6}$ is evaluated further to determine a remedial action to decrease the estimated risk to acceptable levels.

An HI of less than unity (1.0) indicates the exposures are not expected to cause adverse health effects. An HI greater than one (1.0) requires further evaluation. For example, although HQs of the several chemicals present are added and exceed 1.0, further evaluation may show that their toxicities are not additive because each chemical affects different target organs. When total effects are evaluated on an effect and target organ basis, the HI of the separate chemicals may be at acceptable concentrations.

Carcinogenic risks and noncarcinogenic hazards were evaluated for potential exposures to media-specific COCs in surface soil, surface water, surface sediment, and groundwater. Receptor populations were potentially exposed workers, trespassers, and future residents who could, theoretically, use groundwater for a household water source. Risks and hazards for the identified COCs are summarized in Table 6-6.

Estimated potential exposure to COCs in surface water or sediment did not result in unacceptable carcinogenic risk or noncarcinogenic hazard. Current site workers and potential child trespassers did not have an individual pathway or combined single medium pathway with an HI in excess of 0.6 or an ILCR greater than 2E-6. The cross-pathway HI and cancer risk for these two receptor types were also within the acceptable carcinogenic risk range. These projections indicate that neither group is at significant risk of deleterious health effects resulting from RME to all media. These receptor groups do not warrant further consideration.

**Table 6-6**
**Risk and Hazard for Identified COCs and Pathways of Concerns**

| | Potential Future Land Use | | |
|---|---|---|---|
| **Chemical** | **Resident Adult HI** | **Resident Child HI** | **Resident lwa ILCR** |
| **Soil Ingestion Pathway** | | | |
| Chromium (as VI) | 0.2 | 2.3 | ND |
| Aluminum | 0.023 | 0.224 | |
| Benzo(a)pyrene | ND | ND | 3.50e-06 |
| Dibenz(a,h)anthracene | ND | ND | 8.00e-07 |
| **Soil Ingestion Pathway Hazard** | 0 | 3 | |
| **Soil Ingestion Pathway Risk** | | | 4.00e-06 |
| **Soil Dermal Contact Pathway** | | | |
| Chromium | 0.1 | 0.1 | ND |
| Benzo(a)pyrene | ND | ND | 1.40e-06 |
| Dibenz(a,h)anthracene | ND | ND | 3.10e-07 |
| **Soil Dermal Contact Hazard** | 0 | 0 | |
| **Soil Dermal Contact Risk** | | | 2.00e-06 |
| **Shallow/Intermediate Groundwater Ingestion Pathway** | | | |
| 1,2-Dichlorobenzene | 0.4 | 0.8 | ND |
| 1,3-Dichlorobenzene | 0.08 | 0.2 | ND |
| 1,4-Dichlorobenzene | 0.1 | 0.1 | 1.60e-04 |
| Aluminum | 0.24 | 0.55 | ND |
| Arsenic | 0.7 | 1.7 | 2.00e-04 |

**Table 6-6**
**Risk and Hazard for Identified COCs and Pathways of Concerns**

| Chemical | Potential Future Land Use<br>Resident Adult HI | <br>Resident Child HI | <br>Resident lwa ILCR |
|---|---|---|---|
| Bis(2-ethylhexyl)phthalate | 0.01 | 0.03 | 1.67e-06 |
| Cadmium (water) | 0.6 | 1.4 | ND |
| Chlorobenzene | 0.4 | 1 | ND |
| Chromium | 0.1 | 0.24 | ND |
| Manganese | 1.06 | 2.47 | ND |
| Mercury | 0.06 | 0.13 | ND |
| Tetrachloroethene | 0.02 | 0.1 | 5.70e-06 |
| Vinyl chloride | ND | ND | 9.10e-05 |
| **Shallow/Intermediate Groundwater Ingestion Hazard** | 4 | 9 | |
| **Shallow/Intermediate Groundwater Ingestion Risk** | | | 5.00e-04 |
| **Shallow/Intermediate Groundwater Inhalation Pathway** | | | |
| 1,2-Dichlorobenzene | 0.8 | 1.9 | ND |
| 1,3-Dichlorobenzene | 0.08 | 0.2 | ND |
| **Shallow/Intermediate Groundwater Inhalation Pathway** | | | |
| 1,4-Dichlorobenzene | 0.1 | 0.1 | 1.60e-04 |
| Chlorobenzene | 1.5 | 3.6 | ND |
| Tetrachloroethene | 0.02 | 0.05 | 2.21e-07 |
| Vinyl chloride | ND | ND | 1.40e-05 |
| **Shallow/Intermediate Inhalation Hazard** | 2 | 6 | |
| **Shallow/Intermediate Inhalation Risk** | | | 2.00e-04 |
| **Deep Groundwater Ingestion Pathway** | | | |
| Aluminum | 0.1 | 0.2 | ND |
| Arsenic | 0.4 | 1 | 1.25e-04 |
| **Deep Groundwater Ingestion Hazard** | 1 | 1 | |
| **Deep Groundwater Ingestion Risk** | | | 1.00e-04 |

*Notes:*
HI – Hazard Index
Lwa – Lifetime Weighted Average
ILCR – Incremental Lifetime Cancer Risk
ND – Not detected

## 6.5 Soil Performance Standards for Groundwater Protection

The potential for groundwater contamination due to site COCs was also assessed by comparing constituent concentrations in soil with guidance concentrations protective of groundwater (as identified in FDEP's *Soil Cleanup Goals*). These values were used because they are more conservative estimates for groundwater protection than USEPA values. These concentrations are "to be considered" (TBC) criteria for the site. Nineteen COCs were identified as exceeding guidance concentrations when soil concentrations were compared to leaching criterion:

| *Type A* | *Type B* | *Type C* |
|---|---|---|
| Chlorobenzene | Xylene | Benzo(a)pyrene |
| 1,2-Dichlorobenzene | Phenol | Phenanthrene |
| 1,3-Dichlorobenzene | Acenaphthene | Pentachlorophenol |
| 1,4-Dichlorobenzene | Dieldrin | Bis(2-chloroethyl)ether |
| Bis(2-ethylhexyl)phthalate (BEHP) | Endosulfan | |
| Naphthalene | Acetone | |
| | DDE | |
| | DDT | |
| | alpha-BHC | |

***Type A*** constituents were defined as those exceeding Florida guidance concentrations for leachability in soil and promulgated maximum contaminant levels (MCLs) or Florida guidance concentrations in groundwater. Type A compounds in groundwater (except BEHP) are concentrated beneath and east (downgradient) of Sites 32 and 33; these compounds are targeted by the RCRA groundwater recovery system, as they were present in RCRA units at Sites 32 and 33. Soil containing these compounds (except for BEHP) is adjacent to or east of Sites 32 and 33. Because of this, it is not possible to distinguish between groundwater contamination attributable to soil contamination or the former RCRA units. For this reason, FDEP leachability-based guidance concentrations for Type A constituents have been retained as site COCs for developing PRGs. (BEHP, a common laboratory contaminant, is not expected to be present in site soil, and therefore has not been retained as a site COC.)

***Type B*** compounds were present in both soil and groundwater. They exceeded Florida guidance concentrations for leachability in soil, but were below MCLs or Florida guidance concentrations in groundwater. Type B compounds are present in soil above FDEP guidance concentrations at various locations at OU 10, primarily single-boring detections; contaminant mass associated with these detections is expected to be low. The spatial distribution of Type B compounds in groundwater does not necessarily correlate with soil borings containing soil contamination above FDEP leachability-based guidance concentrations. However, groundwater contamination associated with these compounds is also concentrated primarily beneath Site 32 and is being addressed by the RCRA groundwater recovery system. Because groundwater monitoring is required as part of the RCRA groundwater recovery program, Type B constituents were not included in developing site-specific PRGs.

***Type C*** compounds were present in soil at concentrations exceeding Florida guidance concentrations for leachability in soil, but not detected in groundwater. The spatial distribution of Type C compounds in soil above FDEP guidance concentrations is limited to primarily single-boring detections; contaminant mass associated with these detections is expected to be low. Because these compounds are not impacting groundwater, and ongoing groundwater monitoring is required under the RCRA groundwater recovery program, these compounds were not included in developing site-specific PRGs.

The State of Florida considers these TBC criteria applicable to OU 10.

## 6.6 Risk Uncertainty

The following areas of uncertainty were associated with the estimation of chemical uptake from exposure to groundwater.

Exposure scenarios based on USEPA guidance use conservative assumptions, which means actual risk will not be greater than the estimate and may be lower. For this reason, estimated cancer risks based on USEPA guidance, such as these presented in this document, may not represent actual risks to the population.

Because of data set limitations, the 95th percentile may exceed the maximum concentration reported in some evaluations. This may occur when there are a large number of nondetects and the detection limits are unusually high due to interferences in the analyses. In these cases, consistent with USEPA Region IV guidance, the maximum reported values were used as exposure point concentrations to estimate human exposures. Although use of maximum values is generally recognized as an appropriate screening approach, it should be recognized that this procedure may overestimate actual exposure.

This is also the case for use of detection limits as nondetect values when a chemical has been reported as not detected in most of the samples collected and analyzed. Since some nondetects may be zero, assuming that a concentration equal to half the detection limit is present instead of zero may overestimate actual chemical concentrations onsite. This is particularly true if interfering chemicals affect the analyses and the nondetect value is elevated.

Environmental sampling and analysis can contain significant errors and artifacts. At this site, data are believed to adequately and accurately represent current conditions.

When long-term health effects are evaluated, it is assumed that chemical concentrations are constant for the exposure period being evaluated. This may not be accurate since reported chemical concentrations are changing due to various degradation processes (i.e., dilution by uncontaminated water, sorption, dispersion of contaminated groundwater, volatilization, biodegradation, chemical degradation, and photo degradation). Use of steady-state conditions will likely overestimate exposure.

Exposures to vapors and dust at the site, dermal contact with groundwater from household uses other than bathing (i.e., laundry, washing dishes), and other possible exposures to surface soil and surface water were not evaluated. Although these and other exposures could occur, magnitudes of these exposures are expected to be much lower than exposures evaluated, and would not quantitatively affect the total health impact from the site.

Since groundwater in the surrounding area is not used for drinking water or for other household water needs, exposures related to drinking and bathing are theoretical and relate to potential future exposures. This is unlikely since the domestic treatment plant is still operating and the area will remain industrial.

The following are uncertainties associated with estimation of risks:

In hazard and risk evaluations, risks or hazards presented by several chemicals reported for the same exposure have been added to provide a sum of estimated total risk or hazard for that particular exposure. This is a conservative assumption and is scientifically accurate only in those instances where health effects of individual chemicals are directed at the same effect and same target organ. Effects may be additive, synergistic, or antagonistic. Since a large number of chemicals have no similarity as to their noncarcinogenic action or target of their action, this approach may overestimate risk.

Risks calculated from slope factors are derived using a linearized multistage procedure; therefore, they are likely to be conservative upper-bound estimates. Actual risks may be much lower.

There is a degree of uncertainty regarding the RfD for manganese in the groundwater ingestion scenario. There is currently a debate whether it is appropriate to separate exposures from food and water as currently done by Integrated Risk Information System (IRIS) for some chemicals and, in particular, for manganese and some other inorganics. Due to the high degree of uncertainty associated with the present RfD of 0.005 mg/kg/day for manganese, the RfD determination is scheduled for USEPA review. The current USEPA RfD for manganese in water of 0.005 mg/kg/day was used to evaluate risks concerning manganese drinking water intake.

## 6.7 Human Health Risk Summary

Risk and/or hazard associated with exposure to all environmental media (and combinations) was within USEPA's generally acceptable ranges for both current site workers and potential current child trespassers.

For an unlikely hypothetical future site resident, exposure media were shown to exceed acceptable residential goals. These media included surface soil, shallow/intermediate groundwater, and deep groundwater.

### Surface Soil RGOs

Table 6-7 provides remedial goal options (RGOs) for the combined surface soil pathway (ingestion and dermal contact). The RGOs for benzo(a)pyrene and dibenz(a,h)anthracene apply to the identified hot spot. Remediating soil in the limited area will reduce potential human health risk to below acceptable goals.

**Shallow/Intermediate Groundwater RGOs**

Table 6-8 provides RGOs for the combined shallow/intermediate groundwater pathways (ingestion/inhalation exposures). Arsenic, chromium, hexachloroethane, and mercury are below corresponding applicable or relevant and appropriate regulations (ARARs) which may influence remediation concentrations deemed necessary. Arsenic and cadmium, which account for greater than 30% of the hazard, may be associated with saltwater intrusion. Manganese is considered to be associated with natural geology.

**Table 6-7**
**Remedial Goal Options for Surface Soil (0 to 1 foot depth interval)**

| Chemical | Carcinogenic Risk-Based RGOs Risk Goal 1E-04 | 1E-05 | 1E-06 | Hazard-Based RGOs Hazard Quotient Goal 10 | 1 | 0.1 | Unadjusted EPC (mg/kg) | Reference Concentration (mg/kg) | Risk-Based Screening Value (mg/kg) | Source | Soil HI-child | Soil Risk-Lwa |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | NA | NA | NA | 744898 | 74490 | 7449 | 17500 | 3833 | 3700 | RBCr | 0.2349315 | 0 |
| Chromium VI | NA | NA | NA | 3724 | 372 | 37 | 910 | 6.1 | 39 | RBCr | 2.4432877 | 0 |
| Chromium III | NA | NA | NA | 744898 | 74490 | 7449 | 910 | 6.1 | 7800 | RBCr | | |
| Benzo(a)pyrene | 126 | 13 | 1.3 | NA | NA | NA | 6.2 | NA | 0.088 | RBCr | 0 | 4.9E-06 |
| Dibenzo(a,h)anthracene | 126 | 13 | 1.3 | NA | NA | NA | 1.4 | NA | 0.088 | RBCr | 0 | 1.109E-06 |

***Notes:***
NA — Indicates an RGO was not applicable for this chemical under risk and/or hazard-based conditions.
ND — Indicates the chemical was not detected in reference (background) surface soil samples.
RBCr — Indicates the risk (1E-6) or hazard (HQ=0.1) based screening value as presented in USEPA Region 3, "Risk-Based Screening Concentration Tables", March 18, 1994.
EPC — Exposure Point Concentration
No risk-based RGOs were calculated for the combined soil pathway (ingestion and dermal) because the combined risk was computed to be <1E-4.
Noncarcinogenic hazard-based RGOs were computed on the future child site resident scenario with combined ingestion and dermal exposure (where applicable).
Carcinogenic risk-based RGOs were computed based on the future site resident lifetime weighted average scenario with combined ingestion and inhalation exposure (where applicable).
The RGO for trivalent chromium is approximately 200 times that of hexavalent chromium.

**Table 6-8**
**Remedial Goal Options for Shallow/Intermediate Groundwater**

| Chemical | Carcinogenic Risk-Based RGOs | | | Hazard-Based RGOs Hazard Goal | | | EPC (mg/L) | Reference Concentration (mg/L) | ARAR (mg/L) | Source |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1.00e-04 | 1.00e-05 | 1.00e-06 | 10 | 1 | 0.1 | | | | |
| 1,2-Dichlorobenzene | NA | NA | NA | 4.35 | 0.435 | 0.043 | 1.17 | NA | 0.6 | FPDWS |
| 1,3-Dichlorobenzene | NA | NA | NA | 6.96 | 0.696 | 0.070 | 0.274 | NA | 0.01 | FSDWS-OL |
| 1,4-Dichlorobenzene | 1.40e-01 | 1.00e-02 | 1.4E-03 | 17.92 | 1.792 | 0.179 | 0.442 | NA | 0.075 | FPDWS |
| Aluminum | NA | NA | NA | 156.40 | 15.64 | 1.564 | 8.66 | 3.82 | 0.2 | FSDWS-OL |
| Arsenic | 3.8E-03 | 3.8E-04 | 3.8E-05 | 0.05 | 0.005 | 0.0005 | 0.0077 | NA | 0.05 | FPDWS |
| Benzene | 1.10e-01 | 1.00e-02 | 1.14E-03 | 0.24 | 0.024 | 0.002 | 0.0016 | NA | 0.001 | FPDWS |
| Bis(2-ethylhexyl)phthalate | 4.80e-01 | 5.00e-02 | 4.78E-03 | 3.11 | 0.311 | 0.031 | 0.008 | NA | 0.006 | FPDWS |
| Cadmium | NA | NA | NA | 0.08 | 0.008 | 0.0008 | 0.011 | 0.0096 | 0.005 | FPDWS |
| Chlorobenzene | NA | NA | NA | 0.70 | 0.07 | 0.007 | 0.321 | NA | 0.1 | FPDWS |
| Chromium | NA | NA | NA | 0.78 | 0.078 | 0.008 | 0.0191 | 0.0325 | 0.1 | FPDWS |
| Hexachloroethane | 2.40e-01 | 2.00e-02 | 0.00244 | 0.08 | 0.008 | 0.001 | 0.0011 | NA | 0.01 | FDWS-C |
| Manganese | NA | NA | NA | 0.78 | 0.078 | 0.008 | 0.193 | 0.022 | 0.05 | FSDWS |
| Mercury | NA | NA | NA | 0.05 | 0.005 | 0.0005 | 0.000624 | NA | 0.002 | FPDWS |
| Tetrachloroethene | 1.20e-01 | 1.20e-02 | 1.20e-03 | 0.78 | 0.078 | 0.008 | 0.0073 | NA | 0.003 | FPDWS |
| Vinyl Chloride | 0.0031 | 3.10e-04 | 0.000031 | NA | NA | NA | 0.00321 | NA | 0.001 | FPDWS |

***Notes:***
NA – Indicates an RGO was not applicable for this chemical under risk and/or hazard-based conditions.
ND – Indicates the chemical was not detected in reference (background) wells.
Noncarcinogenic hazard-based RGOs were computed based on the future child site resident scenario with combined ingestion and inhalation exposure (where applicable).
Carcinogenic risk-based RGOs were computed based on the future site resident lifetime weighted average scenario with combined ingestion and inhalation exposure (where applicable).
FPDWS – Means Florida Primary Drinking Water Standard.
FSDWS-OL – Indicates Florida secondary drinking water standard.
FDWS-C – Indicates Florida guidance concentration based on carcinogenicity.
* – Indicates the inhalation pathway was not considered in establishing RGOs.
EPC – Exposure Point Concentration
mg/L – milligrams per liter

**Deep Groundwater RGOs**

The RGOs for deep groundwater pathway are provided in Table 6-9. Each COC is potentially related to saltwater intrusion and/or suspended sediment in samples. The arsenic concentration is below its corresponding ARAR.

## 6.8 Ecological Considerations

Ecological risk was assessed to determine actual or potential effects of contamination at OU 10 to ecological receptors such as plants and animals. This assessment focused on both land at OU 10 and contamination in groundwater discharging to nearby surface water bodies. Potential impacts to wetlands near OU 10 and the southern drainage ditch will be evaluated during the Site 41, NAS Pensacola Wetlands, RI. Potential impacts to Pensacola Bay (Site 42) and Bayou Grande (Site 40) from groundwater contaminants will be assessed during RIs at those sites. Risk from soil north of the IWTP is limited to metals in surface soil. Risk associated with concentrations present is most likely minimal. Because the IWTP is industrial and there is considerable human activity, wildlife habitat is absent and avian and terrestrial wildlife are not drawn to the site. Contact with soil would be limited to animals traveling across the area only. Therefore, soil contaminant concentrations identified do not present an unacceptable risk to the environment.

An initial groundwater study was conducted to evaluate whether ecological effects occur from contaminated groundwater discharging into surface water bodies. The only organic compound detected in shallow groundwater that may possibly impact ecological receptors in surface water was dieldrin. Metals that could potentially affect ecological receptors include: cadmium, chromium, lead, mercury, and zinc. All contaminants will be studied further during the Pensacola Bay, Bayou Grande, and NAS Pensacola Wetlands investigations.

**Table 6-9**
**Remedial Goal Objectives for Deep Groundwater**

| | Carcinogenic Risk-Based RGOs Risk Goal | | | Noncarcinogenic Hazard-Based RGOs (mg/L) Hazard Index Goal | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Chemical** | **1.00e-04** | **1E-05** | **1E-06** | **10** | **1** | **0.1** | **Exposure Point Concentration (mg/L)** | **Reference Concentration (mg/L)** | **ARAR (mg/L)** | **Source** |
| Aluminum* | NA | NA | NA | NA | NA | NA | 11.8 | ND | 0.05-0.2 | FSDWS/SMCL |
| Arsenic* | 4E-03 | 4E-04 | 4E-05 | 0.05 | 0.005 | 0.0005 | 0.0048 | ND | 0.05 | FPDWS/SMCL |

***Notes:***
NA — Indicates an RGO was not applicable for this chemical under risk and/or hazard-based conditions.
ND — Indicates the chemical was not detected in reference (background) wells.
FSDWS — Means Florida Secondary Drinking Water Standard, SMCL means Secondary Maximum Contaminant Levels
* — Indicates the inhalation pathway was not considered for deep groundwater COCs in establishing RGOs.
mg/L — milligrams per liter
Noncarcinogenic hazard-based RGOs were computed based on the future child site resident scenario with combined ingestion and inhalation exposure (where applicable).
Carcinogenic risk-based RGOs were computed based on the future site resident lifetime weighted average scenario with combined ingestion and inhalation exposure (where applicable).

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## 7.0 DESCRIPTION OF THE REMEDIAL ALTERNATIVES

The OU 10 FFS report presented the results of the detailed analysis of four potential remedial action alternatives. These alternatives have been developed to provide a range of remedial actions for the site. This section of the ROD summarizes the four alternatives that are described in the FFS report, which include:

- No action with continued groundwater treatment under the RCRA program;
- Institutional controls with groundwater treatment under the RCRA program modified to meet CERCLA requirements;
- Capping with groundwater treatment under the institutional controls alternative; and
- Excavation with groundwater treatment under the institutional controls alternative.

Four remedial action alternatives were developed to address contaminated groundwater and soil and various areas of concern (AOCs) within OU 10. Performance standards are defined in Section 9. The AOCs were identified by comparing media-specific contaminant concentrations detected at OU 10 to media-specific remediation goals developed in the FFS. The AOCs identified for OU 10 include:

- Contaminated soil above performance standards
- Contaminated soil above FDEP leachability guidance (TBCs)
- Contaminated groundwater above performance standards

Figure 7-1 shows the general location of the above-mentioned AOCs for soil and groundwater. Table 7-1 summarizes the remedial objectives for soil. A concise description of how each alternative will address contamination at OU 10 as well as estimated cost follows.

**Table 7-1**
**Soil Remedial Objectives**

| Objective | Location | Contaminated Media Estimated Volume (CY) | Rationale |
|---|---|---|---|
| Eliminate human health risk above $1x10^{-6}$ for residential land use. | West of closed ISDBs (Area A) | 185 | Benzo(a)pyrene and dibenz(a,h)anthracene above risk levels |
| Protect groundwater from leachable compounds. | Swale (Area B)<br>Swale (Area C)<br>North of operations building (Area D) | 130<br>270<br>370 | Chlorinated benzenes and naphthalene above performance standards |

## 7.1 Alternative 1: No Action

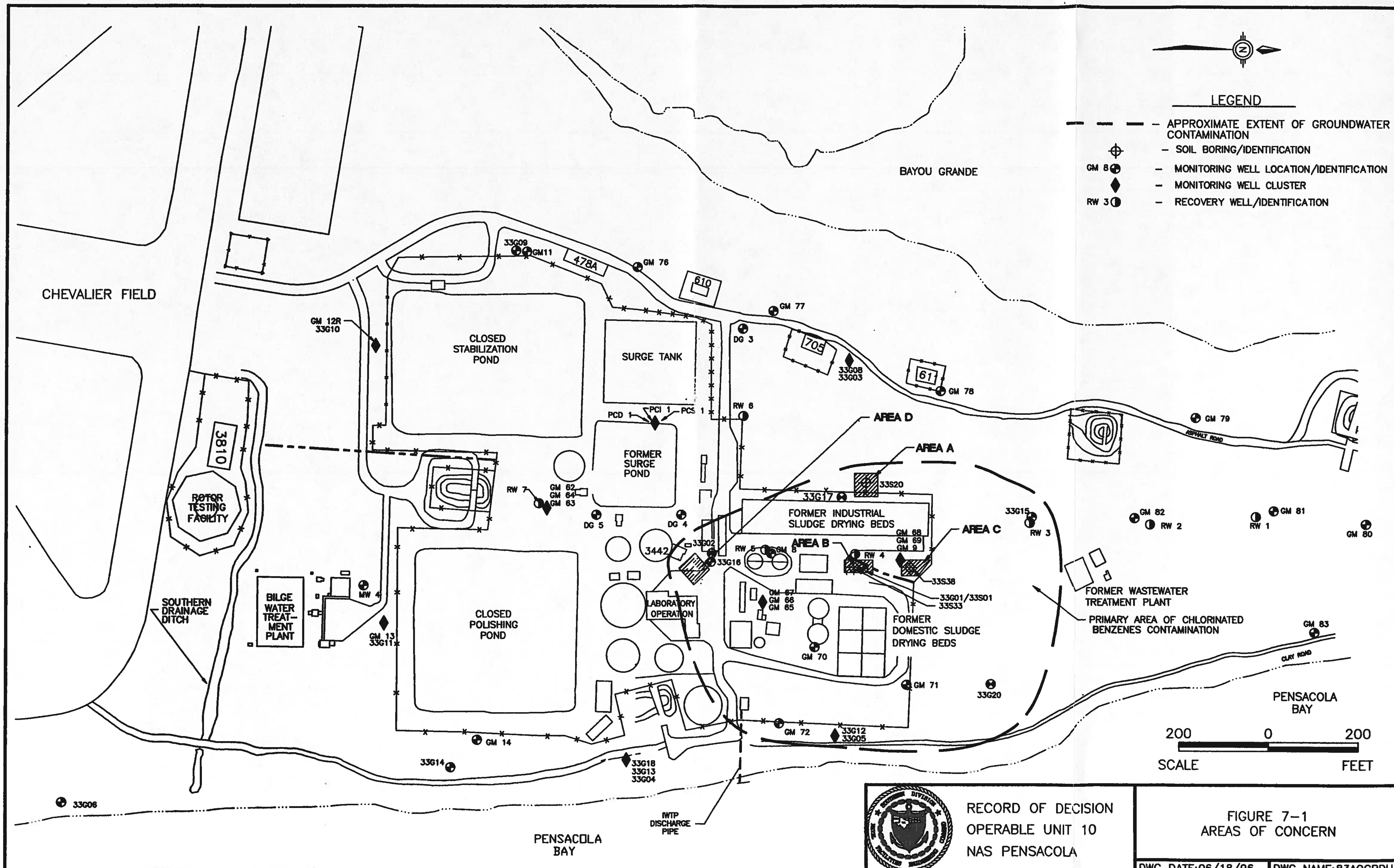
Capital Cost: $0

Annual Operation and Maintenance (O&M) Costs: $0

Net Present Worth $0

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires consideration of a no-action alternative to serve as a baseline against which other alternatives are compared. In the no-action alternative, no further action will be taken to contain, remove, or treat soil contaminated above risk- or leachability-based performance standards. Recovered groundwater will continue to be treated and disposed at the wastewater treatment plant in accordance with the RCRA permit.

Health risks for the future resident will remain and no chemical-specific ARARs will be met. This alternative does not meet the effectiveness criterion as it does not reduce future child exposures to benzo(a)pyrene and dibenz(a,h)anthracene.




RECORD OF DECISION
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 7-1
AREAS OF CONCERN

DWG DATE:06/18/96 DWG NAME:83AOCRDU

### 7.2 Alternative 2: Institutional Controls

| | |
|---|---|
| Capital Cost: | $130,000 |
| Annual O&M Costs: | $0.00 |
| Net Present Worth: | $130,000 |

During the RD/RA period after the ROD is issued, a leachability study will be conducted to demonstrate whether contaminants in soil above Florida cleanup goals are contributing significantly to groundwater contamination onsite. If the leachability study demonstrates that groundwater is being impacted by soil contaminants, Alternative 4 is the contingency remedy and the capital costs of the alternative would increase by $247,000 to a total of $377,000.

Institutional controls will maintain industrial use and limit exposure to contaminated groundwater. This alternative eliminates risk to potential child residents by not allowing the site to be residential. In addition, the Navy will meet the groundwater performance standards. Modification of the RCRA corrective action groundwater treatment system will include the groundwater performance standards as a permit requirement. Attainment of standards will be confirmed through groundwater monitoring. Because the RCRA system is operating and can be modified to meet the performance standards for groundwater onsite, no other alternatives for groundwater are evaluated.

### 7.3 Alternative 3: Capping

| | |
|---|---|
| Capital Cost: | $79,000 |
| Annual O&M Costs (for 30 years): | $6,000 |
| Net Present Worth: | $185,000 |

In the capping alternative, all four areas will be capped with asphalt. Caps will reduce risk of contact with contaminated soil and reduce quantity of leachate generated when rainwater filters through contaminated soil. The present worth cost of this alternative is estimated at $185,000, assuming 30 years of maintenance.

## 7.4 Alternative 4: Excavation with Offsite Disposal

| | |
|---|---|
| Area A Excavation with Offsite Disposal | $56,500 |
| Area B Excavation with Offsite Disposal | $47,850 |
| Area C Excavation with Offsite Disposal | $66,550 |
| Area D Excavation with Offsite Disposal | $76,100 |
| Total Capital Cost: | $247,000 |
| Annual O&M Costs: | $0 |
| Net Present Worth: | $247,000 |

In the excavation and offsite disposal alternative, soil exceeding PRGs will be removed from OU 10 and disposed at an approved Subtitle D landfill to remove all current and future threats to human health and the environment posed by soil contamination. This alternative will provide for unrestricted land use at OU 10. Soil will be sampled at the excavation extent to verify that soil remaining meets performance standards. The excavation will be backfilled with clean soil.

Total costs presented above for the four area removals are $247,000 including engineering services/report preparation, and contingency costs. The cost estimate supplied by the Navy for engineering services/report preparation is $100,000. Dewatering may be required during removal activities. Short-term dewatering costs are expected to be $10,000 per week for equipment rental and operation.

## 7.5 Applicable or Relevant and Appropriate Requirements (ARARs)

The remedial action for OU 10, under CERCLA Section 121(d), must comply with federal and state environmental laws that are either applicable or relevant and appropriate. Applicable requirements are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encountered onsite that their use is well-suited to the particular site. TBC criteria are nonpromulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup to protect health or the environment.

The affected groundwater in the aquifer beneath OU 10 has been classified by USEPA and Florida as Class IIA and G-1, a source of drinking water. It is Florida and USEPA's policy that groundwater resources be protected and restored to their beneficial uses. A complete definition for USEPA's groundwater classification is provided in the *Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy*, Final Draft, December 1986. Florida groundwater classification is defined in Chapter 62-520, Groundwater Classes, Standards, and Exemptions.

While TBCs do not have the status of ARARS, the approach to determining whether a remedial action is protective of human health and the environment involves considering TBCs along with ARARs.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely on the basis of location. Examples of location-specific ARARs include state and federal requirements to protect floodplains, critical habitats, and wetlands, along with solid and hazardous waste facility siting criteria. Table 7-2 summarizes the potential location-specific ARARs for OU 10.

**Table 7-2**
**Potential Location-Specific ARARs**

| | Location | Citation |
|---|---|---|
| TBC | Several wetlands on Magazine Point fit the definition of a wetland | Executive Order 11990 Wetlands Protection Policy |
| R&A | Sets forth minimum requirements for design, construction, and operation for RCRA facilities within a 100-year floodplain | RCRA Location Requirements 40 CFR 264.18(c) |

*Notes:*

R&A — Relevant and appropriate requirements which while they are not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at OU 10, address problems or situations sufficiently similar to those encountered at this site that their use is well-suited.

TBC — To-Be-Considered Criteria are nonpromulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of health or the environment.

CFR — Code of Federal Regulations

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, various requirements can be ARARs. Table 7-3 lists potential action-specific ARARs and TBCs for the selected and contingency soil remedy for OU 10.

**Table 7-3**
**Potential Action-Specific ARARs for the Selected Remedy and Contingent Remedial Action**

| | Location | Citation |
|---|---|---|
| **Clean Water Act – 33 U.S.C. §§ 1251-1376** | | |
| R&A | 40 CFR Part 131 – Ambient Water Quality Criteria | Ambient water standards for the protection of human health and aquatic life. |
| R&A | 40 CFR Part 122, 125, 129, 136 – Clean Water Act Discharge Limits NPDES Permit, 40 CFR 403.5 – Pretreatment Standards | Requires permits for the discharge of pollutants for any point source into waters of the United States. |

**Table 7-3**
**Potential Action-Specific ARARs for the Selected Remedy and Contingent Remedial Action**

| | Location | Citation |
|---|---|---|
| **Clean Water Act — 33 U.S.C. §§ 1251-1376** | | |
| R&A | 40 CFR Part 141 National Primary Drinking Water Standards | Specifies sampling, analytical, and monitoring requirements for public water systems. |
| **Resource Conservation and Recovery Act – 42 U.S.C. §§ 6901-6987** | | |
| R&A | 40 CFR Part 261 – Identification & Listing of Hazardous Wastes | Characterization of hazardous waste. |
| R&A | 40 CFR Part 262 – Standards Applicable to Generators of Hazardous Waste | General requirements for identifying and managing hazardous wastes and manifest requirements for hazardous wastes |
| R&A | 40 CFR Part 263 – Standards Applicable to Transporters of Hazardous Waste | Establishes standards which apply to transporting hazardous waste within the U.S., if required under 40 CFR 262. |
| R&A | 40 CFR Part 264 – Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities | Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store, or dispose of hazardous wastes. |
| R&A | 40 CFR 268 – RCRA Land Disposal Restrictions. | Certain classes of waste are restricted from land disposal without acceptable treatment. |
| R&A | 49 CFR Parts 107 and 171-179 – Department of Transportation Rules for the Transport of Hazardous Substances. | Regulates the labeling, packaging, and transportation of solid and hazardous wastes offsite. |
| **Clean Air Act – 42 U.S.C. §§ 7401-7642** | | |
| R&A | 40 CFR Part 50 – National Primary and Secondary Ambient Air Quality Standards | Establishes standards for ambient air quality to protect public health and welfare. |
| **State of Florida Regulations** | | |
| R&A | FAC Title 62 Chapter 62-4 Florida Rules on Permits | Establishes requirements and procedures for all permitting. |
| R&A | Florida Hazardous Substance Release Notification | Establishes notification requirements for hazardous substance releases. |

**Table 7-3**
**Potential Action-Specific ARARs for the Selected Remedy and Contingent Remedial Action**

| | Location | Citation |
|---|---|---|
| **State of Florida Regulations** | | |
| R&A | Florida Hazardous Waste Rules<br>Title 62 Chapter 62-730 | Establishes standards for generators and transporters of hazardous wastes, and owners and operators of hazardous waste facilities, outlining permitting requirements. |
| TBC | Well Permits | Establishes local criteria for design and installation of monitoring wells. |

*Notes:*

R&A — Relevant and appropriate requirements which, while they are not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance onsite, address problems or situations sufficiently similar to those encountered at OU 10 that their use is well-suited to the site.

TBC — To-Be-Considered Criteria are nonpromulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of health or the environment.

Chemical-specific ARARs are specific numerical quantity restrictions on individually listed chemicals in specific media. Examples of chemical-specific ARARs include the MCLs specified under the Safe Drinking Water Act as well as the ambient water quality criteria that are enumerated under the Clean Water Act. Since there are usually numerous chemicals of concern for any remedial site, various numerical quantity requirements can be ARARs. Table 7-4 lists potential chemical-specific ARARs for OU 10.

**Table 7-4**
**Potential Chemical-Specific ARARs**

| | Citation | Location |
|---|---|---|
| **Clean Water Act – 33 U.S.C. §§ 1251-1376** | | |
| A | 40 CFR Part 131 – Ambient Water Quality Criteria | Suggested ambient standards for the protection of human health and aquatic life. |
| **Resource Conservation and Recovery Act – 42 U.S.C. §§ 6901-6987** | | |
| R&A | 40 CFR Part 261 – Identification and Listing of Hazardous Wastes | Defines solid wastes subject to regulation as hazardous wastes under 40 CFR Parts 263-265 and Parts 124, 270, and 271. |
| R&A | 40 CFR Part 262 – Standards Applicable to Generators of Hazardous Waste | Establishes standards for generators of hazardous waste. |
| **Clean Air Act – 42 U.S.C. §§ 7401-7642** | | |
| R&A | 40 CFR Part 50 – National Primary and Secondary Ambient Air Quality Standards | Establishes standards for ambient air quality to protect public health. |
| **Safe Drinking Water Act – 40 U.S.C. §§ 300** | | |
| R&A | 40 CFR Part 141 – National Primary Drinking Water Standards | Establishes MCLs which are health-based standards for public water systems. |
| R&A | PL No. 99-339 100 Stat. 462 (1986) – Maximum Contaminant Level Goals (MCLGs) | Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects with an adequate margin of safety. |
| **State of Florida Regulations** | | |
| A | Florida Water Quality Standards Title 62 Chapter 62-3 | Establishes minimum water quality criteria for groundwater. |
| A | Florida Surface Water Standards Title 62 Chapter 62-301 and 62-302 | Establishes water quality standards for all waters of the state. |
| A | Florida Groundwater Classes, Standards, and Exemptions Chapter 62-520 | Establishes protective minimum criteria for state groundwater. |
| A | Florida Drinking Water Standards, Monitoring and Reporting Title 62 Chapter 62-550 | Establishes MCLs for drinking water, and secondary requirements. |

**Table 7-4**
**Potential Chemical-Specific ARARs**

| | Citation | Location |
|---|---|---|
| **State of Florida Regulations** | | |
| A | Florida Ambient Air Quality Standards | Establishes standards for ambient air quality to protect public health. |
| TBC | Florida Soil Cleanup Goals | Establishes cleanup concentrations for contaminants in Florida soil. |

***Notes:***

A — Applicable requirements promulgated under law to specifically address a hazardous substance, pollutant, contaminant, remedial action location, or other circumstance at OU 10.

R&A — Relevant and appropriate requirements which, while they are not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at OU 10, address problems or situations sufficiently similar to those encountered at OU 10 that their use is well-suited to OU 10.

TBC — To-Be-Considered Criteria are nonpromulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of health or the environment.

## 8.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA, 42 U.S.C. Section 9621, and in the NCP, 40 Code of Federal Regulations, Section 300.430. The major objective of the FFS was to develop, screen, and evaluate alternatives for remediating OU 10. A variety of alternatives and technologies were identified as candidates to remediate contamination at OU 10. These were screened based on their feasibility with respect to the contaminants present and site characteristics. After the initial screening, the remaining alternatives/technologies were combined into potential remedial alternatives and evaluated in detail. The remedial alternative was selected from the screening process using the following nine evaluation criteria:

- Overall protection of human health and the environment;
- Compliance with applicable and/or relevant federal or state public health or environmental standards;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants;
- Short-term effectiveness or the impacts a remedy might have on the community, workers, or the environment during the course of implementation;
- Implementability, that is, the administrative or technical capacity to carry out the alternative;

- Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project, including additional costs should it fail;

- Acceptance by the state; and

- Acceptance by the community.

The NCP categorizes the nine criteria into three groups:

- Threshold Criteria – Overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

- Primary Balancing Criteria – Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

- Modifying Criteria – State and community acceptance are modifying criteria that are formally taken into account after public comments are received on the proposed plan and incorporated in the ROD.

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis of alternatives is primarily based. The final two criteria, known as Modifying Criteria, assess the acceptance of the alternative.

The following analysis summarizes the evaluation of alternatives for remediating OU 10 under each criterion. Each alternative is compared for achievement of a specific criterion.

## 8.1 Threshold Criteria

All alternatives considered for selection must comply with the threshold criteria, overall protection of human health and the environment, and compliance with ARARs.

### 8.1.1 Overall Protection of Human Health and the Environment

This criterion evaluates, overall, the degree of protectiveness afforded to human health and the environment. It assesses the overall adequacy of each alternative.

The no-action alternative will not mitigate the risks associated with contamination at or originating from OU 10. Therefore, this alternative is not protective of human health and the environment and will no longer be discussed.

Alternative 2 will use institutional controls and a leachability study to protect human health and the environment by maintaining industrial use. If the leachability study shows that contaminants in soil are adversely impacting groundwater, the contingency excavation remedial action will be implemented. Groundwater will be remediated by modifying the RCRA Corrective Action Plan to meet the performance standards listed in Section 9. This alternative protects human health and the environment by restoring the Class IIA/G-1 aquifer and preventing any potential migration of the contaminated plume.

Alternative 3 will protect human health by capping the contaminated areas, thus reducing the amount of rainfall infiltrating through the contaminants. Alternative 4 will excavate the contaminated soil, thereby providing the best and most immediate protection of human health and the environment. Alternatives 3 and 4 will meet groundwater performance standards by modifying the RCRA Corrective Action Plan as described under Alternative 2.

### 8.1.2 Compliance with ARARs

Alternatives 2, 3, and 4 will meet all of their respective ARARs. Groundwater ARARs include MCLs and Florida drinking water standards that establish chemical-specific limits on certain contaminants in community water systems. For Alternatives 2, 3, and 4, remedial action will include further sampling and analysis of groundwater to ensure that groundwater beneath OU 10 will meet ARARs through groundwater treatment in a reasonable time frame. Alternatives 2, 3, and 4 will be able to meet all federal and state standards for contaminants and proposed actions.

## 8.2 Primary Balancing Criteria

### 8.2.1 Long-Term Effectiveness and Permanence

Alternatives 2, 3, and 4 will provide long-term effectiveness and permanence. All of these alternatives will use treatment technologies to reduce hazards posed by contaminants in groundwater. The selected alternative will be evaluated 5 years after implementation to determine its effectiveness in achieving the required cleanup objectives.

Assuming the leachability tests indicate contamination is not moving into groundwater, the use of institutional controls will provide long-term effectiveness and a permanent solution.

The impermeable caps proposed under Alternative 3 will provide long-term effectiveness and permanence in preventing the migration of water through the contaminated soil. To ensure continued effectiveness, the caps will require continued maintenance and monitoring for at least five years after performance standards were met to ensure continued effectiveness.

With the removal of contaminated soil under Alternative 4, the source will be eliminated. This results in long-term effectiveness and a permanent cleanup. However, Alternative 4 will present long-term liabilities associated with disposal of contaminated soil in a secure landfill or treatment facility.

### 8.2.2 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternatives 2, 3, and 4 will provide for groundwater remediation and treatment by modifying the RCRA permit. Alternative 2 does not provide for soil treatment unless the leachability study shows the contaminants are adversely impacting groundwater. Alternative 3 will reduce the toxicity, volume, and mobility of the soil contaminants by capping the areas. Toxicity, volume, and mobility of soil contaminants will be reduced through excavation in Alternative 4.

Therefore, Alternatives 3 and 4 (and Alternative 2 if the contingency soil excavation remedial action is implemented) will best satisfy CERCLA's statutory preference for treatment and use of treatment to reduce toxicity, mobility, and volume of contaminants.

### 8.2.3 Short-Term Effectiveness

Alternative 2 is expected to have the least short-term effectiveness because contamination is left in place. Its effectiveness will be achieved by land use restrictions. The contingent remedial action with Alternative 2 will ensure that if contaminants in soil are adversely impacting groundwater, the effectiveness of Alternative 4 will be achieved.

Alternative 3 will also be effective in the short-term. Alternative 3 (capping with groundwater treatment) will more quickly reduce the amount of contaminants leaching from soil. Alternative 4 is the most effective in the short-term by excavating the contaminated soil. The excavation activities may impose risks by disturbing the contaminants in soil; however, it is not expected to pose unacceptable short-term environmental or health hazards which cannot be controlled.

The installation of groundwater wells in each alternative or as required in the RCRA permit modification may impose risks by disturbing the contamination in the soil or groundwater; however, it is not expected to pose unacceptable short-term environmental or health hazards which cannot be controlled.

#### 8.2.4 Implementability

Alternative 2 is the simplest to implement and operate. Alternatives 3 and 4 are more technically difficult to implement. Alternative 4 requires offsite disposal of contaminated soil at regulated offsite facilities. Implementation of groundwater treatment is the same for Alternatives 2, 3, and 4.

#### 8.2.5 Cost

Cost details are provided in the FFS and are summarized in Table 8-1. Alternative 2, institutional controls, has the lowest present worth cost and Alternative 4, excavation, has the highest. Alternative 4 is significantly more expensive because of the transportation and disposal costs for the contaminated soil. Alternative 3 costs are higher than Alternative 2 because of the maintenance required on the asphalt caps. The contingency remedial action in Alternative 2 includes the treatment costs associated with Alternative 4; however, it is expected that the leachability study will show that the contaminants in soil are not adversely impacting the groundwater. Alternative 2 provides for the best ratio of costs to benefit received through the permanent reduction of risk to human health and the environment. A comparison of the estimated costs indicates Alternative 2 is the most cost effective means of achieving the permanent reduction of risk to human health and the environment at OU 10.

### 8.3 Modifying Criteria

#### 8.3.1 State Acceptance

The State of Florida has concurred with the remedy selected for OU 10.

**Table 8-1**
**Cost Comparison for Alternatives**

| Alternative | Direct and Indirect Costs | Annual O&M Costs | Total Net Present Worth |
|---|---|---|---|
| Alternative 1 | None | None | None |
| Alternative 2 | $130,000[b] | None | $130,000[a,b] |
| Alternative 3 | $102,000[b] | $6,000 | $185,000[b] |
| Alternative 4 | $247,000[b] | None | $247,000[b] |
| Area A | $56,500 | | $56,500 |
| Area B | $47,850 | | $47,850 |
| Area C | $66,550 | | $66,550 |
| Area D | $76,100 | | $76,100 |

*Notes:*
Net present worth costs, where appropriate, were calculated using a 6% discount rate over 30 years.
a — If the leachability study determines that threats to groundwater are unacceptable, present worth costs may increase to $377,000 (including Alternative 4 costs).
b — This includes cost estimates of engineering services/report preparation ($50,000 for Alternatives 2 and 3, $100,000 for Alternative 4) that were supplied by the Navy.

### 8.3.2 Community Acceptance

Based on comments expressed at the February 27, 1996, public meeting and receipt of written comments during the comment period, it appears that the Pensacola community generally agrees with the selected remedy. Specific responses to issues raised by the community can be found in Appendix B, the Responsiveness Summary.

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# 9.0 THE SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, the Navy has selected two components of the preferred alternative (e.g., leachability study on Areas B, C, and D with excavation as a contingency and groundwater treatment under RCRA) and a component of Alternative 4 (e.g., excavation of Area A). At the completion of this remedy, the risk associated with OU 10 will be protective of human health and the environment.

The selected alternative for OU 10 is consistent with the requirements of Section 121 of CERCLA and the NCP. The selected alternative will reduce the mobility, toxicity, and volume of contaminated groundwater onsite. In addition, the selected alternative is protective of human health and the environment, will attain all federal and state ARARs, is cost-effective, and uses permanent solutions to the maximum extent practicable.

Based on the information available at this time, the remedy represents the best balance among the criteria used to evaluate remedies. The remedy is believed to be protective of human health and the environment, will attain ARARs, will be cost-effective, and will use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

## 9.1 Source Control

Source control remediation will address removing contaminated soil onsite and preventing potential migration of soil contaminants to groundwater. Source control shall include excavation and disposal of contaminated soil from Area A, a leachability study on Areas B, C, and D to verify that contaminants in soil are not adversely impacting groundwater, and groundwater remediation under the RCRA Corrective Action Plan permit modification.

The major components of source control to be implemented include:

- Excavation and disposal of Area A.
- Leachability study on Areas B, C, and D.
- The Navy will consider requiring a contingency remedial action, as discussed in Alternative 4, if the leachability study indicates that the contaminants in soil are adversely impacting groundwater. Soil excavation will extend until contaminant concentrations are below the performance standards listed in Table 9-1 or below concentrations determined to be protective of groundwater during the leachability study.

**Table 9-1**
**Performance Standards for Soil**

| Contaminant | Performance Standards |
|---|---|
| Benzo(a)pyrene | 1,300[a] |
| Dibenz(a,h)anthracene | 1,300[a] |
| Chlorobenzene | 600[b] |
| 1,2-Dichlorobenzene | 5,800[b] |
| 1,3-Dichlorobenzene | 400[b] |
| 1,4-Dichlorobenzene | 900[b] |
| Naphthalene | 100[b] |

*Notes:*

a – Calculated value based on an acceptable risk or a HQ of 1 assuming combined ingestion and skin contact with the soil. It is assumed that a resident child eats 200 milligrams per day of soil and has 2,000 $cm^2$ of exposed skin and is exposed for 350 days a year for six years and weighs 33 pounds (15 kilograms).

b – Exceedance of Florida leachability value protective of groundwater to below the drinking water standards.

## 9.2 Groundwater Treatment and Monitoring

Groundwater remediation and monitoring will be implemented at OU 10 to treat contaminated groundwater and to prevent movement of contamination to nearby surface water bodies as determined during the remedial design developed in the Corrective Action Plan for the RCRA permit modification. The major components of groundwater remediation/monitoring to be implemented include:

- Implementation of a groundwater remediation system that meets performance standards listed in Table 9-2. The remedial design for groundwater treatment will be developed in the Corrective Action Plan for the RCRA permit modification.

- Groundwater monitoring will continue at sampling intervals established during the remedial design developed in the Corrective Action Plan for the RCRA permit modification. The groundwater monitoring program will continue until a five-year review concludes that the alternative has continuously attained the performance standards and remains protective of human health and the environment.

**Table 9-2**
**Performance Standards for Groundwater**

| Contaminant | Performance Standards (ppb) |
|---|---|
| 1,2-Dichlorobenzene | 600[a] |
| 1,3-Dichlorobenzene | 10[b] |
| 1,4-Dichlorobenzene | 75[a] |
| Benzene | 1[a] |
| Bis(2-ethyhexyl)phthalate | 6[a] |
| Cadmium | 5[a] |
| Chlorobenzene | 100[a] |

**Table 9-2**
**Performance Standards for Groundwater**

| Contaminant | Performance Standards (ppb) |
|---|---|
| Hexachloroethane | 10[b] |
| Tetrachlorothene | 3[a] |
| Vinyl chloride | 1[a] |

*Notes:*
a – Florida Primary Drinking Water Standard or MCL, whichever is lower.
b – Florida Guidance Concentration based on carcinogenicity or organoleptic thresholds.
N/A – Not applicable

## 9.3 Extraction, Treatment, and Discharge of Contaminated Groundwater

### Performance Standards

Groundwater shall be remediated until the maximum concentrations listed in Table 9-3 are attained at the wells designated during the design as compliance points. These parameters are indicator contaminants that encompass the area of standard exceedances for groundwater.

**Table 9-3**
**Indicator Parameters for Groundwater Treatment**

| Contaminant | Performance Standards (ppb) |
|---|---|
| 1,2-Dichlorobenzene | 600[a] |
| 1,3-Dichlorobenzene | 10[b] |
| 1,4-Dichlorobenzene | 75[a] |
| Chlorobenzene | 100[a] |

*Notes:*
a – Florida Primary Drinking Water Standard or MCL, whichever is lower.
b – Florida Groundwater Guidance Concentration for organoleptic thresholds.

## 9.4 Compliance Testing

Groundwater shall be monitored in accordance with the Corrective Action Plan for the RCRA permit modification.

## 10.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, 42 U.S.C. § 9621, the Navy must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA prefers remedies employing treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as its principal element. The following sections discuss how the selected remedy at OU 10 meets these statutory requirements.

### 10.1 Protection of Human Health and the Environment

The selected remedy with contingency protects human health and the environment by eliminating, reducing, and controlling risk through soil excavation as delineated through performance standards described in Section 9. Contaminated groundwater will be treated to meet the performance standards through remediation under the RCRA permit modification.

### 10.2 Attainment of the ARARs

Remedial actions performed under CERCLA, Section 121, 42 U.S.C. § 9621 must comply with all ARARs. All alternatives considered for OU 10 were evaluated based on the degree to which they comply with these requirements. The selected remedy with contingent remedial action of Areas B, C, and D meets or exceeds identified ARARs.

The selected remedy with contingent remedial action meets or exceeds ARARs identified in Tables 7-2, 3, and 4. The following is a short narrative in support of attainment of the pertinent ARARs.

**Chemical-Specific ARARs**

Groundwater restoration performance standards identified as MCLs are the groundwater protection standards set in this ROD as performance standards for remedial action.

**Action-Specific ARARs**

Performance and treatment standards are consistent with RCRA ARARs identified in Table 7-3, and these regulations will be incorporated into the design and implementation of this remedy. All groundwater treatment standards will be met as per the RCRA permit.

**Location-Specific ARARs**

Performance standards are consistent with ARARs identified in Tables 7-2.

**Waivers**

Section 121 (d)(4)(C) of CERCLA, 42 U.S.C. § 9621(d)(4)(c), provides that an ARAR may be waived when compliance is technically impracticable from an engineering perspective.

**Other Guidance to be Considered**

Other guidance TBCs include health-based advisories and guidance. TBCs have been used in estimating incremental cancer risk numbers for remedial activities at the sites and in determining RCRA applications to contaminated media. TBCs for OU 10 include *Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy*, Final Draft, December 1986.

## 10.3 Cost-Effectiveness

The Navy believes the selected remedy will eliminate risk to human health at an estimated cost of $186,500. If soil contamination is adversely affecting groundwater, soil excavation costs for Areas B, C, and D will be $190,500 for a potential total cost of $377,000.

## 10.4 Use of Permanent Solutions to the Maximum Extent Practicable

The Navy, with USEPA and Florida concurrence, has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for final remediation at OU 10 at NAS Pensacola. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy, with USEPA and Florida concurrence, has determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost, while also considering the statutory preference for treatment as a principal element and consideration of state and community acceptance. The selected remedy will satisfy the statutory preference for treatment of Area A and will satisfy the statutory preference for treatment of Areas B, C, and D if the contingency remedial action is implemented. The selected remedy provides for long-term effectiveness and permanence; is easily implemented; reduces toxicity, mobility, or volume; and is cost-effective.

## 10.5 Preference for Treatment as a Principal Element

The selected remedy with contingency uses treatment technologies to the extent practicable. The statutory preference for remedies that employ treatment as a principal element is satisfied.

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## 11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The proposed plan for OU 10 released in February 1996 identified Alternative 2, Institutional Controls, with Alternative 4, Excavation and Disposal, as a contingency as the preferred alternative. The Navy has evaluated the alternative and has determined that it prefers the land have unrestricted use. The final remedy combines two components of the preferred alternative (e.g., leachability study on Areas B, C, and D with excavation as a contingency and groundwater treatment under RCRA) and a component of a different alternative (e.g., excavation of Area A) presented in the FS report and proposed plan.

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# Appendix A

## Glossary

This glossary defines terms used in this record of decision describing CERCLA activities. The definitions apply specifically to this record of decision and may have other meanings when used in different circumstances.

**ADMINISTRATIVE RECORD:** A file that contains all information used by the lead agency to make its decision in selecting a response action under CERCLA. This file is to be available for public review and a copy is to be established at or near the site, usually at one of the information repositories. Also a duplicate is filed in a central location, such as a regional or state office.

**AQUIFER:** An underground formation of materials such as sand, soil, or gravel that can store and supply groundwater to wells and springs. Most aquifers used in the United States are within a thousand feet of the earth's surface.

**BASELINE RISK ASSESSMENT:** A study conducted as a supplement to a remedial investigation to determine the nature and extent of contamination at a Superfund site and the risk posed to public health and/or the environment.

**CARCINOGEN:** A substance that can cause cancer.

**CLEANUP:** Actions taken to deal with a release or threatened release of hazardous substances that could affect public health and/or the environment. The noun "cleanup" is often used broadly to describe various response actions or phases of remedial responses such as Remedial Investigation/Feasibility Study.

**COMMENT PERIOD:** A time during which the public can review and comment on various documents and actions taken, either by the Department of Defense installation or the USEPA. For example, a comment period is provided when USEPA proposes to add sites to the National Priorities List.

**COMMUNITY RELATIONS:** USEPA's, and subsequently Naval Air Station Pensacola's, program to inform and involve the public in the Superfund process and respond to community concerns.

**COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA):** A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The act created a special tax that goes into a trust fund, commonly known as "Superfund," to investigate and clean up abandoned or uncontrolled hazardous waste sites.

Under the program the USEPA can either:

- Pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work.

- Take legal action to force parties responsible for site contamination to clean up the site or reimburse the federal government for the cost of the cleanup.

**DEFENSE ENVIRONMENTAL RESTORATION ACCOUNT (DERA):** An account established by Congress to fund Department of Defense hazardous waste site cleanups, building demolition, and hazardous waste minimization. The account was established under the Superfund Amendments and Reauthorization Act.

**DRINKING WATER STANDARDS:** Standards for quality of drinking water that are set by both the USEPA and the FDEP.

**EXPLANATION OF DIFFERENCES:** After adoption of final remedial action plan, if any remedial or enforcement action is taken, or if any settlement or consent decree is entered into, and if the settlement or decree differs significantly from the final plan, the lead agency is required to publish an explanation of any significant differences and why they were made.

**FEASIBILITY STUDY:** See Remedial Investigation/Feasibility Study.

**GROUNDWATER:** Water beneath the earth's surface that fills pores between materials such as sand, soil or gravel. In aquifers, groundwater occurs in sufficient quantities that it can be used for drinking water, irrigation, and other purposes.

**HAZARD RANKING SYSTEM (HRS):** A scoring system used to evaluate relative risks to public health and the environment from releases or threatened releases of hazardous substances. USEPA and states use the HRS to calculate a site score, from 0 to 100, based on the actual or potential release of hazardous substances from a site through air, surface water, or groundwater to affect people. This score is the primary factor used to decide if a hazardous site should be placed on the NPL.

**HAZARDOUS SUBSTANCES:** Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

**INFORMATION REPOSITORY:** A file containing information, technical reports, and reference documents regarding a Superfund site. Information repositories for Naval Air Station Pensacola are at the West Florida Regional Library, 200 West Gregory Street, Pensacola, Florida; John C. Pace Library, University of West Florida; and the NAS Pensacola Library, Building 633, Naval Air Station, Pensacola, Florida.

**MAXIMUM CONTAMINANT LEVEL:** National standards for acceptable concentrations of contaminants in drinking water. These are legally enforceable standards set by the USEPA under the Safe Drinking Water Act.

**MONITORING WELLS:** Wells drilled at specific locations on or off a hazardous waste site where groundwater can be sampled at selected depths and studied to assess the groundwater flow direction and the types and amounts of contaminants present, etc.

**NATIONAL PRIORITIES LIST (NPL):** The USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from the trust fund. The list is based primarily on the score a site receives on the Hazard Ranking System. USEPA is required to update the NPL at least once a year.

**PARTS PER BILLION (ppb)/PARTS PER MILLION (ppm):** Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene in a million ounces of water is 1 ppm; 1 ounce of trichloroethylene in a billion ounces of water is 1 ppb. If one drop of trichloroethylene is mixed in a competition-size swimming pool, the water will contain about 1 ppb of trichloroethylene.

**PRELIMINARY REMEDIATION GOALS:** Screening concentrations that are provided by the USEPA and the FDEP and are used in the assessment of the site for comparative purposes prior to remedial goals being set during the baseline risk assessment.

**PROPOSED PLAN:** A public participation requirement of SARA in which the lead agency summarizes for the public the preferred cleanup strategy, and the rationale for the preference, reviews the alternatives presented in the detailed analysis of the remedial investigation/feasibility study, and presents any waivers to cleanup standards of Section 121(d)(4) that may be proposed. This may be prepared either as a fact sheet or as a separate document. In either case, it must actively solicit public review and comment on all alternatives under agency consideration.

**RECORD OF DECISION (ROD):** A public document that explains which cleanup alternative(s) will be used at NPL sites. The Record of Decision is based on information and technical analysis generated during the remedial investigation/feasibility study and consideration of public comments and community concerns.

**REMEDIAL ACTION (RA):** The actual construction or implementation phase that follows the remedial design and the selected cleanup alternative at a site on the NPL.

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS):** Investigation and analytical studies usually performed at the same time in an interactive process, and together referred to as the "RI/FS." They are intended to: (1) gather the data necessary to determine the type and extent of contamination at a Superfund site; (2) establish criteria for cleaning up the site; (3) identify and screen cleanup alternatives for remedial action; and (4) analyze in detail the technology, and costs of the alternatives.

**REMEDIAL RESPONSE:** A long-term action that stops or substantially reduces a release or threatened release of hazardous substances that is serious, but does not pose an immediate threat to public health and/or the environment.

**REMOVAL ACTION:** An immediate action performed quickly to address a release or threatened release of hazardous substances.

**RESOURCE CONSERVATION AND RECOVERY ACT (RCRA):** A federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new, uncontrolled hazardous waste sites.

**RESPONSE ACTION:** As defined by Section 101(25) of CERCLA, means remove, removal, remedy, or remedial action, including enforcement activities related thereto.

**RESPONSIVENESS SUMMARY:** A summary of oral and written public comments received by the lead agency during a comment period on key documents, and the response to these comments prepared by the lead agency. The responsiveness summary is a key part of the ROD, highlighting community concerns for USEPA decision-makers.

**SECONDARY DRINKING WATER STANDARDS:** Secondary drinking water regulations are set by the USEPA and the FDEP. These guidelines are not designed to protect public health, instead they are intended to protect "public welfare" by providing guidelines regarding the taste, odor, color, and other aesthetic aspects of drinking water which do not present a health risk.

**SUPERFUND:** The trust fund established by CERCLA which can be drawn upon to plan and conduct cleanups of past hazardous waste disposal sites, and current releases or threats of releases of nonpetroleum products. Superfund is often divided into removal, remedial, and enforcement components.

**SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA):** The public law enacted on October 17, 1986, to reauthorize the funding provisions, and to amend the authorities and requirements of CERCLA and associated laws. Section 120 of SARA requires that all federal facilities "be subject to and comply with, this act in the same manner and to the same extent as any non-governmental entity."

**SURFACE WATER:** Bodies of water that are aboveground, such as rivers, lakes, and streams.

**VOLATILE ORGANIC COMPOUND:** An organic (carbon-containing) compound that evaporates (volatizes) readily at room temperature.

# Appendix B

# Responsiveness Summary

# RESPONSIVENESS SUMMARY

## Overview

During the public comment period, the U.S. Navy proposed a preferred remedy to address soil and groundwater contamination at OU 10 on NAS Pensacola. This preferred remedy was selected in coordination with the USEPA and the FDEP. The NAS Pensacola Restoration Advisory Board, a group of community volunteers, reviewed the technical details of the selected remedy.

The sections below describe the background of community involvement on the project and comments received during the public comment period.

## Background of Community Involvement

Throughout the site's history, the community has been kept abreast of site activities through press releases to the local newspaper and television stations that reported on site activities. Site-related documents were made available to the public in the administrative record at information repositories maintained at the NAS Pensacola Library, the West Florida Regional Library, and the John C. Pace Library of the University of West Florida.

On February 15, 1996, newspaper announcements were placed to announce the date and location of the public meeting to present the proposed plan, the public comment period (February 19 through April 4, 1996) and included a short description of the proposed plan. The announcement appeared in the *Pensacola News Journal*. In conjunction with these newspaper announcements, copies of the proposed plan were mailed to addresses on the Installation Restoration Program mailing list. A public meeting was held at the Pensacola Junior College Warrington Campus on February 27, 1996. In addition to the five Restoration Advisory Board community members, one citizen attended.

A responsiveness summary is required to document how the Navy addressed citizen comments and concerns, raised during the public comment period. All comments summarized in the appendix have been factored into the final decisions of the remedial action for OU 10 at NAS Pensacola.

## Summary of Major Questions and Comments Received During the Public Comment Period and the Navy's Responses

| Comment | Response |
| --- | --- |
| 1. Will the contaminants detected in soil affect the NAS Pensacola drinking water? | The aquifer beneath OU 10 is considered a potable water source by the State of Florida. However, NAS Pensacola receives all of its potable water from Corry Station, approximately 4 miles away. In addition, Bayou Grande and Pensacola Bay limit groundwater use to the north, east, and west of the site.<br><br>The RCRA groundwater treatment system will also be modified to contain and remediate the contaminants detected in OU 10 groundwater. If the leachability study finds the contaminated soil to be adversely impacting groundwater, the soil will be removed. |
| 2. Should the NAS Pensacola residents be given carbon-filtering devices or millipore filters to put on all faucets used for drinking water? | NAS Pensacola receives all of its potable water from Corry Station, approximately 4 miles away. The potable water is tested regularly and does not pose a risk to the NAS Pensacola residents. If contaminants are detected in the potable water supply, NAS Pensacola residents are notified and appropriate action is taken. Therefore, filtering systems are not required currently for NAS Pensacola residents. |
| 3. If the contaminated soil is excavated and dumped somewhere else, will it leach into the groundwater at that location? | As explained in the Feasibility Study report, excavation effectively protects human health and the environment. If the soil is removed for offsite disposal, the soil will be taken to an approved facility that is equipped to handle this type of waste. |
| 4. Will the asphalt cap allow the contaminants to continue to leach into the soil and eventually contaminate the aquifer? | As explained in the Feasibility Study report, capping effectively protects human health and the environment. Capping contaminated soil reduces the amount of rainwater that can move through the contaminated soil and pick up contaminants along the way, thereby reducing the impact to groundwater. |
| 5. How will groundwater contamination reaching Pensacola Bay be addressed? | Pensacola Bay, Bayou Grande, and NAS Pensacola wetlands will be addressed during the remedial investigations of those sites. Groundwater contamination at OU 10 will be remediated by modifying the existing RCRA Corrective Action Plan to remediate the contaminated groundwater before it reaches the bay. |
| 6. Is the area safe for industrial users? | The baseline risk assessment concluded that there was no unacceptable risk to industrial users of the site. Any excavation work would be monitored to prevent unacceptable exposure. |
| 7. If the leachability study shows that the soil is adversely impacting groundwater, how much will it cost to implement both Alternatives 2 and 4? | If the leachability study shows the soil to be adversely impacting groundwater, the costs include both the $130,000 estimated for Alternative 2 and the $247,000 estimated for Alternative 4 totalling $377,000. |