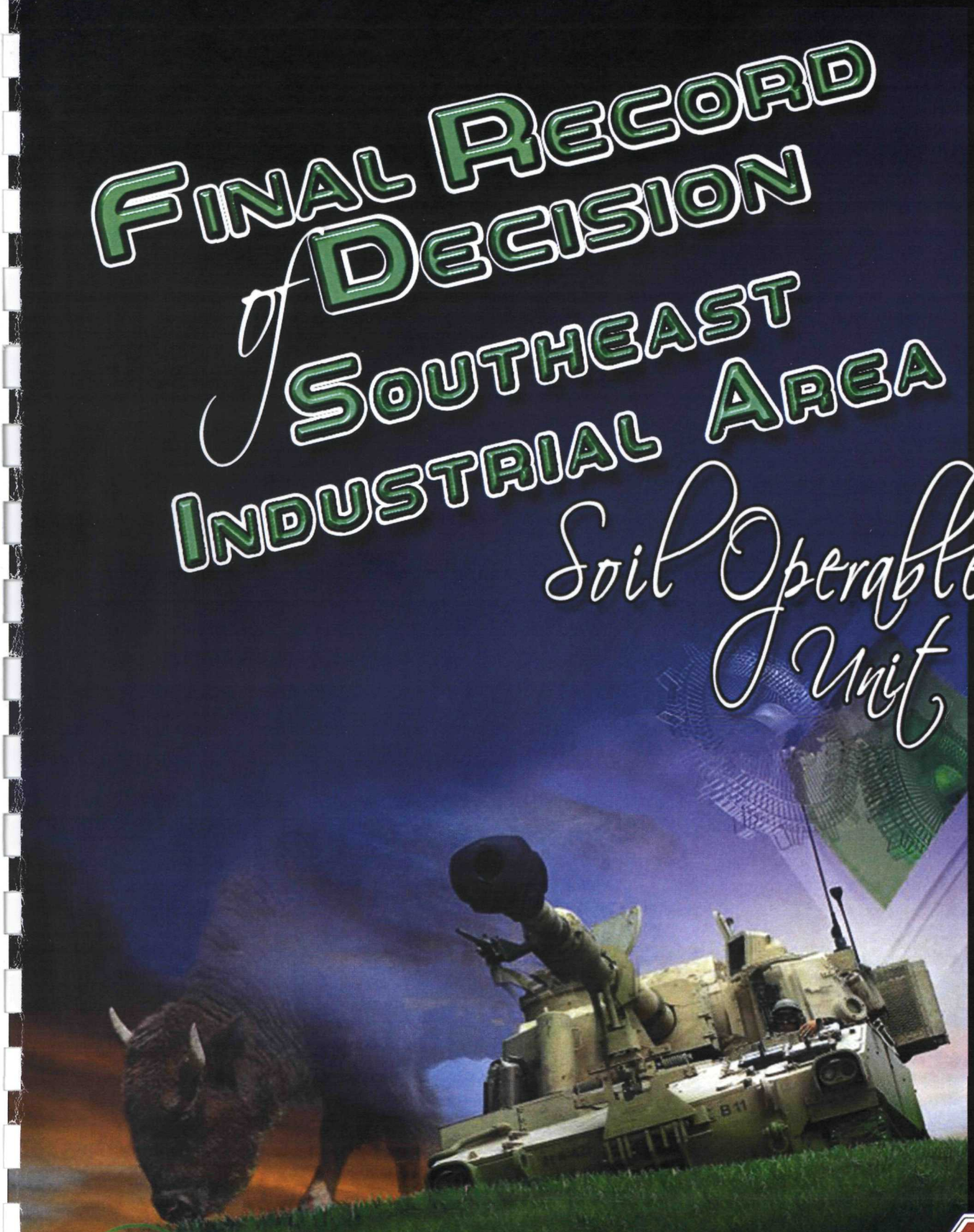
Final Record of Decision
Southeast Industrial Area
Soil Operable Unit 2



Anniston Army Depot

July 2008

ANNISTON ARMY DEPOT
WEAPONS ♦ COMBAT VEHICLES ♦ AMMUNITION

FINAL RECORD OF DECISION

FOR

SOUTHEAST INDUSTRIAL AREA
SOIL OPERABLE UNIT 2
ANNISTON ARMY DEPOT

ANNISTON ARMY DEPOT
ANNISTON, ALABAMA

July 2008

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ACRONYMS AND ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
ANAD	Anniston Army Depot
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
ASA	Ammunition Storage Area
AWWSB	Anniston Water Works and Sewer Board
BEIAS	Biomedical and Environmental Information Analysis Section
bgs	below ground surface
BMP	best management practice
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	CERCLA Information System
CFR	Code of Federal Regulations
COC	chemical of concern
COPC	chemical of potential concern
CRDL	contract-required detection limit
CRQL	certified reporting quantitation limit
CSM	conceptual site model
CTE	central tendency exposure
EPC	exposure point concentration
ERA	ecological risk assessment
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ER-L	effects range – low
FFA	Federal Facility Agreement
FS	feasibility study
ft	foot or feet
gpm	Gallons per minute
gpd	Gallons per day
HAZMAT	hazardous material
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ID	Identification
IDW	Investigation-derived waste
lb	Pound
IWTP	Industrial Wastewater Treatment Plant
LOAEL	Lowest Observable Adverse Effect Level
LUC	land-use control
mg/kg	milligrams per kilogram

mg/kg/day	milligrams per kilogram per day
MMRP	Military Munitions Response Program
NA	not applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NFA	no further action
NOAEL	no observable adverse effects level
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PP	Proposed Plan
PPE	personal protective equipment
QA/QC	quality assurance/quality control
RA	Remedial Action
RAO	remedial action objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act of 1976
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act of 1986
SIA	Southeast Industrial Area
SOP	Standard Operating Procedure
SRC	site-related contaminant
STP	Sewage Treatment Plant
SWMU	solid waste management unit
TBC	To Be Considered
TDU	Treatment/Disposal Unit
TSD	treatment, storage, or disposal
UCL_{95}	95% upper confidence level of the mean
µg/dL	microgram per deciliter
µg/L	microgram per liter
WIA	Western Industrial Area

Final Record of Decision
for
Southeast Industrial Area Soil Operable Unit 2
Anniston Army Depot
Anniston, Alabama

This Final Record of Decision (ROD) documents the selected remedial actions for 28 solid waste management units (SWMUs) in Soil Operable Unit 2 at Anniston Army Depot's Southeast Industrial Area, Anniston, Alabama. Chapter 1.0 presents key information regarding this ROD. The Decision Summary (Chapter 2.0) details the site, alternatives evaluated, selected remedies, and associated cleanup levels for the chemicals of concern. This section also explains how the selected remedies fulfill statutory and regulatory requirements. The third component of this ROD (Chapter 3.0) summarizes information about the views of the public and regulatory agencies regarding the remedial alternatives and general concerns about the site.

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1.0 THE DECLARATION

This section provides key information regarding this Final ROD, including the authorizing signatures for its implementation.

1.1 SITE NAME AND LOCATION

Anniston Army Depot (ANAD) is an active military facility located in northeastern Alabama in Calhoun County. The Southeast Industrial Area (SIA), which occupies approximately 525 acres on the 15,200-acre installation, was placed on the National Priorities List (NPL) on March 13, 1989. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) Information System (CERCLIS) identification number for the ANAD SIA is AL3210020027. Facilities and operations in the SIA support the installation's missions of munitions storage and the refurbishment, testing, and decommissioning of combat vehicles and various types of ordnance.

The ANAD and SIA cleanup strategy includes designation of operable units (OUs) that are targeted for discrete remedial actions. Five OUs have been defined to date: (1) the SIA Groundwater OU (OU 1), (2) the SIA Soil OU (OU 2), (3) the Ammunition Storage Area (ASA) OU (OU 3), (4) the Military Munitions Response Program (MMRP) (OU 4), and (5) the Western Industrial Area (WIA) (OU 5). The SIA Soil OU 2, which includes areas within the SIA where soil, sediment, and surface water media have been impacted by historic site operations and where potential risks may be present, is the subject of this ROD. An Interim ROD has been completed for OU-1. A Final ROD for OU-3 was completed in 2006 and OU-4 and OU-5 are scheduled for future completion. This is the final ROD for OU-2.

Solid Waste Management Unit (SWMU) 2 (Sanitary Landfill) was originally to be included as part of the SIA OU 2. However, this SWMU is actually addressed under the Subtitle D, Solid Waste Management Regulations (40CFR Part 258) and was removed from OU-2.

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedies for the ANAD SIA Soil OU 2, which were chosen by EPA and the Army in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Resource Conservation and Recovery Act (RCRA) and to the extent practicable, the National Contingency Plan (NCP). The Alabama Department of Environment Management (ADEM) concurs with the selected remedies. The remedy solutions will be consistent with RCRA–CERCLA integration as discussed in Sections I, III, and VIII of the Federal Facilities Agreement (FFA). This decision is based on the Administrative Record file for this site. The ANAD anticipates that this will be the final decision for this OU.

1.3 ASSESSMENT OF THE SITE

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

1.4 DESCRIPTION OF SELECTED REMEDIES

The ANAD SIA was placed on the NPL in March 1989. As a result of the NPL listing, the Army signed a three-party FFA with EPA Region 4 and ADEM in June 1990 (ANAD 1990). Environmental restoration activities for SWMUs included in the FFA (Sections I, III, and VIII) must comply with CERCLA and RCRA requirements and procedures in accordance with the Agreement.

The FFA is intended to ensure that the environmental impacts associated with past and present activities at ANAD are investigated thoroughly and that appropriate remedial/corrective actions are developed and implemented to protect the public health and welfare and the environment. Furthermore, the FFA establishes the requirements and procedural framework for developing, implementing, and monitoring response actions for the SWMUs in accordance with CERCLA and RCRA requirements. The FFA requires environmental restoration activities at 47 SWMUs, encompassing the NPL SIA (29 SWMUs), the non-NPL ASA (11 SWMUs), WIA (4 SWMUs) and MMRP (3 SWMUs).

This ROD has been prepared for 28 of the 29 SIA SWMUs addressed in the Remedial Investigation/Feasibility Study (RI/FS) [Science Applications International Corporation (SAIC) 1998a]. Soils were not investigated under CERCLA at SWMU 2 because it was understood at the time the work plans were written that the landfill would be closed under RCRA Subtitle D. Soils at SWMU 2 were addressed under the Subtitle D Solid Waste Management Regulations. Groundwater affected by SWMU-2 is being investigated as part of the on-post groundwater OU (OU1). The selected remedies for each SWMU are presented in **Table 1-1**. No unacceptable ecological or human health risks were identified for current and anticipated future land use scenarios at 14 SIA SWMUs, and, as a result, no further action (NFA) is being taken at these sites. At eight SWMUs, only residential risks were identified; consequently, land-use controls (LUCs) will be implemented to control related risks. At six additional SWMUs where industrial and/or ecological risks are present, soil will be excavated and/or capped to protect workers and ecological receptors.

1.5 STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment; comply with federal and State of Alabama requirements that are applicable or relevant and appropriate to the remedial action; are cost-effective; and utilize permanent solutions and alternative treatment and resource recovery technologies to the extent practicable.

The selected remedies for 14 SWMUs will result in hazardous substances and contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. LUCs, which will be the key measures to control site access and use, will be defined in a remedial design document (see Section 2.12.2). Consequently, statutory reviews will be conducted at a frequency of no less than every 5 years after initiation of remedial actions to examine the selected remedies, correct any deficiencies and ensure that remedies are protective of human health and the environment. Statutory reviews will be conducted at the prescribed intervals until such time that the LUCs can be removed and land use is unrestricted.

1.6 DATA CERTIFICATION CHECKLIST

A data certification checklist is provided in **Table 1-2**. This checklist certifies that the ROD contains specific remedy selection information. References to page numbers where the information can be found in the body of this document are also indicated.

Table 1-1. Remedies for the 28 SIA SWMUs
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

SWMU	Applicable Media	Selected Remedy
SWMU 3 (Old Industrial Wastewater Treatment Plant) SWMU 4 (New Industrial Wastewater Treatment Plant) SWMU 6 (Sodium Valve Disposal Pit) SWMU 25 (Building 130 Sump) SWMU 31 (Metal Plating Shop – Building 114) SWMU 32 (Hazardous Waste Storage Building – Building 512) SWMU 33 (Hazardous Waste Storage Building – Building 466/Old 512 Annex) SWMU 38 (Abrasive Dust Collectors) SWMU 39 (Dynamometer Wastewater Treatment Building – Building 410) SWMU 40 (Oil-Water Separator – Building 501) SWMU 41 (Steam Cleaning Buildings) SWMU 42 (Paint Booths) SWMU 43 (Cyanide Pretreatment Facility)	Soil	No further action/no action
SWMU 1 (Landfill Z-1) SWMU 19 (Old Sewage Treatment Plant) SWMU 20 (New Sewage Treatment Plant) SWMU 21 (Abrasive Dust Landfill) SWMU 22 (A-Block Lagoon) SWMU 23 (Asbestos Waste Disposal Trench) SWMU 24 (Old Sanitary Landfill) SWMU 28 (Waste Wood Landfill)	Soil	Land-use controls (LUCs)
SWMU 7 (Chemical Waste Burial Pit) SWMU 9 (Calcium Hypochlorite Pit) SWMU 12 (Facility 414 Old Lagoons) SWMU 13 (Acid Chemical Waste Pit) SWMU 29 (Old Lumber Disposal Yard) SWMU 30 (Northeast Lagoon Area)	Soil	Soil excavation, off-site treatment and disposal, containment, and LUCs
SWMU 44 (Dry Creek)	Surface Water and Sediment	No further action/no action

SIA = Southeast Industrial Area.
SWMU = solid waste management unit.

Table 1-2. Data Certification Checklist
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Information	Information in ROD	ROD Section (Page Number)
Chemicals of Concern	✓	Section 2.5.2 (Page 2-4), Table 2-4 (page 2-24) and Section 2.7.1.1 (Page 2-22)
Baseline Risk	✓	Section 2.7 (Page 2-19)
Cleanup Levels	✓	Section 2.12.4 (Page 2-56) and Table 2-22 (Page 2-57)
Source Materials	✓	Section 2.11 (Page 2-48)
Current and Future Land and Groundwater Use	✓	Section 2.6 (Page 2-19)
Land and Groundwater Use with Remedy	✓	Section 2.12.4 (Page 2-56) and Table 2-21 (Page 2-56)
Capital, Operation and Maintenance, Present Worth Costs, Discount Rate, and Years	✓	Section 2.12.3 (Page 2-56)
Factors Influencing Remedy Selection	✓	Section 2.12.1 (Page 2-48)

ROD = Record of Decision.

1.7 AUTHORIZING SIGNATURES

S. B. KELLER
COL, LG
U.S. Army
Commanding

16 JUL 2008
Date

WILLIAM GERALD HARDY
Chief
Land Division
Alabama Department of Environmental Management

07/29/08
Date

FRANKLIN HILL
Director
Superfund Division
U.S. EPA Region 4

8/14/08
Date

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2.0 THE DECISION SUMMARY

In this chapter, details about the site, the alternatives evaluated, the selected remedies, and the associated remedial action cleanup levels for the chemicals of concern (COCs) are provided. This section also explains how the selected remedies fulfill statutory and regulatory requirements.

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

ANAD is an active military facility located in Calhoun County, northeastern Alabama, about 10 miles west of the city of Anniston. ANAD's 525-acre SIA was placed on the NPL in 1989 (CERCLIS ID No. AL3210020027).

General activities in the SIA include overhaul, testing, and storage of combat vehicles. In addition, the maintenance, storage, and demilitarization of conventional munitions and missiles, as well as the storage and disposal of chemical munitions, are significant parts of ANAD's overall mission and capabilities.

The U. S. Army is the lead agency responsible for the remedial action for the SIA Soil OU 2. EPA and ADEM are the support agencies and provide regulatory oversight, review, and approval. The U.S. Department of Defense–Defense Environmental Restoration Account is the source of related cleanup funds.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

In this section, an overview of the SIA's operations and its investigative history is presented. This discussion is followed by a summary of the regulatory framework for investigation and cleanup of the site.

2.2.1 Site Overview

The storage, maintenance, and industrial functions of ANAD historically have resulted in the generation of hazardous wastes. Typical waste-generating processes at ANAD have included vapor degreasing, metal cleaning, sandblasting, electroplating, and painting. Generated solid and liquid wastes have included metals, cyanide, phenols, pesticides, herbicides, chlorinated hydrocarbons, petroleum hydrocarbons, solvents, acids, alkali-chelating agents, asbestos, and creosote. Wastes generated at ANAD were disposed of on-post in trenches, lagoons, landfills, or other holding vessels from the 1940s through the late 1970s. The majority of the waste generated and disposed of has occurred within the SIA. Based on previous investigations, 29 locations within the SIA are known, or suspected, to contain wastes and were designated as SWMUs.

Environmental studies and investigations on the ANAD SIA have been conducted since the first quantitative assessment of industrial wastewater was completed in 1966. Studies completed in the 1990s include the Phase 1 and 2 Remedial Investigations (RIs) (Jacobs Engineering Group 1994 and SAIC 1998a), SWMU 12 supplemental investigation, and Feasibility Studies (FSs) for the Groundwater and Soil OUs 1 and 2 (SAIC 1998b and 1999). These studies identified the presence, the nature, and the extent of contaminated soil and groundwater within the SIA and identified approaches to site cleanup. As a result of these investigations and assessments, waste management practices were changed and interim remedial actions at some of the SWMUs completed. For instance, disposal areas at SWMU 1 (Chemical Sludge Waste Pits), SWMU 12 (Facility 414 Old Lagoons), SWMU 22 (A-Block Lagoon), and

SWMU 23 (Asbestos Waste Disposal Trench) were excavated and wastes removed with contaminated soil from 1981 to 1983. An interim groundwater extraction and treatment system began operation in 1990, and additional remediation of soil and groundwater beneath SWMU 12 was completed in the late 1990s. Currently, a comprehensive groundwater RI for the SIA is characterizing the entire groundwater regime using newly obtained data and historic information. The results of this study will be used to develop and finalize the groundwater remedial strategy for the SIA Groundwater OU 1.

2.2.2 Regulatory Framework

As noted in Section 2.1, the ANAD SIA was placed on the NPL in March 1989. As a result of the NPL listing, the Army signed a three-party FFA with EPA Region 4 and ADEM in June 1990 (ANAD 1990). Environmental restoration activities within OU 2 must comply with the CERCLA and RCRA requirements and procedures in accordance with the FFA.

The FFA is intended to ensure that the environmental impacts associated with past and present activities at ANAD are investigated thoroughly and that appropriate remedial/corrective actions are developed and implemented to protect the public health and welfare and the environment. Under the FFA, environmental restoration is required at 47 SWMUs, encompassing the non-NPL (18 SWMUs) and the NPL SIA (29 SWMUs).

2.3 COMMUNITY PARTICIPATION

The RI, FS, and Proposed Plan (PP) for the ANAD SIA were made available to the public in July 2000 (SAIC 1998a, SAIC 1999, and ANAD 2000). These documents are located in the Administrative Record file at ADEM's Main Offices in Montgomery, Alabama, and at the established document repository noted below:

Anniston Main Library
108 East 10th Street
Anniston, AL 36201-5662
Monday – Friday: 9 a.m. – 6:30 p.m.
Saturday: 9 a.m. – 5 p.m.
Sunday: 1 p.m. – 5 p.m.

The notice of availability of these documents was published in the *Anniston Star* on July 4, 2000, and a public comment period was held from July 21 to August 31, 2000. In addition, a public meeting and poster session was held on August 1, 2000, at the Anniston City Meeting Center to present the PP to a broader community audience than had been involved already at the site. At this meeting, representatives from ANAD, EPA, and ADEM answered questions regarding problems at the site and the remedial alternatives. The Proposed Plan was revised to include all Solid Waste Management Units (SWMUs) within the Soil OU and to reflect modifications to some remedies. An additional public meeting and poster session was held at the Anniston City Meeting Center on December 11, 2006 to present the modifications to the selected remedy. This meeting was held in conjunction with the quarterly Restoration Advisory Board meeting which solicits a wide cross-section of the community. Since 2000 the Army has apprised the community of the status of the ROD through the quarterly Restoration Advisory Board meetings.

2.4 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As with many Superfund sites, the problems at the SIA are complex and require a strategy to address each critical issue in terms of the scope and planned sequence of actions. To date, OUs have been defined to address five distinct ANAD contamination problems:[1]

- **OU 1:** SIA groundwater,
- **OU 2:** SIA soil,
- **OU 3:** Ammunition Storage Area (ASA) (all media),
- **OU 4:** Military Munitions Response Program, and
- **OU 5:** Western Industrial Media, all media.

OU 2 is the subject of this ROD. This ROD identifies 14 SWMUs where NFA/NA is necessary, as well as those 14 SWMUs for which remedial action is necessary. A separate Phase 3 RI/FS is in progress for the SIA groundwater (OU 1).

Upon approval of the ROD, the Army will prepare and finalize a remedial design (RD) document and remedial action work plan (RAWP) to develop the specific requirements of the remedial action (RA), monitoring requirements, and the applicable LUCs specified under the ROD. In the case of the SIA, the RA will include the removal of soils, capping areas posing ecological risks, and LUCs. The RD and RAWP will also provide the quality assurance and control (QA/QC) protocols and review requirements. The RD will be used by the installation to implement RA including select removal of affected soils; the disposal of materials removed; the administrative and physical aspects of LUCs; and the periodic review protocols. The RA will adhere to CERCLA and RCRA regulations and be geared toward reducing human health and ecological risks to within allowable tolerances for the current use scenario of the SIA, which is industrial use. The RA will address human health risks at SWMUs 7, 9, 13, 29 and 30 and will also address ecological risks at SWMUs 9, 12 and 13. This action is expected to be the final action for this operable unit.

For ANAD, the response strategy is being implemented based on OUs, which have been defined to address five distinct ANAD contamination problems.

2.5 SITE CHARACTERISTICS

This section presents an overview of the site, including the environmental setting (Section 2.5.1) and nature and extent of contamination (Section 2.5.2). The site conditions also are depicted as a conceptual site model (CSM), which provides the framework for assessing risks to potential receptors (Section 2.5.3).

2.5.1 Environmental Setting

The SIA, situated west of Anniston, is in the vicinity of several small communities (**Figure 2-1**). Also in close proximity are a state fish hatchery to the southwest, catfish ponds owned by ANAD to the south, and a public water supply, Coldwater Spring, to the southeast.

[1] The OUs defined herein are consistent with the Army's current understanding of remedial strategies for the SIA and ASA. Earlier decision documentation reflects different OU designations. These differences will not affect the goal of restoring the SIA and ASA to their beneficial uses.

The SIA lies in a northeast–southwest trending valley and is surrounded by flat to gently rolling terrain. The SIA is drained by several small, unnamed tributaries that flow into Dry Creek, the major drainage feature of the SIA. Geologic data indicate that the SIA is underlain by variably weathered carbonate bedrock. The groundwater flow system in ANAD is the result of complex geologic structures; shallow flow in the weathered zone; conduit flow paths in bedrock and weathered zone; and discontinuities of hydrogeologic units, resulting from presumed and defined fault zones. Groundwater movement in the vicinity of ANAD is toward the south, with an eastern and western component. Additional details on the site characteristics are provided in the RI and FS for the SIA (SAIC 1998a and 1999).

Groundwater exists in two separate aquifers in the ANAD region, within the shallow residuum over the bedrock and within the carbonate bedrock (limestone, dolomite) and shale of the Upper Cambrian Conasauga Formation and undifferentiated Knox Group. ANAD is located within the Coldwater Spring recharge basin, which is a complex overthrust fault groundwater system covering approximately 90 square miles.

The shallow aquifer lies within a cherty residuum generally between 30 and 100 feet thick. The residuum is a sandy to silty clay with generally low permeability in the upper unconsolidated zone. Just above the bedrock is a transitional zone that has a higher permeability because it contains substantial amounts of sand and gravel plus highly fractured bedrock above the consolidated bedrock. The transitional zone tends to behave as a semi-confined aquifer because of the lower permeability of the upper unconsolidated soils and the bedrock. The groundwater in the residuum and transitional zone is primarily the result of precipitation infiltrating the surface and migrating downward to the top of the bedrock where the groundwater comes into hydraulic communication with the groundwater in the bedrock. Within the SIA, the shallow groundwater generally flows to the southwest. Local topography and subsurface conditions cause variances within the general groundwater flow regimes and small, perched groundwater tables may exist because of lenses of clay or other low permeability soils that prevent or hinder the downward migration of groundwater.

The groundwater in the transitional zone serves as the primary source of water recharge to the groundwater within the bedrock. The recharge occurs primarily through fractures and minor faults within the bedrock. The hydraulic communication is generally poor, but in that Knox Group rock contains carbonates, localized areas can have high transmisivities because of multiple fractures and dissolution-enhanced fractures and voids (i.e., karst terrane). The karst terrane also accounts for small, regional areas of higher groundwater flow rates within the groundwater.

On the larger scale, the SIA is within the Coldwater Spring recharge basin. Coldwater Spring is situated in the southern tip of the basin and is located approximately 1.5 miles south of ANAD. Coldwater Spring is the primary water supply for the population in the Anniston area serving approximately 60,000 persons. The Jacksonville Fault bisects the Coldwater Spring recharge basin on a northeast to southwest axis.

2.5.2 Nature and Extent of Contamination

The RI (SAIC 1998a) included sampling and monitoring of soil, sediment, surface water, and groundwater to determine the nature and extent of contamination in the SIA. **Table 2-1** provides a summary description of the site and its history, the nature and extent of contamination, and the COCs identified in the baseline risk assessment (see Section 2.7) for the 28 SWMUs addressed in this ROD. Additional information on the site history and RI results is provided in the RI and FS (SAIC 1998a and 1999, respectively). The location of all SWMUs is presented in **Figure 2-2**.

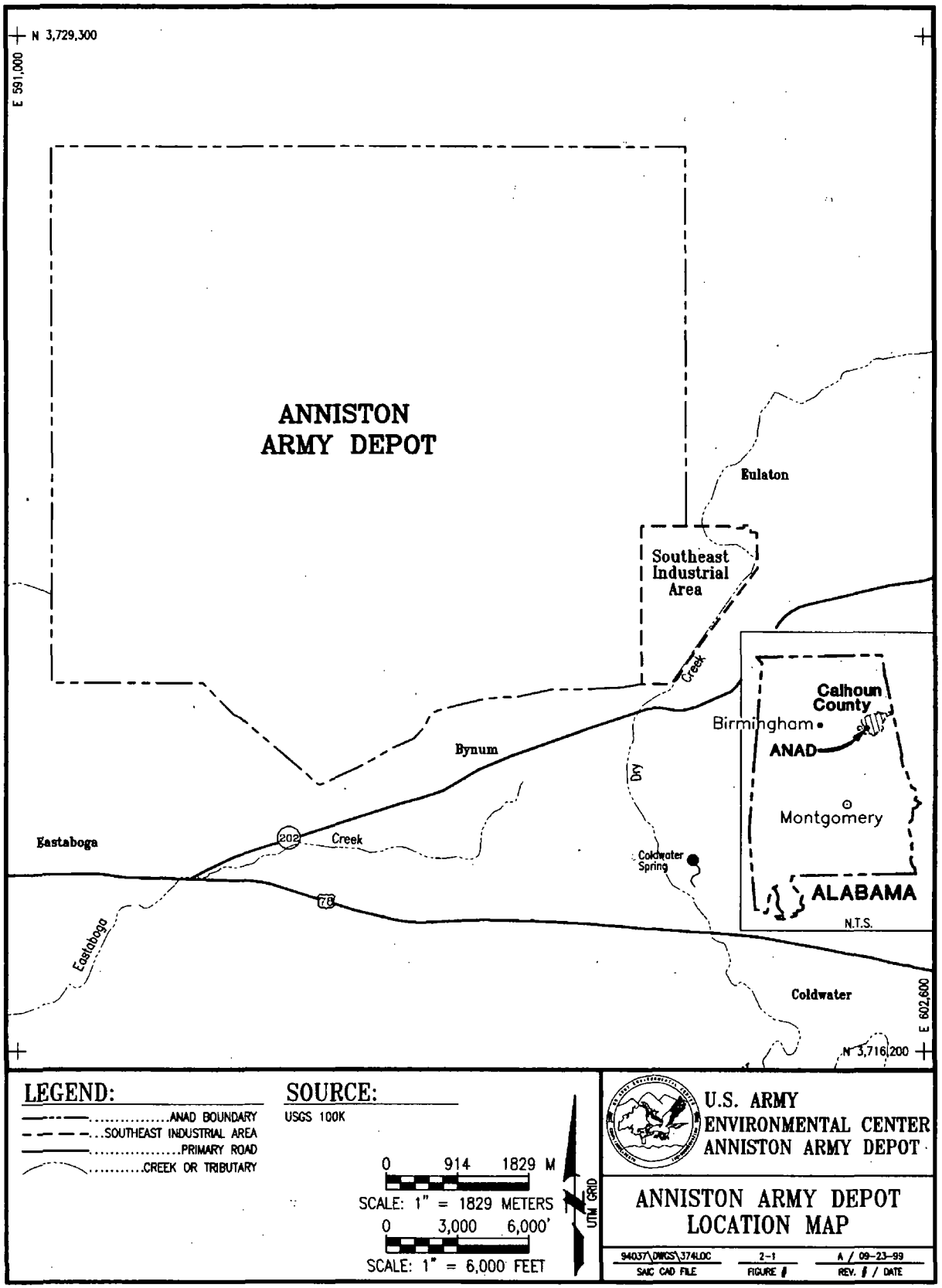


Figure 2-1. Location of ANAD

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 3 (Old Industrial Wastewater Treatment Plant)/ SWMU 4 (New Industrial Wastewater Treatment Plant)					
Old Wastewater Treatment Plant 0.93-acre site located in northeastern section of the SIA. Used from 1976 to 1981 to treat industrial wastewater. Effluent directed to one of four lagoons and discharged to Dry Creek or given final treatment at the Sewage Treatment Plant (STP). **New Wastewater Treatment Plant** Built over old IWTP in 1981 to treat all SIA industrial wastes (250,000 gpd). Old IWTP lagoons replaced with filter press, clarifiers, sumps, chemical addition tanks, and an in-ground holding tank; old IWTP components incorporated into facility (Building 505, chromium pretreatment reactors, and steam cleaning waste grit and grease removal building).	SWMUs 3 & 4 overlay each other. An initial passive soil gas survey conducted on 46 spatially located points plus 49 locations along the surface routing of the process sewer lines serving the steam cleaning buildings, SWMU 41. Investigation also included video inspections and hydrostatic testing of sewer process lines. The hydrostatic testing estimated losses of 6,123 GPH for the general waste system, 3,960 GPH for the chrome system, and 6,608 GPH in the steam system. The results of the soil gas survey were used to determine locations for soil borings within the water treatment plant area and along the process collection lines serving numerous buildings and processes. Five samples were collected around SWMU 3 and 4 locations and another 24 soil borings were advanced to the elevation or just below elevation of sewer collection system. Soil samples were analyzed for VOCs, SVOCs, and inorganic constituents	**Old Wastewater Treatment Plant** No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present **New Wastewater Treatment Plant** No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 6 (Sodium Valve Disposal Pit)					
Small disposal area (5,500 SF) located in southwest corner of SIA, south of SWMU 12. Approximately 10,000 engine valves buried at site in 50- by 110-ft disposal area.	The soil investigation used previous geophysical survey results and soil borings data for the RI. Advanced a single soil boring to bedrock in the center of a large geophysical anomaly noted in 1994. Soil sample were collected near the surface (~1 ft bgs) and in the subsurface (~10 ft bgs) and were analyzed for VOCs, SVOCs, and inorganic constituents (including hexavalent chromium).	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None
SWMU 25 (Building 130 Sump)					
Site (< 0.5 acre) contained former Building 130 Sump, an 8,000-gal underground sump located in northeastern SIA. Operated from 1943 to 1975 and used for temporary storage of chemical wastes from Building 130 operations. Building 130 generated wastewater, phenol wastes, and chromium wastes from engine rebuilding tasks. A chemical waste generation study determined that the Building 130 wastes of primary concern were TCE, methylene chloride, and methyl phenols (Battelle 1984).	Conducted initial soil gas survey at 17 points irregularly spaced due to access constraints. Advanced soil borings to between 10 and 15 ft bgs around southeast corner of Building 103. Collected primarily shallow subsurface soil samples. Samples analyzed for VOCs, SVOCs, and inorganic constituents.	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 31 (Metal Plating Shop – Building 114)					
Consisted of Old and New Building 114 (~250 x 205 ft) in the eastern SIA. Operations shifted to the new facility in 1982. Facilities housed principal metal-treating operations. SWMU 43 (Cyanide pretreatment facility) located adjacent to SWMU 31	Active building. Conducted an initial soil gas survey using 25 sample points around the perimeter of building and the cyanide pretreatment facility (SWMU 43). Subsequently advanced soil borings around perimeter of the building and collecting subsurface soil samples. Eight soil borings were advanced around the new and old sections of the building and just downgradient of the cyanide collection sump. Samples analyzed for VOCs, SVOCs, and inorganic constituents.	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None
SWMU 32 (Hazardous Waste Storage Building – Building 512)					
Building used for > 90-day storage of hazardous waste.		No further action recommended in Phase 1 RI (Jacobs Engineering Group 1994)	NA	None	None
SWMU 33 (Hazardous Waste Storage Building – Building 466/Old 512 Annex)					
Building used to accumulate drums containing hazardous waste < 90 days.		No further action recommended in Phase 1 RI (Jacobs Engineering Group 1994)	NA	None	None
SWMU 38 (Abrasive Dust Collectors)					
Approximately 50 abrasive dust collectors (baghouses) located at 11 buildings (105, 106, 114, 117, 129, 130, 147, 409, 413, 433, and 434).	Investigation of SWMU consisted of collecting surface and shallow subsurface soils from adjacent to the buildings' baghouses. Samples analyzed for inorganic	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk	NA	None	None

**Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama**

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
Baghouses collected particulate emissions from sandblasting operations.	constituents.	receptors is present			
SWMU 39 (Dynamometer Wastewater Treatment Building – Building 410)					
Facility used to treat wastewater from engine-testing operations. Wastewater routed to new IWTP.		No further action recommended in Phase 1 RI (Jacobs Engineering Group 1994)	NA	None	None
SWMU 40 (Oil-Water Separator – Building 501)					
SWMU 40 is an oil water separator constructed of concrete beneath Building 501. Used to treat wastewater from steam cleaning operations in Building 503. This SWMU is located in area where former USTs were located and numerous monitoring wells are present.	The investigation of this unit consisted of three shallow soil borings to depth of ~8 ft. No surface soil samples because area is paved or has concrete surface. Samples analyzed for VOCs and SVOCs.	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None
SWMU 41 (Steam Cleaning Buildings)					
SWMU 41 consists of Buildings 129, 130, 409, 421, and 503, these buildings have been used for steam cleaning operations since 1953.	Conducted a soil gas survey of three of the steam cleaning buildings (Bldgs 129, 409 and 421) 31 locations adjacent to the buildings and along the process sewer lines serving buildings. Installed 11 soil borings adjacent three buildings. Soil samples were analyzed for VOCs, SVOCs, and inorganic constituents.	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health[a]	Ecological
SWMU 42 (Paint Booths)					
Paint Booths located in Buildings 129, 130, 143, 409, and 433 used for spray-painting mechanical parts. No evidence of contaminant releases from operations.	The paint booths were evaluated using visual observations. No evidence of releases from these active units.	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None
SWMU 43 (Cyanide Pretreatment Facility)					
Small facility (~15 x 35 ft) built in 1974 to treat cyanide-containing wastes generated in Building 114. System includes four 1,200-gal underground concrete tanks.	Investigation of SWMU was accomplished through the investigation of SWMU 31 (see above).	No COCs were identified in the human health risk assessment that exceeded EPA targets for cancer and non-cancer effects Ecological risk assessment not completed given that no suitable habitat for ecological risk receptors is present	NA	None	None
SWMU 44 (Dry Creek)					
Principal surface water drainage for southeastern portion of ANAD. Possible direct discharges from SWMUs 3, 19, 25, and 31; possible indirect discharges from SWMUs 7, 28, 29, and 30. Possible wastes include treated wastewaters, creosote, waste oil, chlorinated solvents, and metals from paint removers and other process chemicals.	In Phase 1 RI, 15 sediment and surface water samples were collected in linear fashion including one upstream and one downstream sample. Samples analyzed for VOCs and inorganic constituents. In Phase 2 RI, 4 additional sediment and 5 additional surface samples collected in linear fashion. Samples analyzed for VOCs, SVOCs, and inorganic constituents.	Cadmium and polycyclic aromatic hydrocarbons (PAHs) in sediment detected above recommended cleanup levels at several areas within the creek. Zinc detected in surface above a recommended guidance level. Subsequent ecological risk assessment of surface water and sediments (SAIC 2002) determined that ecological risks were not present in the surface water or sediments above regulatory guidance.	NA	None[b]	None

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 1 (Landfill Z-1)					
Chemical Sludge Waste Pits, known as Landfill Z-1, included seven trenches transecting 2 acres north of the vehicle test track and were used to dispose of chemical waste. Closed under the Resource Recovery and Conservation Act of 1976 (RCRA) in 1983.	Phase 2 RI focused on defining fill and former pit areas. Began with a passive soil gas survey using 50 points on 40-foot centers. Detected volatiles and focused soil sampling (4 surface & 13 subsurface) in northern area of site where volatiles were concentrated in soil gas survey. Samples analyzed for VOCs, SVCOs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined hazard index (HI) for the child. The elevated HI of 3 is due to the soil ingestion route. Thallium was identified as a COC. Maximum concentration in soil was 44 mg/kg (subsurface).		Soil: Thallium (Future Residential Scenario)	Soil: None[c]
SWMU 19 (Old Sewage Treatment Plant)					
Old Sewage Treatment Plant (STP) co-located with New Sewage Treatment Plant and designed to treat domestic waste and pre-treated industrial waste. Located southeast of vehicle test track. Old STP included primary clarifier, dosing siphon, trickling filters, aerobic digester, and four sludge drying beds. Old STP was converted in 1975 to trickling filter plant with addition of secondary clarifier and chlorinating contact chamber.	Investigated concurrently with SWMU 20. Advanced four soil borings between the sewage treatment plant and the treatment lagoon. Collected surface and subsurface samples. Sample points and analyses used to complement four prior investigation samples. Samples analyzed for VOCs, SVOCs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 3 is due to the soil ingestion route. Thallium was identified as a COC. Maximum concentration in soil was 15 mg/kg (subsurface).		Soil: Thallium (Future Residential Scenario)	Soil: None[c]

**Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama**

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 20 (New Sewage Treatment Plant)					
Combined area of water treatment plant and treatment lagoon is ~2.5 acres. New STP incorporated some of the older facilities and a new activated biofilter design. Facility designed to combine wastewater from new IWTP with domestic wastewater, resulting in a single point of discharge to Coldwater Creek.	Identical to SWMU 19 investigation. See above. Both SWMUs occupy the same location.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 3 is due to the soil ingestion route. Thallium was identified as a COC. Maximum concentration in soil was 15 mg/kg (subsurface).		Soil: Thallium (Future Residential Scenario)	Soil: None[c]
SWMU 21 (Abrasive Dust Landfill)					
3-acre open area located north of the Sanitary Landfill (SWMU 2). Used to dispose of waste from sandblasting operations (1977 – 1981). Abrasive dust used to grade landfill. Site is contiguous to SWMU 23 (Asbestos Disposal Trench).	Conducted initial soil gas survey at 15 locations primarily around the rough boundary of the landfill. Soil borings were installed both within and around perimeter of landfill and collected surface and subsurface samples. Use these samples in conjunction with six prior sample results. Samples were analyzed for VOCs, SVOCs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 2 is due to the soil ingestion route. Non-cancer effects were segregated according to target organ; lead was above the blood level guideline for the resident child. Lead was identified as a COC. Maximum concentration in soil was 2,000 mg/kg (subsurface).		Soil: Lead (Future Residential Scenario, Construction Worker)	Soil: None[d]

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 22 (A-Block Lagoon)					
SWMU is a synthetically lined lagoon (~275 x 175 ft) constructed in 1978 to contain liquid waste previously held by SWMU 12. Wastes removed and closed under RCRA in 1982.	Conducted initial soil gas survey using 15 points on 60 ft spacing. Collected soil samples from eight borings, four within the SWMU boundary, to groundwater (20 - 32 ft bgs) to investigate impacts to the soils. Data used in conjunction with prior data to evaluate SWMU. Soil samples were analyzed for VOCs, SVOCs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 4 is due to the soil ingestion route. The HI for the construction worker scenario is 2. Thallium was identified as a COC. Maximum concentration in soil was 36 mg/kg (subsurface).		Soil: Thallium (Future Residential Scenario, Construction Worker)	Soil: None[d]
SWMU 23 (Asbestos Waste Disposal Trench)					
SWMU (~0.66 acres) is a shallow trench that was used from 1980 to 1981 for disposal of insulation containing asbestos. Located adjacent to SWMU 21 (Abrasive Dust Landfill).	No previous sampling on site. Advanced three soil borings within the SWMU limits in a triangular pattern down 51 ft bgs. Groundwater was not encountered in borings. Samples analyzed for VOCs, SVOCs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 2 is due to the soil ingestion route. Non-cancer effects were segregated according to target organ; lead was above the blood level guideline for the resident child. Lead was identified as a COC. Maximum concentration in soil was 2,000 mg/kg (subsurface).		Soil: Lead (Future Residential Scenario, Construction Worker)	Soil: None[d]

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 24 (Old Sanitary Landfill)					
SWMU 24 (the old landfill) is located in southwestern corner of vehicle test track. Large area (~19 acres) that was used to dispose of municipal and domestic waste from 1942 until the New Sanitary Landfill (SWMU 2) was opened in 1972. This site is covered with clean fill and gravel and is used for storage of military hardware.	Initial investigation using geophysical investigation and aerial photography overlay interpretation. Conducted soil gas survey at 30 locations using a 125 x 160 ft grid. Advanced 16 borings (14 within unit) to groundwater or refusal. Collected surface and subsurface soil samples. Analyzed samples for VOCs, SVOCs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 3 is due to the soil ingestion route. Non-cancer effects were segregated according to target organ; lead was above the blood level guideline for the resident child.		Soil: Thallium, Lead (Future Residential Scenario)	Soil: None[d]
SWMU 28 (Waste Wood Landfill)					
This 2-acre landfill is located west of the IWTP (SWMU 4). The landfill was used for disposal of various wood products from 1976 to 1991. SWMU 32 lies partially within the limits of site and SWMU 33 is located just to east.	Conducted initial soil gas survey using 15 points extending in irregular pattern east to west. Seven soil borings were advanced to collect surface and subsurface soil samples. Data used with six prior soil boring location data to asses site. Samples were analyzed for VOCs, SVOCs, and inorganic constituents.	Under residential use, all effects were at or below the EPA targets for non-cancer and cancer effects, with the exception of the combined HI for the child. The elevated HI of 3 is due to the soil ingestion route. Non-cancer effects were segregated according to target organ; lead was above the blood level guideline for the resident child. Thallium was identified as a COC. Maximum concentration in soil was 20 mg/kg (subsurface).		Soil: Lead, Thallium (Future Residential Scenario)	Soil: None[c]

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs
ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 7 (Chemical Waste Burial Pit)					
This site (~5.7 acres) was a pit where corrosive liquids (alkaline corrosion removers) were reportedly dumped into a pit (200 ft X 540 ft) over a 6-month period during 1960. Three separate spills of paint stripper from a 1,000-gallon tank occurred in this area during an unspecified timeframe.	Conducted an initial soil gas survey in a semi-spatial pattern covering the northern limits of the site and the lower 2/3rd of the site. Six subsurface and 4 surface samples were collected based upon the soil gas survey results to complement 9 samples collected from a prior investigation in 1994. Soil samples were analyzed for VOCs, SVOCs, and inorganic constituents.	Lead concentrations exceeded the recommended cleanup level[e] in surface and subsurface soil (2-ft depth) in three areas at depths of 0.5 and 2 ft. Maximum lead concentration in soil was 2,210 mg/kg.		Soil: Antimony, Lead, Thallium (Current/Future Industrial Scenario)	Soil: None[c]
SWMU 9 (Calcium Hypochlorite Burial Pit)					
This small site (~12 X 62 ft) is contiguous to SWMU 12 (see below). SWMU 9 was a subsurface pit used to dispose of 40,000 lbs of calcium hypochlorite stored in 100-lb containers in 1974. Disposal area is approximately 20 to 30 x 75 to 100 ft.	Phase 2 investigation approach used test pits and trenches to define limits of the SWMU and used four soil borings to collect analytical and geochemical data. Soil borings from the contiguous SWMU site plus prior soil investigation data were also used to develop the RI data population. Samples were analyzed for VOCs, SVOCs, and inorganic constituents.	Cadmium, chromium, lead, and zinc concentrations were above their associated cleanup levels in two areas to a depth of 2 ft. Maximum concentrations of lead, cadmium, chromium, and zinc were 1850, 47, 629, and 647 mg/kg, respectively.		Soil: Lead (Current/Future Industrial Scenario)	Soil: Cadmium Chromium Lead Zinc

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 12 (Facility 414 Old Lagoons)					
A 440-ft x 220-ft lagoon included three unlined lagoons where abrasive dust and industrial liquid wastes were stored. Lagoons were dredged and sludge disposed of off-site in 1978. Emergency removal action was initiated in 1997 to treat organic contamination in soil and groundwater.	Conducted an initial soil gas investigation at 40 even spaced points. Collected surface and subsurface soil samples from 10 borings advanced to groundwater (~35-36 ft bgs) to delineate impacts at the site and supplement data from a prior investigation. Soil samples were analyzed for VOCs, SVOCs, and inorganic constituents.	Cadmium, chromium, lead, and/or zinc exceeded their respective cleanup levels to a depth of 2 ft at one area. Maximum concentrations of lead, cadmium, chromium, and zinc were 841, 62, 240, and 419 mg/kg, respectively.		Soil: (Future Residential Scenario Construction Worker)	Soil: Cadmium Lead Zinc
SWMU 13 (Acid Chemical Waste Pit)					
SWMU 13 was a subsurface disposal area Reportedly used for the disposal of tank-truck quantities of unspecified chemical wastes of unknown origin. The site was used from the late 1940s to 1950s or from 1957 to 1972.	Phase 2 RI focused on delineating northern extent of pit and characterize surface and subsurface in and adjacent pit. Conducted soil gas survey at 15 locations in the SWMU, primarily in northern portion. Installed three borings in north portion of SWMU to complement prior investigation data. Soil samples analyzed for VOCs, SVOCs, and inorganic constituents.	Cadmium, lead, and/or zinc exceeded their respective cleanup levels in two areas at depths of 0.5 and 2 ft. Maximum concentration of lead, cadmium, and zinc were 263, 8, and 542 mg/kg, respectively.	6,933 CY	Soil: Antimony[a] (Future Residential Scenario, Construction Worker)	Soil: Cadmium Zinc

Table 2-1. Nature and Extent of Contamination and the COCs at the 28 SIA SWMUs ANAD, Southeast Industrial Area, Anniston, Alabama

Description/History	Investigation Approach	Nature & Extent of Impacts	Waste Quantity	Media/COCs	
				Human Health	Ecological
SWMU 29 and 30 (Old Lumber Disposal Yard and Northeast Lagoon Area)					
SWMU 29, a 6.24-acre site, was used for incineration of waste oil and as a wood disposal and stockpile site. Currently it is the site of a paved parking lot. Waste types and quantities disposed of at SWMU 30 (former lagoon), a 1.8-acre site, are not documented. SWMU 30 is contiguous to the southern portion of SWMU 29. It may also have been used for the disposal of chlorinated solvents.	Investigation consisted of conducting soil sampling within SWMU 29 to complement prior investigation results from four soil borings. Conducted a soil gas survey within limits of former lagoon (SWMU 30) and advanced two soil borings in lagoon plus collected surface samples from three locations to complement data from five previous soil borings. Samples analyzed for VOCs, SVOCs, and inorganic constituents.	SWMU 29 Lead concentrations exceeded the recommended cleanup level at one location at a depth of 0.5 ft. The maximum lead soil concentration was 438 mg/kg. SWMU 30 Lead concentrations exceeded the recommended cleanup level in two areas at depths of 0.5 and 2 ft. The maximum lead soil concentration was 2,800 mg/kg.		Soil: Lead (Current/Future Industrial Scenario)	Soil: None[c]

[a] Identified as a COC in the human health risk assessment; however, based on the cleanup level of 820 mg/kg, no remediation is required. The maximum soil concentration of antimony at SWMU 13 was 383 mg/kg.

[b] Exposures to Dry Creek sediment and surface water were evaluated for residents assuming a wading scenario. Risks to residents did not exceed regulatory targets.

[c] Assessment of risk was not needed because exposure of ecological receptors was determined to be unlikely.

[d] Baseline ecological risk assessment indicated no COCs were identified having a high probability of risk to ecological receptors; therefore, NFA was necessary.

[e] Cleanup levels for each of the COCs are defined in **Table 2-22**.

ANAD = Anniston Army Depot.

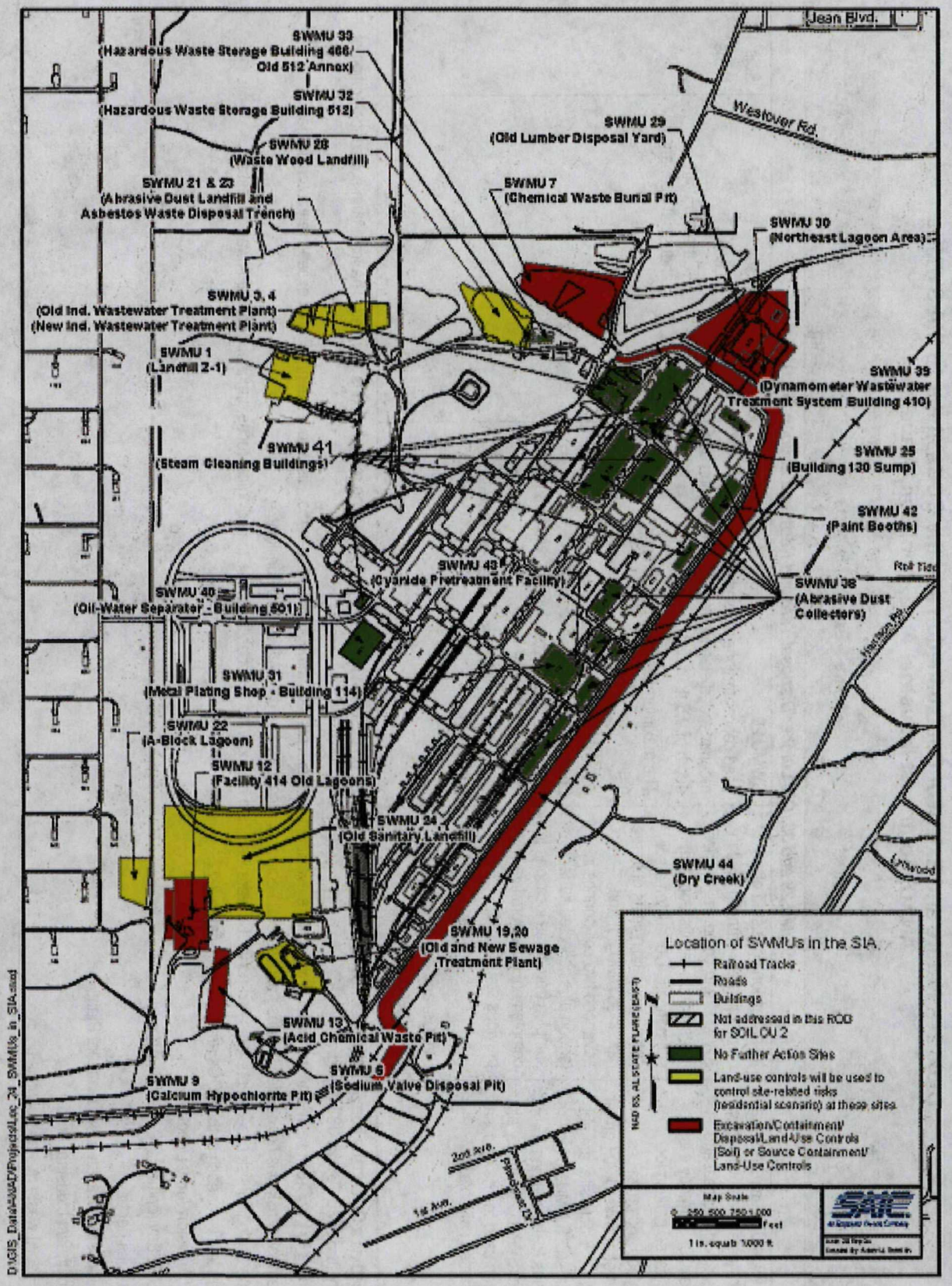
EPA = U.S. Environmental Protection Agency.

gpd = gallons per day.

IWTP = Industrial Wastewater Treatment Plant.

SIA = Southeast Industrial Area.

SWMU = solid waste management unit.



*Land-use controls only.

Figure 2-2. Location of SWMUs Within the ANAD SIA Soils OU

2.5.3 Risk Assessment Conceptual Site Model

Exposure pathways describe the course a chemical or physical agent takes from the source to the exposed receptor. As a result, there are four components to an exposure pathway: (1) a source and mechanism for chemical release, (2) a retention or transport medium, (3) a point of potential contact with the contaminated medium, and (4) an exposure route (e.g., ingestion, dermal adsorption, and inhalation). The exposure pathways evaluated in the risk assessment are presented graphically in CSMs for humans and ecological receptors.

Figure 2-3 presents the CSM for human receptors, who include the industrial worker, resident, and construction worker. **Figure 2-4** presents the ecological CSM.

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The SIA is an active industrial operation area of ANAD. ANAD contains more than 50 buildings and a vehicle test track. Approximately 6,600 people work at ANAD. Access is controlled at the perimeter by fences and guards posted at entry points. According to the 2005 ANAD Master Plan (ANAD 2005), "... land uses are not expected to change significantly during the planned future development of Anniston Army Depot." Therefore, the SIA land use will remain industrial for the foreseeable future, which will prohibit residential use. Land surrounding the installation includes residential, agricultural, and commercial uses.

Currently, water is supplied to ANAD by pipeline from Anniston Water Works and Sewer Board (AWWSB); consequently, there are no current exposures to groundwater beneath ANAD as a drinking water source. For the foreseeable future, water will continue to be supplied from AWWSB.

Humans, livestock, and wildlife may be exposed to groundwater from a well, spring, or surface water within 1 mile of the ANAD boundary. Groundwater is a source of Anniston's public water supply, which is managed by AWWSB. Groundwater from wells and springs is used for residential and agricultural purposes. In 2003, there were 55 homes in the vicinity of ANAD that use groundwater as their sole source of water supply. Surface water is used primarily for recreational and agricultural activities.

2.7 SUMMARY OF SITE RISKS

A baseline risk assessment was conducted to determine the potential for adverse effects associated with exposures to chemicals present at sites within the SIA. Baseline risks are risks to human and ecological receptors in the absence of remediation or institutional controls at the site. The results of the human health and ecological risk assessments (ERAs) are provided in Sections 2.7.1 and 2.7.2, respectively. Section 2.7.3 describes the basis for proceeding with remedial actions at these SWMUs.

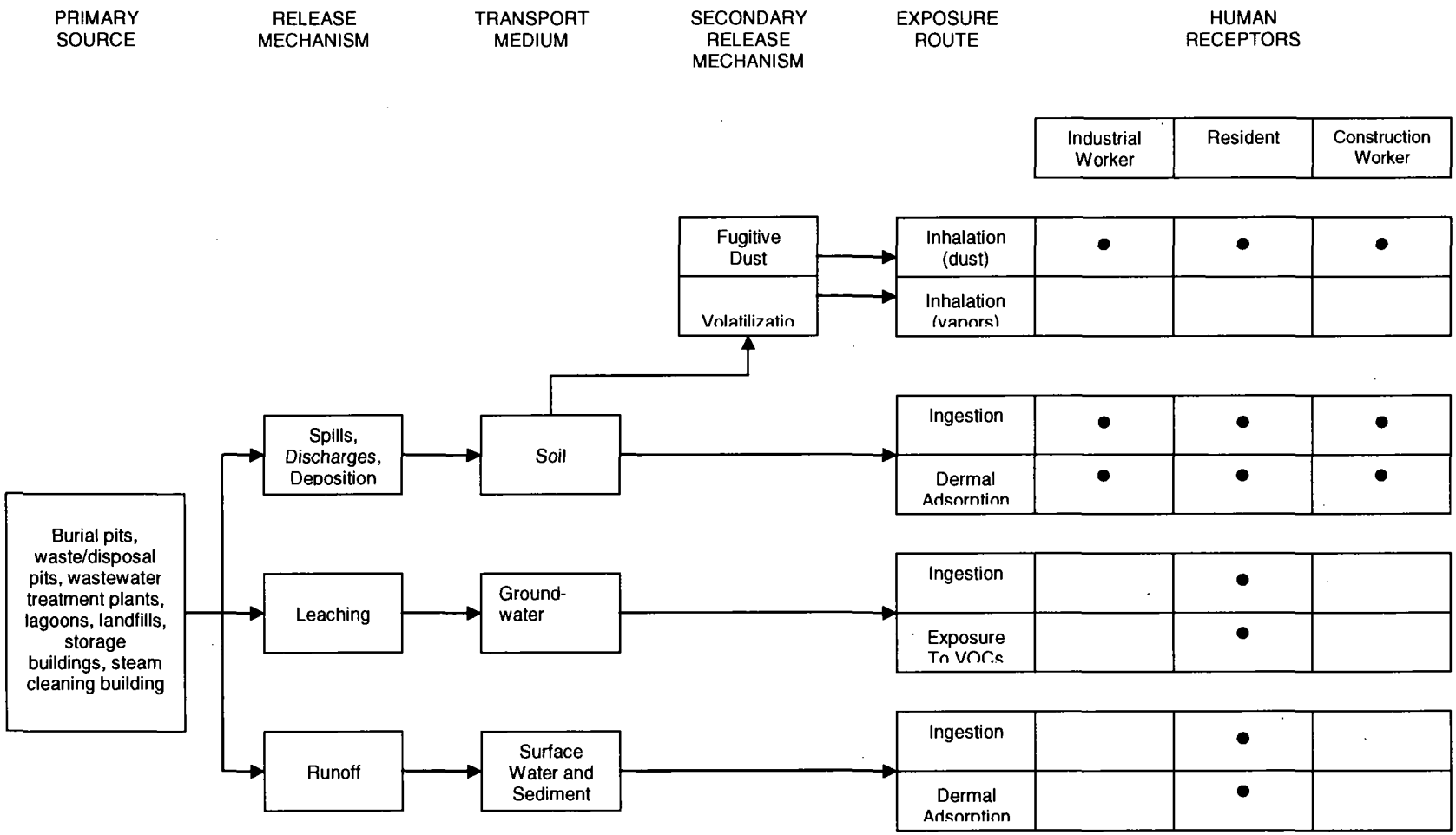


Figure 2-3. Conceptual Site Model for Human Receptors

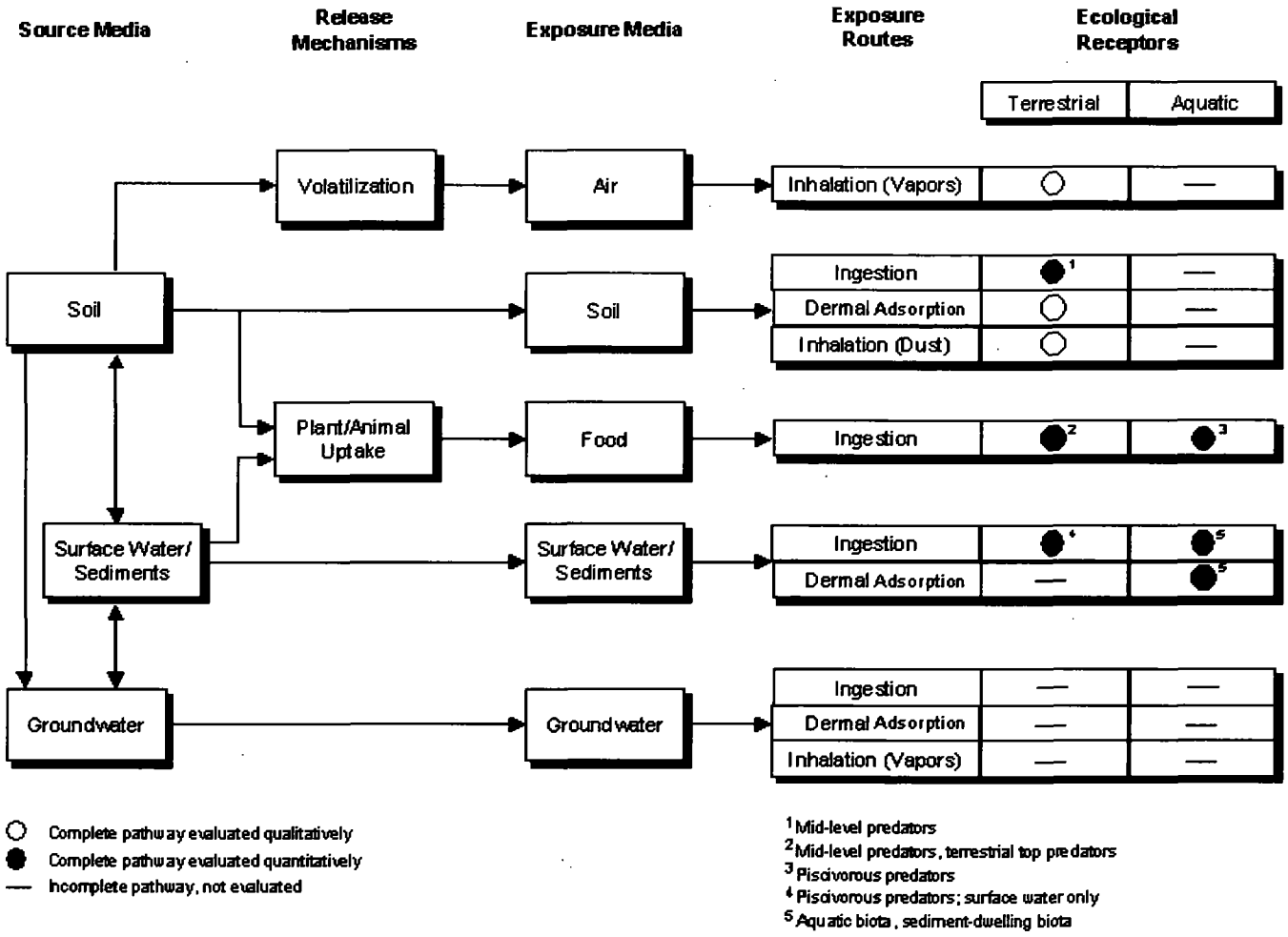


Figure 2-4. Conceptual Site Model for Ecological Receptors

2.7.1 Summary of Human Health Risk Assessment

This section presents a summary of the human health risks for each SWMU evaluated. These risks, together with the results of the ERA, support decisions for NFA or further action. In the case of the latter, the human health risk results also support the selection of the remedial action that will be implemented at a given SWMU (e.g., LUCs, excavation). The selected remedies for each SWMU are presented in **Table 1-1**. It should be noted that the RI and FS addressing the SIA also include groundwater (OU 1) within its scope; however, the groundwater is part of a separate operable unit.

For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1E-04 and 1E-06 using information on the relationship between dose and response. The 1E-06 risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure. Regulatory target for non-cancer risk is a hazard index (HI) of 1. In all cases, the final remedy for the SWMU is selected considering both human health and ecological risk. The human health cancer and non-cancer risks are summarized in **Table 2-2**. The results of the modeling that determines levels of lead in the blood are summarized in **Table 2-3**.

The subsequent discussion focuses on the current and reasonably anticipated future land use (i.e., industrial) and begins with a presentation of the associated COCs identified in the risk assessment. These COCs are the most important because they are the drivers for the selected remedy and the cleanup goals at a given SWMU. The following discussion presents the major steps in the risk assessment process that result in identification of these COCs: exposure assessment, toxicity assessment, and risk characterization (including associated uncertainty).

2.7.1.1 Chemicals of Concern

In accordance with EPA Region 4 supplemental guidance (EPA 1995), COCs in the Human Health Risk Assessment (HHRA) are defined as chemicals that significantly contribute to a pathway that exceeds a 1E-04 cumulative cancer risk or a non-cancer HI of 1. Lead (which is not evaluated in terms of cancer risk or non-cancer hazard) is identified as a COC if blood lead levels exceed the proposed benchmark concentration developed by the CDC. Under this guideline, there must be a 95% probability that blood lead levels will not exceed 10 micrograms per deciliter (µg/dl) [EPA 1994].

Table 2-4 identifies the COCs for the industrial land-use scenario and their associated exposure point concentrations (EPCs) [i.e., the concentration used to estimate exposure and risk]. This table also includes the range of concentrations detected, the frequency of detection (i.e., the number of times the chemical was detected in the samples collected), and how the EPC was derived. The EPCs are included in Table 2-4 for the Industrial Land-Use scenario.

As shown in **Table 2-4**, the COCs identified for the industrial land-use scenario are as follows:

- lead at SWMUs 7, 9, 29, and 30 due to exceedance of the target blood lead level, and
- antimony (at SWMU 13)[2] due to exceedance of the non-cancer target HI.

[2] Antimony was identified as a COC in the human health risk assessment using overly conservative exposure assumptions and is included in this ROD. However, a revised cleanup level was calculated using more realistic exposure assumptions and concentrations in soil at SWMU 13 do not exceed the revised cleanup level. Therefore, no remediation is required for antimony at SWMU 13.

Table 2-2. Summary of Human Health Cancer and Non-cancer Risks Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

SWMU(s)*	Industrial Worker		Construction Worker		Resident Child		Resident Adult	
	Non-cancer HI	Cancer Risk	Non-cancer HI	Cancer Risk	Non-cancer HI	Cancer Risk	Non-cancer HI	Cancer Risk
1	2E-01	2E-05	1E+00	2E-06	**3E+00**	2E-05	4E-01	3E-05
3, 4, 41	4E-04	0E+00	5E-01	2E-06	1E+00	2E-05	2E-01	2E-05
6	NA	NA	9E-02	2E-06	2E-01	1E-05	3E-02	9E-06
7	6E-01	2E-05	**2E+00**	3E-06	**6E+00**	2E-05	1E+00	4E-05
9	1E+00	5E-05	**4E+00**	7E-06	**1E+01**	5E-05	**2E+00**	9E-05
12	4E-01	2E-05	8E-01	3E-06	**2E+00**	2E-05	6E-01	3E-05
13	**3E+00**	1E-05	**7E+00**	5E-06	**2E+01**	4E-05	**5E+00**	4E-05
19, 20	2E-01	5E-06	1E+00	7E-07	**3E+00**	5E-06	6E-01	9E-06
21, 23	2E-03	5E-05	9E-01	1E-05	**2E+00**	9E-05	5E-01	1E-04
22	2E-01	9E-06	**2E+00**	2E-06	**4E+00**	2E-05	6E-01	2E-05
24	6E-02	1E-05	1E+00	3E-06	**3E+00**	2E-05	4E-01	2E-05
25	NA	NA	7E-03	4E-06	2E-02	3E-05	6E-03	5E-05
28	2E-01	2E-05	1E+00	6E-06	**3E+00**	5E-05	5E-01	5E-05
29, 30	3E-01	1E-05	1E+00	5E-06	**4E+00**	4E-05	7E-01	5E-05
31, 43	NA	NA	7E-02	2E-06	2E-01	2E-05	2E-02	2E-05
38	1E-01	0E+00	7E-01	5E-06	2E+00**	4E-05	3E-01	5E-05
40	NA	NA	9E-05	0E+00	2E-04	0E+00	4E-05	0E+00
44	NA	NA	NA	NA	6E-01	2E-05	1E-01	3E-05

NA = pathway not evaluated.

0E+00 = pathway evaluated but risks were not calculated due to lack of EPA-approved toxicity values.

Bolded values represent exceedance of regulatory targets (the regulatory target for cancer risk is 1E-04; the regulatory target for non-cancer hazard index (HI) is 1).

* A human health risk assessment was not conducted for SWMUs 32, 33, 39, and 42. No further action was recommended for these SWMUs (only a visual inspection was recommended for SWMU 42) in the Phase 1 RI (Jacobs Engineering Group 1994).

** At SWMU 38, although the overall non-cancer HI for the resident child exceeds the regulatory target, the target organ HI does not exceed the target; therefore, no human health chemicals of concern were identified for this SWMU.

Table 2-3. Summary of Human Health Lead Modeling
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

SWMU(s)	Industrial Worker	Construction Worker	Resident Child
7	**> target**	**> target**	**> target**
9	**> target**	**> target**	**> target**
12	= target	**> target**	**> target**
21,23	NA	**> target**	**> target**
28	< target	**> target**	**> target**
29,30	**> target**	**> target**	**> target**

Bolded text represents exceedance of target.
Target = blood lead levels in 95% of the population are at or below the 10-µg/dL level of concern established by the Centers for Disease Control and Prevention, Atlanta, Georgia.

Table 2-4. COCs and Exposure Point Concentrations in Soil
For The Industrial Land-Use Scenario
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

SWMU[a]	Chemical of Concern	Concentration Detected (mg/kg)		Frequency of Detection	Exposure Point Concentration (µg/g)	Statistical Measure
		Minimum	Maximum			
7	Lead	42.4	1,300	6/6	1,300	Maximum
9	Lead	30.1	1,850	9/9	1,850	Maximum
13	Antimony	20.4	383	3/9	367	95% UCL[b]
29 and 30	Lead	18.4	2,080	13/16	1,050	95% UCL[b]

[a] SWMU = Solid waste management unit.
[b] UCL = Upper confidence limit.
COC = chemical of concern.

For all other SWMUs, risks for the industrial land-use scenario were below regulatory targets (therefore, no COCs were identified). The 95% upper confidence limit (UCL_{95}), however, on the arithmetic mean was used as the EPC at SWMUs 13 and 29 and 30. At SWMUs 7 and 9, the maximum concentration was used as the default EPC. The UCL_{95} is a calculated statistic and may not always represent actual exposures (e.g., when data sets are small). Therefore, when the UCL exceeds the maximum detected concentration at a SWMU, the maximum is used as the EPC as was the case for SWMUs 7 and 9.

2.7.1.2 Exposure Assessment

The baseline risk assessment addressed risks associated with current and future industrial and future residential land-use scenarios. Industrial workers, construction workers, and resident children and adults were evaluated in the RI as part of these land-use scenarios. However, the focus of this ROD is on the industrial land-use scenario because this scenario is the current and most likely future land use of the SIA (ANAD 1987). The residential scenario is hypothetical because no residents currently live on the sites. Furthermore, residents are not expected to occupy the sites in the future.

The exposure pathways evaluated in the baseline risk assessment are presented in the CSM (see **Figure 2-2**). For the industrial land-use scenario, the pathways evaluated include soil ingestion, dermal

contact with soil, and inhalation of suspended soil particulates. The exposure assumptions for this scenario are presented in **Table 2-5**. These assumptions are combined with the EPCs to calculate intake or dose. Migration of contaminants in the soil to the groundwater was eliminated as a pathway of concern in the 1998 RI based upon comparison to soil screening levels and comparison of chemicals that exceeded the soil screening levels to chemicals detected and evaluated in the groundwater.

2.7.1.3 Toxicity Assessment

The objectives of the toxicity assessment are to evaluate the inherent toxicity of the compounds under investigation and to identify and select toxicity values for use in risk characterization. For antimony, toxicity data are available indicating its potential for adverse non-cancer health effects in humans. The chronic toxicity data available for oral exposure to antimony have been used to develop an oral reference dose (RfD). The RfD is an acceptable intake value for chronic exposure to chemicals causing non-cancer effects. The oral RfD for antimony is presented in **Table 2-6** and was obtained from EPA's Integrated Risk Information System (IRIS) database (EPA 1997). At this time, RfDs are not available for the dermal route of exposure. Therefore, an adjustment factor was applied to convert the oral RfD into a dermal RfD (**Table 2-7**). Antimony is not classified as a carcinogen and, thus, does not have a toxicity value for cancer effects.

Table 2-5. Exposure Assumptions for the Human Health Risk Assessment Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Pathway	Assumption	Units	Current/Future Land Use (Industrial Worker)
			RME
General	Body Weight	kg	70
	Exposure Duration	years	25
	Averaging Time – Non-cancer	days	9,125
	Averaging Time – Cancer	days	25,550
Soil Ingestion	Ingestion Rate	mg soil/day	50
	Exposure Frequency	days/year	250
	Conversion Factor	kg soil/mg soil	1E-06
	Exposure Duration	years	25
	Averaging Time – Non-cancer	days	9,125
Soil Dermal Contact	Skin Surface Area Available	cm^2/day	5,800
	Soil-to-Skin Adherence Factor	mg soil/cm^2	1
	Dermal Absorption Factor	unitless	Chemical-specific
	Exposure Frequency	days/year	250
	Conversion Factor	kg soil/mg soil	1E-06
Fugitive Dust Inhalation	Inhalation Rate	m^3 air/day	20
	Particulate Emission Factor	m^3 air/kg soil	4.63E+09
	Exposure Frequency	days/year	250
	Conversion Factor	kg soil/mg soil	1E-06

RME = Reasonable maximum exposure.

For lead, toxicological studies indicate that there may be no threshold of exposure to lead below which adverse effects do not occur. Lead is classified as a B2 carcinogen (probable human carcinogen), but EPA does not provide a non-cancer RfD or a cancer toxicity value. Instead, biokinetic models were used to

estimate blood lead levels in resident children and adult workers (EPA 1994 and 1996, respectively) as recommended by EPA. Biokinetic models attempt to establish a relationship between lead concentrations in environmental media and the concentration of lead in the blood of an exposed person using information on exposure, absorption, and the transfer of lead between the blood and other body tissues. The estimated blood lead concentrations were then compared to the CDC target of 10 µg/dL at the 95th percentile of the exposed population.

Table 2-6. Toxicity Values for Evaluation of Ingestion and Inhalation Pathways: Non-cancer Chronic Effects
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Compound	Oral Route			Inhalation Route			Non-carcinogenic Target Organ and Critical Effect
	RfD (mg/kg/day)	Uncertainty Factor	Source	RfC	Uncertainty Factor (mg/m³)	Source	
Antimony	4.E-04	1,000	EPA 1997	–	–	–	Whole body, blood; including mortality

RfC = Reference concentration.
RfD = Reference dose.

Table 2-7. Toxicity Values for Evaluation of the Dermal Contact Pathway: Non-cancer Effects
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Compound	Dermal Route Chronic RfD (mg/kg/day)	Gastrointestinal Absorption Factor (unitless)	Source	Dermal Absorption Factor (unitless)	Source	Dermal Permeability Coefficient (cm/hour)	Source
Antimony	8.0E-06	0.02	[b]	0.001	[c]	1.0E-03	[d]

[a] The chronic RfD for the dermal route was calculated by multiplying the chronic oral RfD by the gastrointestinal absorption factor (GAF).
[b] This GAF was compiled by the Biomedical and Environmental Information Analysis Section of the Health and Safety Research Division of Oak Ridge National Laboratory for use at all U.S. Department of Energy–Office of Research and Development sites.
[c] EPA 1995. EPA Region 4 recommends default dermal absorption factors of 1% for organic compounds and 0.1% for inorganic analytes.
[d] The default permeability coefficient from EPA's *Dermal Exposure Assessment* (1992) was used for these metals in the absence of chemical- specific coefficients.
RfD = Reference dose (mg/kg/day).

2.7.1.4 Risk Characterization

Risk characterization combines the exposure and toxicity assessments by comparing estimates of intake or dose with appropriate toxicity values. The objective of the baseline risk characterization is to determine whether exposure to chemicals at the sites under investigation poses risks that exceed target levels for human health effects.

For exposure to antimony, the potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified period with an RfD derived for a similar exposure period. The RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ <1 indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that

chemical are unlikely. Where multiple chemicals are involved, the HI is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) or that operate through the same mechanism of action within a medium or across all media to which a given individual reasonably may be exposed. An HI <1 indicates that based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI >1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

$$HQ = CDI/RfD,$$

where

CDI = chronic daily intake (mg/kg/day),
RfD = reference dose (mg/kg/day).

For lead, biokinetic models were used to estimate blood levels of lead in resident children and adult workers. "LEAD 0.99d" (EPA 1994) is the model recommended by EPA for children and is based on the uptake of lead originating from various sources in the environment. For adult workers, a model developed by EPA was used that is designed to evaluate and protect the fetuses of pregnant, working women (EPA 1996). Lead exposures pose an unacceptable risk if the blood lead level of the resident child or the fetus of a female adult worker exceeds the proposed benchmark concentration developed by the CDC. Under this guideline, there must be a 95% probability that blood lead levels will not exceed 10 µg/dL. If blood lead levels exceed this guideline, site-related exposures may present a risk to human health.

Tables 2-8 through **2-11** provide the risk characterization summaries for the industrial land-use scenario pathways at SWMUs 7, 9, 13, 29, and 30, respectively. These risk estimates are based on a reasonable maximum exposure (RME) and were developed by taking into account various conservative assumptions about the frequency and duration of an industrial worker's exposure to soil, as well as the toxicity of the COCs. At SWMUs 7, 9, 29, and 30, the mean blood lead levels in the fetus of an industrial worker at the 95th percentile are 12, 15, and 11 µg/dL, respectively (exceeding the CDC target of 10 µg/dL). At SWMU 13, the estimated HI of 3.4 indicates that the potential for adverse non-cancer effects could occur from exposure to contaminated soil.

Antimony was identified as a COC in the human health risk assessment using overly conservative exposure assumptions and is included in this ROD. However, a revised cleanup level was calculated using more realistic exposure assumptions and concentrations in soil at SWMU 13 do not exceed the revised cleanup level. Therefore, no remediation is required for antimony at SWMU 13.

Table 2-8. Risk Characterization Summary for Industrial Land Use Chemical of Concern at SWMU 7
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Mean Blood Level in Fetus at 95th Percentile (µg/dL)
Soil	Soil on-site, direct contact	Lead	Central nervous system, blood	12

SWMU = Solid waste management unit.

Table 2-9. Risk Characterization Summary for Industrial Land Use Chemical of Concern at SWMU 9
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Mean Blood Level in Fetus at 95th Percentile (µg/dL)
Soil	Soil on-site, direct contact	Lead	Central nervous system, blood	15

SWMU = Solid waste management unit.

Table 2-10. Risk Characterization Summary for Industrial Land Use Chemical of Concern at SWMU 13
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-cancer Hazard Quotient		
				Ingestion	Dermal	Total
Soil	Soil on-site, direct contact	Antimony[3]	Whole body, blood	0.4	3	3.4

SWMU = Solid waste management unit.

Table 2-11. Risk Characterization Summary for Industrial Land Use Chemical of Concern at SWMUs 29 and 30
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Mean Blood Level in Fetus at 95th Percentile (µg/dL)
Soil	Soil on-site, direct contact	Lead	Central nervous system, blood	11

SWMU = Solid waste management unit.

Uncertainty is inherent in every step of the risk assessment process. Uncertainty is associated with the analytical data (e.g., representativeness of the sample data and accuracy of the laboratory analyses) and creates the potential for either overestimating or underestimating risks to receptors. In addition, uncertainty is a part of the exposure assessment and primarily is associated with the exposure scenarios evaluated, the models used, and the exposure parameters used to estimate intake. In the baseline HHRA, the industrial scenario is realistic and representative of current and likely future land use. The models and exposure parameters used to estimate risk are fairly conservative (i.e., would tend to overestimate risk) because the assumptions used represent a reasonable maximum scenario (e.g., an industrial worker is exposed to contaminants at each site for 5 days per week, 50 weeks per year, for 25 years).

[3] Antimony was identified as a COC in the human health risk assessment using overly conservative exposure assumptions and is included in this ROD. However, a revised cleanup level was calculated using more realistic exposure assumptions and concentrations in soil at SWMU 13 do not exceed the revised cleanup level. Therefore, no remediation is required for antimony at SWMU 13.

Many aspects of the toxicity assessment are uncertain. For example, the conditions under which the experimental studies used to derive the toxicity values are conducted are different from typical human exposure in an environmental setting (e.g., the study design, species, sex, and routes of exposure may differ). In general, conservatism is built into the existing toxicity values (e.g., safety factors are included in the derivation of these values). However, toxicity values are not available for some chemicals and, thus, may contribute to the underestimation of risks. In an effort to quantify some of the uncertainty associated with the risk assessment, a central tendency exposure scenario was included in the baseline risk assessment that incorporated assumptions representing average or mid-range exposure rather than an RME scenario. The inclusion of this scenario provided stakeholders with a range of possible risks (as opposed to a single risk estimate) that could be used to facilitate risk-based decisions. However, the COCs addressed in this ROD and cleanup levels proposed are based on the RME scenario.

2.7.2 Summary of Ecological Risk Assessment

An ERA for the SIA identified and evaluated the current and future risk to biota exposed to site related contaminants (SRCs) under existing conditions in accordance with EPA guidance.

Twenty-five SWMUs were assessed in the SIA ERA.[4] Eight SWMUs (SWMUs 9, 12, 13, 22, and 24 in the Southwest Area; SWMUs 21 and 23 in the Northwest Area; and SWMU 44 Dry Creek) were evaluated quantitatively in the ERA because ecological receptors are potentially exposed to ecological chemicals of potential concern (COPCs) at these locations. The potential exposure pathways were judged to be incomplete in the remaining 17 SWMUs (SWMU's 1, 3, 4, 6, 7, 19, 20, 25, 28, 29, 30, 31, 38, 40, 41, 42, and 43). Based on comparison of soil concentrations to toxicity benchmarks for soil invertebrates and modeled doses to wildlife receptors exposed to COPCs in soil, unacceptable risks to biota were identified at three SWMUs: SWMU 9, SWMU 12, and SWMU 13. Based on toxicity tests of sediment and surface water in Dry Creek (SWMU 44), no unacceptable risk was identified for aquatic and sediment-dwelling biota (SAIC 2001). Section 2.7.2.1 identifies the ecological COCs identified in the ERA. Highlights of each of the ERA steps are provided in Sections 2.7.2.2 to 2.7.2.4 (SAIC 1998a).

2.7.2.1 Chemicals of Concern

The ERA for the SIA identified four metals in soil (cadmium, chromium, lead, and zinc) at SWMUs 9, 12 and 13 and zinc in surface water, 12 polycyclic aromatic hydrocarbons (PAHs) and lead in sediment at SWMU 44 as posing a potential for significant risk to ecological receptors. Subsequently, toxicity tests of sediment and surface water from Dry Creek found no samples with significantly lower survival of test species compared to background surface water and sediment (SAIC 2001). Therefore, COCs identified in the ERA for sediment and surface water in SWMU 44 do not pose an unacceptable risk to aquatic and sediment-dwelling biota and are not discussed further in this ROD. **Table 2-12** identifies the COCs for soil identified in the ERA and these are based upon concentrations in soils or sediments exceeding NOAELs (no observed adverse effect levels) for key individual species. The table includes the maximum, RME, and mean concentrations detected; two times (2×) the mean background concentrations; toxicity benchmarks; and risk quotient values. The RME concentration is the lower of the UCL_{95} on the mean and the maximum detected concentration.

2.7.2.2 Problem Formulation

Problem formulation provided the basis for the implementation of the subsequent three steps of the ERA. During this phase, the CSM shown in Section 2.5.3 was defined. Based on two reconnaissance trips made to the SIA to evaluate qualitatively the suitability of the terrestrial and aquatic habitats for ecological

[4] SWMUs 32, 33, and 39 were recommended for no further action in the Phase 1 RI (Jacobs Engineering Group 1994).

receptors and to identify likely exposure pathways, 17 SWMUs were judged not to have complete exposure pathways due to the absence of a source medium (surface soil, sediment, or surface water) or suitable foraging or nesting habitat for ecological receptors. Most of the SIA is highly industrialized, containing little to no vegetation or exposed soil. A quantitative screening-level risk assessment was identified as being necessary for the eight remaining SWMUs where ecological receptors were judged to be potentially exposed to COPCs: SWMUs 9, 12, 13, 22, 24, 21, 23, and 44. Assessment and measurement endpoints were identified during problem formulation.

2.7.2.3 Exposure Assessment

Potential exposure pathways were evaluated in the exposure assessment. The concentrations of ecological COPCs to which each endpoint receptor could be exposed (i.e., exposure concentrations) were estimated for those pathways judged to be most likely to lead to the highest potential risk. Exposure estimates were computed from the measured concentrations of ecological COPCs in soil. These exposure concentrations were compared to published effects-threshold concentrations to characterize risks to endpoint receptors from exposure to the ecological COPCs in the exposure media.

Table 2-13 identifies the ecological pathways of concern used in the ERA for the exposure medium (soil) and receptor. The table also identifies if any of the media involve a potentially sensitive environment or if the receptor is a threatened or endangered species. The ERA assessment and measurement endpoints also are defined for each receptor. Assessment endpoints are statements indicating the desired condition of the environment for receptors known or likely to be present at ANAD and potentially exposed to site contaminants. Measurement endpoints (i.e., contaminant concentrations and toxicity benchmarks) were used in the ERA to indicate if risk to an ecological receptor was unlikely or if further evaluation was needed.

2.7.2.4 Effects Assessment

The effects assessment describes the relationship between the magnitude of exposure to contaminants and the severity of adverse effects to biota. Effects-threshold concentrations are the maximum exposure concentrations associated with a level of effect that does not cause an unacceptable degree of harm to receptors. The effects-threshold concentrations were identified from published sources and used to calculate risk quotients for ecological COPCs. All of the benchmarks used in the ERA are documented in the Phase 2 RI (SAIC 1998a) for each of the receptors defined in **Table 2-13**. Toxicity tests of Dry Creek (SWMU 44) sediment and surface water found no samples with significantly lower survival of test species compared to background surface water. Constituents in surface water and sediment are, thus, not considered COCs for SWMU 44.

2.7.2.5 Risk Characterization

In risk characterization, the potential for adverse effects was estimated for each receptor species and ecological COPC at a given SWMU as the ratio of the estimated exposure concentration and the effects-threshold concentration. The final characterization of risk was based on an evaluation of these risk quotients in view of the assumptions and uncertainty in the data used in the exposure and effects assessments. Modeled doses to wildlife receptors exposed to COPCs in soil suggested unacceptable risks to wildlife biota at three SWMUs: SWMU 9, SWMU 12, and SWMU 13.

Table 2-12. Occurrence and Distribution of ERA Chemicals of Concern in Soil Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

COC	SWMU	Concentration (mg/kg)				Toxicity Benchmark		Risk Quotient Value[a]
		Max	RME	Arithmetic Mean	Background (2 Times the Mean)	Value (mg/kg)	Source	
Cadmium	9	76.9	77	21.5	ND	0.1	NOAEL (Opresko et al. 1994, 1995)[b]	1,500 (Shrew)
Chromium	9	647	647	147	48.7	0.4	Will and Suter (1995)[c]	1,600 (Soil invertebrates)
Lead	9	1,850	1,850	426	47	12	NOAEL (Opresko et al. 1994, 1995)[b]	76 (American robin)
Zinc	9	629	629	206	37.7	34	NOAEL (Opresko et al. 1994, 1995)[b]	9.4 (American robin)
Cadmium	12	62	41	8.98	ND	0.1	NOAEL (Opresko et al. 1994, 1995)[b]	790 (Short-tailed shrew)
Chromium	12	240	150	65.1	48.7	0.4	Will and Suter (1995)[c]	9.6 (American robin) 380 (Soil invertebrates)
Lead	12	841	763	183	47	12	NOAEL (Opresko et al. 1994, 1995)[b]	65 (American robin)
Zinc	12	346	215	133	37.7	34	NOAEL (Opresko et al. 1994, 1995)[b]	6.4 (American robin)
Cadmium	13	8	6	4.69	ND	0.1	NOAEL (Opresko et al. 1994, 1995)[b]	110 (Short-tailed shrew)
Lead	13	263	199	154	109	12	NOAEL (Opresko et al. 1994, 1995)[b]	17 (American robin)
Zinc	13	430	250	181	37.7	34	NOAEL (Opresko et al. 1994, 1995)[b]	7.4 (American robin)

[a] Quotients calculated using RME concentration (lower of the 95% upper confidence limit on the mean and the maximum detected concentration).
[b] Benchmark derived from NOAEL dietary thresholds (Opresko et al. 1994, 1995) and exposure factors.
[c] Benchmark derived from toxicity data (Will and Suter 1995).
[d] Benchmark derived from published data (Long and Morgan 1991).
[e] Lowest of fish, daphnid, and invertebrate lowest chronic values (Suter and Mabrey 1996).
COC = Chemical of concern.
EPA = U.S. Environmental Protection Agency.
ER-L = Effects Range – Low.
Max = Maximum detected concentration.
RME = Reasonable maximum exposure.
ND = Not detected.
NOAEL = No observed adverse effect level.
SWMU = Solid waste management unit.

Table 2-13. Ecological Pathways of Concern for Soil
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Sensitive Environment Flag (Y or N)	Receptor	Endangered/ Threatened Species Flag (Y or N)	Exposure Routes	Assessment Endpoints	Measurement Endpoints
N	Soil invertebrates (earthworms)	N	Ingestion and dermal absorption of contaminants in soil	Maintenance of community for nutrient and energy processing	Soil concentrations and earthworm toxicity benchmarks
N	Short-tailed shrew	N	Ingestion of contaminants in soil and tissue of food	Maintenance of population size	Soil concentrations, predicted residue levels in food, and toxicity data for endpoint species
N	American robin	N	Ingestion of contaminants in soil and tissue of food	Maintenance of population size	Soil concentrations, predicted residue levels in food, and toxicity data for endpoint species
N	Red-tailed hawk	N	Ingestion of contaminants in tissue of prey	Maintenance of reproductive success of terrestrial top predators	Soil concentrations, predicted residue levels in prey, and toxicity data for endpoint species
N	Cooper's hawk	Y (state-protected species)	Ingestion of contaminants in soil and tissue of prey	Maintenance of reproductive success of State-protected species	Soil concentrations, predicted residue levels in prey, and toxicity data for endpoint species

Table 2-14 summarizes the COC concentrations in soil expected to be protective of ecological receptors, and the basis for these concentrations. The basis for the protective concentration is the lowest observed adverse effect level (LOAEL) for the wildlife receptor species with the highest risk estimate. All the protective concentrations assume the ecological receptor obtains all of its diet from each sample location.

Table 2-14. COC Soil Concentrations (mg/kg) Expected to Provide Adequate Protection of Ecological Receptors
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

COC	SWMUs	Protective Level[a]	Basis	Assessment Endpoint (Species)
Cadmium	9, 12, 13	4	LOAEL	Mammalian insectivore (shrew)
Chromium	9, 12	64	LOAEL	Avian insectivore (robin)
Lead	9, 12	220	LOAEL	Avian insectivore (robin)
Zinc	9, 12, 13	137	LOAEL	Avian insectivore (robin)

[a] Soil concentration resulting in dose to Assessment Endpoint Species corresponding to LOAEL dose.
COC = Chemical of concern.
SWMU = Solid waste management unit.
LOAEL = Lowest observed adverse effect level.

2.8 REMEDIAL ACTION OBJECTIVES

The remedial action objectives (RAOs) follow for each medium:

- *Soil*
  - ***Human Health***—Prevent ingestion/inhalation/direct contact of industrial workers with COCs in excess of recommended cleanup levels at SWMUs 7, 9, 29, and 30 (lead). At sites where future residential risks were identified, the objective is to prevent exposure of this population to soil at SWMUs 1, 12, 13, 19, 20, 21, 22, 23, 24, and 28.
  - ***Environment***—Prevent exposure of ecological receptors to COCs in excess of cleanup levels at SWMUs 9 and 12 (cadmium, chromium, lead, and zinc) and SWMU 13 (cadmium and zinc). The cleanup levels are shown above in Table 2-14 as "Protective Level."

These objectives address the requirement to reduce the current risks to human health and the environment by reducing the concentrations of the COCs in their respective media or controlling site risks through other measures. As noted in Section 2.7, human health COCs are those contaminants that were identified in the risk assessment under the industrial scenario, the reasonably anticipated future land use at ANAD's SIA.

2.9 DESCRIPTION OF ALTERNATIVES

Remedial action alternatives for the 28 SWMUs are presented in this section. The alternatives presented and discussed in this section are based on updates to the final alternatives presented in the FS (SAIC 1999). Note that the soil alternatives were expanded to include a LUC alternative (Soil Alternative 2 in this ROD); therefore, Soil Alternatives 2 to 4 in the FS are now Soil Alternatives 3 to 5 in this ROD. Furthermore, as noted in Section 2.14, the Dry Creek Selected Remedy has been updated to reflect the results of the toxicity testing completed in 2001 (SAIC 2001).

Figures 2-5 to **2-8** show the areas targeted for soil excavation and removal at SWMUs 7, 9, 12, 13, 29, and 30, respectively. **Table 2-15** identifies the area size, depth, and volume associated with these SWMUs where one or more constituent(s) exceeds its respective cleanup level (see Section 2.12.4). This information supports the discussion below on the alternatives.

2.9.1 Description of Remedy Alternatives and Components

This ROD addresses 28 total SWMUs. Thirteen SWMUs have been designated as NFA for soils (SWMU's 3, 4, 6, 25, 31, 32, 33, 38, 39, 40, 41, 42, and 43); one is designated as NFA for sediments and surface water (SWMU 44); eight have been designated for LUCs for potential future residential use scenarios (SWMUs 1, 19, 20, 21, 22, 23, 24, and 28); and, six are designated for RA and LUCs because of human health or ecological risk for the current industrial use scenario (SWMUs 7, 9, 12, 13, 29, and 30). The key elements of feasible remedial action alternatives are presented in **Table 2-16**.

The following discussion presents an overview of the alternative, key technologies, construction and operation and maintenance (O&M) requirements, system reliability, project life, and estimated costs. As noted in Section 2.10, Soil Alternative 1 would apply to 13 of the SWMUs for which NFA is appropriate.

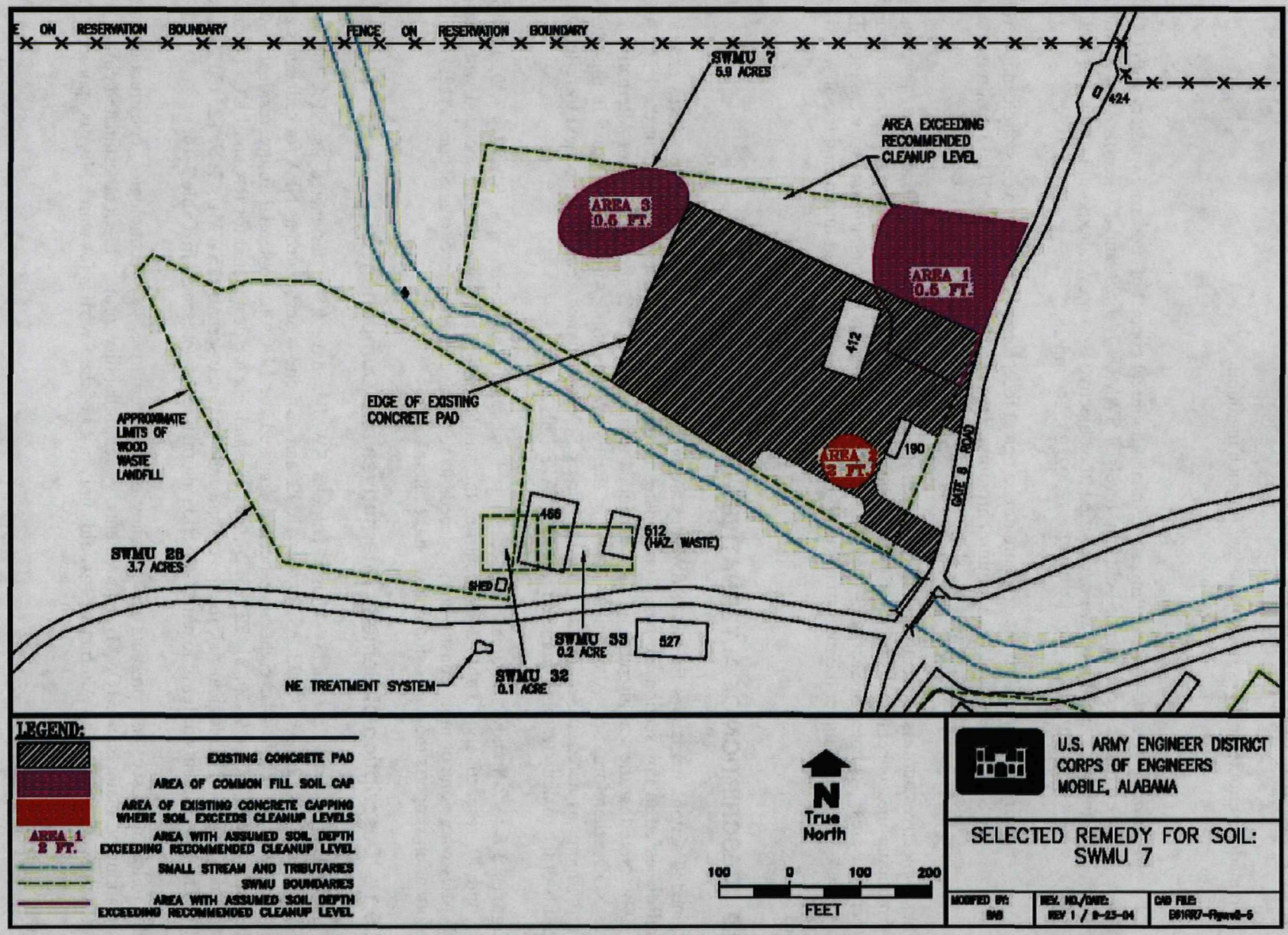


Figure 2-5. Selected Remedy for Soil – SWMU 7

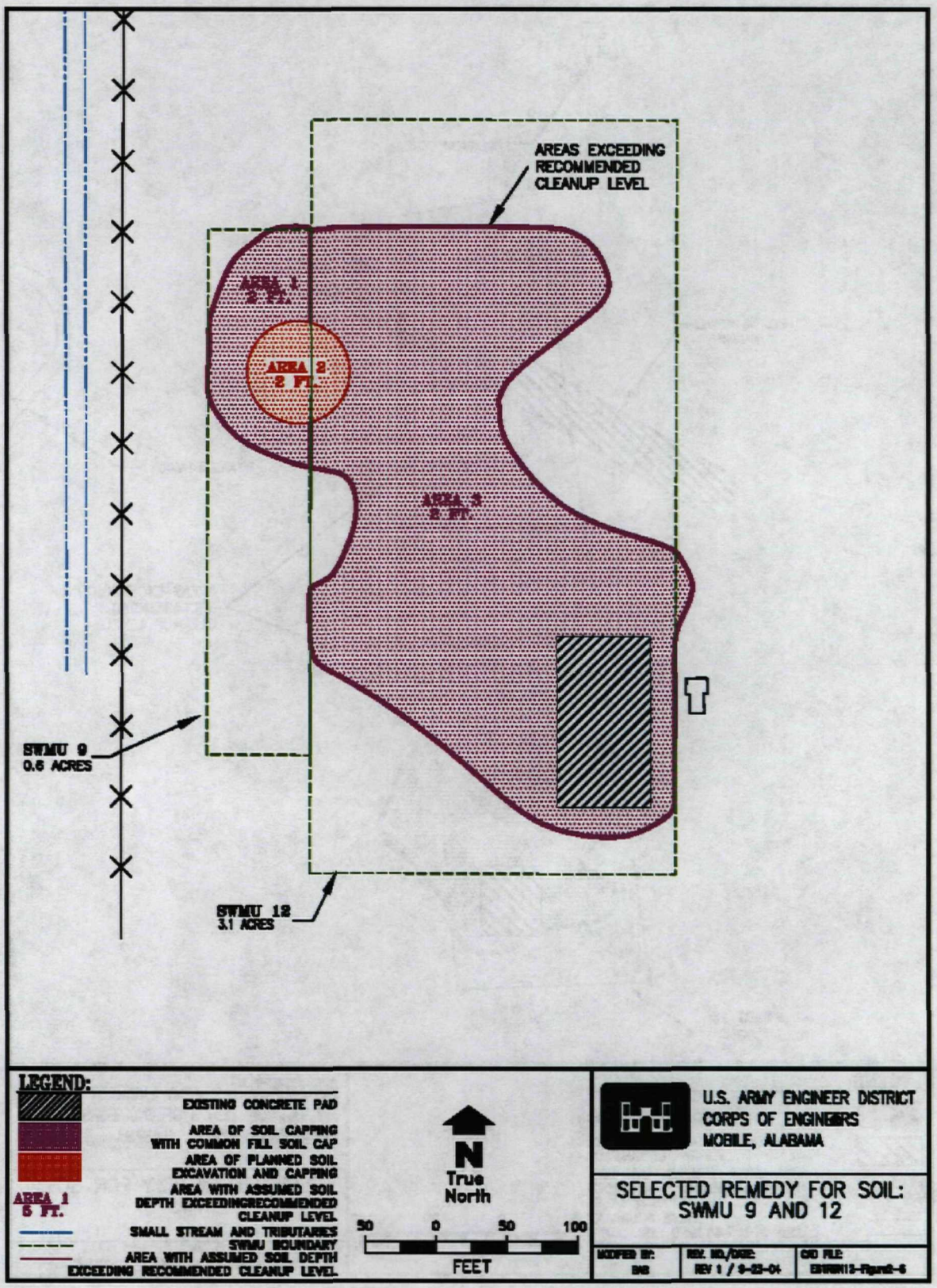


Figure 2-6. Selected Remedy for Soil – SWMU 9 and 12

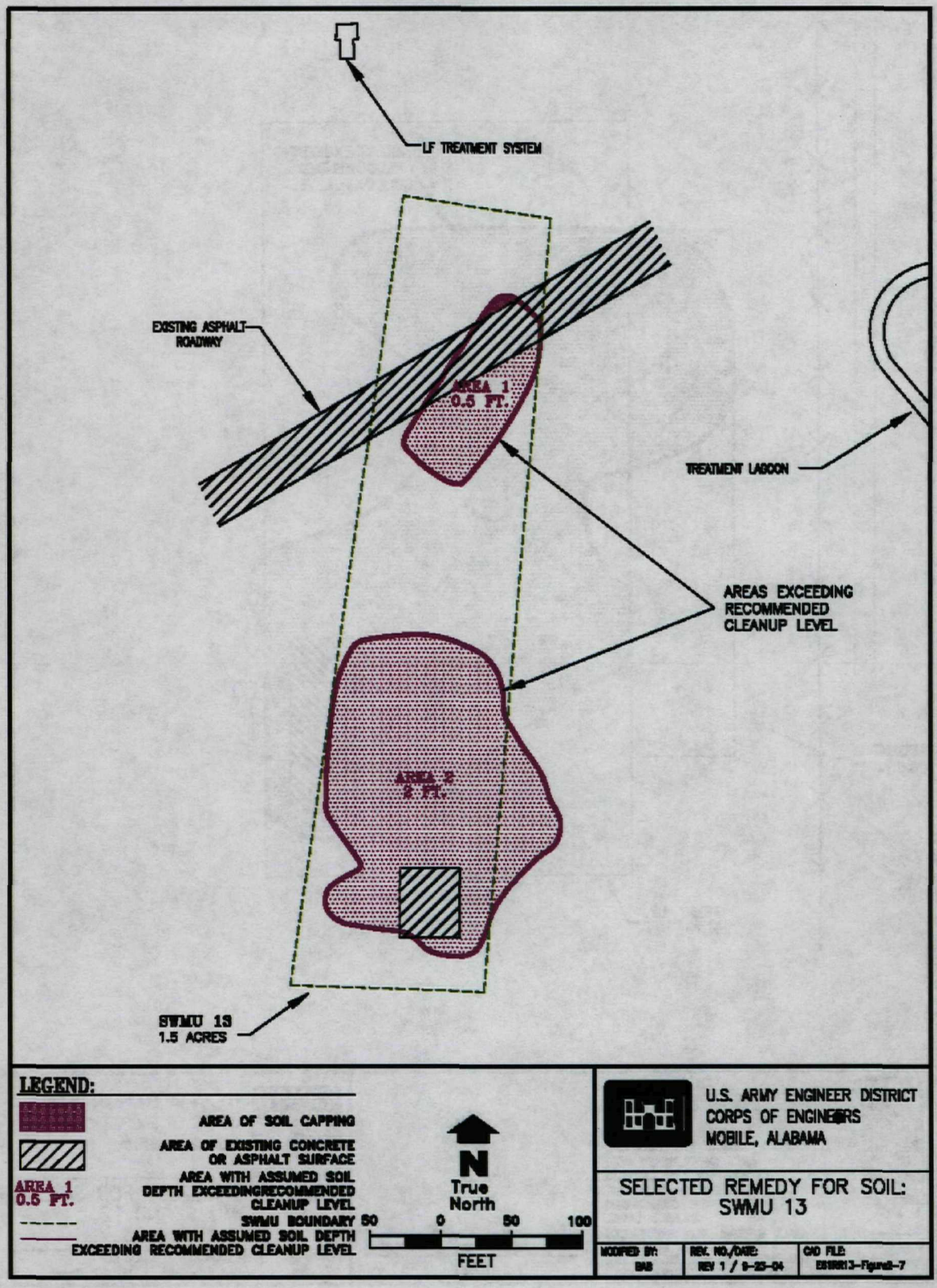


Figure 2-7. Selected Remedy for Soil – SWMU 13

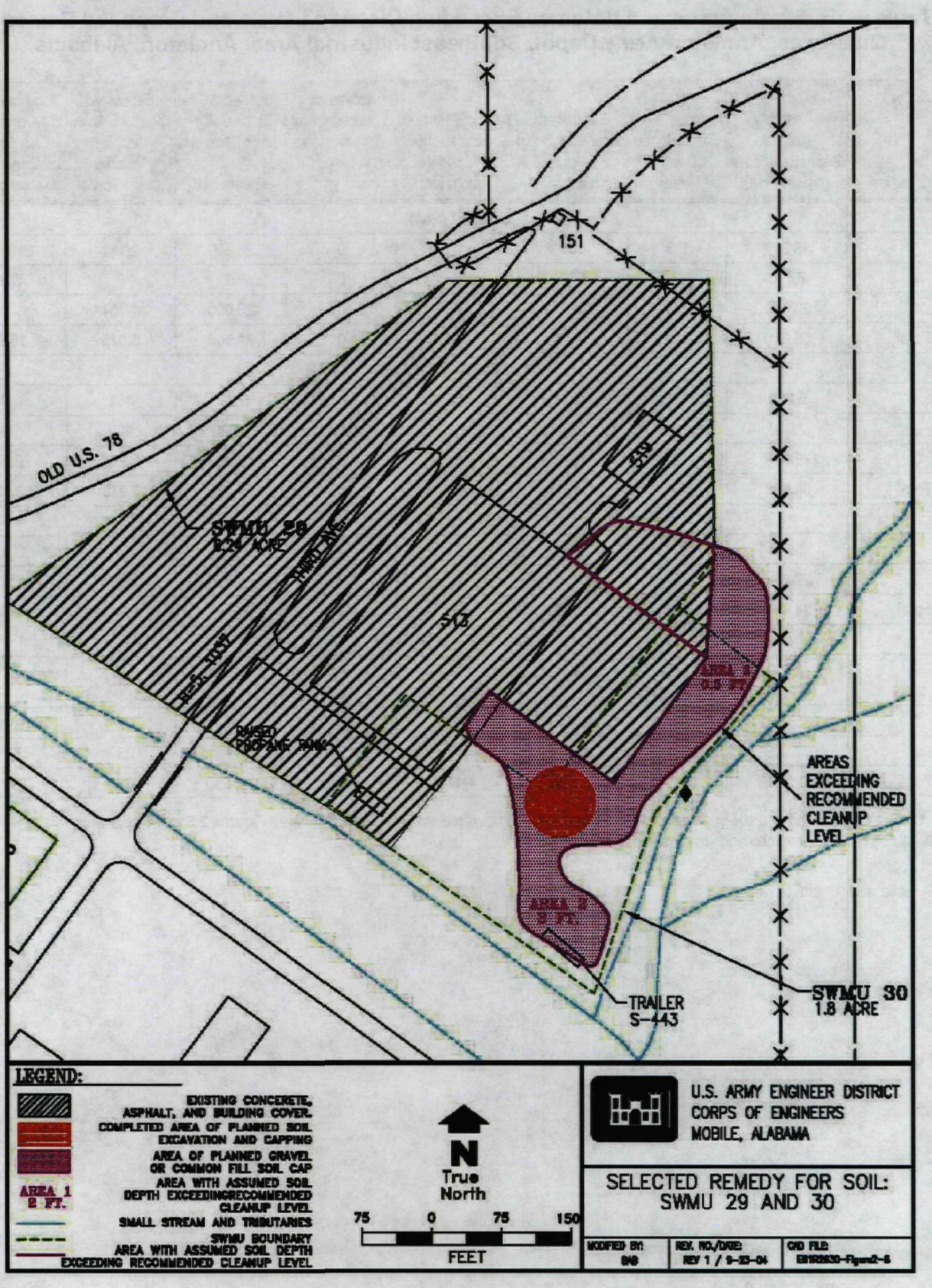


Figure 2-8. Selected Remedy for Soil – SWMUs 29 and 30

Table 2-15. Media Areas and Volumes Exceeding Cleanup Levels and Proposed Remedy Quantities, Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Area Identification	Area of Impacted Media (square feet)	Exceedance Depth (feet)	Estimated Impacted Soil Volume (cubic yards)	Area of Planned Soil Excavation/ Disposal (square feet)	Estimated Volume of Soil Excavation and Disposal (cubic yards)	Planned 2.0-ft-Thick Soil or 6-in. Gravel Cap (square feet)	Estimated Soil or Gravel Capping Volume (cubic yards)	Area of Existing Concrete, Asphalt, or Gravel Cap (square feet)[a]
SWMU 7 (Soil)								
1	36,010	0.5	667	0	0	28,500	2,111	7,510
2	7,800	2	578	0	0	0	0	7,800
3	23,000	0.5	426	0	0	23,000	1,704	0
Total	**66,810**	**NA**	**1671**	**0**	**0**	**51,500**	**3,815**	**15,310**
SWMUs 9 and 12 (Soil)								
1	6,230	2	462	0	0	6,230	461	0
2	2,820	2	209	2,820	209	2,820	209	0
3	79,608	2	5,897	0	0	70,233	5,203	9,375
Total	**88,658**	**NA**	**6,933**	**2,820**	**209**	**79,283**	**5,873**	**9,375**
SWMU 13 (Soil)								
1	6,913	0.5	128	0	0	3,913	289	3,000
2	27,258	2	2,040	0	0	25,028	1,854	2,500
Total	**34,441**	**NA**	**2,168**	**0**	**0**	**28,941**	**2,143**	**5,500**
SWMUs 29 and 30 (Soil)								
1	4,418	0.5	82	4,418 (completed)	82 (completed)	0	0	4,418
2	16,464	2	1,220	0	0	0	0	16,464
3	21,900	0.5	406	0	0	13,650 (gravel)	337	8,250
Total	**42,782**	**NA**	**2,108**	**4,418**	**82**	**13, 650**	**337**	**29,132**

[a] Each of the SWMUs will have a soil or gravel cap for areas not already covered with asphalt or concrete. **Figures 2-5** to **2-8** note which areas within a given SWMU have an existing cap and will require capping.

NA = not applicable.

SWMU = Solid waste management unit.

Table 2-16. Key Technologies in the SIA Alternatives
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Technology	Alternative 1 (No Action)	Alternative 2	Alternative3	Alternative 4	Alternative 5
Soil					
No Action	✓				
Land-Use Controls		✓	✓	✓	✓
Containment			✓		✓
Excavation/Removal				✓	✓
Treatment/Disposal				✓	✓

NA = not applicable (i.e., an Alternative 5 for sediment and surface water was not developed).

Soil Alternative 2 would apply to 8 of the SWMUs for which risks to potential future residents would apply, and Soil Alternatives 2, 3, 4 and 5 would apply to 6 of the SWMUs for which human health (industrial workers) and/or ecological risks were identified. No human health or ecological risks were identified at SWMU 44 (Dry Creek); therefore NFA is required at SWMU 44. The remedy alternatives only address soil as that is the only media of concern under this operable unit.

Soil

Soil Alternative 1: No Action—CERCLA requires that the "no action" alternative be evaluated to establish a baseline for comparison. Under this alternative, no action would be implemented at a given SWMU regardless of whether or not there was a potential risk to human or ecological receptors. This alternative is expected to apply to 13 SWMUs (i.e., SWMUs 3, 4, 6, 25, 31, 32, 33, 38, 39, 40, 41, 42, and 43) given that no human health or ecological risks were identified. The present worth and capital costs for this alternative are each $0 because no remedial action is implemented.

Soil Alternative 2: Land-Use Controls—Soil Alternative 2 includes LUCs, which include physical mechanisms, administrative actions, and legal mechanisms, any of which may be applied to a given SWMU. This alternative utilizes a combination of LUCs, including the ANAD SOP for LUC Implementation and any others if determined to be necessary for protection of human health and the environment. Refer to Section 2.12.2 for additional LUC information.

The costs for this alternative are based on the assumption that physical and administrative controls would be applied to those SWMUs only where unacceptable residential risks were identified. These eight SWMUs are SWMUs 1, 19, 20, 21, 22, 23, 24, and 28. The time frame for this alternative is baselined at 5 years and includes costs for monitoring implementation of LUCs and preparations for the Five-Year Review. The total present value of Soil Alternative 2 is $196,000. The capital costs are $20,000, and first-year O&M costs are $8,000.

Soil Alternative 3: Land-Use Controls and Containment—Soil Alternative 3 includes the use of containment technology (e.g., a barrier or capping system) and LUCs. These restrictions include notifications in the official site Master Plan. LUCs would be implemented at each impacted SWMU, where necessary to ensure the effectiveness of the remedy. This alternative includes the construction of a cap or barrier in areas containing soil in excess of cleanup levels. The proposed cap or barrier (e.g., asphalt, concrete, gravel, and soil/vegetative layer) would prevent human and ecological exposure to these

contaminated soils (concrete or asphalt would be used to prevent human contact, and a 2-ft soil/vegetative layer is planned to prevent ecological receptor exposures). Therefore, traditional geosynthetic, clay, or RCRA-type caps are not proposed. The capping/barrier systems proposed are consistent with existing land use of the targeted SWMUs at the SIA. Inspection and maintenance of these systems would ensure that the cap/barrier's integrity and competence are not compromised from cracking, burrowing animals, and erosion.

LUCs are required by this containment alternative. These controls may include physical mechanisms, administrative actions, and legal mechanisms, any or all of which may be applied to a given SWMU. This alternative utilizes a combination of LUCs, including the ANAD SOP for LUC Implementation and any others if determined to be necessary for protection of human health and the environment. Refer to Section 2.12.2 for additional LUC information.

The estimated remediation period is 30 years. The costs for this alternative are based on the assumption that an area of lead contamination in soil within SWMU 7 is capped (Area 3 and part of Area 1) with concrete and an area of lead exceedance in soil within SWMUs 29/30 has been excavated. The total present value of Soil Alternative 3 is $602,000. The capital costs are $465,000, and first-year O&M costs are $8,520.

Soil Alternative 4: Excavation, Off-site Treatment/Disposal, and Land-Use Controls—This alternative consists of soil excavation from accessible areas. This alternative also contains off-site treatment/delisting and/or disposal of excavated soils at a RCRA Subtitle C or D landfill, and LUCs. Excavation of impacted soils and proper waste characterization, processing, and disposal activities are implemented in this alternative. Soils not located beneath existing buildings, asphalt, and/or concrete that contain COCs above acceptable risk values would be excavated at specified depths.

Generally, the potential for access of ecological receptors to subsurface soils will not exceed 2 ft below ground surface (bgs). Human health exposures to soil were estimated to 5 ft bgs. In all excavation actions, clean fill soil would be returned to the site. The remedial design will include provisions for erosion, sedimentation, and surface water controls.

Disposal in a RCRA Subtitle C or D facility depends upon waste analyses and the processing requirements of the selected landfill. In certain SWMUs, characteristic or listed hazardous waste may be generated. Characteristic or listed wastes may require application of special stabilization or treatment techniques before being accepted into an appropriate disposal facility. Any treatment or stabilization will not be performed on site. Treatment and stabilization will be performed at a permitted Subtitle C treatment, storage, or disposal (TSD) facility. Certain treatment technologies delist certain metal-containing wastes by permit. Landfill disposal for excavated soil containing COCs above acceptable risk levels would involve either RCRA Subtitle C (hazardous waste) or D (solid waste) landfills. Any waste streams left on site while awaiting characterization results and/or disposal approval will be maintained in a less than 90-day accumulation area. The off-site disposal will also adhere to the requirements of the Land Disposal Restrictions (LDRs) of 40 CFR 268.

LUCs include physical mechanisms, administrative actions, and legal mechanisms, any of which may be applied to a given SWMU. This alternative also utilizes a combination of LUCs, including the ANAD SOP for LUC Implementation and any others if determined to be necessary for protection of human health and the environment. Refer to Section 2.12.2 for additional LUC information.

The estimated remediation time is 30 years. The total present value of Soil Alternative 4 is $3,053,500. The capital costs are $2,896,350, and first-year O&M costs are $10,000.

Soil Alternative 5: Excavation, Off-site Treatment/Disposal, Containment, and Land-Use Controls— Soil Alternative 5 includes excavation of selected areas that contain one or more COCs at levels that pose a human health or ecological risk, off-site waste treatment/delisting and/or disposal at a RCRA Subtitle C or D landfill, placement of caps or barriers in selected areas, and LUCs. Any treatment or stabilization will not be performed on site. Treatment and stabilization will be performed at a permitted Subtitle C TSD facility. The major technologies in Soil Alternative 3 (containment) and Soil Alternative 4 (excavation, treatment, and disposal) are combined in this alternative. Excavation and off-site treatment/delisting and/or disposal of excavated soils at a RCRA Subtitle C or D landfill and LUCs are implemented in support of this remedial action. Soils not presently under buildings, asphalt, and/or concrete and that contain COCs above acceptable human health risk values will be excavated at selected locations and depths. Excavation depths depend on the associated human health risks.

Similar to the Soil Alternative 4, clean fill soil would be returned to the excavated locations. The remedial design would include the application of erosion, sedimentation, and surface water controls. Inspection and maintenance of existing structures would be required to ensure system integrity. As with Soil Alternatives 3 and 4, land-use restrictions would be required in areas presently containing concrete or asphalt to ensure that if land-use changes occur in these areas and/or soil is excavated, the soil will be staged, characterized, processed, and disposed of properly in an appropriate licensed landfill.

Soil Alternative 5 differs from Soil Alternative 4 in that cap/barrier construction is proposed for certain areas instead of excavation. The use of capping or excavation depends on COC concentrations in soil, current and proposed land use at ANAD, location of SWMUs relative to site accessibility, and the type of risk (human or ecological).

LUCs include physical mechanisms, administrative actions, and legal mechanisms, any of which may be applied to a given SWMU. Alternative 5 incorporates a combination of LUCs, to include the ANAD SOP for LUC Implementation and any others if determined to be necessary for protection of human health and the environment. Refer to Section 2.12.2 for additional LUC information.

Disposal in a RCRA Subtitle C or D facility depends upon waste analyses and the processing requirements of the selected landfill. In certain SWMUs, characteristic or listed hazardous waste may be generated. Characteristic or listed wastes may require application of special stabilization or treatment techniques before being accepted into an appropriate disposal facility. Any treatment or stabilization will not be performed on site. Treatment and stabilization will be performed at a permitted Subtitle C treatment, storage, or disposal (TSD) facility. Certain treatment technologies delist certain metal-containing wastes by permit. Landfill disposal for excavated soil containing COCs above acceptable risk levels would involve either RCRA Subtitle C or D landfills. Any waste streams left on site while awaiting characterization results and/or disposal approval will be maintained in a less than 90-day accumulation area. The off-site disposal will also adhere to the requirements of the Land Disposal Restrictions (LDRs) of 40 CFR 268.

The estimated remediation time is 30 years. The total present value of Soil Alternative 5 is $779,000. The capital costs are $660,000, and first-year O&M costs are $11,000.

2.9.2 Expected Outcomes of Each Alternative

For remedies involving soil, the remedial time frame baselined is 30 years or earlier if Five-Year Reviews indicate an individual SWMU can be closed out. Available land uses upon achievement of cleanup levels are industrial, commercial, and residential land uses, subject to certain LUCs, such as those further developed during the remedial design for the Selected Remedies.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares the relative performance of each remedial alternative against nine evaluation criteria so that the advantages and disadvantages of each are clearly understood. Using the results of this evaluation, ANAD compared the alternatives and selected the preferred cleanup alternative for the site presented in the PP.

The nine criteria listed in the NCP (see **Table 2-17**) are categorized into three groups: (1) threshold criteria, (2) primary balancing criteria, and (3) modifying criteria. The alternative that ultimately is implemented must satisfy the threshold criteria, which are the most important. Primary balancing criteria are used to compare the major trade-offs among alternatives. Modifying criteria are considered after public comment on the PP. Each final alternative has been evaluated in detail using the nine evaluation criteria, which are categorized into the following three criteria groups:

1. Threshold criteria:

    a. overall protection of human health and the environment, and
    b. compliance with applicable or relevant and appropriate requirements (ARARs).

2. Primary balancing criteria:

    a. long-term effectiveness and permanence;
    b. reduction of toxicity, mobility, and/or volume through treatment;
    c. short-term effectiveness;
    d. implementability; and
    e. cost (O&M).

3. Modifying criteria:

    a. state support agency acceptance, and
    b. community acceptance.

Tables 2-18 provide a comparative summary of each of the alternatives against the evaluation criteria for soil.

Table 2-17. EPA Evaluation Criteria
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Criteria	Description
Overall Protection of Human Health and the Environment	Addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or land-use controls.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Addresses whether or not a remedy will meet all of the applicable or relevant and appropriate federal and state environmental statutes and requirements or whether grounds exist for invoking a waiver.
Long-Term Effectiveness and Permanence	Refers to the ability of a remedy to maintain reliable protection of human health and the environment over time after cleanup goals have been met.
Reduction of Toxicity, Mobility, and Volume Through Treatment	Refers to the anticipated performance of the treatment technologies a remedy may employ.
Short-Term Effectiveness	Addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until the cleanup goals are achieved.
Implementability	Refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
Cost	Includes the estimated capital and operation and maintenance costs and net present worth costs of each alternative.
State/Support Agency Acceptance	Indicates whether, based on a review of the remedial investigation and feasibility reports and Proposed Plan, the state/support agency concurs, opposes, or has no comment on the preferred alternative at the present time.
Community Acceptance	Will be assessed in the Record of Decision following review of the public comments received on the Proposed Plan.

EPA = U.S. Environmental Protection Agency.

Table 2-18. Comparative Analysis of Remedial Alternatives for Soil Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Criterion	Soil Alternative 1 – No Action	Soil Alternative 2 – Land-Use Controls	Soil Alternative 3 – Land-Use Controls and Containment	Soil Alternative 4 – Excavation, Off-site Treatment/Disposal, and Land-Use Controls	Soil Alternative 5 – Excavation, Off-site Treatment/Disposal, Containment, and Land-Use Controls
Overall Protection	No reduction in human health or ecological risk. Potential for exposure to chemicals of concern (COCs) remain, if risks are present.	Meets the remediation objectives for protection of human health and the environment.	Meets the remediation objectives for protection of human health and the environment.	Meets the remediation objectives for protection of human health and the environment.	Meets the remediation objectives for protection of human health and the environment.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	Does not comply with chemical-specific ARARs. For SWMUs with no human health or ecological risks, ARAR compliance is not necessary.	Complies with land-use control guidance.	Complies with chemical-, action-, and location-specific ARARs.	Complies with chemical-, action-, and location-specific ARARs.	Complies with chemical-, action-, and location-specific ARARs.
Long-Term Effectiveness	Long-term effectiveness is not achieved where site risks are present.	Land-use controls required to provide long-term effectiveness. The remediation time may be 30 years or less, depending on the results of the 5-year reviews.	Land-use controls, including inspection and repair of containment systems, required to provide long-term effectiveness. The remediation time exceeds 30 years.	Provides for long-term effectiveness and permanence by removing soil containing COCs exceeding acceptable risk concentration levels. Areas presently containing concrete or asphalt remain and must be maintained. The remediation time exceeds 30 years.	Long-term effectiveness is attained by removing or capping soil to eliminate human health risks and capping to mitigate ecological risks. Long-term effectiveness of capped areas depends on inspection and maintenance actions. The remediation time exceeds 30 years.
Reduction of Toxicity, Mobility, and/or Volume	No reduction in COC toxicity, mobility, or volume, if COCs are present.	Does not reduce the toxicity or volume of COC-contaminated soil.	Reduces COC mobility through wind and water erosion controls. COCs are not likely to migrate to groundwater. Does not reduce toxicity or volume of COCs in soil.	Does not reduce the toxicity or volume of COC-contaminated soil. Soil is transferred to a secure landfill, thereby eliminating the potential for receptor contact. Reduces COC mobility by disposal in a secure landfill.	Does not reduce the toxicity or volume of COC-contaminated soil. Soil is either capped or excavated to eliminate human health risks or is capped to eliminate ecological risks. Mobility of COCs resulting from wind or water erosion is minimized through appropriate control measures.

Table 2-18. Comparative Analysis of Remedial Alternatives for Soil Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama (Continued)

Criterion	Soil Alternative 1 – No Action	Soil Alternative 2 – Land-Use Controls	Soil Alternative 3 – Land-Use Controls and Containment	Soil Alternative 4 – Excavation, Off-site Treatment/Disposal, and Land-Use Controls	Soil Alternative 5 – Excavation, Off-site Treatment/Disposal, Containment, and Land-Use Controls
Short-Term Effectiveness	There are no short-term hazards to site workers and the community because no remedial actions are implemented.	No significant risks to site workers and the community exist.	No significant risks to site workers and the community exist.	No significant risks to site workers and the community exist.	No significant risks to site workers and the community exist.
Implementability	There are no technical or administrative implementability issues.	There are no technical or administrative implementability issues. Technology is available and reliable. Maintenance and inspections are implemented easily. Services and materials are available regionally.	There are no technical or administrative implementability issues. Technology is available and reliable. Maintenance and inspections are implemented easily. Services and materials are available regionally.	There are no technical or administrative implementability issues. Technologies are available and reliable. Disposal facilities are within 200 miles of ANAD. Inspection and maintenance of existing concrete or asphalt areas are implemented easily.	There are no technical or administrative implementability issues. Technologies are available and reliable. Disposal facilities are within 200 miles of ANAD. Inspection and maintenance of existing concrete or asphalt areas are implemented easily.
Cost:					
Capital	$0	$20,000	$465,000	$2,896,400	$660,000
First-Year O&M	$0	$8,000	$8,500	$10,000	$11,000
Present Worth	$0	$196,000	$602,000	$3,053,500	$779,000
State Acceptance	Not Acceptable. Does not protect human health or the environment if risks are present.	Acceptable	Acceptable	Acceptable	Acceptable
Community Acceptance	Not Acceptable. Does not protect human health or the environment if risks are present.	Acceptable	Acceptable	Acceptable	Acceptable

2.10.1 Overall Protection of Human Health and the Environment

This section provides a comparative analysis of each alternative against the evaluation criterion human health and the environment. This analysis compares and contrasts the four final alternatives for site wide treatment of soil that present human health and/or ecological risks.

Soil Alternatives 2, 3, 4, and 5 would adequately protect human health and the environment by preventing or controlling site access and/or either eliminating or preventing access to soils containing COCs above acceptable risk values. Soil alternatives in all instances include LUCs to control site access and use. Soil Alternative 1 is only protective of human health and environment at those SWMUs where no human health or ecological risks are present.

2.10.2 Compliance with ARARs

Each final alternative for soil (except Final Alternative 1, "No Action") is designed to meet chemical-, action-, and location-specific ARARs. The final alternatives include monitoring and evaluation of the Selected Remedy. Therefore, inspection, maintenance, monitoring, and reporting are essential components of the final remedy. These institutional actions will document compliance with ARARs through reports and other methods. At the 14 SWMUs where NFA is appropriate, compliance with ARARs is not applicable since no risks are present at these sites.

2.10.3 Long-Term Effectiveness and Permanence

The soil final alternatives are compared to the long-term effectiveness and permanence evaluation criterion in this section. The no-action alternative does not achieve remediation objectives where risks are present. Each final alternative presumes the implementation of institutional actions, such as monitoring, inspection, and maintenance, to meet remedial objectives.

Soil Alternative 4 provides the highest degree of long-term effectiveness, given the volume of soil excavated and disposed. Final Soil Alternatives 3, 4, and 5 include capping or barriers that will require inspection, maintenance, and repairs over extended time frames to be effective Soil Alternative 3 would include capping or barriers only in existing locations. The remaining soil would be excavated. Soil Alternative 5, which includes excavation at locations posing unacceptable human health risks (except under existing caps or barriers) and capping in other areas to mitigate ecological risks, would provide the next highest level of long-term effectiveness and permanence. LUCs ensure long-term effectiveness and permanence by prohibiting any use of the property that would not be protective of human health.

Soil Alternatives 2, 3, 4, and 5 must include LUCs to be effective. Land-use restrictions, monitoring, and maintenance of proposed, or existing, capped areas must be implemented. These final soil alternatives do not require specialized inspection, maintenance, or monitoring expertise. Soil Alternative 3 would generate the greatest amount of waste requiring disposal. Soil Alternatives 4 and 5 would provide adequate remedial controls and processes to classify, analyze, process, dispose of, and/or treat wastes generated during remediation. Disposal technologies consist of excavating and transporting impacted soil to a more secure site.

2.10.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

The following subsections detail the comparative analysis results for this evaluation criterion. Alternative 1 (no action) would not reduce the toxicity, mobility, and/or volume of contaminants.

Soil Alternatives 3, 4, and 5 reduce mobility by protecting the soil and solid waste in SWMUs from wind and water erosion and/or by excavating and transporting soil to a landfill. Each final soil alternative also prevents human and ecological receptors from exposure to soil containing COCs at unacceptable risk concentrations. None of the soil alternatives reduces the overall toxicity or volume of COCs in soil.

2.10.5 Short-Term Effectiveness

Short-term effectiveness is evaluated to determine if there are significant site or worker impacts related to the alternative's implementation. The short-term effectiveness evaluation criterion is discussed for the final soil, sediment, and surface water alternatives in the following subsections.

There are no significant risks to site workers in the community by the implementation of Soil Alternatives 3, 4, and 5. All three alternatives would be conducted over the same time frame and involve similar construction activities and practices.

2.10.6 Implementability

Alternative 1 (no action) would be the easiest to implement; however, this alternative would not accomplish remedial action objectives. The implementability evaluation criterion is discussed for the final soil, sediment, and surface water alternatives in the following subsections.

There are no implementability (technical or administrative) concerns related to implementation of Soil Alternatives 2, 3, 4, and 5 at ANAD. Alternatives 3, 4, and 5 would rely on standard construction techniques and practices. Excavation and earth-moving equipment would be used to install earthen caps, provide for sub-base development in proposed concrete areas, and excavate soil requiring transportation and disposal. Disposal facilities exist for hazardous and non-hazardous waste within 200 miles or less of ANAD. Soil Alternatives 3, 4, and 5 would each require the import of clean soil for capping or excavated sites. Soil Alternatives 3, 4, and 5 will require institutional controls to monitor, inspect, or repair either existing or planned capped areas over 30 years. Monitoring requirements to determine the effectiveness of Soil Alternatives 3, 4, and 5 would be similar. Inspection and maintenance activities would be performed to evaluate the competency of either existing or proposed caps. Soil Alternative 4 would require the least effort in this regard. Inspection of only one existing concrete area (SWMUs 29 and 30) would be required.

Environmental permits from the ADEM or the local Soil Conservation District are required for all alternatives. These permits require preparation of erosion and sedimentation control plans and implementation of these controls to prevent off-site movement of soil by wind or water erosion during earthmoving activities.

2.10.7 Cost

Tables 2-19 identify the costs of each of the soil alternatives, including the capital cost and O&M (present worth) cost. The total cost (present worth) includes the capital costs of design and equipment and associated activities, as well as O&M over the remediation period. Monitoring LUCs of the eight SWMUs (SWMUs 1, 19, 20, 21, 22, 23, 24 and 28) would involve costs of approximately $8,000 per year (first-year O&M).

2.10.8 State Acceptance

The state of Alabama has expressed support for Soil Alternatives 1, 2, and 5. The state does not support Alternative 1 for each medium, except for the sites where there is NFA (i.e., SWMUs 3,4, 6, 25, 31, 32,

33, 38, 39, 40, 41, 42, 43, and 44), because it does not satisfy threshold criteria for protection of human health and the environment or use treatment.

2.10.9 Community Acceptance

There were no adverse comments received on ANAD's selected remedies or any of the other treatment alternatives during the public comment period.

Table 2-19. Capital and O&M Costs for the Four Soil Alternatives[a]
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Soil Alternative	Capital Cost	O&M Cost (present worth)	Total Cost
1	$0	$0	$0
2	$20,000	$176,000	$196,000
3	$465,000	$136,800	$602,000
4	$2,896,350	$157,180	$3,053,530
5	$660,000	$119,000	$779,000

[a] Alternative 1 addresses Solid Waste Management Units (SWMUs) 3, 4, 6, 25, 31, 32, 33, 38, 39, 40, 41, 42, and 43. Alternative 2 addresses SWMUs 1, 19, 20, 21, 22, 23, 24, and 28. Total costs for remediation of soil in SWMUs 7, 9, 12, 13, 29, and 30 are represented by Alternatives 3, 4, and 5.
O&M = Operation and maintenance.

2.11 PRINCIPAL-THREAT WASTES

Principal-threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained or would present a significant risk to human health or the environment should exposure occur. Source materials, which may include hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to other media or act as a source for direct exposure, have not been identified within the SIA OU 2 addressed in this ROD, including SWMUs 7, 9, 12, 13, 29, and 30. Dry Creek (SWMU 44) is not a source; however, wastes from sources within the SIA have been introduced to the surface water and sediment through such processes as erosion and surface water runoff.

2.12 SELECTED REMEDIES

In this section, the rationale for the selected remedies (Section 2.12.1) is presented and followed by a description of the remedies for soil, surface water, and sediment (Section 2.12.2). The cost estimate and expected outcome of implementing the selected remedies are then presented in Sections 2.12.3 and 2.12.4, respectively.

2.12.1 Summary of Rationale for the Selected Remedies

Several factors supported the prioritization and ultimate determination of the Selected Remedies for soil, sediment, and surface water. Because Soil Alternatives 2, 3, and 4 protect human health and the environment, comply with ARARs, and use treatment and permanent solutions as principal elements of the

remedy, Army examined each alternative individually, and with respect to each other, regarding the remaining evaluation criteria. Consistent with NCP, each soil alternative was evaluated with respect to its long-term effectiveness and permanence; implementability; reduction in toxicity, mobility, and volume; and acceptance. Costs then were examined to determine an option's overall effectiveness. For the 14 SWMUs for which NFA was necessary, the Soil Alternative 1, "No Action," was selected given the fact that human health and ecological risks were not identified. As a result of this analysis, the preferred alternatives were identified for each media as specified in Section 2.12.2. A similar process was used with regard to remedies proposed for Dry Creek sediment and surface water (SWMU 44) with due consideration to the results of the ecological toxicity testing and follow-on remedial design activities (SAIC 2001 and 2002). Based on the results of these activities, no further action is required at SWMU 44.

2.12.2 Description of the Selected Remedies

The selected remedies for soil in the SIA include remedial strategies for the SWMUs addressed in this ROD. The preferred alternatives for each media are listed below.

— Soil Alternative 1, "No Action" – SWMUs 3, 4, 6, 25, 31, 32, 33, 38, 39, 40, 41, 42, 43, and 44;

— Soil Alternative 2, "Land-Use Controls" – SWMUs 1, 19, 20, 21, 22, 23, 24, and 28; and

— Soil Alternative 5, "Excavation, Off-site Treatment/Disposal, Containment, and Land-Use Controls" – SWMUs 7, 9, 12, 13, 29, and 30.

A description of these alternatives is provided in Section 2.9.1.

LUCs will be a component of remedial action at SWMUs 1, 7, 9, 12, 13, 19, 20, 21, 22, 23, 24, 28, 29 and 30. Soil contamination remains at these 14 SWMUs at concentrations precluding unrestricted use. To address unacceptable risk, the land use at these SWMUs is restricted to industrial use only. This means no other uses (i.e., residential, commercial, or agricultural) are permitted. In addition, the LUCs will also seek to prevent the excavation and uncontrolled removal of soil with contaminant concentrations above cleanup levels and to maintain the integrity of any current or future monitoring or remediation system. These SWMUs, as well as the 14 SWMUs for which NFA is appropriate, are identified in **Figure 2-2**. LUCs are defined as physical, legal, or other mechanisms used to restrict property use. LUCs will be applied as part of remedies at the SWMUs, where remedial action is required and will result in contaminated media being left in place at levels that do not allow for unrestricted use and unlimited exposure. A LUC Remedial Design (LUC RD) or remedial action work plan (LUC RAWP) will be prepared and submitted to EPA and ADEM as the land use component of the RD or RAWP on a schedule consistent with and enforceable under, the Federal Facility Agreement. The LUC RD or LUC RAWP shall contain implementation and maintenance actions, including periodic inspections. The Army will implement, monitor, maintain, enforce, and report on the LUCs. Specific implementation, maintenance and inspections, concerning the LUCs at each SWMU will be detailed in the RD/RAWP. The LUCs include the ANAD SOP for LUC implementation, which are referenced in the Installation Master Plan. The RD or RAWP will also provide the quality assurance and control (QA/QC) protocols and review requirements to be undertaken by the Army during the life of the remedial actions.

Table 2-20 outlines the LUC performance objectives and identifies the key elements of the objectives, the implementing organization, the geographic area addressed by the LUC, and the expected duration of the LUC. The Army will retain responsibility for ensuring the integrity of the selected CERCLA remedies in this ROD. This responsibility for remedy integrity means that the Army must ensure that LUC performance objectives are met and that the remedy(ies) remains protective.

The overall goal of the LUCs is to prevent exposure to contaminants within the SIA at the SWMUs that currently pose unacceptable risk to human health. The LUCs will be maintained until the concentration of contamination is at such levels as to allow for unrestricted use and exposure. The boundaries of SWMUs to be covered by the LUCs are shown in **Figures 2-9 through 2-13**. The LUCs address soil as discussed in this ROD.

Table 2-20. Land-Use Controls for the Selected Remedy[a]

Land-Use Control Performance Objectives	Description	Implementing Organization	Geographic Boundary Encompassed by the Land-Use Control	Expected Duration
• Prohibit residential reuse of the site, including housing, elementary and secondary schools, child care facilities and playgrounds • Prevent the excavation and uncontrolled removal of soil with contaminant concentrations above cleanup levels. • Maintain the integrity of any existing or future monitoring or remediation system(s).	Maintain and update the Installation Master Plan.	Anniston Army Depot (ANAD). Directorate of Risk Management	Designated SWMU boundaries within the SIA	Maintenance of the LUC will continue until concentrations of hazardous substances in the soil allow for unrestricted use and unlimited exposure

[a] Land-use controls (LUCs) include physical, legal, and administrative mechanisms that restrict the use of, or limit access to, real property to prevent or reduce risks to human health or the environment. Specific LUC implementation actions will be defined in the remedial design.
[b] See **Figure 2-2**.
SIA = Southeast Industrial Area.
SWMU = Solid waste management unit.

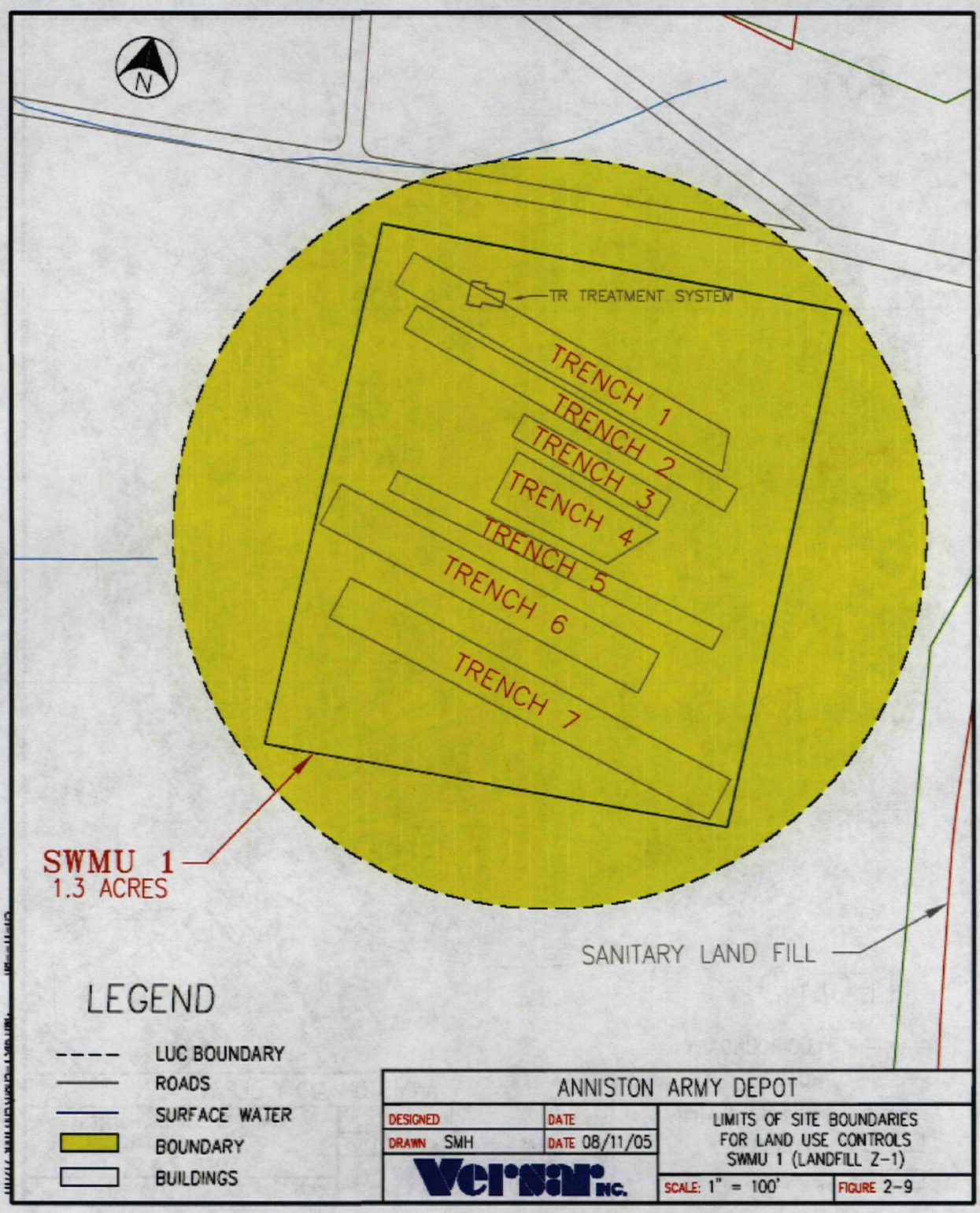


Figure 2-9. SWMU 1 (Landfill Z-1) Limits of Site Boundaries for Land Use Controls

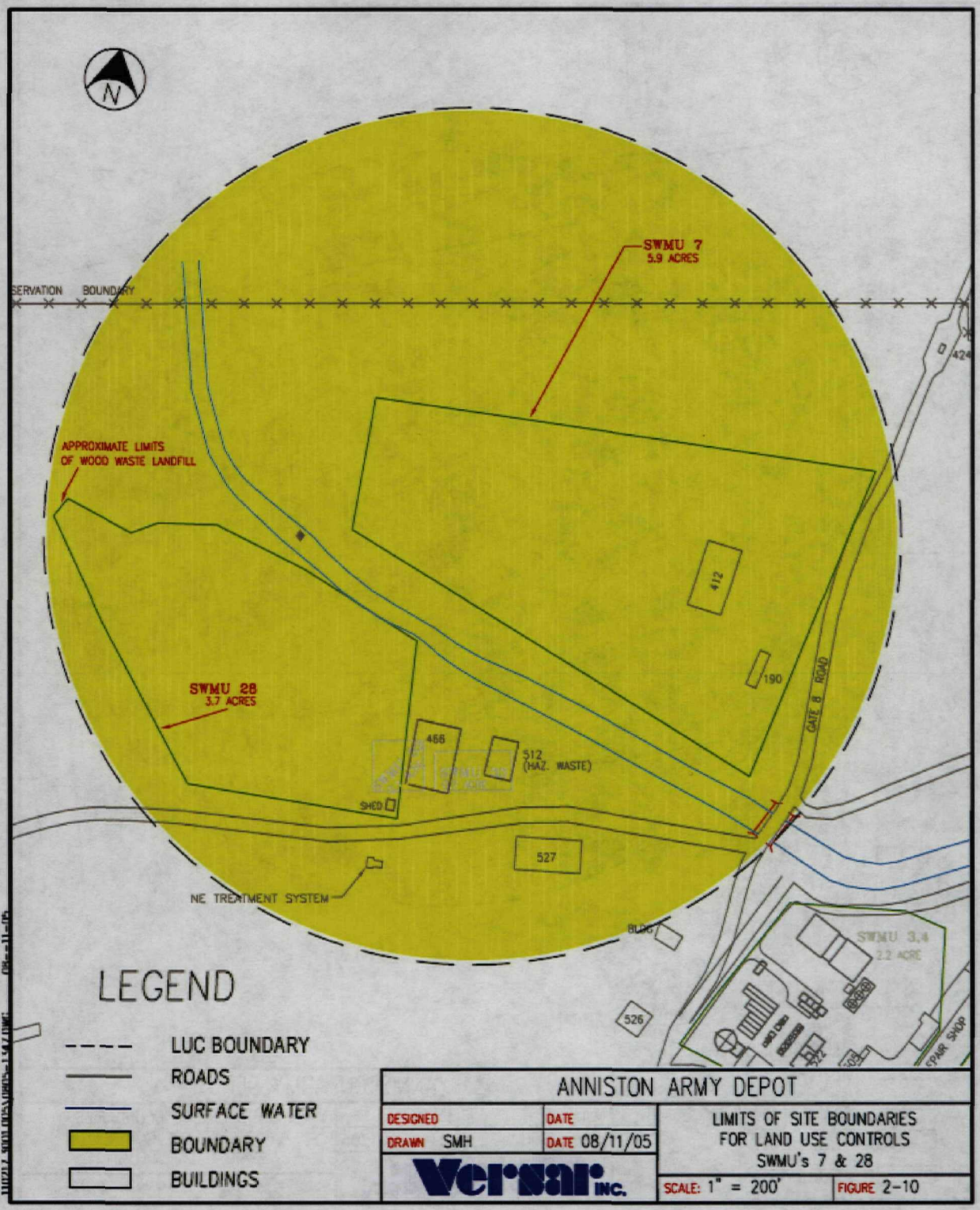


Figure 2-10. SWMUs 7 (Chemical Waste Burial Pit) and 28 (Waste Wood Landfill) Limits of Site Boundaries for Land Use Controls

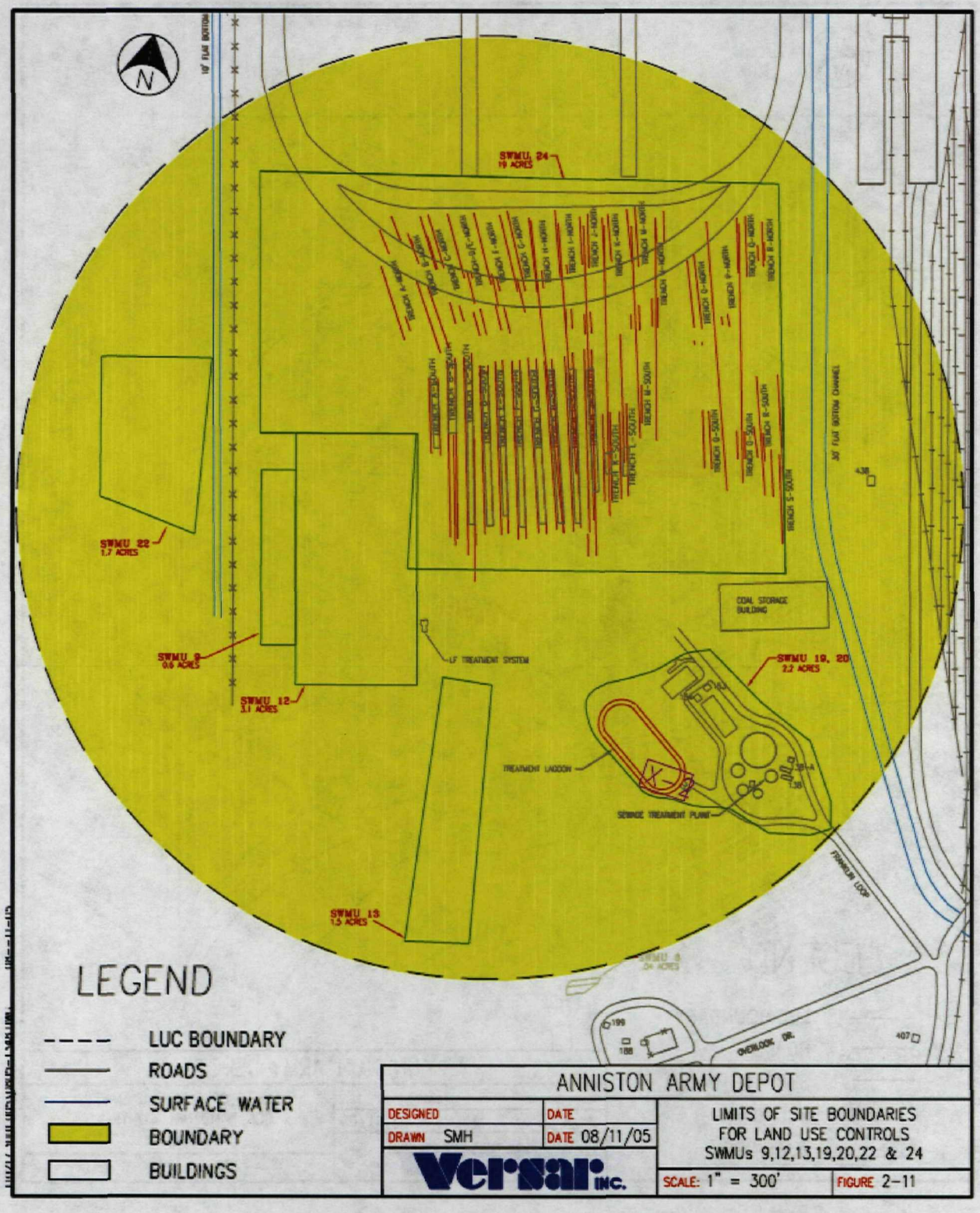


Figure 2-11. SWMUs 9 (Calcium Hypochlorite Pit), 12 (Facility 414 Old Lagoons), 13 (Acid Chemical Waste Pit), 19 (Old Sewage Treatment Plant), 20 (New Sewage Treatment Plant), 22 (A-Block Lagoon), and 24 (Old Sanitary Landfill) Limits of Site Boundaries for Land Use Controls

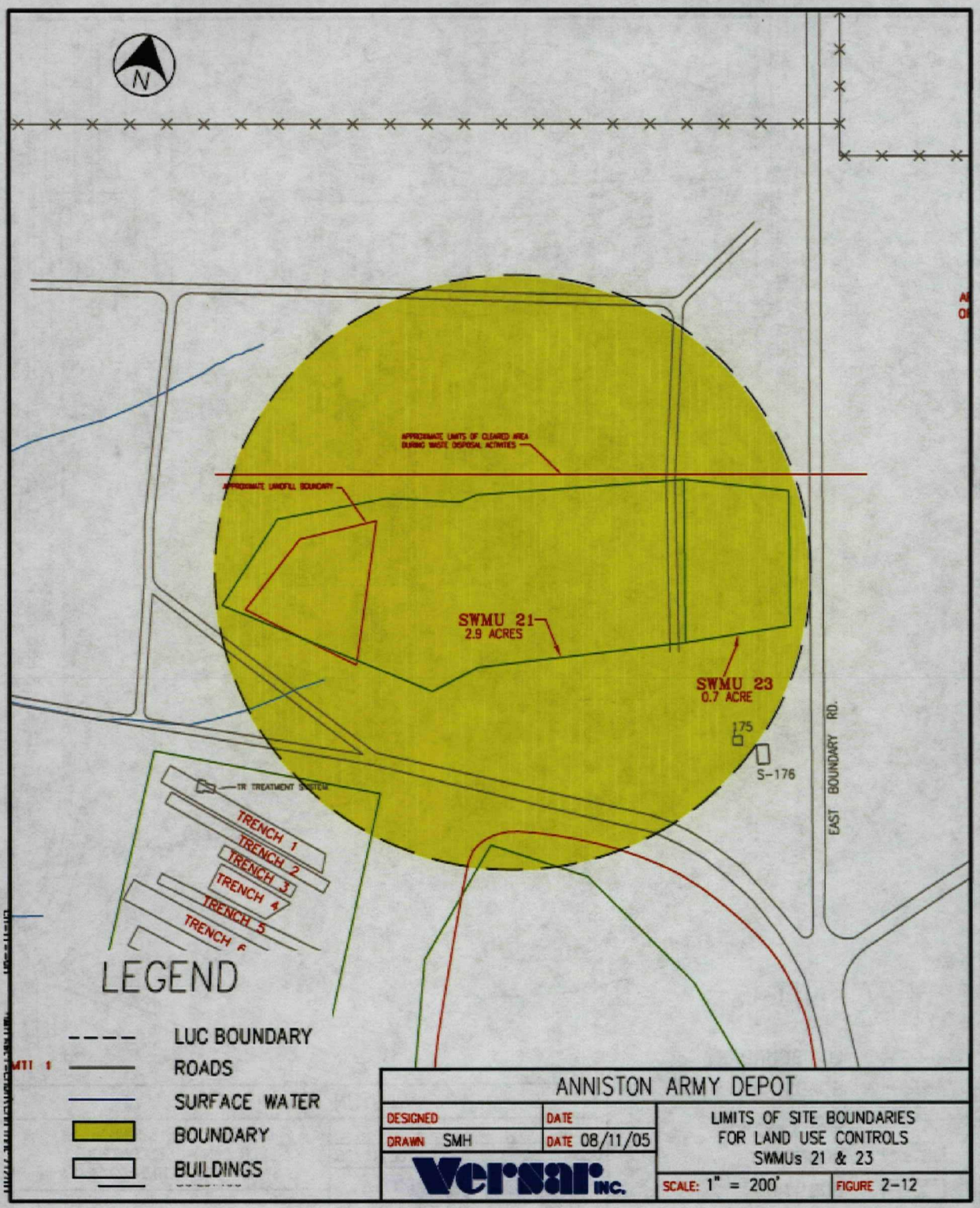


Figure 2-12. SWMUs 21 (Abrasive Dust Landfill) and 23 (Asbestos Waste Disposal Trench) Limits of Site Boundaries for Land Use Controls

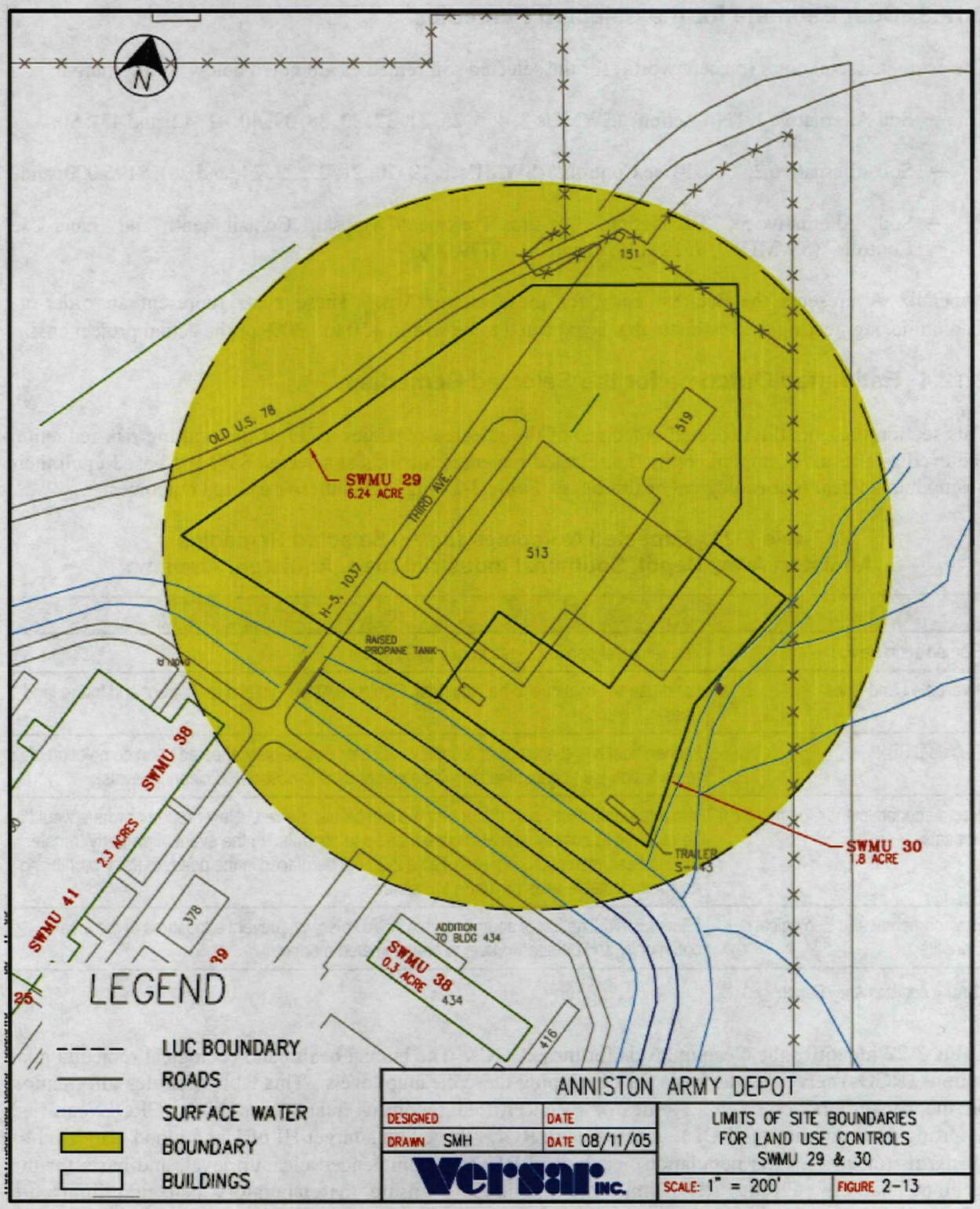


Figure 2-13. SWMU 29 (Old Lumber Disposal Yard) and 30 (Northeast Lagoon Area) Limits of Site Boundaries for Land Use Controls

2.12.3 Cost Estimate for the Selected Remedies

The estimated total costs (present worth) for the selected soil remedies are noted below by alternative:

— Soil Alternative 1, "No Action" (SWMUs 3, 4, 6, 25, 31, 32, 33, 38, 39, 40, 41, 42, and 43): $0;

— Soil Alternative 2, "Land-Use Controls" (SWMUs 1, 19, 20, 21, 22, 23, 24, and 28): $196,000; and

— Soil Alternative 5, "Excavation, Off-site Treatment/Disposal, Containment, and Land-Use Controls" (SWMUs 7, 9, 12, 13, 29, and 30): $779,000.

Appendix A presents the detailed costs for these alternatives. These costs represent an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30% of the actual project cost.

2.12.4 Estimated Outcome for the Selected Remedies

This section presents the expected outcomes of the selected remedies in terms of resulting risk reduction achieved as a result of implementing the selected remedies for soils at selected SWMUs based upon their posing human health or ecological health risks. **Table 2-21** highlights these expected outcomes.

Table 2-21. Expected Outcomes for the Selected Remedies
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Feature	Outcome
Remediation Period	The remedial period ranges from 5 to 30 years.
Available Land-Uses	Land-use will continue to be industrial. Controls will be in place for current and future land uses.
Residual Risk	Human health and ecological receptors will not be adversely affected upon completion of remediation (i.e., contamination will be cleaned up to associated cleanup levels).
Socio-economic and Community Impacts	Impacts would occur only if property were to be transferred. New property owners would be required to comply with associated land-use controls. In the event of property transfer, the land use restrictions noted in Table 2-20 will be placed in the deed, thereby prohibiting any unacceptable uses by future transferees.
Environmental and Ecological Benefits	Elimination/mitigation of sources within ANAD also will prevent exposures of the local community and on-site workers to contaminated media.

ANAD = Anniston Army Depot.

Table 2-22 identifies the cleanup levels for these COCs. The human health and ecological remedial goal options (RGOs) served as the basis for developing these cleanup levels. This table provides information on the background criterion (2 × mean), EPA-certified reporting quantitation limit (CRQL)/certified reporting detection limit (CRDL), human-health RGOs (based on a target HI of 1 and blood lead level of 10 µg/dL for 95% of the population), ecological RGOs, recommended cleanup level, and basis for the recommendation. CRQL/CRDL limits are provided to ensure that laboratory detection limits are consistent with recommended cleanup levels.

Table 2-22. Cleanup Levels for Soil (mg/kg)
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

COC	Background Criterion (2 × mean)	CRQL/CRDL[a]	RGO (Human Health) [b]	RGO (Ecological)[c]	Ecological Receptor (Species)	Recommended Cleanup Level	Rationale[d]
Cadmium	ND	1	NA	4 (revised)	Mammalian/Avian Insectivore (Shrew/Robin)	4	Ecological RGO
Chromium	48.8	2	NA	64 (revised)	Avian Insectivore (Robin)	64	Ecological RGO
Lead	47	0.6	1350 (revised)[e]	220 (revised)	Avian Insectivore (Robin)	1350/220	Human Health & Ecological RGO
Antimony	ND	12	820 (revised)[f]	NA	Avian Insectivore (Robin)	820	Human Health RGO
Zinc	37.8	4	NA	137 (revised)	NA Avian Insectivore (Robin)	137	Ecological RGO

Source: SAIC (1998a and 1999).

[a] U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) Contract-Required Quantitation Limit (CRQL) for Organics and Contract Required Detection Limits (CRDL) for Inorganics.

[b] Values are for the future industrial worker.

[c] SAIC 1998a, Volume 2, Table 5.2-1 indicated original RGOs [primarily based on No Observable Adverse Effect Level (LOAEL) and a "biased" diet] were 0.05 mg/kg for cadmium (shrew), 0.4 mg/kg for chromium (earthworm), 117 mg/kg for lead (robin), and 27.3 mg/kg for zinc (hawk). Revised RGOs are based on LOAEL for earthworms, shrews, and robins and a diverse diet. In addition, more current toxicity data for chromium by valence state were used.

[d] The applicable cleanup level at a SWMU depends on whether or not the COC is present and, if so, the type of associated risk (human health or ecological). CRQLs/CRDLs are selected if an RGO is lower than these values (none was selected at the Southeast Industrial Area SWMUs). The human health revised RGO selected for lead and antimony is based on the Partnering Team's [Anniston Army Depot (ANAD), Alabama Department of Environmental Management, and EPA) would be consensus on the risk-management strategy that would be protective of both human health and ecological receptors. This strategy factored in the recommendations of the Independent Technical Review Team's study of the ANAD environmental program in May 2000. In areas where the ecological RGO is exceeded for lead, the area will incorporate containment technology. For locations where the human-health RGOs are exceeded, the soils will be removed.

[e] Revised lead cleanup level for industrial workers is based on simple averages from census data to determine a more realistic baseline blood level and geometric standard deviation (inputs to the adult lead model).

[f] Revised antimony cleanup level is based on EPA Region 9's preliminary remediation goal of 820 mg/kg (soil ingestion) for the industrial worker, calculated assuming an ingestion rate of 50 mg/day; the Region 9 PRG was selected based on discussion with EPA Region 4 because it is protected and readily defensible.

COC = Chemical of concern.

NA = Not applicable.

ND = Not detected.

2.13 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, ANAD must select remedies that are protective of human health and the environment, comply with ARARs, are cost-effective, and use permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedies meet these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The selected remedies for all 28 SWMUs will protect human health and the environment. The non-cancer risk for current and most likely future industrial land use will be reduced to an HI of 1, and blood lead level will be reduced to the target (i.e., 95% of the population giving blood lead levels at or below 10 µg/dL). Potential risks to ecological receptors from exposure to contaminated soil will be mitigated with treatment technologies. At Dry Creek (SWMU 44), the toxicity evaluation indicated ecological receptors were not at risk; therefore, no further action is required at SWMU 44. There are no short-term threats associated with the selected remedies that cannot be controlled. In addition, no adverse cross-media impacts are expected. LUCs will also be applied to limit access and prevent worker and ecological exposures to impacted media within the SIA boundaries.

2.13.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedies comply with all federal and state of Alabama ARARs. The key ARARs significant to the selected remedies are presented in **Table 2-23** for SWMUs 7, 9, 12, 13, 29 and 30. Note that LUCs specified in **Table 2-21** also will apply to SWMUs 1, 19, 20, 21, 22, 23, 24, and 28. No chemical-specific ARARs are defined for soil. Location-specific ARARs are not likely to be of concern given the remedial alternatives selected; however, requirements for protection of wetlands and sensitive species are noted for completeness. ARARs also are indicated for specific aspects of the selected remedies and are referred to as action-specific ARARs. These apply primarily to remedial activities related to the management of soil excavated or left in place and protected by a cap or barrier.

2.13.3 Other Criteria, Advisories, or To-Be-Considered Guidance for Remedial Action

During the assessment of the selected remedies, ANAD considered a number of nonbinding criteria, referred to as To-Be-Considered (TBC) Guidance. This guidance will be considered during the design and implementation of the selected remedies.

2.13.4 Cost-Effectiveness

In Army's judgment, the selected remedies are cost-effective and represent a reasonable value for the money to be expended. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness (40 CFR 300.430 (f)(5)(ii)(D)." This decision was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs; hence, the selected remedies represent a reasonable value for the money spent.

Table 2-23. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Guidance for Remediation of Soils in the SIA
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
No chemical-specific applicable or relevant and appropriate requirements (ARARs) have been identified for the selected actions.					
Executive Order 11988 40 *CFR* §6 Appendix A (1999) (Solid Waste Management Units [SWMUs] 29 and 30)	Soil	Executive Order directing federal agencies in the protection of floodplains	To-Be-Considered (TBC) Guidance	Federal agencies must evaluate the potential effect of actions in floodplains, ensure consideration of flood hazards and floodplain management, and take actions to avoid adverse effects and minimize potential harm.	Remedial actions will be implemented to avoid or minimize adverse effects to floodplains.
Executive Order 11990 40 *CFR* §6 Appendix A (1999) (SWMU 7, 9, and 12)	Soil	Executive Order directing federal agencies in the protection of wetlands	TBC Guidance	Whenever possible, actions must avoid or minimize adverse impacts on wetlands. Consideration for protecting wetlands must be incorporated into planning and decision-making processes.	Remedial actions will be implemented to avoid or minimize adverse impacts on wetlands.
Alabama Regulatory Requirement Alabama Department of Environmental Management (ADEM) Admin. Code R. 335-6-6-.03(b)(1995)	Soil	Alabama Water Quality Program National Pollutant Discharge Elimination System (NPDES) Rules and Regulations	Applicable	Any activity for which application for a storm water discharge permit is required by 40 *CFR* 122.26 (1994) must comply with the substantive requirements of the NPDES permit regulations, including the substantive requirements of a General Permit.	Remediation activities will comply with the substantive requirements of the NPDES permit regulations by following the suggested Best Management Practices (BMPs) of the Alabama General Permit for construction activities.

Table 2-23. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Guidance for Remediation of Soils in the SIA
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama (Continued)

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
Alabama Regulatory Requirement ADEM Admin. Code R. 335-14-3-.01(2)(1998)	All solid wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	This section of the Alabama Hazardous Waste Program regulations requires all generators of solid wastes to determine if such solid wastes are also hazardous wastes based on their knowledge of the wastes or through testing the wastes.	All solid wastes (soil, Personal Protective Equipment [PPE], and other secondary wastes) generated will be characterized to determine if they are also hazardous wastes.
Alabama Regulatory Requirements ADEM Admin. Code R. 335-14-3-.03(5)(1999) ADEM Admin. Code R. 335-14-6-.09(1) to ADEM Admin. Code R. 335-14-6-.09(5)(1998) ADEM Admin. Code R. 335-14-6-.09(6)(a and c)(1998) ADEM Admin. Code R. 335-14-6-.09(9)(1998) ADEM Admin. Code R. 335-14-5-.02(5)(1998) ADEM Admin. Code R. 335-14-5-.03(2) to ADEM Admin. Code R. 335-14-5-.03(6)(1998) ADEM Admin. Code R. 335-14-5-.07(2)(1998) ADEM Admin. Code R. 335-14-5-.07(5)(1998)	RCRA hazardous soil and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	Containers storing hazardous wastes must be: • Compatible with the waste. • Transferred to other containers, if any container starts to leak or is no longer in good condition because of rust, corrosion, etc. • Always closed during storage, except to add/remove waste. • Clearly marked with the date upon which accumulation began. • Clearly labeled as "Hazardous Waste" with the U.S. Environmental Protection Agency (EPA) hazardous waste number. • Managed in a manner to prevent rupture of leakage. • Not stacked over two containers high, if the containers are 30 gal or greater in volume. • Inspected, along with the container storage area, at least every 7 days for leaks, deterioration of containers, corrosion, etc. In addition, the substantive portions of the general facility standards and closure requirements for container storage areas must be followed.	Excavated soils and other secondary wastes, which are classified as hazardous wastes, will be stored in containers that meet the requirements for containers and container storage areas.

Table 2-23. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Guidance for Remediation of Soils in the SIA
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama (Continued)

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
Alabama Regulatory Requirements ADEM Admin. Code R. 335-14-6-09(6)(b) (1998)	Decontamination water contaminated with RCRA hazardous waste	Alabama Hazardous Waste Program Rules and Regulations	Applicable	Containers storing hazardous wastes containing free liquids must be placed in an accumulation area designed with an impervious base and sloped or otherwise designed to drain and remove liquids from leaks, spills, and precipitation (unless containers are elevated or otherwise protected from liquids). The area also must have a containment system with a prescribed capacity and with measures to control run-on into the system or sufficient additional capacity.	Any storage area containing hazardous wastes with free liquids will be designed and constructed with the prescribed base and secondary containment system with run-on controls.
Alabama Regulatory Requirements[5] ADEM Admin. Code R. 335-14-3-.03(1) to ADEM Admin. Code R. 335-14-3-.03(4)(1999) (incorporating by reference: 40 *CFR* §172; 40 *CFR* §173; 40 *CFR* §178; and 40 *CFR* §179)	RCRA hazardous soil, and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	The Alabama Hazardous Waste Program regulations incorporate by reference the federal hazardous material (HAZMAT) requirements. The federal HAZMAT regulations require generators and transporters of hazardous waste to package, label, and mark each package of hazardous waste in accordance with the specified requirements and placard, or offer the appropriate placards to the transporter, in order to ensure safe transport prior to transporting hazardous waste or offering hazardous waste for transportation off-site.	Off-site transportation of contaminated soil and any secondary hazardous waste will be shipped in accordance with the Alabama requirements for generators and transporters.
Alabama Regulatory Requirement ADEM Admin. Code R. 335-14-9-.01(7)(1999) [incorporates by reference: 40 *CFR* §268.7(a)(1); 40 *CFR* §268.7(a)(2) (1998)]	RCRA hazardous soil, and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	Generators of hazardous waste must determine if a waste meets the applicable treatment standards of 40 *CFR* §268. In the instance where a waste does not meet the applicable treatment standards, the generator must give written notification to the treatment, storage, or disposal (TSD) facility where a waste is shipped.	If a waste is determined not to meet the appropriate treatment standard, the proper notification will be made to the TSD facility.

[5]Although not classified or listed as ARARs, all legally applicable requirements (substantive and administrative) must be met when the waste stream is managed off-site, including the Alabama Hazardous Waste Program Rules and Regulations for manifesting (ADEM Admin. Code R. 335-14-3-.02), permitting (ADEM Admin. Code R. 335-14-8), and record-keeping and reporting (ADEM Admin. Code R. 335-14-3-.04) and the pertinent Department of Transportation HAZMAT regulations (40 *Code of Federal Regulations* §172-179).

Table 2-23. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Guidance for Remediation of Soils in the SIA
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama (Continued)

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
Alabama Regulatory Requirement ADEM Admin. Code R. 335-14-9-.01(3)(1999)	RCRA hazardous soil, and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	The listed section of the Alabama Hazardous Waste Program regulations sets forth the prohibition of dilution as a substitute for treatment.	The generated waste will be appropriately treated by a permitted off-site facility.
Alabama Regulatory Requirement ADEM Admin. Code R. 335-14-9-.01(9)(1999)	RCRA hazardous soil, and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	The listed section of the Alabama Hazardous Waste Program regulations sets forth the additional requirement for characteristic wastes, including the determination by the generator of the proper waste codes.	Prior to shipment, the generated waste will be assigned the proper waste codes.
Alabama Regulatory Requirement ADEM Admin. Code R. 335-14-9-.04(1)(1999) ADEM Admin. Code R. 335-14-9-.04(8)(1999)	RCRA hazardous soil, and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	Wastes that do not meet the appropriate treatment standard must be treated to the universal treatment standards prior to land disposal.	The generated waste will be appropriately treated by a permitted off-site facility.
Alabama Regulatory Requirement ADEM Admin. Code R. 335-14-9-.04(9)(1999)	RCRA hazardous soil, and other secondary hazardous wastes	Alabama Hazardous Waste Program Rules and Regulations	Applicable	This requirement establishes the treatment standard under the Land Disposal Restrictions for contaminated soil. The treatment standard requires a 90% reduction in contaminant concentration with treatment levels capped at 10 times the Universal Treatment Standard in 40 *CFR* 268.48.	The generated waste will be appropriately treated by a permitted off-site facility prior to disposal.
Federal Regulatory Requirement 40 *CFR* § 300.430(a)(1)(iii)(D) (1999)	All media	National Contingency Plan	Applicable	This requirement defines the use and implementation of institutional controls within the CERCLA remedial context.	Land-use control measures will be employed to supplement the active soil remedial measures.

Table 2-23. Applicable or Relevant and Appropriate Requirements and To-Be-Considered Guidance for Remediation of Soils in the SIA
Anniston Army Depot, Southeast Industrial Area, Anniston, Alabama (Continued)

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action To Be Taken To Attain Requirement
Principles and procedures for specifying, monitoring, and Enforcement of Land-Use Controls and other Post-ROD Actions, EPA, March 17, 2003	All media	EPA	TBC Guidance	Defines mutually agreeable framework to implement land-use controls at NPL installations.	Land-use control performance objectives to be documented in ROD. Details to be provided in remedial design or remedial action work plan.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980.
CFR = Code of Federal Regulations.
NPDES = National Pollutant Discharge Elimination System.
ROD = Record of Decision.

2.13.5 Utilization of Permanent Solutions

ANAD has determined that the selected remedies applicable to specific SWMUs represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the selected remedies provide the best balance of trade-offs in terms of the five balancing criteria while also considering the statutory preference for treatment as a principal element, the bias against off-site treatment and disposal, and state and community acceptance.

The selected remedies address source materials at SWMUs 7, 9, 12, 13, 29, and 30 through the use of excavation, waste treatment, and disposal technologies. Other areas will be addressed through capping/barrier systems to mitigate ecological risks. The remedies also satisfied the criterion for long-term effectiveness by including LUCs for current and future land use for the 14 SWMUs for which remedial action is necessary. The selected remedies do not present risks different from other treatment alternatives. There are no special implementability issues that set the Selected Remedies apart from any of the other alternatives evaluated.

2.13.6 Preference for Treatment as a Principal Element

Principal threat areas were removed through early removal actions and no additional principal threat wastes were identified during the remedial investigation. Therefore the remedies outlined herein were not required to meet the statutory element for treatment as a principal element. Off site disposal of contaminated soil was reduced through the use of Land Use Controls. The selected remedies addresses principal threats posed by the site through the use of a combination of several technologies, including treatment, containment, excavation, disposal, natural attenuation, and LUCs. In using treatment as a portion of the remedy for soil, the statutory preference for remedies that employ treatment as a principal element is satisfied.

Treatment alternatives were evaluated and found not to be cost effective. Onsite management of contaminated soil under reasonably anticipated future land use was selected to minimize off site disposal. Soil that was transported off site included treatment of the soil as a permit requirement prior to disposal.

2.13.7 Five-Year Review Requirements

These selected remedies will result in hazardous contaminants remaining on-post above levels that allow for unlimited use and unrestricted exposure at SWMUs 1, 7, 9, 12, 13, 19, 20, 21, 22, 23, 24, 28, 29 and 30. Therefore, a statutory review will be conducted within 5 years after initiation of the remedial action.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

There are several significant changes from the PP in this ROD. These changes are summarized below:

- **Scope** – The number of SWMUs addressed in the PP increased from 7 to 28 SWMUs. This decision document would serve as the basis for addressing sites where NFA is necessary and sites where remedial action is necessary to address impacted media.

- **Cleanup Levels** – Cleanup levels in the PP for lead and antimony, 760 and 120 mg/kg, were changed in this ROD to 1,350 and 820 mg/kg, respectively. These values resulted in a decrease to the soil excavation volumes and remedial costs. Changes in these cleanup levels were based on

the results of an independent technical review and subsequent analyses by EPA and SAIC, which indicated the modifications would not impact the risk to potential human receptors.

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3.0 THE RESPONSIVENESS SUMMARY

As noted in Section 2.3, the PP was made available to the public in August 2000. The public was offered the opportunity to comment on this plan during the public comment period, July 21 to August 21, 2000, as well as at a public meeting (August 1, 2000). No public comments were received during this period on the selected remedies. In December 2006, an additional public meeting was held to present modifications to the selected remedies and no public comments were received.

EPA Region 4 and the ADEM supported the PP and offered no additional comments beyond those provided during the preparation of the FS.

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Appendices for this Record of Decision are available by placing a request using the Customized CERCLIS/RODS Report Order Form.

http://www.epa.gov/superfund/sites/phonefax/rods.htm