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**THE UNITED STATES NAVY  
INSTALLATION RESTORATION PROGRAM**



**FINAL**

**RECORD OF DECISION  
FOR  
INSTALLATION RESTORATION PROGRAM  
SITES 3 AND 21**

**ANDERSEN AIR FORCE BASE, GUAM**

**April 2011**

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## Table of Contents

Acronyms .....	vii
1.0 Declaration .....	1-1
1.1 Site Name and Location.....	1-1
1.2 Statement of Basis and Purpose.....	1-1
1.3 Assessment of Site.....	1-2
1.4 Description of Selected Remedy.....	1-2
1.5 Statutory Determinations.....	1-4
1.6 Data Certification Checklist.....	1-4
1.7 Authorizing Signatures .....	1-7
1.7.1 U.S. Navy.....	1-7
1.7.2 U.S. Environmental Protection Agency.....	1-9
1.7.3 Guam Environmental Protection Agency.....	1-11
2.0 Decision Summary .....	2-1
2.1 Site Name, Location, and Description.....	2-1
2.2 Site History and Enforcement Activities .....	2-2
2.2.1 Base Operational History.....	2-2
2.2.2 Sites 3 and 21 History.....	2-2
2.2.3 Previous Investigations and Response Actions.....	2-13
2.2.4 Enforcement Activities .....	2-20
2.3 Community Participation.....	2-23
2.4 Scope and Role of Operable Unit or Response Action.....	2-24
2.5 Site Characteristics .....	2-25
2.5.1 Physiography and Climate.....	2-25
2.5.2 Geology.....	2-25
2.5.3 Hydrogeology .....	2-26
2.5.4 Ecology .....	2-26
2.5.5 Cultural Resources.....	2-27
2.5.6 Nature and Extent of Contamination.....	2-28
2.5.7 Conceptual Site Model.....	2-29
2.6 Current and Potential Future Land and Resource Uses .....	2-29
2.6.1 Land Use.....	2-29
2.6.2 Groundwater and Surface Water Uses.....	2-30
2.7 Summary of Site Risks .....	2-35
2.7.1 Summary of Human Health Risk Assessment.....	2-35
2.7.2 Summary of Ecological Risk Assessment.....	2-52
2.7.3 Basis for Action .....	2-57
2.8 Remedial Action Objectives .....	2-64
2.8.1 Remedial Action Objectives, Site 3.....	2-64
2.8.2 Remedial Action Objectives, Site 21.....	2-64
2.9 Description of Alternatives.....	2-66
2.9.1 Description of Remedial Alternatives, Site 3.....	2-66
2.9.2 Common Elements and Distinguishing Features of Each Retained Alternative, Site 3 .....	2-70
2.9.3 Expected Outcome of Each Retained Alternative, Site 3 .....	2-70

2.9.4	Description of Remedial Alternatives, Site 21.....	2-70
2.9.5	Common Elements and Distinguishing Features of Each Retained Alternative, Site 21 .....	2-73
2.9.6	Expected Outcome of Each Retained Alternative, Site 21 .....	2-74
2.10	Summary of Comparative Analysis of Alternatives .....	2-74
2.10.1	Comparative Analysis of Alternatives, Site 3 .....	2-76
2.10.2	Comparative Analysis of Alternatives, Site 21 .....	2-78
2.11	Principal Threat Wastes .....	2-80
2.12	Selected Remedies .....	2-80
2.12.1	Preferred Remedial Alternative, Site 3 .....	2-81
2.12.2	Preferred Remedial Alternative, Site 21 .....	2-89
2.13	Statutory Determinations .....	2-95
2.13.1	Statutory Determinations, Site 3 .....	2-95
2.13.2	Statutory Determinations, Site 21 .....	2-102
2.14	Documentation of Significant Changes .....	2-104
3.0	Responsiveness Summary .....	3-1
3.1	Stakeholder Comments and Lead Agency Responses .....	3-1
3.2	Technical and Legal Issues .....	3-1
4.0	References .....	4-1

## Tables

2-1	Public Notification of Document Availability.....	2-23
2-2	Public Comment Period Requirements.....	2-24
2-3	Exposure Point Concentrations for COCs Detected at Sites 3 and 21 .....	2-36
2-4	Carcinogenic Toxicity Information for the Ingestion, Dermal Pathway .....	2-40
2-5	Carcinogenic Toxicity Information for the Inhalation Pathway.....	2-41
2-6	Non-Cancer Toxicity Information for the Ingestion, Dermal Pathway.....	2-41
2-7	Site 3 Risk Summary .....	2-43
2-8	Site 3 Non-Cancer Risk Summary.....	2-45
2-9	Site 21 Risk Summary .....	2-46
2-10	Site 21 Non-Cancer Risk Summary.....	2-47
2-11	Assessment and Measurement Endpoints for Step 3a BERA Considerations for Sites 3 and 21.....	2-55
2-12	IRP Site 3 Contaminants of Potential Environmental Concern.....	2-58
2-13	IRP Site 21, Contaminants of Potential Environmental Concern.....	2-61
2-14	Site-Specific COCs and RGs for Surface and Subsurface Soils, Site 3 .....	2-65
2-15	Site-Specific COCs and RGs, Site 21 .....	2-66
2-16	Common Elements and Distinguishing Features of Retained Alternatives, Site 3 ...	2-69
2-17	Expected Outcome of Each Retained Alternative, Site 3 .....	2-70
2-18	Common Elements and Distinguishing Features of Retained Alternatives, Site 21 ..	2-73
2-19	Expected Outcome of Each Retained Alternative, Site 21 .....	2-74
2-20	Preferred Remedial Alternative Cost Estimate Summary, Site 3 .....	2-88
2-21	Preferred Remedial Alternative Cost Estimate Summary, Site 21 .....	2-91
2-22	Description of ARARs and TBCs, Site 3 .....	2-97

2-23	Cost and Effectiveness Summary for Site 3 .....	2-100
2-24	Description of ARARs and TBCs, Site 21 .....	2-105
2-25	Cost and Effectiveness Summary for Site 21 .....	2-108

## Figures

1	Guam Location Map .....	2-3
2	Andersen AFB Location Map .....	2-5
3	IRP Site Location Map .....	2-7
4	Location Map, IRP Site 3 .....	2-9
5	Location Map, IRP Site 21 .....	2-11
6	Soil Sampling Locations, IRP Site 3 .....	2-15
7	Soil Sampling Locations, IRP Site 21 .....	2-21
8	Conceptual Site Model (completed exposure routes), IRP Site 3 .....	2-31
9	Conceptual Site Model (completed exposure routes), IRP Site 21 .....	2-33
10	Proposed Land Use Control Boundary, IRP Site 03 .....	2-83
11	Proposed Excavation Areas, IRP Site 21 .....	2-93

## Appendices

- A Federal Facility Agreement Notice Letters
- B Responsiveness Summary and Response to Regulatory Comments
- C Cost Estimates

## Acronyms

§	Section
%	percent
°F	degree Fahrenheit
µg/dL	microgram per deciliter
µg/L	microgram per liter
36 ABW	36th Air Base Wing
AFB	Air Force Base
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
BERA	baseline ecological risk assessment
bgs	below ground surface
BTV	background threshold value
Cal/EPA	California Environmental Protection Agency
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	contaminant of concern
CSM	conceptual site model
DERP	Defense Environmental Restoration Program
DSI	detailed site inventory
EE/CA	engineering evaluation and cost analysis
EM	electromagnetic
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency, United States
EPC	exposure point concentration
ER	environmental response
ERA	ecological risk assessment
ESD	explanation of significant differences
FFA	Federal Facilities Agreement
FS	feasibility study
ft	foot or feet
GEPA	Guam Environmental Protection Agency
GIS	geographic information system
HARM	Hazard Assessment Rating Methodology
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
LUC	land use control

LUCMP	land use control management plan
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
mg/kg	milligram per kilogram per day
mg/m <sup>3</sup>	milligram per cubic meter
MOU	memorandum of understanding
mph	mile per hour
MSA	munitions storage area
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NFRAP	no further response action planned
ng/kg	nanogram per kilogram
NGL	Northern Guam Lens
NPL	National Priorities List
O&M	operation and maintenance
OEW	ordnance and explosive waste
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxin
PP	proposed plan
PPRTV	Provisional Peer Reviewed Toxicity Values
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RfD	reference dose
RG	remedial goal
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RSL	regional screening level
SARA	Superfund Amendments and Reauthorization Act
SBC	soil benchmark concentration
SI	site inspection
SUF	site use factor
SVOC	semivolatile organic compound
TBC	to be considered
TEQ	toxic equivalency
TRV	toxicity reference value
U.S.	United States

UCL upper confidence limit  
USAF United States Air Force  
USFWS United States Fish and Wildlife Service  
VOC volatile organic compound  
WHO World Health Organization

## 1.0 Declaration

### 1.1 Site Name and Location

Facility Name: Andersen Air Force Base (AFB)

Site Location: Guam

CERCLIS ID Number: GU6571999519

Operable Unit (OU)/Site: Installation Restoration Program (IRP) Site 3 and IRP Site 21

### 1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedies for IRP Site 3 and Site 21 at Andersen AFB, Guam, which were selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This document is issued by the Navy<sup>1</sup>, as the lead agency. The Navy is managing remediation of contamination at IRP Site 3 and Site 21 in accordance with CERCLA as required by the Defense Environmental Restoration Program (DERP).

This decision is based on all of the previous work conducted at the sites, which is documented in the Administrative Record (AR) for these sites. The primary documents supporting this decision are listed below and are included in the AR:

- *Final Remedial Investigation Report for IRP Sites 3, 10, 13, 15, 21, 26, and 27, Andersen Air Force Base, Guam (AECOM 2010b)*

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<sup>1</sup> The Department of Defense (DoD) is in the process of realigning installation management functions at Andersen AFB. On 1 October 2009, pursuant to the *2005 Defense Base Closure and Realignment Commission Report (DBCRC 2005)*, administrative custody of all real property on Andersen AFB and responsibility for installation support functions, including Environmental Restoration Program responsibilities, transferred within the DoD from the Department of the Air Force to the Department of the Navy. Title to Andersen AFB real property will remain with the United States (U.S.), and the Air Force will continue to utilize the Base. The Navy will also utilize portions of the Base. In accordance with the *Environmental Supplemental Guidance for Implementing and Operating a Joint Base (DoD 2008)*, at the time of property transfer, the Navy, as the new property manager at the Base, assumed responsibility "for all existing and future environmental permits, requirements, plans, and agreements" at the Base (DoD 2008, Ch. 1.1.2) and was required to: "honor all existing, previously negotiated Federal Facility Agreements in place" (DoD 2008, Ch. 2.17.5).

In January 2009, the Navy and the Air Force entered into a separate Memorandum of Agreement, which delegated installation support and authority back to the Air Force General who is the Andersen Base Commanding Officer (BCO) under the authority, control, and direction of the Joint Region Commander, who is a Navy Admiral. This delegation includes the authority to sign RODs. The Andersen BCO and Andersen environmental staff continue to administer the Federal Facilities Agreement (FFA) under Navy direction. Both the Air Force and the Navy notified the U.S. Environmental Protection Agency (EPA) of the change of administrative responsibility under the FFA (See Appendix A).

- *Final Feasibility Study Report for IRP Site 3 and IRP Site 21, Andersen Air Force Base, Guam (AECOM 2010a)*
- *Draft Proposed Plan (PP) for IRP Sites 3 and 21, Andersen Air Force Base, Guam (USAF 2010)*

Historical information can be found through the internet at <http://www.adminrec.com/PACAF.asp> and the above referenced documents can be found at the following locations:

Nieves M. Flores Memorial Library and  
254 Martyr Street  
Hagåtña, Guam 96910  
Phone: (671) 475-4751

University of Guam (UOG)  
Government Documents Department  
Robert F. Kennedy Library, UOG Station  
Mangilao, Guam 96923  
Phone: (671) 735-2316

The Navy and United States (U.S.) Environmental Protection Agency (EPA) have jointly selected the remedy for the site. The Guam Environmental Protection Agency (GEPA) concurs with the selected remedy.

### **1.3 Assessment of Site**

The remedies selected in this ROD are necessary to protect the public health or welfare, or the environment from actual or threatened releases of hazardous substances into the environment.

Areas within Site 3 cannot support unrestricted use due to the presence of polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and the metals antimony, arsenic, cobalt, lead, mercury and thallium remaining in soil after implementation of the selected remedy. Land use restrictions are recommended as part of this response action and will be achieved through implementation of land use controls (LUCs) that limit the use of the property. Areas within Site 21 will be able to support unrestricted use following implementation of the selected remedy.

The Navy is committed to implementing, monitoring, maintaining, and enforcing all components of the selected remedy to ensure that it remains protective of human health and the environment.

### **1.4 Description of Selected Remedy**

Remedial alternatives for Site 3 and Site 21 were developed and evaluated through a feasibility study (FS) (AECOM 2010a). Based on the results of the FS, the Navy selected LUCs as the preferred alternative for Site 3, and Soil Removal as the preferred alternative for Site 21. The major components of the selected remedies are presented below.

#### Site 3

- Land use (i.e., current and foreseeable) is zoned for industrial purposes within the landfill complex.

- LUCs will include notice of contamination in the Real Property records system and deed restrictions for residential development including engineering controls for construction activities within the area(s) of remaining contamination.
- LUCs will be maintained until the concentration of contaminants of concern (COCs) in the soil are at such levels to allow for unrestricted use and exposure.
- Periodic monitoring through physical inspections will be conducted to ensure that LUCs are enforced and posted warning signs are visible. The annual inspection forms will be maintained in the Land Use Control Management Plan (LUCMP).
- Deed restrictions for land use will be noted at the Real Property office, incorporated in the Base General Plan, and entered on the Andersen AFB geographic information system (GIS) environmental layer overlay indicating the types of LUCs implemented for the site.
- No intrusive activities shall occur within a designated LUC area without prior written approval of the Navy in the form of a dig and/or construction permit. If intrusive activities are conducted within the designated LUC area, the work would require an approved health and safety work plan and procedures for the proper handling and disposal of displaced waste and/or soil. Dig and construction permits shall be maintained as part of the LUCMP.
- The Navy will conduct formal 5-year reviews at Site 3, as required by CERCLA, because contamination is left in place. The 5-year reviews will continue as long as COCs remain at levels above those suitable for unrestricted use of the site.

#### Site 21

- Conduct pre-excavation soil sampling to delineate the extent of soil contamination and verify the volume of media to be removed prior to soil excavation (which is presently estimated at 3,700 cubic yards).
- Excavate soil contaminated with metals, dioxins, or PAHs with concentrations above remedial goals (RGs), thereby reducing the risk of exposure for future residents, mammals, and avian receptors to acceptable levels and allowing unrestricted land use.
- Screen, and if found, properly manage and dispose of any munitions and explosives of concern (MEC) during site preparation and excavation.
- Conduct post-excavation soil sampling to confirm that RGs have been met; i.e., soils that remain behind do not contain concentrations of metals, dioxins or PAHs above RGs.
- Dispose of excavated contaminated media (contaminated soil) and debris at the Andersen AFB Consolidation Unit located at IRP Site 2, located approximately 4.3 miles away. The Consolidation Unit is used to manage CERCLA waste.

## **1.5 Statutory Determinations**

The selected remedies for Site 3 and Site 21 are protective of human health and the environment, comply with promulgated applicable or relevant and appropriate requirements (ARAR) to the remedial actions, and are cost effective.

The selected remedies are protective of human health and the environment, comply with Federal and State ARARs to the remedial action, are cost-effective, and utilize permanent solutions and resource recovery technologies to the maximum extent practicable.

There are no principal threat wastes at the sites addressed in this ROD, so the NCP preference for treatment of principal threat wastes does not apply. The selected remedies in this ROD do not satisfy the statutory preference for treatment as a principal element of the remedy because no treatment is readily available to handle the variety of wastes addressed (i.e., metals and semivolatile organic compounds [SVOCs]), and the volume of soil is contaminated at low levels and can be appropriately managed via excavation and disposal, in the case for Site 21.

Because the selected remedy for Site 3 will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted for Site 3 within 5 years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

Because the selected remedy for Site 21 will not result in COCs, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a 5-year review will not be required for this remedial action.

## **1.6 Data Certification Checklist**

The following information is included in the Decision Summary section of this ROD (Section 2.0).

- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.6)
- Baseline human health risk represented by the COCs (Section 2.7.1)
- List of COCs and their respective concentrations (Section 2.7.1.1 and Table 2-3)
- Ecological risk represented by the COCs (Section 2.7.2)
- RGs established for COCs and the basis for these levels (Section 2.8)

- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (For Site 3, see Section 2.10.1.7, Section 2.12.2.3, and Table 2-16. For Site 21, see Section 2.10.2.7, Section 2.12.2.3, and Table 2-18)
- Key factor(s) that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Section 2.12.1.1; and Section 2.12.2)

1.7.3 Guam Environmental Protection Agency

The Territory of Guam EPA concurs with the remedy selected in this ROD for Sites 3 and 21 at Andersen AFB, Guam.

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Ivan C. Quinata  
Administrator  
Guam Environmental Protection Agency

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Date

## 2.0 Decision Summary

The Decision Summary identifies the Selected Remedy, explains how the remedy fulfills statutory and regulatory requirements, and provides a substantive summary of the AR file that supports the remedy selection decision.

### 2.1 Site Name, Location, and Description

Andersen AFB is the home for the Headquarters of the Pacific Air Force's 36th Air Base Wing (36 ABW), which comes under the command jurisdiction of the 13th Air Force, and Pacific Air Forces based at Joint Base Pearl Harbor – Hickam, Hawaii (Figure 1). Andersen AFB is also home for the Air Mobility Command's 734th Air Mobility Support Squadron, and several other tenant organizations.

Andersen AFB occupies the northern portion of Guam and consists of three major subdivisions: the North Field, the Northwest Field, and the Marbo Annex (Figure 2). The North Field is referred to as the Main Base, where most of the active operations take place. Site 3 is located on the Main Base, while Site 21 is located in the Northwest Field (Figure 3).

Site 3 is located southeast of the active Base sanitary landfill, and is located within the area known as the Base Landfill Complex, which is comprised of former, inactive landfills and the active Base sanitary landfill, approximately 1,500 feet (ft) west of the intersection of Arc Light Boulevard and Perimeter Road (Figure 4). The Site is located within an abandoned quarry that is approximately 1,200 to 1,500 ft long by 500 to 700 ft wide, and occupies approximately 19 acres. The northern portion of the quarry is approximately 7 acres in size and consists of a limestone quarry wall and floor. The southern portion of the quarry is the area of concern, and is approximately 12 acres in size. This southern portion is densely vegetated with a mixture of trees and shrubs.

Site 21 is located within the Andersen AFB munitions storage area (MSA), Northwest Field (Figure 5), approximately 2 miles north of the intersection of Routes 3 and 9 at Potts Junction. The original site was described as an abandoned quarry, approximately 2 acres in size, which was reportedly used as a landfill (ESE 1985). This site investigation encompasses approximately 18.3 acres. There are no active roads through the site; however, there is evidence of former road construction and earth-moving activities at the site. The adjacent lands are currently Navy property that is used by Andersen AFB for contingency purposes and as the primary MSA. An open trench, approximately 675 ft long, 60 ft wide, and 20 ft deep is situated in the southwestern corner of the site. The trench is cut into the limestone and is filled with assorted debris.

As the lead agency for remedial activities, the Navy has conducted environmental restoration at Sites 3 and 21 in accordance with CERCLA under the DERP, which was established by Section 211 of the SARA of 1986.

As the support agencies, EPA Region 9 provides primary oversight of the environmental restoration actions, in accordance with the Federal Facilities Agreement (FFA) with concurrence by the GEPA.

Funding is provided by the Defense Environmental Restoration Account, a funding source approved by Congress to clean up contaminated sites on Navy installations.

## **2.2 Site History and Enforcement Activities**

This section provides background information and summarizes the series of investigations that led to the ROD. It describes the CERCLA response actions undertaken at Site 3 and Site 21.

### **2.2.1 Base Operational History**

Historically, the U.S. Army Air Corps built and maintained three air bases on Guam after World War II when U.S. forces took control of the island from the Japanese in July 1944. Construction began on the North Field in November 1944 and at Northwest Field in January 1945, and was completed in the first half of 1945. Since October 2009, the Department of the Navy has assumed responsibility for the real estate administration and the implementation of the FFA for Andersen AFB. The Navy has delegated signature authority for the ROD to the Andersen AFB Base Commanding Officer. The Northwest Field has remained inactive since 1949, and it has since been used by the military for various training exercises.

Andersen AFB was placed on the National Priorities List (NPL) on 14 October 1992. Final listing brought Andersen AFB under the Federal facility provisions of CERCLA. In March of 1993, the U.S. Air Force (USAF) entered into a FFA with the EPA and the Territory of Guam for installation environmental restoration efforts specific to a design remedial investigation (RI)/FS.

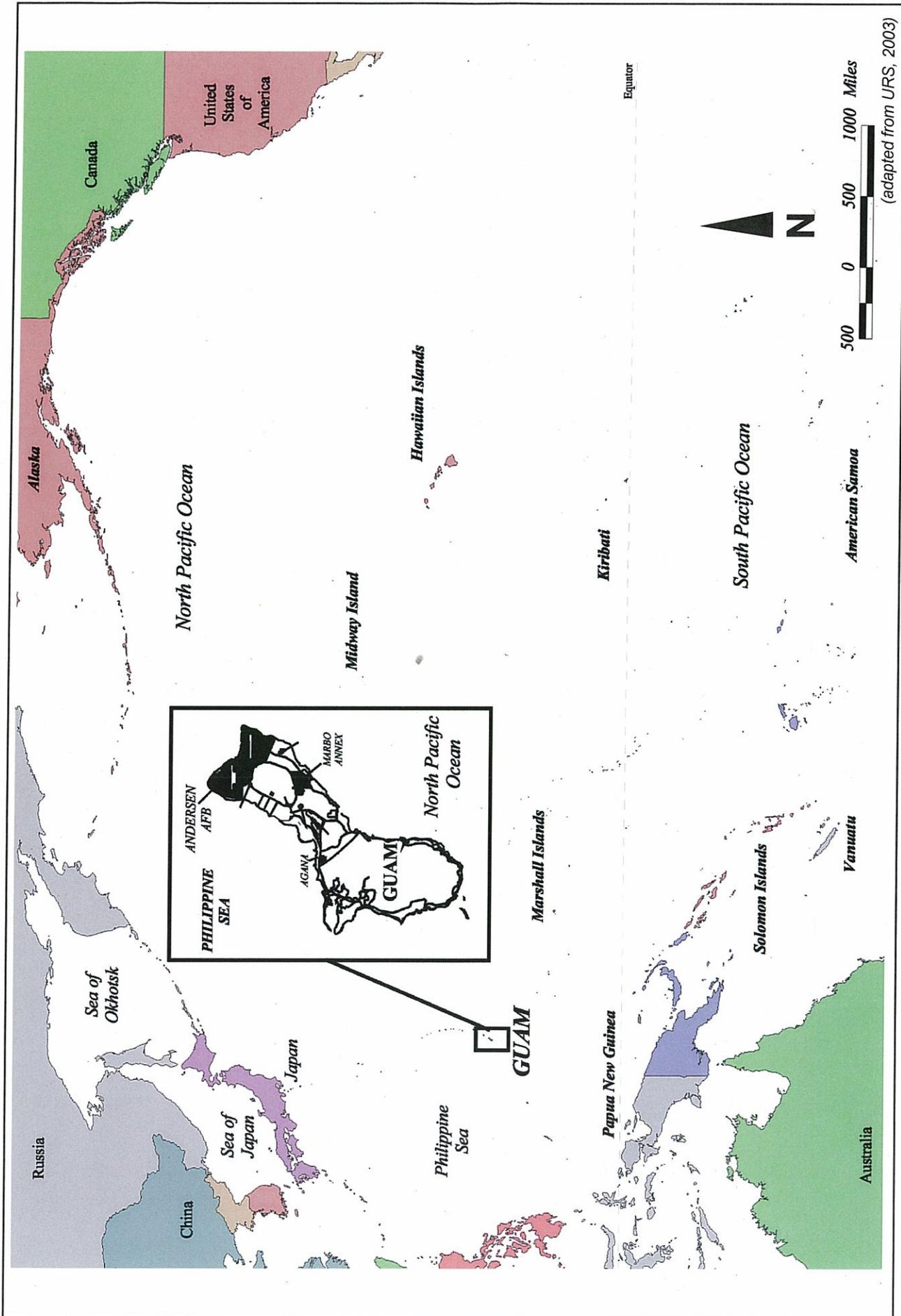
Both sites were first identified during the *IRP Phase I Records Search* (ESE and RSH 1985) in August 1984, whereupon the sites were assessed using the Hazard Assessment Rating Methodology (HARM), which evaluated factors such as site characteristics, waste characteristics, potential for contaminant migration, and waste management practices (ESE 1985). The HARM system was designed to indicate the relative need for remedial action. Sites receiving a HARM score were recommended for further investigation.

A Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted in 1986 and assessed 63 solid waste management units and other areas of concern to evaluate their respective potential for releases to the environment (SAIC 1986). Site 3 was included in the RFA, but Site 21 was not due to access limitations.

### **2.2.2 Sites 3 and 21 History**

#### **2.2.2.1 Site 3 History**

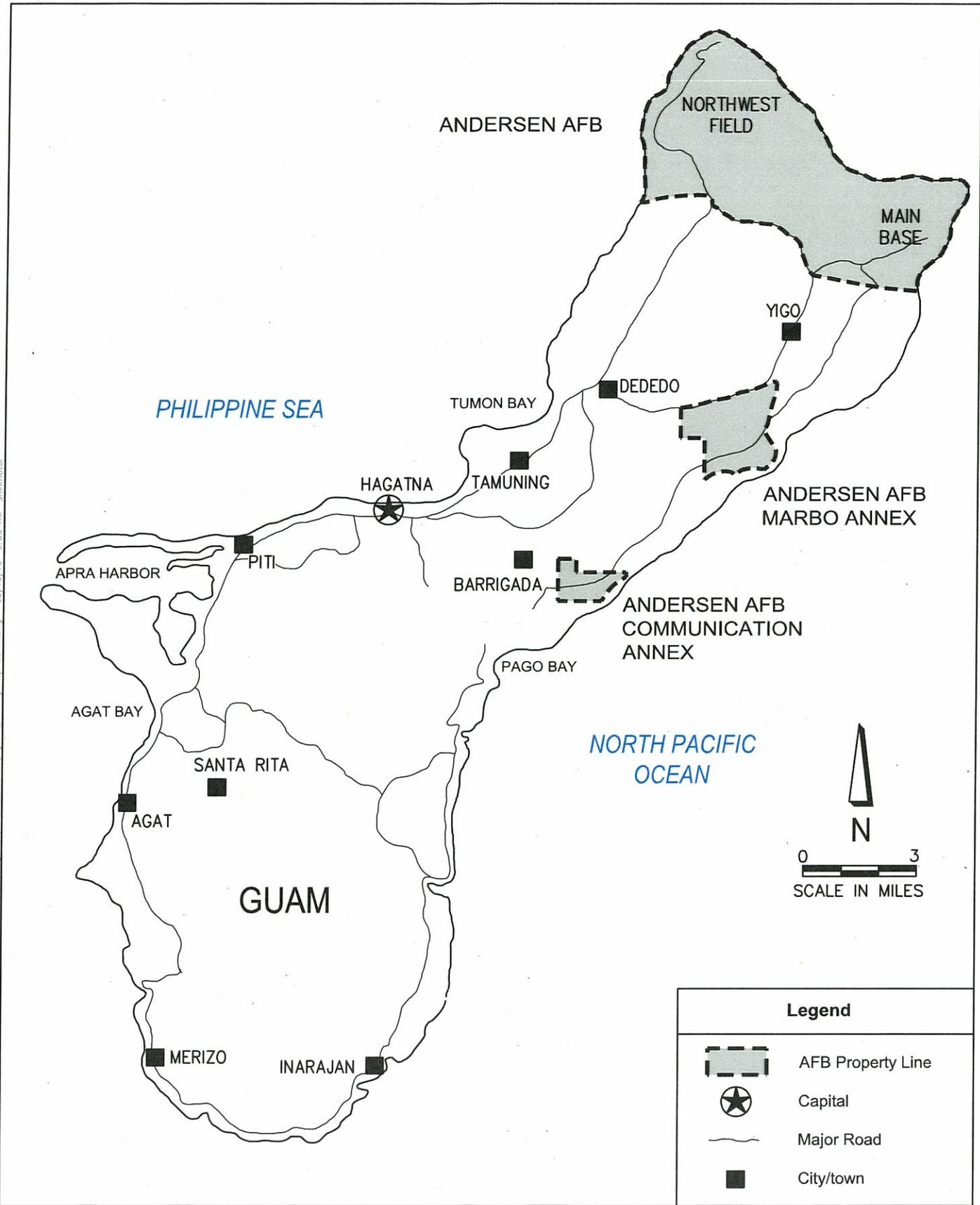
Site 3 was reportedly operated as an open dump from 1947 until 1977 for disposal of a variety of wastes, including construction debris, asphalt, sanitary trash, scrap metal, solvents, waste contaminants, pesticides, and waste oils. Relative quantities of waste are unknown. Periodic fires were also reported at this site prior to closure.



(adapted from URS, 2003)

Figure 1  
 Guam Location Map  
 Record of Decision for IRP Sites 3 and 21  
 Andersen AFB, Guam

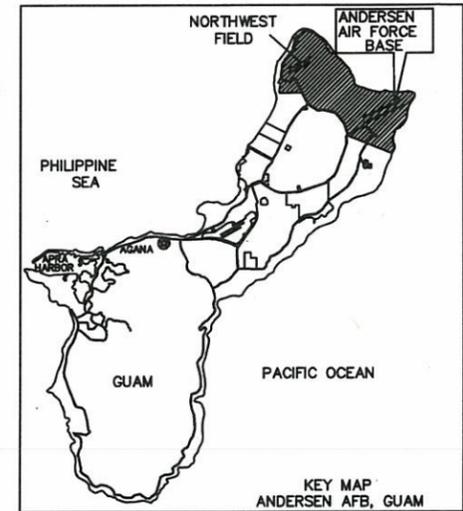
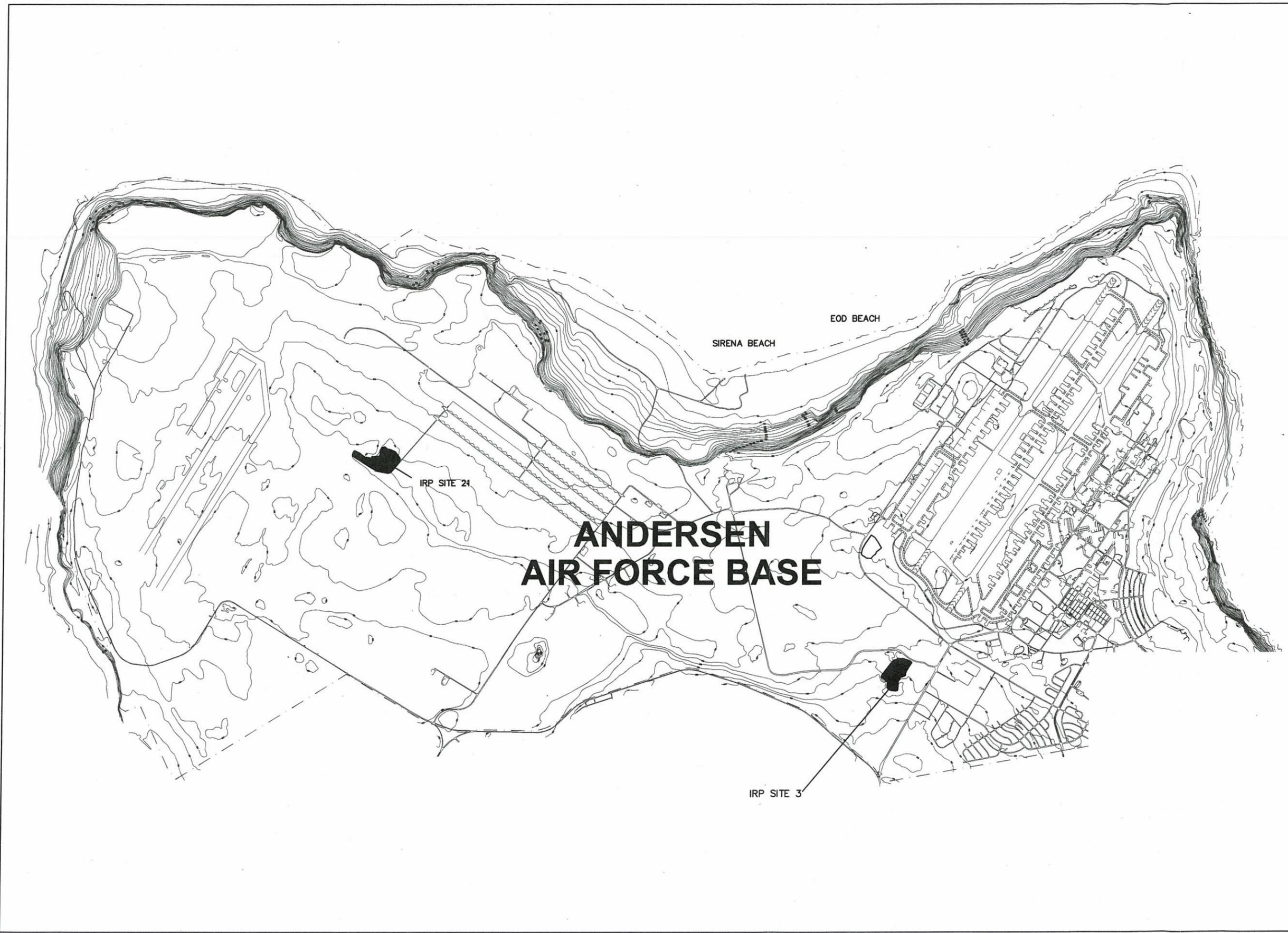
L:\work\AFCEE\Guam\10\_0025\_(60133951)\Reports\01\_Report\Andersen\Figures\Fig\_2\_Vicinity\_Map\_GUAM.dwg 03/15/10 9:35 AM shmmotor



**Figure 2**  
**Andersen AFB Location Map**  
**Record of Decision for IRP Sites 3 and 21**  
**Andersen AFB, Guam**

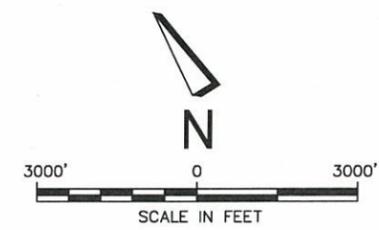
Legend	
	AFB Property Line
	Capital
	Major Road
	City/town

L:\work\AFCEE\Guam\TO 0025 (60133951)\Reports\PP ROD\Records of Decision\02--ROD Sites 3 & 21\3 Draft\Figures\Fig\_3\_Site Loc Map.dwg 07/22/10 8:34 AM shimmator



**LEGEND**

- - - EXISTING AIR FORCE PROPERTY LINE
- ROADS, PAVED
- SURFACE TOPOGRAPHY (25 FOOT CONTOUR INTERVAL)
- IRP SITE 15 ■ IRP SITES



**Figure 3**  
IRP Site Location Map  
Record of Decision for  
IRP Sites 3 and 21  
Andersen AFB, Guam

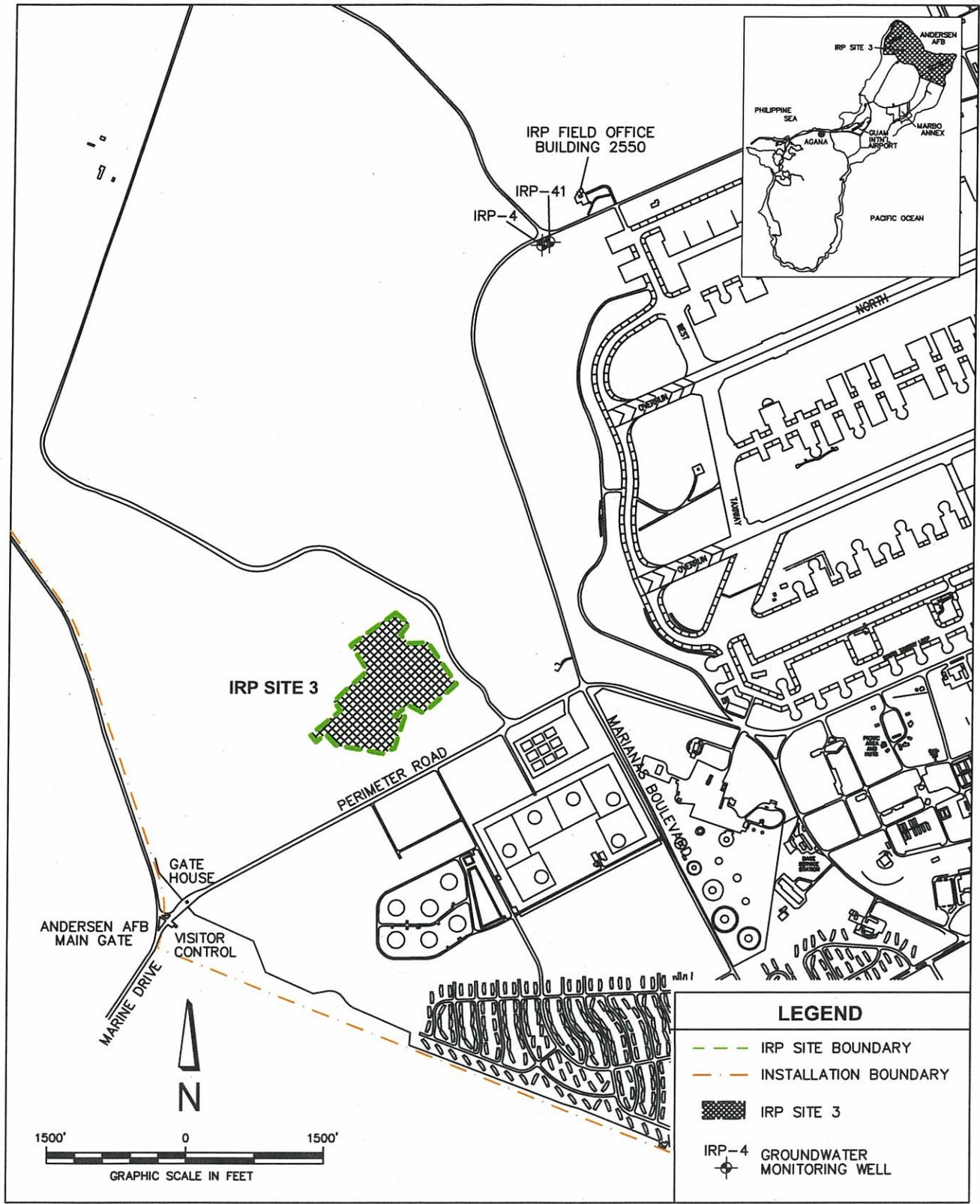
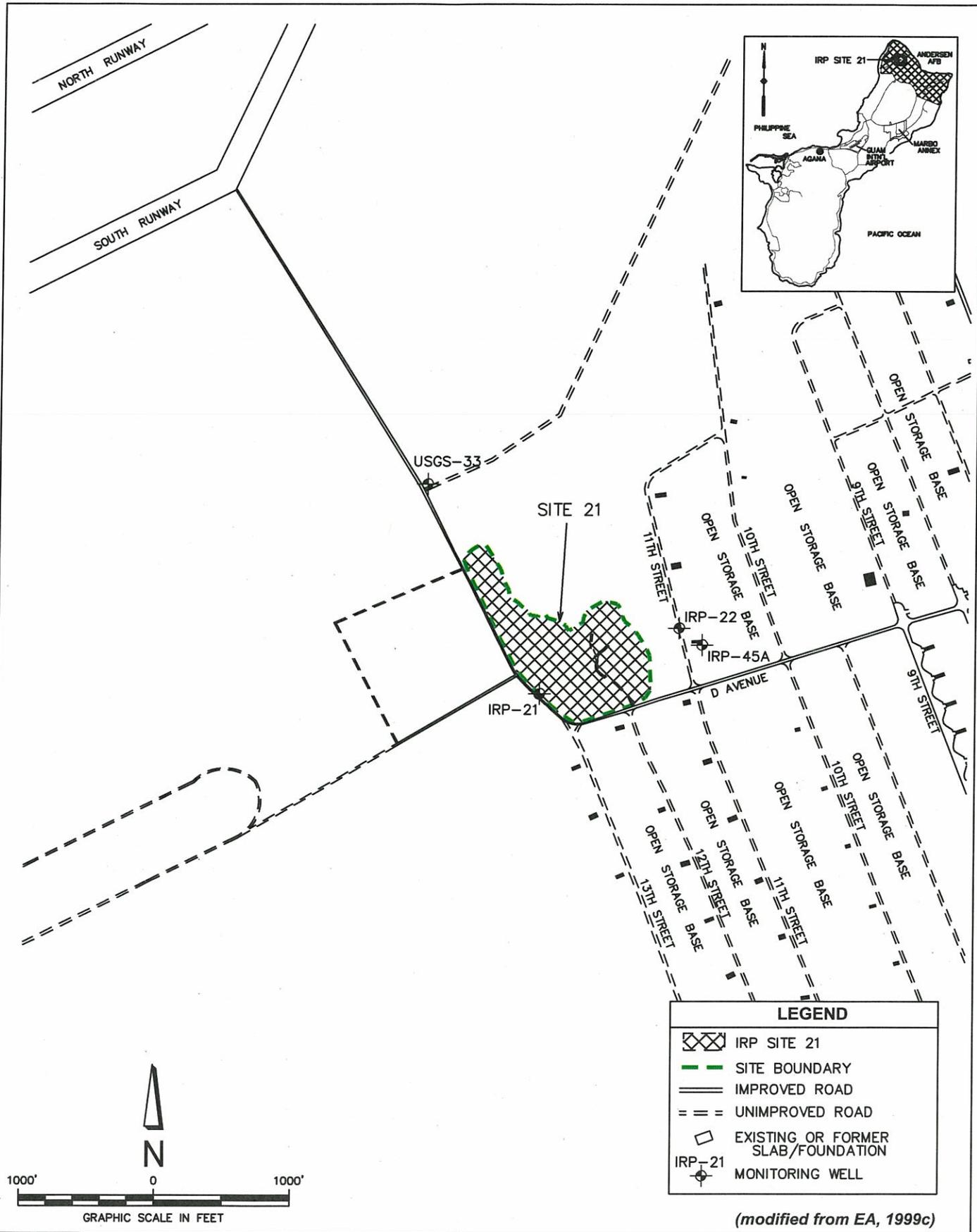


Figure 4  
Location Map, IRP Site 3  
Record of Decision for IRP Sites 3 and 21  
Andersen AFB, Guam

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**Figure 5**  
**Location Map, IRP Site 21**  
**Record of Decision for IRP Sites 3 and 21**  
**Andersen AFB, Guam**

#### 2.2.2.2 Site 21 History

The site was operated as an open dump in 1966. Sanitary trash and construction debris were reportedly disposed of at this site using the trench disposal method and the site was closed with a soil cover. The quarry floor and the quarry bench contain piles of rusted ordnance and explosive waste (OEW) and miscellaneous surface debris. Several dozen 55-gallon drums are located on the quarry floor in three separate clusters. Small quantities of an asphalt or tar-like substance are present in approximately 5 drums. The remaining drums were either empty or contained a residual coating of an asphaltic tar-like substance, presumably from the former drum contents.

Within the trench, debris was apparently disposed of from the top of the trench wall along 13th Street. The surficial debris comprises tires, empty 1,000-gallon storage tanks, approximately 30 55-gallon drums with asphalt/tar-like material, and abundant metallic debris such as aircraft parts. All metal materials are severely weathered, and the ground surface is littered with rust flakes. The presence of burnt wood indicated that fires may have been started within the trench for debris disposal.

#### 2.2.3 Previous Investigations and Response Actions

##### 2.2.3.1 Site 3 Previous Investigations and Response Actions

A record review of the site was completed between June 1993 and June 1994. The earliest written documentation pertaining to disposal at Site 3 was included in the *1955 Base Master Plan* (USAF 1955). That document indicates that garbage was placed in Site 3 and periodically covered with soil. The *IRP Phase I Report* (ESE and RSH 1985) indicates that Site 3 was operated from 1947 to 1977.

##### 2.2.3.1.1 Site 3 Site Characterization

A field investigation was conducted at the site between May 1995 and March 1996 as part of a multi-site site characterization study, and is documented in the *Site Characterization Report, Waste Piles 1, 2 and 3, Andersen AFB, Guam*, dated March 1998 (ICF 1998). The field investigation at Site 3 included a visual site reconnaissance/detailed site inventory (DSI), electromagnetic (EM) geophysical survey, soil gas survey, test trenching and ditching, and sampling of both surface and subsurface soils.

A site reconnaissance and DSI were performed at the site to document physical evidence of surface disposal and to approximate the horizontal boundary of the site. Surface anomalies (i.e., scattered debris, waste piles, and soil mounds) were inventoried and noted in site logbooks and sketches. Additionally, the areal extent of the site was delineated based on visual observations.

The debris identified at Site 3 consisted of a wide range of refuse materials, including tires, bottles, electrical wire and conduit, telephone poles, iron pipe, kitchenware, corrugated sheet metal, angle iron, drums, brake shoes, chain-link fencing, wire cable, engine parts, reinforcing bar, aluminum flashing, roofing, aluminum siding, and I-beams.

Subsequent to the DSI, an EM geophysical investigation was performed at Site 3. The results of the EM survey indicated numerous anomalies. A comparison of the EM survey with the DSI indicated that almost all of the anomalies are related to areas where surface metal was identified. Where this was not the case, test ditches were excavated in these areas (ICF 1998).

Whole-air active and passive soil gas samples were collected at Site 3 to determine whether volatile organic compounds (VOCs) were present in the near subsurface. Secondary whole-air active soil gas samples were collected around each sampling point that yielded significant detections to further define the area within the site. A tertiary survey, consisting of both whole-air active and passive soil gas samples, was performed to corroborate the initial results. A total of 160 whole-air active soil gas samples and 13 passive soil gas samples were collected at Site 3 (ICF 1998). Trace levels (<1 microgram per liter [ $\mu\text{g/L}$ ]) of VOCs were detected in two of the initial 86 samples and in one of the secondary samples.

Active soil gas results were confirmed with passive soil gas sample results, which indicated the presence of trace amounts (<1 microgram) of VOCs in several samples collected from the southern portion of the site.

Using a trackhoe, 57 test ditches were excavated at Site 3. Ditches were generally terminated when bedrock was encountered. A total of 11 additional test pits were excavated at Site 3 along mounds and surface depressions to investigate the presence of buried waste, and to characterize that waste. Only 9 of these ditches contained buried debris. The debris observed in these ditches was generally described as scrap metal, bomb strapping bands, automobile parts, concrete, and crushed drums. Burnt material was noted along some areas of the quarry wall.

A total of 36 surface and 10 subsurface soil samples, plus quality assurance/quality control samples, were collected at Site 3 and analyzed for VOCs, SVOCs, PAHs, pesticides, PCBs, metals, cyanide, dioxins, and furans. One subsurface soil sample was collected from the bottom of each test pit and test trench excavation that contained buried waste.

Distribution of detected organic compounds was scattered, although generally more frequently near the debris pile in the east-central portion of the Site. Three surface soil samples and one subsurface soil sample contained concentrations of various PAH compounds at concentrations exceeding one or both (i.e., residential and/or industrial) of their respective 1998 EPA Region 9 Preliminary Remediation Goals (PRGs). Three PCB Aroclors (1248, 1254, and 1260) were detected in excess of their respective residential PRGs in one or more samples, with exceedances occurring in both surface and subsurface soils. The pesticide dieldrin was identified in three soil samples (one surface and two subsurface) collected from the debris pile in the east-central portion of the site at concentrations above its residential PRG. Figure 6 shows soil sampling locations with contaminant concentrations above screening levels.



The metals antimony, arsenic, cobalt, iron, lead, and mercury were detected in surface and subsurface soils at concentrations that exceeded their respective residential PRGs and Guam background threshold values (BTVs). Arsenic, lead, and thallium levels also exceeded their industrial PRGs. Exceedances for lead and iron were relatively widespread, occurring across the Site at 11 and 7 locations, respectively, in both surface and subsurface soils. In contrast, cobalt exceeded PRGs in only one sample and antimony in only two, suggesting localized soil impacts from these two metals.

Low levels of dioxins were detected in several surface and subsurface soil samples. However, site-wide toxic equivalency (TEQs) values calculated for Site 3 surface and subsurface soils were both below the residential PRG.

The disseminated nature of both organic and metals contamination in Site soils, and the general lack of any identifiable "hot spots" (Figure 6) reflect the heterogeneous nature of the wastes at Site 3, which was used for more than 30 years for debris and waste disposal.

Based upon the results of the Site Characterization in 1995 and 1996, a no further response action planned (NFRAP) was signed in March 1998 (Andersen AFB 1998).

#### 2.2.3.2 Site 21 Previous Investigations and Response Actions

During the *IRP Phase I Records Search* in August 1984 (ESE and RSH 1985), Site 21 was identified as potentially containing hazardous contaminants resulting from past activities. The record search indicated that the site had minimal potential for contamination or hazardous leachate formation and therefore was removed from further consideration.

The *RFA Report* (SAIC 1986) described the site location at the northwest corner of the conventional weapons storage area and noted that the site was revegetated by overgrowth. The report claimed that sanitary wastes and construction rubble were the only wastes disposed of at the landfill from the mid-1950s through 1963. Reportedly, past releases of methane may have occurred at the site, but "all putrescible wastes are likely to have decomposed" because of the time since operation. A visual site inspection (SI) was not performed because of access limitations.

The *IRP Phase II Stage 1-Confirmation/Quantification Investigation* (Battelle 1989) for Andersen AFB did not include the investigation of Site 21. However, the report did recommend an investigation during the Phase II, Stage 2 study because trichloroethylene was detected in groundwater from monitoring well USGS-33, located approximately 1,000 ft northwest of the site, at 3.7 µg/L.

The IRP Stage 2, RI/FS was conducted from January 1989 through September 1989 (SAIC 1991a,b). The investigation included a magnetometer survey, soil sampling, installation of two groundwater monitoring wells (IRP-21 and IRP-22), and groundwater sampling. Three groundwater samples and nine soil samples were collected at the site. Toluene and xylenes were detected in the groundwater surrounding the site; however, none of the concentrations exceeded maximum contaminant levels. Based on the investigation, it was determined that insufficient data existed to assess health hazards at the site. It was

recommended that one well be installed downgradient of the site to determine whether contaminants from the landfill were impacting groundwater.

Surface soil sampling was conducted during the IRP Stage 2, RI/FS (SAIC 1991b). Bis (2-ethylhexyl) phthalate was detected and attributed to laboratory contamination. The metals barium, cadmium, chromium, and lead were detected in soil samples collected at the site. Concentrations of barium ranged from 2.3 milligrams per kilogram (mg/kg) to 21 mg/kg, cadmium at 3 mg/kg, chromium from 18 mg/kg to 280 mg/kg, and lead from 18 mg/kg to 490 mg/kg. Lead exceeded the BTV in one sample (490 mg/kg).

#### 2.2.3.2.1 Site 21 Engineering Evaluation and Cost Analysis (EE/CA)

A field investigation was conducted at the site between June 1997 and August 1998 as part of an engineering evaluation and cost analysis (EE/CA), and is documented in the *Final Decision Summary, No Further Response Action Planned (NFRAP) for IRP Site 21/Landfill 26* dated September 1999 (EA 1999a). The field investigation at Site 21 included a site reconnaissance/DSI, EM geophysical survey, soil gas survey, surface and subsurface soil sampling, and test ditch/trench excavations.

A site reconnaissance and DSI were conducted to describe the physical characteristics and boundaries of Site 21. The site is characterized by surface debris on the quarry floor and slopes, surface disposal of drums, and landfill disposal of waste in an open trench, which was found in the northwest corner of the site. Piles of 55-gallon drums were found in both the quarry floor and within the open trench. The quarry floor consists primarily of limestone bedrock with approximately 0 to 0.5 ft of scattered soil and debris cover.

The quarry floor and the quarry bench contain piles of rusted OEW pieces and miscellaneous surface debris. These piles vary from approximately 1 ft to 12 ft high and cover an area of 40 ft by 80 ft. Each pile is comprised of one to three different types of OEW indicating organized disposal methods. The variety of OEW found at the site includes bomb fuse covers, bomb shoes, metal banding, metal clamps, and bomb racks/pallets. The waste materials have been both methodically stockpiled and dispersed on the quarry floor.

The 55-gallon drums are located on the quarry floor in three separate clusters of 11, 56, and 9 drums each. Small quantities of an asphalt or tar-like substance are present in approximately five drums. The remaining drums contain a thin layer of the asphalt/tar-like substance or are empty. The lids to most of the drums are not intact, and drum labels are illegible. Because the drums are severely pitted and corroded, the ground surrounding the drums is littered with rust flakes. Some of the drums are crushed, some are remnants, and some are partially buried.

The open trench is approximately 675 ft long, 60 ft wide, and 20 ft deep. It is situated in the southwestern corner of the site. The trench is cut into the limestone and is filled with assorted debris. The debris was apparently disposed of from the top of the trench wall along 13th Street. The surficial debris consists of tires, empty 1,000-gallon storage tanks, approximately 30 55-gallon drums with asphalt/tar-like material, and abundant metallic debris such as aircraft parts. All metal materials are severely weathered and litter the ground

surface with rust flakes. The bottom and eastern wall of the trench contain lesser amounts of debris. However, partially buried drums and other debris were noted in the western portion of the trench.

During the initial site survey, several types of fragmented OEW were discovered at the site. Andersen AFB explosive ordnance disposal (EOD) personnel identified the OEW as empty photo-flash bomblet casings, empty double-star flare casings, and several deteriorated, empty bomb casings. One piece of potential unexploded ordnance, a Vietnam-Era jet engine adapter booster, was identified by EOD personnel and removed from the site. EOD personnel determined that the remaining pieces of OEW present at the site were properly disarmed, with no potential for detonation, prior to disposal. The material left on the site lies within a controlled area, and the potential risk to the surrounding population is minimal.

An EM induction geophysical survey was subsequently conducted to characterize magnetic anomalies that may represent buried fill. An EM survey covering the entire site was not conducted because of the possible interference from the large piles of scrap metal. In addition, a geophysical survey was unnecessary over areas of bedrock outcrop. Small anomalies identified were related to metal debris observed on the surface. The magnetic anomalies observed in the northwestern portion of the site were related to surficial as well as subsurface debris found in the trench.

A soil-gas survey was conducted to evaluate the extent of VOCs in the subsurface soil and bedrock. A total of 45 soil gas samples were collected from 32 locations. No VOCs were detected in any of the soil gas samples.

Eleven test excavations were conducted to delineate the lateral extent of wastes, characterize the content of soil mounds and evaluate the nature of the material within the elongated trench. In five of the test ditches, no evidence of waste materials was identified. Small amounts of metal and construction debris, with some evidence of burning, were found in five others. The excavation within the elongated trench identified electrical components, steel cable, empty fuel tanks, one 55-gallon drum lid, and scrap metal such as brackets, fixtures, pipes, plating, casings, and capsules.

Twenty-eight surface and one subsurface soil samples were collected at Site 21 and analyzed for VOCs (subsurface only), PAHs, SVOCs, metals, and cyanide. Only one subsurface soil sample was collected due to the thin soil cover (< 2 ft). Due to the evidence of waste disposal and burning within the elongated trench, 14 additional surface soil samples were collected and analyzed for dioxins and furans. Figure 7 shows soil sampling locations with contaminant concentrations above 1998 PRGs (EPA Region 9 1998).

One surface soil sample (and its duplicate) collected near several rusting drums leaking an asphalt-like substance contained four PAH compounds at concentrations above the residential PRGs (benzo[a]anthracene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene), and the PAH compound benzo(a)pyrene above its industrial PRG. Benzo(a)pyrene was detected in a second nearby sample at a concentration also above its residential PRG.

Aluminum, antimony, iron, lead, and copper were detected at concentrations above their respective residential PRGs and BTVs in one or more soil samples. All but two of the soil metals exceedances were collected from the area of the open trench (Figure 7). Note also that each of these surface samples represented "samples of opportunity" and were collected in areas of scrap metal and debris. Sampling logs indicate that many of the samples could not be collected without including some metal fragments.

Of the 14 surface soil samples collected from the elongated trench, 9 contained dioxins above the residential PRG for total EPA TEQ, and 5 exceeded the industrial PRG for total EPA TEQ.

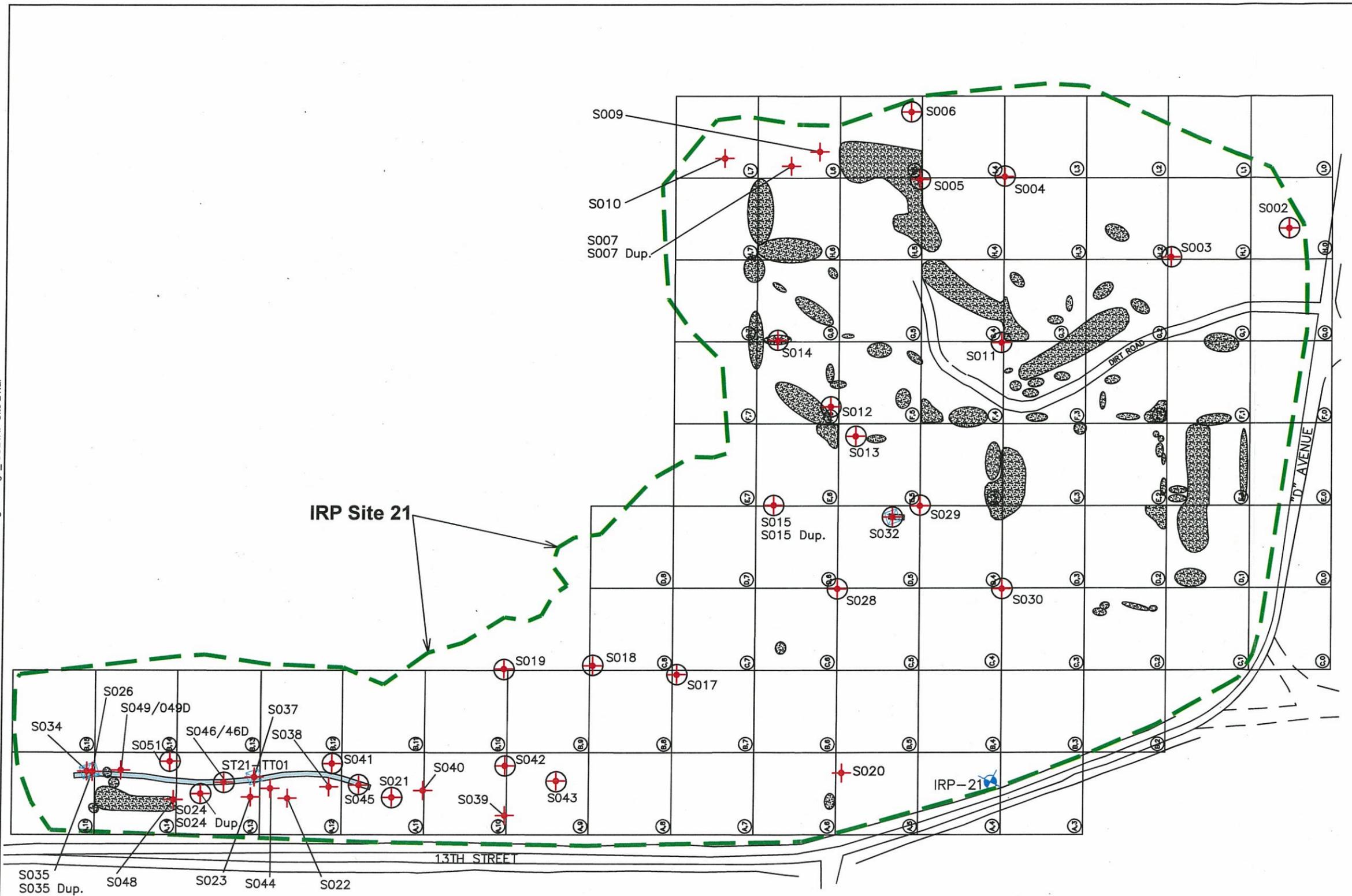
Based upon the results of the investigations, the site was recommended for no further action in September 1999 (EA 1999a).

#### 2.2.4 Enforcement Activities

Andersen AFB was listed on the NPL on 14 October 1992. The enforcement activities for Andersen AFB were initiated when the USAF entered into a FFA with the EPA Region 9 and GEPA. The FFA, finalized on 30 March 1993, established a framework for performing detailed environmental investigations at Andersen AFB. The FFA was based upon applicable environmental laws including CERCLA, the Hazardous and Solid Waste Amendments, SARA, and the NCP.

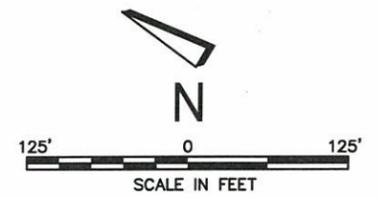
In accordance with Navy policy, to the extent practicable, National Environmental Policy Act (NEPA) values have been incorporated throughout the CERCLA process culminating in this ROD. Separate NEPA documentation will not be issued.

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**LEGEND**

- SURFACE SOIL SAMPLE LOCATION
- SUBSURFACE SOIL SAMPLE LOCATION
- SAMPLING LOCATION WITH NO REGULATORY CRITERIA EXCEEDENCES
- OPEN TRENCH
- METAL DEBRIS
- IRP-21 MONITORING WELL
- APPROXIMATE SITE BOUNDARY
- GRID BLOCK IDENTIFICATION



**Figure 7**  
Soil Sampling Locations, IRP Site 21  
Record of Decision for IRP Sites 3 and 21  
Andersen AFB, Guam

(modified from EA, 1999c)

### 2.3 Community Participation

NCP Section 300.430(f)(3) establishes a number of public participation activities that the lead agency must conduct following preparation of the PP and review by the support agency. Components of these items and documentation of how each component was satisfied for Site 3 and Site 21 are described in Table 2-1 and Table 2-2 below.

Navy responses to comments received during the public comment period are included in the Responsiveness Summary, which is provided as Section 3.0 of this ROD.

Community involvement is an important component of the 36 ABW Environmental Response (ER) Program. Public participation has been encouraged throughout the decision process for environmental activities at Andersen AFB. Numerous documents have been made available in the AR to inform and update interested parties on the progress of the site investigations and response actions.

Information regarding the 36 ABW ER Program is also provided through regular meetings of the Andersen AFB Restoration Advisory Board (RAB). The Andersen RAB was formed and held its first meeting in August 1994. The RAB meets quarterly to increase community awareness about the ER Program and elicit the public's voice in environmental restoration issues at Andersen AFB. Information regarding environmental work at Andersen AFB is regularly made available through the RAB process.

**Table 2-1: Public Notification of Document Availability**

Requirement	Satisfied by
Notice of availability of the PP and RI/FS must be made in a widely-read section of a major Local newspaper.	Notice of availability was published in the Guam Pacific Daily News newspaper.
Notice of availability should occur at least two weeks prior to the beginning of the public comment period.	Notice of availability was published on 4 May 2010. The public comment period began on 18 May 2010.
Notice of availability must include a brief abstract of the PP which describes the alternatives evaluated and identifies the preferred alternative (NCP Section 300.430(f)(3)(i)(A)).	Notice of availability included all of these components and is included for reference as Appendix B to this ROD.
Notice of availability should consist of the following information: <ul style="list-style-type: none"> <li>• Site name and location</li> <li>• Date and location of public meeting</li> <li>• Identification of lead and support agencies</li> <li>• Alternatives evaluated in the detailed analysis</li> <li>• Identification of preferred alternative</li> <li>• Request for public comments</li> <li>• Public participation opportunities including:               <ul style="list-style-type: none"> <li>– Location of information repositories and AR file</li> <li>– Methods by which the public may submit written and oral comments, including a contact person</li> <li>– Dates of public comment period</li> <li>– Contact person for the community advisory group (e.g., RAB) if applicable</li> </ul> </li> </ul>	

**Table 2-2: Public Comment Period Requirements**

Requirement	Satisfied by
Lead agency should make document available to public for review on same date as newspaper notification.	Document was made available to the public on 4 May 2010. The notification of availability was made on 4 May 2010.
Lead agency must ensure that all information that forms the basis for selecting the response action is included as part of the AR file and made available to the public during the public comment period.	Andersen AFB maintains the AR file for Site 3 and Site 21. All data collected and all CERCLA primary documents produced for Site 3 and Site 21 are maintained as part of this file at <a href="http://www.adminrec.com/-PACAF.asp">http://www.adminrec.com/-PACAF.asp</a> which is available to the public.
CERCLA Section 177(a)(2) requires the lead agency to provide the public with a reasonable opportunity to submit written and oral comments on the PP. NCP Section 300.430(f)(3)(i) requires the lead agency to allow the public a minimum of 30 days to comment on the RI/FS and the PP.	The Navy provided a public comment period for the RI/FS and the PP from 18 May to 17 June 2010.
The lead agency must extend the public comment period by at least 30 additional days upon timely request.	The Navy received no requests to extend the public comment period.
The lead agency must provide the opportunity for a public meeting to be held at or near the site during the public comment period. A transcript of this meeting must be made available to the public and be maintained in the AR for the site (pursuant to NCP Section 300.430(f)(3)(i)(E)).	A public meeting was held on 19 May 2010 at the Guam Marriott Resort and Spa in Tumon. A transcript of this meeting has been added to the AR file.

## 2.4 Scope and Role of Operable Unit or Response Action

The Navy is required by CERCLA to identify and investigate potential environmental contamination associated with its past military activities and to clean up contamination as necessary to protect human health and the environment. To meet CERCLA's mandates, the Navy implemented an IRP in 1980 under which all eligible investigation and cleanup activities were to be performed. IRP investigations at Andersen AFB were initiated in 1983 with a records search to identify potential sites of concern.

Andersen AFB elected to use an OU approach to manage the RIs under its IRP. As a result, the USAF, with concurrence from the EPA and GEPA, has organized the IRP environmental restoration work at Andersen AFB within six OUs. According to the 1993 FFA, the OUs were formed to (1) expedite the completion of environmental activities, (2) evaluate sites with similar locations and potentially similar requirements as unique groups, (3) complete remedial design investigations at sites where closure decisions have been previously reached with the Government of Guam, and (4) provide a screening mechanism for evaluating newly or tentatively identified sites for inclusion in the RI/FS. Six OUs were initially established in the FFA; however, in 1996, the USAF, EPA, and GEPA agreed that to effectively respond to project property transfers, the criteria used to develop the original OUs were impractical (EA 1999b).

The OUs were redesignated in 1996 with a focus on the need to group sites into geographically-distinct OUs that combined soil, potential contaminant sources, and groundwater: Harmon OU, Marianas Bonins Command OU, Main Base OU, Northwest

the site associated with several leaking drums of tar-like material contained PAHs in surface soils above screening levels.

The potential incremental lifetime cancer risk (ILCR) for residents, excavation/construction workers, and occupational workers for both surface and subsurface soil are within the EPA target cancer risk range.

The HIs for the child resident and excavation/construction worker are above the EPA non-cancer target of 1, while the HIs for an adult resident and occupational worker are below the target value. Non-cancer hazards are driven by soil ingestion (approximately 95%) of dioxin/furans, aluminum, antimony, copper, and iron.

While lead was detected above EPA residential Regional Screening Levels (RSLs) (EPA 2009) in surface soils, modeled blood lead levels were not found to exceed 10 µg/dL for any receptor. As a result, no further response action is warranted with regards to lead in soil.

The Tier 2 ERA identified antimony, copper, lead, benzo(b)fluoranthene, and dioxins in surface soil, which may represent an unacceptable risk of adverse effects to wildlife.

### 2.5.7 Conceptual Site Model

A conceptual exposure model was developed to depict the potential relationship or exposure pathway between contaminant sources and receptors. An exposure pathway describes the means by which a receptor can be exposed to contaminants in environmental media. These pathways are presented on Figure 8 and Figure 9, based upon current and reasonably likely future land uses at Sites 3 and 21, respectively.

## 2.6 Current and Potential Future Land and Resource Uses

### 2.6.1 Land Use

#### 2.6.1.1 Site 3 Land Use

Site 3 is located within the landfill complex and has restricted access which is controlled through fencing and locked gates. It is zoned for industrial usage. The site is situated within an abandoned quarry, with steep walls on most sides. There are no plans to develop this site for residential use at anytime in the future.

The most likely future land use for Site 3 over the foreseeable future is to remain unchanged from current use. This determination is made based on the following facts:

- The site is located in proximity (< 0.5 mile), and in a direct line from the active flight line (Figure 4), which restricts current land use to commercial/industrial use.
- According to the base Master Plan, future use of the site is expected to remain unchanged (Alba 1997).

- The site is located within a former quarry, making it generally unsuitable for commercial/industrial use. Therefore, future construction activities are not expected to take place at the site.
- The current land use of adjacent/surrounding land is industrial. The current use of adjacent/surrounding land is expected to remain the same for the foreseeable future.

#### 2.6.1.2 Site 21 Land Use

Site 21 is situated within a former quarry in the Northwest Field portion of Andersen AFB (Figure 5). Site 21 is located within the MSA, which is guarded by military personnel and restricted to authorized personnel only. The site is currently unused and is rarely frequented by EOD personnel. Although hunting with firearms is not permitted in the MSA, Limited recreational archery hunting of feral pigs and deer is allowed on weekends in November–December of each year. There are designated hunting areas in the Northwest Field as near as 0.5 mile from the site.

Steeply sloping, 25- to 30-ft walls extend from the limestone plateau above, down to the base of the quarry on nearly all sides. Access to the site is generally limited to a small area in the northeast quadrant.

There are no plans to develop this site for residential use at anytime in the future.

#### 2.6.2 Groundwater and Surface Water Uses

Due to the highly porous limestone and permeable soils, there are no significant surface water bodies at or near Sites 3 or 21.

Groundwater at Sites 3 and 21, as is the case for most of northern Guam occurs as a freshwater lens, referred to as the NGL, and is encountered at approximately 400 ft bgs. The EPA has designated the NGL as a sole-source aquifer (BHA and CDM 1982). The important factors governing the volume of freshwater in the lens are (1) the effects of mixing freshwater and marine water, (2) the permeability of the limestone formations, and (3) the rate of recharge (Ward et al. 1965).

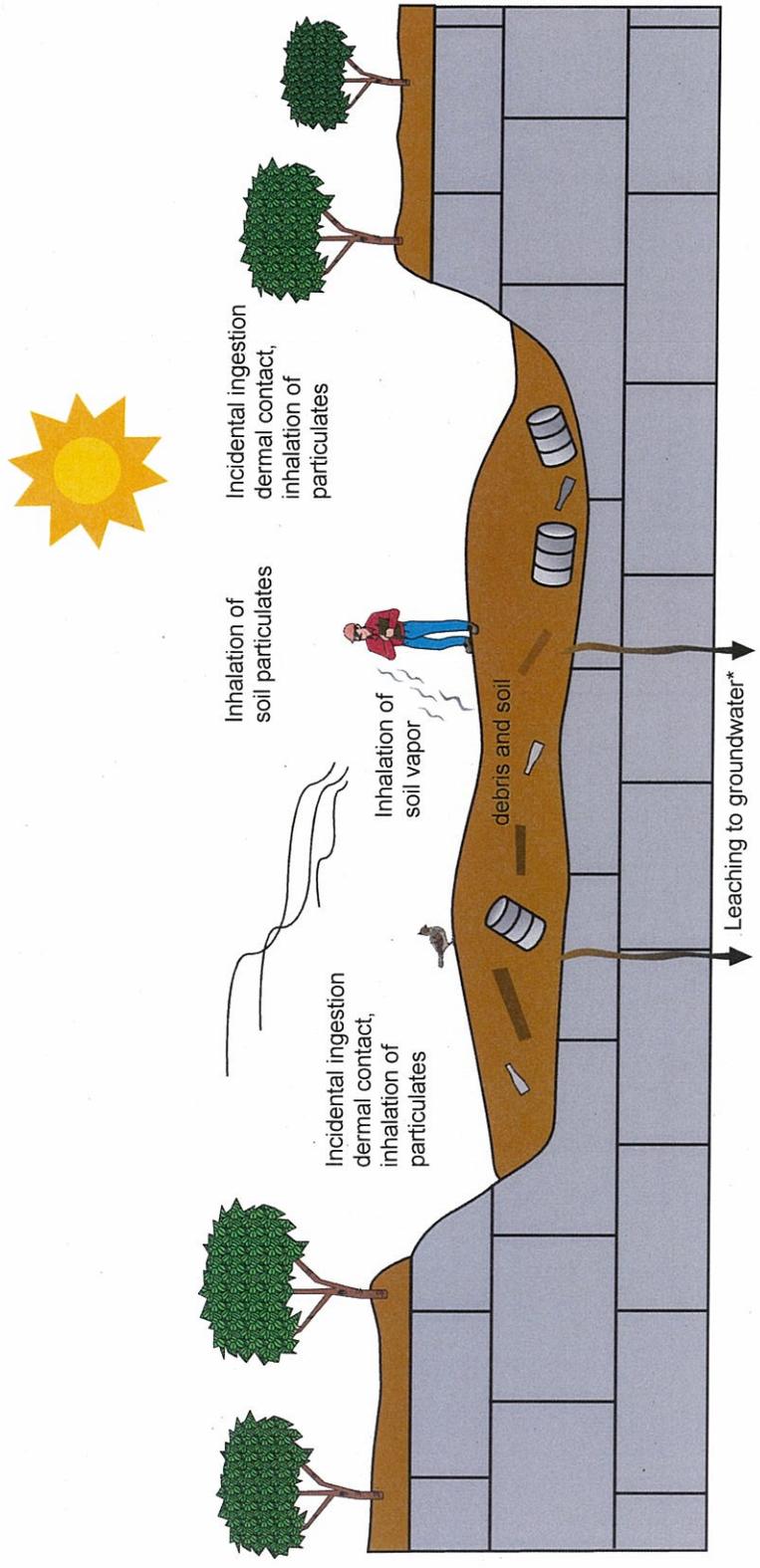
The NGL beneath Andersen AFB is subdivided into six subbasins. OUs at the base overlie four of the six groundwater subbasins. Groundwater flow within each has been shown to flow radially outward toward the Pacific Ocean.

Andersen AFB utilizes 10 deep groundwater wells, and pumps the water through a single treatment plant then on to an on-base reservoir prior to distribution. Potable water from this system is regulated through the GEPA, and Andersen AFB is in full compliance with Guam Safe Drinking Water Regulations (Kingston 2004). Monitoring of the source groundwater is also conducted through the IRP.

It should be noted that no contaminants were detected in groundwater during the long-term groundwater monitoring program for the Northwest Field OU (in which Site 21 is located).

**Legend**

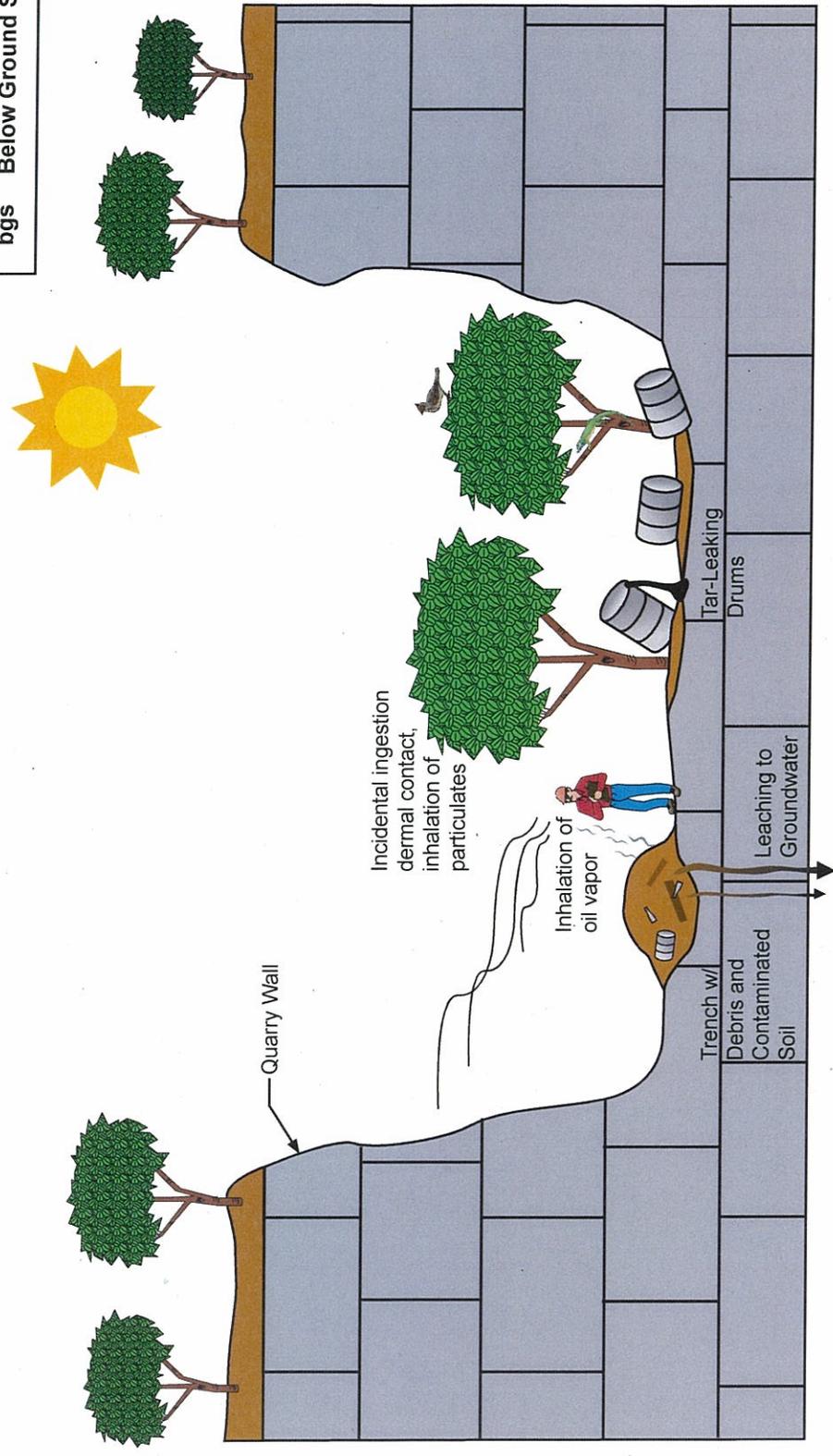
-  Soil
-  Marianas Limestone
-  bgs Below Ground Surface



Note: Depth to groundwater 300 feet bgs  
 \*Groundwater is being addressed on a base-wide approach, and is not included here.

**Figure 8**  
**Conceptual Site Model (completed exposure routes)**  
**IRP Site 3**  
**Andersen AFB, Guam**

Legend	
	Soil
	Marianas Limestone
bgs	Below Ground Surface



\*Groundwater is being addressed on a base-wide approach, and is not included here.

Figure 9  
 Conceptual Site Model (completed exposure routes)  
 IRP Site 21  
 Andersen AFB, Guam