



---

## Uploaded to the VFC Website

▶▶▶ 2019 ◀◀◀

---

This Document has been provided to you courtesy of Veterans-For-Change!

Feel free to pass to any veteran who might be able to use this information!

For thousands more files like this and hundreds of links to useful information, and hundreds of "Frequently Asked Questions, please go to:

[Veterans-For-Change](#)

---

***If Veterans don't help Veterans, who will?***

---

**Note:**

VFC is not liable for source information in this document, it is merely provided as a courtesy to our members & subscribers.



USN-GU-000999-D

NWU  
RECEIVED  
MAY 14 1999  
990162  
Draft

DRAFT ENVIRONMENTAL IMPACT STATEMENT



Copyright 1998 In-Depth Photography, Mitch Warner

for the  
**Disposal and Reuse of  
Surplus Navy Property Identified in the  
*Guam Land Use Plan*  
(GLUP '94)**

Department of the Navy

May 1999





**DRAFT ENVIRONMENTAL IMPACT STATEMENT  
FOR THE DISPOSAL AND REUSE OF SURPLUS NAVY PROPERTY IDENTIFIED  
IN THE GUAM LAND USE PLAN (GLUP '94)**

Lead Agency: United States Department of the Navy  
Proposed Action: Disposal and reuse of surplus Navy property identified in the  
*Guam Land Use Plan (GLUP '94)*

Comment Due Date: July 6, 1999

The Department of the Navy proposes to dispose of approximately 2,798 acres (1,132 hectares) of Navy land and facilities. This action is being taken as a result of the 1995 Base Closure and Realignment Commission recommendations to dispose of surplus property identified in the *Guam Land Use Plan (GLUP '94)*.

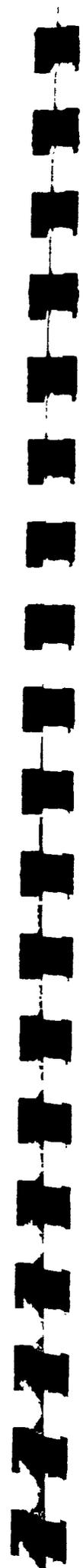
This environmental impact statement (EIS) evaluates the impacts of disposal and long-term reuse of GLUP properties. The properties are divided into 20 parcels located in Dededo, Tamuning, Tiyan, Barrigada, Nimitz Hill, Apra Heights, Naval Station, Piti, and Santa Rita. The Naval Air Station (NAS) Agana Officers Housing parcel, recommended for closure by the Commission, is part of the proposed disposal action although it was not included in the GLUP. For ease of reference, all 20 parcels are referred to as GLUP parcels throughout this document. The National Environmental Policy Act (NEPA) process must be completed before the surplus property can be conveyed.

Reuse alternatives include resort, residential, commercial, industrial, agricultural, parks and recreation, and historical and conservation land uses. Alternatives evaluated in this document include Navy's Preferred Alternative, which is also the recommended alternative of the Guam Economic Development Authority (GEDA), higher and lower intensities of development, and no action. Alternative reuse scenarios for all 20 parcels are described in GEDA's *Reuse Plan for GLUP '94 Navy Properties* approved by Governor Carl T. C. Gutierrez of Guam. The "No Action" Alternative assumes Navy would retain ownership of the properties in a caretaker status.

With the exception of traffic and air quality, no significant impacts are anticipated that cannot be mitigated through compliance with applicable regulations, adoption of standard practices to minimize construction-related impacts, development of appropriate infrastructure to accommodate projected capacity, or implementation of specific measures. There would be no significant environmental impacts associated with the "No Action" Alternative. None of the alternatives would have a disproportionate impact on disadvantaged or minority populations. None pose disproportionate health or safety risks to children. Appropriate treatment of significant cultural resources will be ensured by deed covenants developed in Navy's consultation with the Guam Historic Preservation Officer (HPO) and the Advisory Council on Historic Preservation (ACHP) pursuant to Section 106 of the National Historic Preservation Act.

Comments on the DEIS must be received by the addressee provided below no later than July 6, 1999. Requests for further information may also be addressed to:

Mr. Gerald Gibbons, PLN231GG  
Pacific Division, Naval Facilities Engineering Command  
258 Makalapa Drive, Suite 100  
Pearl Harbor, Hawaii 96860-3134  
Telephone (808) 471-9338; Fax (808) 474-5909



# TABLE OF CONTENTS

---

LIST OF ACRONYMS .....	XI
------------------------	----

EXECUTIVE SUMMARY .....	ES-1
-------------------------	------

## CHAPTER ONE

### PURPOSE AND NEED

1.1	Overview of This EIS.....	1-1
1.2	Description of Proposed Action .....	1-1
1.3	Location of Proposed Action .....	1-2
1.4	Purpose and Need for Proposed Action .....	1-3
1.5	Scope of EIS .....	1-3
1.6	Base Realignment and Closure Process.....	1-4
1.7	Public Involvement Process .....	1-5
	1.7.1 Scoping Process.....	1-5
	1.7.2 EIS Public Review Process .....	1-5
1.8	Summary of Issues, Concerns, and Impacts.....	1-6
1.9	Related Land Use Planning and Environmental Documents.....	1-7
1.10	Original Land Ownership .....	1-8
1.11	Government Permits and Approvals .....	1-8

## CHAPTER TWO

### PROPOSED ACTION AND ALTERNATIVES

2.1	Proposed Action .....	2-1
	2.1.1 Assumptions Used to Develop Reuse Alternatives.....	2-1
	2.1.2 Development Intensities.....	2-1
	2.1.3 Development Constraints .....	2-4
	2.1.4 I Tanò-ta .....	2-4
	2.1.5 Market and Economic Adjustment.....	2-6
2.2	Alternatives .....	2-7
	2.2.1 GEDA-Recommended Alternative (Navy-Preferred Alternative).....	2-7
	2.2.2 Lower Intensity Alternative.....	2-8
	2.2.3 Higher Intensity Alternative.....	2-9
	2.2.4 "No Action" Alternative.....	2-10
2.3	Summary of Potential Impacts.....	2-10

## CHAPTER THREE

### AFFECTED ENVIRONMENT

3.1	Overview .....	3-1
	3.1.1 Physical Environment .....	3-1
	3.1.2 Population .....	3-1
	3.1.3 Economy .....	3-2
	3.1.4 Military Installations .....	3-2
	3.1.5 Biological Environment .....	3-2
	3.1.6 Cultural Environment .....	3-3
	3.1.7 Regions of Influence.....	3-3

3.2	Soils, Geology, and Topography .....	3-4
3.2.1	Introduction .....	3-4
3.2.2	Northern Region .....	3-4
3.2.3	Barrigada Region .....	3-4
3.2.4	Central Region .....	3-6
3.2.4.1	Nimitz Hill Parcels .....	3-6
3.2.4.2	Sasa Valley .....	3-6
3.2.4.3	Tenjo Vista .....	3-6
3.2.4.4	Polaris Point .....	3-7
3.2.5	Southern Region .....	3-7
3.2.5.1	New Apra Heights .....	3-7
3.2.5.2	Route 2A .....	3-8
3.2.5.3	Rizal/Afilleje Beach .....	3-8
3.2.5.4	Old Apra Heights .....	3-8
3.2.5.5	Navy Ordnance Annex North (West Parcel) .....	3-8
3.2.5.6	Navy Ordnance Annex North Housing (East Parcel) .....	3-9
3.3	Drainage .....	3-9
3.3.1	Northern Region .....	3-13
3.3.2	Barrigada Region .....	3-14
3.3.3	Central Region .....	3-14
3.3.3.1	Nimitz Hill Parcels .....	3-14
3.3.3.2	Sasa Valley .....	3-15
3.3.3.3	Tenjo Vista .....	3-15
3.3.3.4	Polaris Point .....	3-16
3.3.4	Southern Region .....	3-16
3.3.4.1	New Apra Heights and Route 2A Parcels .....	3-16
3.3.4.2	Rizal/Afilleje Beach .....	3-17
3.3.4.3	Old Apra Heights .....	3-17
3.3.4.4	Navy Ordnance Annex North (West Parcel) .....	3-17
3.3.4.5	Navy Ordnance Annex North Housing (East Parcel) .....	3-18
3.4	Air Quality .....	3-18
3.5	Land Use Compatibility .....	3-20
3.5.1	Existing On-site and Surrounding Land Uses .....	3-20
3.5.1.1	Northern Region .....	3-20
3.5.1.2	Barrigada Region .....	3-22
3.5.1.3	Central Region .....	3-22
3.5.1.4	Southern Region .....	3-24
3.5.2	Visual Resources .....	3-25
3.5.2.1	Northern Region .....	3-25
3.5.2.2	Barrigada Region .....	3-26
3.5.2.3	Central Region .....	3-27
3.5.2.4	Southern Region .....	3-27
3.6	Noise .....	3-28
3.6.1	Northern Region .....	3-28
3.6.2	Barrigada Region .....	3-29
3.6.3	Central Region .....	3-29
3.6.4	Southern Region .....	3-30

3.7	Cultural Resources .....	3-30
3.7.1	Introduction.....	3-30
3.7.2	Archaeological Investigations .....	3-30
3.7.3	Assessment of Known Historic Properties.....	3-33
3.8	Terrestrial Biota and Habitat .....	3-35
3.8.1	Vegetation Types .....	3-36
3.8.1.1	Northern Region.....	3-36
3.8.1.2	Barrigada Region .....	3-38
3.8.1.3	Central Region.....	3-38
3.8.1.4	Southern Region .....	3-39
3.8.2	Protected Plant Species.....	3-40
3.8.3	Important Habitats .....	3-40
3.8.4	Wildlife .....	3-42
3.8.4.1	Mammals.....	3-42
3.8.4.2	Birds .....	3-42
3.8.4.3	Other Wildlife .....	3-43
3.8.4.4	Protected Animal Species .....	3-43
3.9	Marine Environment .....	3-46
3.9.1	Marine Habitats .....	3-46
3.9.2	Protected Marine Species .....	3-47
3.10	Roads and Traffic .....	3-47
3.10.1	Introduction.....	3-47
3.10.2	Northern Region.....	3-48
3.10.3	Barrigada Region .....	3-48
3.10.4	Central Region (Nimitz Hill) .....	3-50
3.10.5	Southern Region .....	3-53
3.11	Potable Water Supply .....	3-55
3.11.1	Northern Region.....	3-57
3.11.1.1	FAA Housing.....	3-57
3.11.1.2	Harmon Annex.....	3-57
3.11.1.3	Marine Drive Utility .....	3-57
3.11.1.4	Tamuning Telephone Exchange.....	3-57
3.11.1.5	NAS Officers Housing .....	3-57
3.11.2	Barrigada Region .....	3-58
3.11.3	Central Region.....	3-58
3.11.3.1	Nimitz Hill Parcels .....	3-58
3.11.3.2	Sasa Valley/Tenjo Vista.....	3-58
3.11.3.3	Polaris Point .....	3-58
3.11.4	Southern Region .....	3-59
3.11.4.1	Old Apra Heights .....	3-59
3.11.4.2	New Apra Heights and Route 2A .....	3-59
3.11.4.3	Rizal/Afilleje Beach .....	3-59
3.11.4.4	Navy Ordnance Annex North.....	3-59
3.12	Wastewater Collection and Treatment .....	3-59
3.12.1	Northern Region.....	3-61
3.12.1.1	FAA Housing, Harmon Annex, and Marine Drive Utility .....	3-61
3.12.1.2	Tamuning Telephone Exchange.....	3-61
3.12.1.3	NAS Officers Housing .....	3-61
3.12.2	Barrigada Region .....	3-61
3.12.3	Central Region.....	3-62

3.12.3.1	Nimitz Hill Parcels .....	3-62
3.12.3.2	Sasa Valley/Tenjo Vista.....	3-62
3.12.3.3	Polaris Point .....	3-63
3.12.4	Southern Region .....	3-63
3.12.4.1	New Apra Heights .....	3-63
3.12.4.2	Route 2A .....	3-63
3.12.4.3	Rizal/Afilleje Beach .....	3-63
3.12.4.4	Old Apra Heights .....	3-63
3.12.4.5	Navy Ordnance Annex North (West Parcel).....	3-63
3.12.4.6	Navy Ordnance Annex North Housing (East Parcel).....	3-64
3.13	Solid Waste Disposal .....	3-64
3.14	Electrical Supply/Energy Use.....	3-65
3.15	Socioeconomics .....	3-67
3.15.1	Overview.....	3-67
3.15.2	Population and Income .....	3-67
3.15.3	Employment .....	3-67
3.15.4	Guam's Economy .....	3-68
3.15.4.1	Hotels.....	3-68
3.15.4.2	Golf Courses.....	3-68
3.15.4.3	Housing.....	3-69
3.15.4.4	Commercial Property and Activities .....	3-70
3.15.4.5	Industrial Property and Activities .....	3-70
3.15.4.6	Agriculture.....	3-71
3.16	Public Services .....	3-71
3.16.1	Schools .....	3-71
3.16.1.1	Northern Region.....	3-72
3.16.1.2	Barrigada Region .....	3-72
3.16.1.3	Central Region.....	3-72
3.16.1.4	Southern Region .....	3-73
3.16.2	Parks and Recreation .....	3-73
3.16.2.1	Northern Region.....	3-73
3.16.2.2	Barrigada Region .....	3-73
3.16.2.3	Central Region.....	3-73
3.16.2.4	Southern Region .....	3-73
3.16.3	Health Care .....	3-74
3.16.4	Public Safety: Police, Fire Protection, and Civil Defense .....	3-74
3.17	Environmental Contamination .....	3-75
3.17.1	On-Site Contaminated Areas/Hazardous Substances .....	3-75
3.17.1.1	Overall Process Used to Identify Contamination and Description of Contaminated Areas .....	3-75
3.17.2	Northern Region.....	3-82
3.17.2.1	FAA Housing.....	3-82
3.17.2.2	Harmon Annex.....	3-83
3.17.2.3	Marine Drive Utility .....	3-85
3.17.2.4	Tamuning Telephone Exchange.....	3-85
3.17.2.5	NAS Officers Housing .....	3-87
3.17.3	Barrigada Region .....	3-88
3.17.4	Central Region.....	3-91
3.17.4.1	Nimitz Hill Properties.....	3-91
3.17.4.2	Sasa Valley/Tenjo Vista.....	3-92

3.17.4.3 Polaris Point ..... 3-93  
 3.17.5 Southern Region ..... 3-95  
     3.17.5.1 Old Apra Heights ..... 3-95  
     3.17.5.2 New Apra Heights/Route 2A ..... 3-95  
     3.17.5.3 Rizal/Afleje Beach ..... 3-97  
     3.17.5.4 Navy Ordnance Annex North..... 3-97

**CHAPTER FOUR  
 ENVIRONMENTAL CONSEQUENCES**

4.1 Introduction ..... 4-1  
 4.2 Soils, Geology, and Topography ..... 4-7  
 4.3 Drainage ..... 4-7  
     4.3.1 Significance Criteria ..... 4-8  
     4.3.2 Methodology..... 4-8  
     4.3.3 Potential Impacts and Proposed Mitigation ..... 4-9  
     4.3.4 Cumulative Impacts ..... 4-11  
     4.3.5 Compliance/Consistency with Applicable Laws and Regulations..... 4-12  
 4.4 Air Quality ..... 4-12  
     4.4.1 Significance Criteria ..... 4-13  
     4.4.2 Potential Impacts and Proposed Mitigation ..... 4-14  
     4.4.3 Cumulative Impacts ..... 4-16  
     4.4.4 Compliance/Consistency with Applicable Laws and Regulations..... 4-16  
         4.4.4.1 Clean Air Act..... 4-16  
         4.4.4.2 Prevention of Significant Deterioration..... 4-17  
         4.4.4.3 Government of Guam Jurisdiction..... 4-17  
 4.5 Land Use Compatibility ..... 4-18  
     4.5.1 Land Use ..... 4-18  
         4.5.1.1 Significance Criteria..... 4-19  
         4.5.1.2 Potential Impacts and Proposed Mitigation..... 4-19  
         4.5.1.3 Cumulative Impacts..... 4-22  
         4.5.1.4 Compliance/Consistency with Applicable Laws and  
             Regulations..... 4-22  
     4.5.2 Visual Resources ..... 4-23  
         4.5.2.1 Significance Criteria..... 4-23  
         4.5.2.2 Potential Impacts and Proposed Mitigation..... 4-23  
         4.5.2.3 Cumulative Impacts..... 4-25  
         4.5.2.4 Compliance/Consistency with Applicable Laws and  
             Regulations..... 4-26  
 4.6 Noise ..... 4-26  
     4.6.1 Significance Criteria ..... 4-26  
     4.6.2 Methodology..... 4-27  
     4.6.3 Potential Impacts and Proposed Mitigation ..... 4-27  
     4.6.4 Cumulative Impacts ..... 4-29  
     4.6.5 Compliance/Consistency with Applicable Laws and Regulations..... 4-29  
 4.7 Cultural Resources ..... 4-29  
     4.7.1 Impact of Disposal ..... 4-30  
     4.7.2 Significance Criteria ..... 4-30  
     4.7.3 Potential Impacts..... 4-30  
         4.7.3.1 Preferred Alternative..... 4-31

4.7.3.2	Lower Intensity Alternative.....	4-33
4.7.3.3	Higher Intensity Alternative.....	4-33
4.7.3.4	"No Action" Alternative.....	4-34
4.7.4	Proposed Mitigation.....	4-34
4.7.5	Cumulative Impacts.....	4-35
4.7.6	Compliance/Consistency with Applicable Laws and Regulations.....	4-35
4.8	Terrestrial Biota and Habitat.....	4-35
4.8.1	Significance Criteria.....	4-35
4.8.2	Potential Impacts and Proposed Mitigation.....	4-36
4.8.3	Cumulative Impacts.....	4-38
4.8.4	Compliance/Consistency with Applicable Laws and Regulations.....	4-38
4.9	Marine Environment.....	4-39
4.9.1	Significance Criteria.....	4-39
4.9.2	Potential Impacts and Proposed Mitigation.....	4-39
4.9.3	Cumulative Impacts.....	4-40
4.9.4	Compliance/Consistency with Applicable Laws and Regulations.....	4-40
4.10	Roads and Traffic.....	4-41
4.10.1	Significance Criteria.....	4-41
4.10.2	Methodology.....	4-42
4.10.3	Potential Impacts and Proposed Mitigation.....	4-42
4.10.4	Cumulative Impacts.....	4-51
4.10.5	Compliance/Consistency with Applicable Laws and Regulations.....	4-51
4.11	Potable Water Supply.....	4-51
4.11.1	Significance Criteria.....	4-51
4.11.2	Methodology.....	4-53
4.11.3	Potential Impacts and Proposed Mitigation.....	4-54
4.11.4	Cumulative Impacts.....	4-56
4.11.5	Compliance/Consistency with Applicable Laws and Regulations.....	4-56
4.12	Wastewater Collection and Treatment.....	4-57
4.12.1	Significance Criteria.....	4-57
4.12.2	Methodology.....	4-57
4.12.3	Potential Impacts and Proposed Mitigation.....	4-60
4.12.4	Cumulative Impacts.....	4-62
4.12.5	Compliance/Consistency with Applicable Laws and Regulations.....	4-63
4.13	Solid Waste Disposal.....	4-63
4.13.1	Significance Criteria.....	4-63
4.13.2	Potential Impacts and Proposed Mitigation.....	4-65
4.13.3	Cumulative Impacts.....	4-66
4.13.4	Compliance/Consistency with Applicable Laws and Regulations.....	4-66
4.14	Electrical Supply and Energy Use.....	4-67
4.14.1	Significance Criteria.....	4-67
4.14.2	Methodology.....	4-67
4.14.3	Potential Impacts and Proposed Mitigation.....	4-68
4.14.4	Cumulative Impacts.....	4-69
4.14.5	Compliance/Consistency with Applicable Laws and Regulations.....	4-69
4.15	Socioeconomics.....	4-69
4.15.1	Significance Criteria.....	4-70
4.15.2	Potential Impacts and Proposed Mitigation.....	4-70
4.15.2.1	Population, Employment, and Social Impacts.....	4-70
4.15.2.2	Economic Impact of Development.....	4-71

4.15.3	Cumulative Impacts .....	4-78
4.15.4	Compliance/Consistency with Applicable Laws and Regulations.....	4-79
4.15.4.1	Environmental Justice .....	4-79
4.16	Public Services .....	4-79
4.16.1	Significance Criteria .....	4-80
4.16.2	Potential Impacts and Proposed Mitigation .....	4-80
4.16.2.1	Schools.....	4-80
4.16.2.2	Parks and Recreation .....	4-81
4.16.2.3	Health Care .....	4-81
4.16.2.4	Public Safety: Police, Fire Protection, and Civil Defense .....	4-81
4.16.3	Cumulative Impacts .....	4-82
4.16.4	Compliance/Consistency with Applicable Laws and Regulations.....	4-83
4.17	Environmental Contamination .....	4-83
4.17.1	Significance Criteria .....	4-84
4.17.2	Potential Impacts and Proposed Mitigation .....	4-84
4.17.3	Cumulative Impacts .....	4-84
4.17.4	Compliance/Consistency with Applicable Laws and Regulations.....	4-85
4.17.4.1	CERFA/CERCLA Environmental Compliance .....	4-85
4.17.4.2	Resource Conservation and Recovery Act .....	4-85
4.17.4.3	Toxic Substance Control Act.....	4-85
4.17.4.4	Clean Air Act.....	4-85
4.17.4.5	Clean Water Act .....	4-86
4.18	Protection of Children from Health and Safety Risks.....	4-86
4.19	Relationship of Short-Term Uses and Long-Term Productivity .....	4-87
4.20	Irreversible and Irretrievable Commitments of Resources .....	4-87
4.21	Energy Requirements and Conservation Potential .....	4-88
4.22	Unresolved Issues .....	4-88
4.23	Significant Unmitigable Impacts.....	4-88
 <b>CHAPTER FIVE</b>		
<b>LIST OF PREPARERS.....</b>		<b>5-1</b>
 <b>CHAPTER SIX</b>		
<b>REFERENCES.....</b>		<b>6-1</b>
 <b>CHAPTER SEVEN</b>		
<b>DISTRIBUTION OF DEIS .....</b>		<b>7-1</b>

**APPENDICES**

- Appendix A Public Involvement Process
  - A-1 Notice of Intent
  - A-2 Agency Comment Letters and Responses
- Appendix B Land Use Assumptions
- Appendix C Terrestrial Biota and Sensitive Habitats

**LIST OF TABLES**

Table 1.11-1:	Summary of Possible Government Permits and Approvals .....	1-9
Table 2.1-1:	Surplus Navy Properties .....	2-2
Table 2.2-1:	Northern Region Reuse Alternatives and Land Use Assumptions .....	2-13
Table 2.2-2:	Barrigada Reuse Alternatives and Land Use Assumptions.....	2-22
Table 2.2-3:	Central Region Reuse Alternatives and Land Use Assumptions .....	2-26
Table 2.2-4:	Southern Region Reuse Alternatives and Land Use Assumptions .....	2-33
Table 2.2-5:	Summary of Potential Impacts and Mitigation Measures for All Alternatives.....	2-40
Table 3.1-1:	Potentially Significant Issues and Regions of Influence.....	3-3
Table 3.3-1:	FIRM Zone Designations .....	3-11
Table 3.3-2:	Flood Hazard Areas by Parcel .....	3-12
Table 3.4-1:	Summary of National Ambient Air Quality Standards .....	3-19
Table 3.7-1:	Summary of Known Historic Sites .....	3-31
Table 3.7-2:	Archaeological Sensitivity.....	3-34
Table 3.8-1:	Occurrence of Vegetation Types on GLUP Properties.....	3-37
Table 3.8-2:	Endangered, Threatened, and Candidate Plant Species of Guam.....	3-40
Table 3.8-3:	GLUP Parcels Containing Protected Species and Important Habitats and Mitigation .....	3-41
Table 3.8-4:	Bird Species Recorded on GLUP Parcels During 1998 Field Surveys.....	3-43
Table 3.8-5:	Threatened and Endangered Animals of Guam.....	3-44
Table 3.10-1:	Existing Conditions at North Study Area Key Intersections .....	3-48
Table 3.10-2:	Existing Conditions at Barrigada Study Area Key Intersections.....	3-50
Table 3.10-3:	Existing Conditions at Central (Nimitz Hill) Study Area Key Intersections .....	3-53
Table 3.10-4:	Existing Conditions at South Study Area Key Intersections .....	3-55
Table 3.13-1:	Typical Solid Waste Contribution by Category .....	3-64
Table 3.15-1:	Housing Data .....	3-69
Table 3.17-1:	Possible Environmental Contamination, IRP Sites, and POI Sites.....	3-81
Table 4.1-1:	Screening of Potentially Significant Issues .....	4-2
Table 4.3-2:	Unit Development Ratios of Land Uses.....	4-9
Table 4.3-3:	Percent Impermeable Surface Increase by Parcel.....	4-10
Table 4.4-1:	LOS at Selected Intersections With and Without Proposed Reuse (Year 2010).....	4-15
Table 4.4-2:	Intersections Degraded Beyond LOS D with Traffic Mitigation and Vehicle Counts Greater Than 5,500 Per Hour .....	4-16
Table 4.10-1:	Comparison of Trip Generation Among Alternatives.....	4-43
Table 4.10-2:	Average Daily Traffic Volume for the Preferred Alternative .....	4-44

Table 4.10-3:	Traffic Conditions at Key Regional Intersections .....	4-45
Table 4.11-1:	Potable Water Demand Factors .....	4-54
Table 4.11-2:	Water Demands for Proposed Alternatives .....	4-55
Table 4.11-3:	Distance to Nearest Water Source .....	4-55
Table 4.11-4:	Cumulative Water Demand Impacts .....	4-56
Table 4.12-1:	Average Wastewater Generation Rates .....	4-58
Table 4.12-2:	Wastewater Treatment Plants Affected by GLUP Parcels .....	4-59
Table 4.12-3:	WWTP Design Capacities and Estimated 1998 Flows .....	4-60
Table 4.12-4:	Available Capacities of WWTPs .....	4-60
Table 4.12-5:	Average Wastewater Flows to WWTPs by Alternative .....	4-60
Table 4.12-6:	Peak Wastewater Flows to WWTPs by Alternative .....	4-61
Table 4.12-7:	Minimum Sewer Line Requirements.....	4-61
Table 4.12-8:	Cumulative Impacts on Wastewater Treatment Facilities.....	4-62
Table 4.13-1:	Total MSW Generation Forecasts for 1998, 2003, and 2008.....	4-64
Table 4.13-2:	Solid Waste Generation – Daily Rate Factors .....	4-65
Table 4.13-3:	Predicted Solid Waste Generation by Alternative .....	4-65
Table 4.13-4:	Cumulative Solid Waste Impacts .....	4-66
Table 4.14-1:	Electrical Demand and Annual Consumption Estimates for Each Alternative .....	4-68
Table 4.15-1:	Estimated Tax Revenue, Employment and Income from Resort Development.....	4-72
Table 4.15-2:	Estimated Tax Revenue, Employment and Income from Residential Development.....	4-74
Table 4.15-3:	Estimated Tax Revenue, Employment and Income from Commercial and Industrial Development .....	4-76
Table 4.15-4:	Comparison of Economic Impacts .....	4-77

## LIST OF FIGURES

Figure ES-1	GLUP Reuse Parcels and Adjoining Significant Facilities.....	ES-2
Figure 2.2-1	Northern Region Map.....	2-12
Figure 2.2-2	FAA Housing Parcel N2 Reuse Alternatives.....	2-16
Figure 2.2-3	Harmon Annex Parcel N3 Reuse Alternatives .....	2-17
Figure 2.2-4	Marine Drive Utility (Wettengel Junction) Parcel N4B Reuse Alternatives.....	2-18
Figure 2.2-5	Tamuning Telephone Exchange Parcel N4C Reuse Alternatives.....	2-19
Figure 2.2-6	NAS Officers Housing Parcel Reuse Alternatives.....	2-20
Figure 2.2-7	Barrigada Region Map .....	2-21
Figure 2.2-8	Barrigada Parcels N5A, B, C, D Reuse Alternatives .....	2-24
Figure 2.2-9	Central Region Map.....	2-25
Figure 2.2-10	Nimitz Hill Enlisted Housing Parcel N10A Reuse Alternatives .....	2-28
Figure 2.2-11	Nimitz Hill Vacant Lands Parcel N10B Reuse Alternatives.....	2-29
Figure 2.2-12	Sasa Valley/Tenjo Vista Parcel N12 Reuse Alternatives .....	2-30
Figure 2.2-13	Polaris Point Parcel N14 Reuse Alternatives.....	2-31
Figure 2.2-14	Southern Region Map.....	2-32
Figure 2.2-15	New Apra Heights Parcel N15 Reuse Alternatives.....	2-35
Figure 2.2-16	Route 2A Parcel N16 Reuse Alternatives.....	2-36
Figure 2.2-17	Rizal/Affleje Beach Parcel N17 Reuse Alternatives.....	2-37
Figure 2.2-18	Old Apra Heights Parcel N18 Reuse Alternatives.....	2-38

Figure 2.2-19	Navy Ordnance Annex North N19 Reuse Alternatives.....	2-39
Figure 3.2-1	Seismic Fault Zone .....	3-5
Figure 3.3-1	Aquifer Recharge Areas and Surface Area Watersheds .....	3-11
Figure 3.10-1	Existing Traffic Lanes and Controls North Study Area .....	3-49
Figure 3.10-2	Existing Traffic Lanes and Controls Barrigada Study Area .....	3-51
Figure 3.10-3	Existing Traffic Lanes and Controls Nimitz Hill Study Area .....	3-52
Figure 3.10-4	Existing Traffic Lanes and Controls South Study Area .....	3-54
Figure 3.11-1	Navy/GWA Water Distribution Systems .....	3-56
Figure 3.12-1	Wastewater Service Districts.....	3-60
Figure 3.14-1	Major Electrical Distribution Facilities .....	3-66
Figure 3.17-1	Northern Region Areas of Existing Contamination.....	3-76
Figure 3.17-2	Barrigada Region Areas of Existing Contamination .....	3-77
Figure 3.17-3	Central Region Areas of Existing Contamination.....	3-79
Figure 3.17-4	Southern Region Areas of Existing Contamination .....	3-80

## LIST OF ACRONYMS

---

ACM	asbestos-containing material
ACHP	Advisory Council on Historic Preservation
ACOE	Army Corps of Engineers
ADPV	average delay per vehicle
ADT	average daily traffic
AFB	Air Force Base
AST	above ground storage tank
AvGAS	aviation gasoline
BCT	BRAC Cleanup Team
BMP	Best Management Practices
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, xylenes
BTS	brown tree snake
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERFA	Community Environmental Response Facilitation Act
CEQ	Council on Environmental Quality
CFCs	chlorofluorocarbons
C.F.R.	Code of Federal Regulations
CNMI	Commonwealth of the Northern Mariana Islands
COMNAVMARIANAS	Commander, U.S. Naval Forces, Marianas
CSA	Customer Service Agreement
CSO	Caretaker Site Office
CWA	Clean Water Act
CZM	Coastal Zone Management
DBCRA	Defense Base Closure and Realignment Act
DEIS	Draft Environmental Impact Statement
DDT	dichlorophenyl-trichloroethane
DoD	Department of Defense
DoDEA	Department of Defense Education Activity
DOE	Department of Education
DPW	Department of Public Works
EPP	Environmental Protection Plan
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide Fungicide and Rodenticide Act
FISC	Fleet Industrial Supply Center
GEDA	Guam Economic Development Authority
GEPA	Guam Environmental Protection Agency
GIAA	Guam International Airport Authority
GIWFP	Guam Islandwide Wastewater Facilities Plan
GLUP	Guam Land Use Plan
GMH	Guam Memorial Hospital
GMZ	Groundwater Management Zone
GovGuam	Government of Guam
GPA	Guam Power Authority
GRHP	Guam Register of Historic Places
GSA	General Services Administration
GWA	Guam Waterworks Authority
GWFMPU	Guam Water Facilities Master Plan Update

HAPs	Hazardous Air Pollutants
HMO	Health Maintenance Organization
HPO	Historic Preservation Officer
HRP	Hawaiian Rock Products
HUD	Housing and Urban Development
IAS	Initial Assessment Study
IARII	International Archaeological Research Institute, Inc.
IDW	investigation-derived waste
IRP	Installation Restoration Program
ISWMP	Integrated Solid Waste Management Plan
kgcd	kilograms per capita per day
LBP	lead-based paint
LRA	Local Redevelopment Authority
Mgd	million gallons per day
MRU	Maintenance and Repair Unit
MSL	mean sea level
MSW	Municipal Solid Waste
MSWLF	Municipal Solid Waste Landfill Facility
Mw	megawatts
NAA	Nonattainment Areas
NAAQS	National Ambient Air Quality Standards
NAS	Naval Air Station
NAVACTS	Naval Activities
NAVCOMS	Naval Communications Area Master Station
NAVFACENCOM	Naval Facilities Engineering Command
NAVSTA	Naval Station
NCTAMS	Naval Computer and Telecommunications Activity Master Station
NEESA	Naval Energy and Environmental Support Activity
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEXRAD	Next Generation Weather Radar
NMFS	National Marine Fisheries Service
NOA	Notice Of Availability
NOI	Notice Of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSD	Naval Supply Depot
NTCC	Naval Telecommunications Center
OPNAVINST	Chief of Naval Operations Instructions
OSHA	Occupational Health and Safety Act
PA	Programatic Agreement
PAH	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
pcd	pounds per capita per day
pCi	picoCurie
P.L.	Public Law
POI	Point of Interest
POL	petroleum, oil, and lubricants
POW	Prisoner of War
ppm	parts per million
PSD	Prevention of Significant Deterioration
PWC	Public Works Center
RCRA	Resource Conservation and Recovery Act

RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record Of Decision
ROI	Region of Influence
RTF	Radio Transmitting Facility
sf	square foot
SI	Site Investigation
SPS	Sewage Pump Station
SSI	Screening Site Inspection
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
t/d	tons per day
TPH	total petroleum hydrocarbons
TPY	tons per year
TRPH	total recoverable petroleum hydrocarbons
TSCA	Toxic Substance Control Act
U.S.	United States
U.S.C.	United States Code
USCG	United States Coast Guard
USCINCPAC	United States Pacific Command
US EPA	United States Environmental Protection Agency
USFWS	United States Fish And Wildlife Service
UST	underground storage tank
V/C	volume-to-capacity ratio
VHF	Very High Frequency
VOR	Very High Frequency Omnidirectional Radio Range
WESTPAC	Western Pacific
WW II	World War II
WWSD	Wastewater Sewage District
WWTP	wastewater treatment plant

**TABLE OF METRIC EQUIVALENTS**

Multiply	By	To Obtain
°C	$[1.8 \times (°C)] + 32$	°F
millimeter	0.03937	inch
cubic meter	35.31	cubic feet
cubic meter (m <sup>3</sup> )	1.308	cubic yard (yd <sup>3</sup> )
cubic meter (m <sup>3</sup> )	264.2	gallon (gal)
hectare (ha)	2.471	acre (ac)
kilogram	2.205	pound (lb)
kilometer	0.6214	mile
kilopascal (kPa)	0.1450	pounds per square inch (psi)
liter	0.2642	gallon
meter (m)	3.281	feet (ft)
metric ton (t)	1.103	ton (T)
square meter (m <sup>2</sup> )	10.76	square foot (ft <sup>2</sup> )

# Executive Summary

---



## EXECUTIVE SUMMARY

---

### 1. INTRODUCTION

This Environmental Impact Statement (EIS) evaluates the environmental impacts that may result from the proposed disposal and reuse of certain surplus Navy properties in the Territory of Guam. It has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. §4332, Section 102(2)(C), as implemented by regulations of the Council on Environmental Quality (CEQ) (40 C.F.R. Parts 1500-1508) and *Navy Environmental and Natural Resources Program Manual* (OPNAVINST 5090.1B, November 1994). It also has been prepared pursuant to the 1990 Defense Base Closure and Realignment Act, 10 U.S.C. §2687 note, as amended by the 1995 Base Realignment and Closure (BRAC) Act.

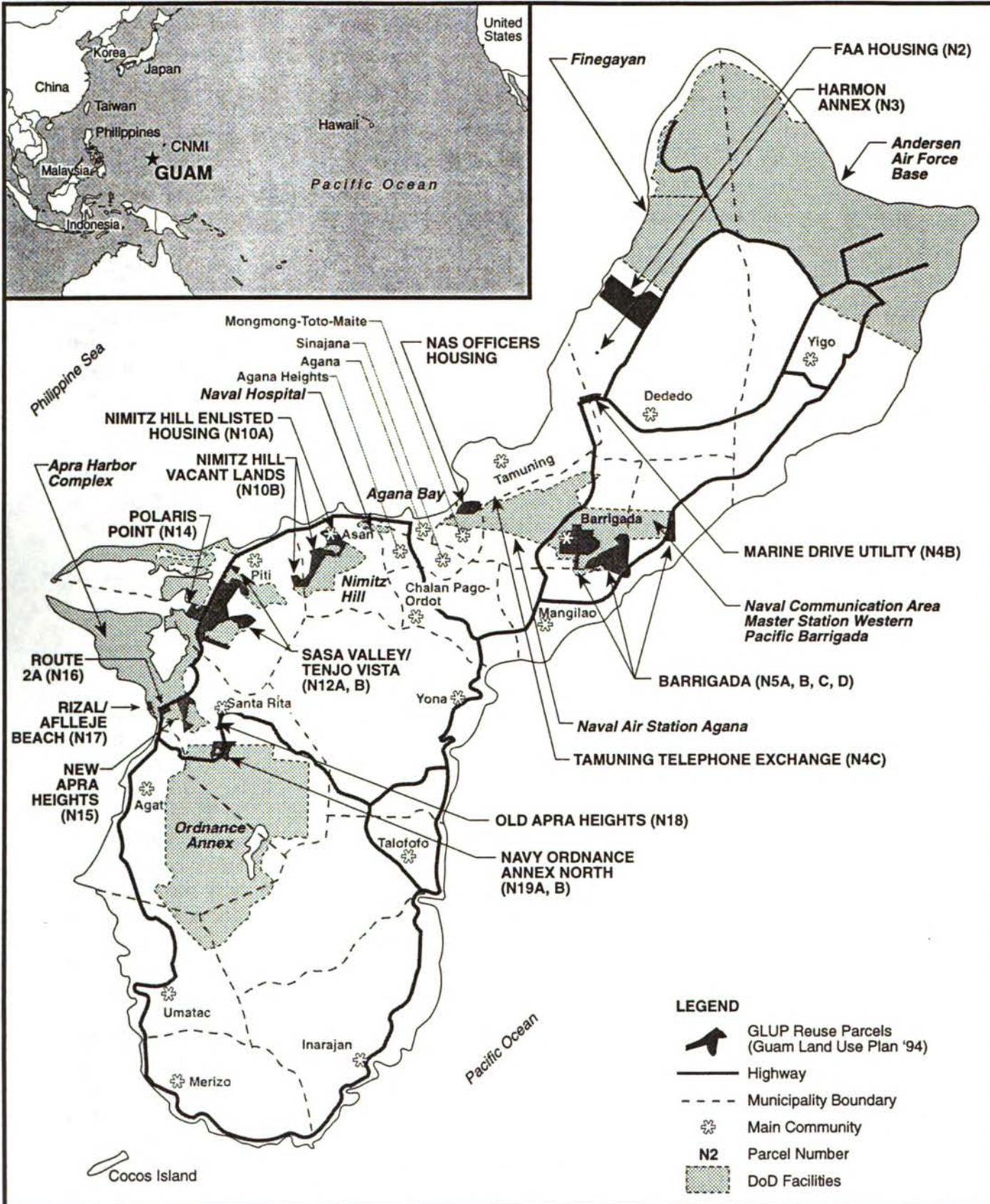
### 2. PURPOSE OF THE DOCUMENT

Findings in this EIS will be used by the Secretary of the Navy in issuing a Record Of Decision (ROD). This document provides decision-makers and the public with information to understand the environmental consequence of alternative reuses and mitigation to avoid or minimize adverse effects. The NEPA process must be completed before surplus property can be conveyed.

### 3. PROPOSED ACTION AND ALTERNATIVES

The proposed action is the disposal of approximately 2,798 acres (1,132 hectares) of surplus Navy properties in the Territory of Guam in a manner consistent with the subsequent reuse and redevelopment of the property as identified in the *Reuse Plan for GLUP '94 Navy Surplus Properties* (Guam Economic Development Authority [GEDA], October 1996) (Figure ES-1). The parcels covered in this EIS have been divided into 20 parcels located in Dededo, Tiyan, Tamuning, Barrigada, Nimitz Hill, Apra Heights, Naval Station, Piti, and Santa Rita. Nineteen of the parcels were identified as releasable in the *Guam Land Use Plan* (GLUP) prepared by Navy for the United States Pacific Command (USCINCPAC). This EIS also includes the Naval Air Station (NAS) Agana Officers Housing parcel which the BRAC Commission also recommended for closure in its 1995 decision. For ease of reference, all 20 parcels are referred to as GLUP parcels throughout this document. No longer needed for defense or other federal purposes, the properties consist of developed and undeveloped land, buildings, and infrastructure.

GEDA, designated as the local redevelopment authority (LRA), developed a reuse plan for the GLUP Navy properties that was approved by Governor Carl T. C. Gutierrez of Guam. The *Reuse Plan* is a conceptual land use plan intended to provide a range of reuse options. For each parcel, GEDA has identified a preferred reuse alternative. These are described in terms of land use, e.g., residential, commercial, industrial, etc. (Table ES-1). GEDA's preferred reuse alternative is presented in this document as the Navy's Preferred Alternative. The EIS evaluates potential environmental impacts of disposal and various reuse alternatives (i.e., higher and lower development intensities), as well as no action. All 20 parcels considered in the EIS are covered in the *GEDA Reuse Plan*.



Source: Department of Navy (April 1995)  
Guam Land Use Plan Update.

**Figure ES-1**  
**GLUP REUSE PARCELS**  
**& ADJOINING SIGNIFICANT FACILITIES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

Table ES-1: Proposed Action and Alternatives

Parcel No.	Name	Approx. Area	Description	Alternatives			"No Action"	
				Preferred	Lower Intensity Development	Higher Intensity Development		
<b>NORTHERN REGION</b>								
N2	Federal Aviation Administration (FAA) Housing	698 acres (282 ha)	FAA housing units (to be demolished). Remainder of land is undeveloped.	<ul style="list-style-type: none"> <li>• (2) Hotels (128 units)</li> <li>• Single-family Housing (390 units)</li> <li>• 18-hole Golf Course</li> <li>• Recreation Facilities</li> <li>• Conservation Land</li> <li>• Roadway Improvements</li> <li>• Recreation or Community Center (24,800 sf [2,304 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> <li>• Commercial (150,000 sf [13,935 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• (1) Hotel (64 units)</li> <li>• Single-family Housing (265 units)</li> <li>• Recreation Facilities</li> <li>• Conservation Land</li> <li>• Roadway Improvements</li> <li>• Community Center or Office for GovGuam Utility (12,400 sf [1,152 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> <li>• Commercial (90,000 sf [8,361 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> <li>• Commercial or Office Development (17,000 sf [1,579 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> <li>• Single-family Housing (52 units)</li> <li>• Neighborhood Commercial (12,000 sf)</li> <li>• Laderan Tiyan Parkway</li> </ul>	<ul style="list-style-type: none"> <li>• (3) Hotels (192 units)</li> <li>• Single-family Housing (500 units)</li> <li>• 27-hole Golf Course</li> <li>• Recreation Facilities</li> <li>• Conservation Land</li> <li>• Roadway Improvements</li> <li>• Recreation or Education or Office Building (60,000 sf [5,574 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> <li>• Commercial (200,000 sf [18,581 m<sup>2</sup>]) (relocation of existing electrical lines)</li> <li>• Roadway Improvements</li> <li>• Commercial or Office or Hotel Development (55,000 sf [5,110 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> <li>• Multi-family Townhouses (576 units)</li> <li>• Commercial or Office Complex (87,000 sf [8,083 m<sup>2</sup>])</li> <li>• Laderan Tiyan Parkway</li> </ul>	Navy Caretaker Status	
N3	Navy Print Shop (Harmon Annex)	7 acres (3 ha)	An access road leads to a 2-story building and a storage shed.	<ul style="list-style-type: none"> <li>• Recreation or Community Center (24,800 sf [2,304 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Community Center or Office for GovGuam Utility (12,400 sf [1,152 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Recreation or Education or Office Building (60,000 sf [5,574 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Recreation or Education or Office Building (60,000 sf [5,574 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	Navy Caretaker Status
N4B	Wettengel Junction (Marine Drive Utility)	25 acres (10 ha)	One vacant building is on a grassy parcel that is crossed by electrical easements.	<ul style="list-style-type: none"> <li>• Commercial (150,000 sf [13,935 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial (90,000 sf [8,361 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial (200,000 sf [18,581 m<sup>2</sup>]) (relocation of existing electrical lines)</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial (200,000 sf [18,581 m<sup>2</sup>]) (relocation of existing electrical lines)</li> <li>• Roadway Improvements</li> </ul>	Navy Caretaker Status
N4C	Tamuning Telephone Exchange	2 acres (0.8 ha)	Two vacant buildings, one used for storage, are surrounded by paved areas.	<ul style="list-style-type: none"> <li>• Commercial (27,000 sf [2,508 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial or Office Development (17,000 sf [1,579 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial or Office or Hotel Development (55,000 sf [5,110 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial or Office or Hotel Development (55,000 sf [5,110 m<sup>2</sup>])</li> <li>• Roadway Improvements</li> </ul>	Navy Caretaker Status
	NAS Agana Officers Housing	92 acres (37 ha)	Vacant residential units, Navy Exchange, a pump house, and recreation areas are located on the Tiyan plateau.	<ul style="list-style-type: none"> <li>• Multi-family Housing (200 units)</li> <li>• Neighborhood Commercial (12,000 sf)</li> <li>• Laderan Tiyan Parkway</li> </ul>	<ul style="list-style-type: none"> <li>• Single-family Housing (52 units)</li> <li>• Neighborhood Commercial (12,000 sf)</li> <li>• Laderan Tiyan Parkway</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-family Townhouses (576 units)</li> <li>• Commercial or Office Complex (87,000 sf [8,083 m<sup>2</sup>])</li> <li>• Laderan Tiyan Parkway</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-family Townhouses (576 units)</li> <li>• Commercial or Office Complex (87,000 sf [8,083 m<sup>2</sup>])</li> <li>• Laderan Tiyan Parkway</li> </ul>	Navy Caretaker Status

Table ES-1: Proposed Action and Alternatives (continued)

Parcel No.	Name	Approx. Area	Description	Alternatives			"No Action"
				Preferred	Lower Intensity Development	Higher Intensity Development	
<b>BARRIGADA REGION</b>							
<b>NCTAMS Barrigada</b>							
N5A	Barrigada Route 16	345 acres (140 ha)	Land is undeveloped except for a Navy Pesticide Storage Unit. Subparcels are leased to GovGuam for agriculture and recreation. Parcel contains closed landfills.	<ul style="list-style-type: none"> <li>Industrial or Warehouse (100,000 sf [9,290 m<sup>2</sup>])</li> <li>Expand Barrigada Sports Complex</li> <li>Expand Agricultural Activities</li> <li>Roadway Improvements</li> <li>Single-family Housing (1,500 units)</li> <li>Roadway Improvements</li> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (30,000 sf [2,787 m<sup>2</sup>])</li> <li>Roadway Improvements</li> <li>Single-family Housing (220 units)</li> <li>Neighborhood Commercial (10,000 sf [929 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Industrial or Warehouse (50,000 sf [4,645 m<sup>2</sup>])</li> <li>Retain Existing Barrigada Sports Complex</li> <li>Existing Agricultural Activities</li> <li>Roadway Improvements</li> <li>Single-family Housing (750 units)</li> <li>Roadway Improvements</li> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (15,000 sf [1,394 m<sup>2</sup>])</li> <li>Roadway Improvements</li> <li>Single-family Housing (88 units)</li> <li>Neighborhood Commercial (10,000 sf [929 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Industrial or Warehouse (400,000 sf [37,161 m<sup>2</sup>])</li> <li>Expand Recreation and Golf Facilities</li> <li>Expand Agricultural Activities</li> <li>Single-family Housing (10 acres [4 ha])</li> <li>Roadway Improvements</li> <li>Single-family Housing (2,000-2,500 units)</li> <li>Roadway Improvements</li> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (60,000 sf [5,574 m<sup>2</sup>])</li> <li>Roadway Improvements</li> <li>Single-family Housing (440 units)</li> <li>Commercial (20,000 sf [1,858 m<sup>2</sup>])</li> <li>Motel</li> <li>Recreation Facilities</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N5B	Barrigada Route 15	358 acres (145 ha)	Undeveloped except for golf course maintenance building and closed landfills.	<ul style="list-style-type: none"> <li>Single-family Housing (1,500 units)</li> <li>Roadway Improvements</li> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (30,000 sf [2,787 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Single-family Housing (750 units)</li> <li>Roadway Improvements</li> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (15,000 sf [1,394 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Single-family Housing (2,000-2,500 units)</li> <li>Roadway Improvements</li> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (60,000 sf [5,574 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N5C	Barrigada Hawaiian Rock	15 acres (6 ha)	Hawaiian Rock Products leases 6.5 acres (2.6 ha) for quarry support operations. Remainder of land is undeveloped.	<ul style="list-style-type: none"> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (30,000 sf [2,787 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (15,000 sf [1,394 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Continue Quarry Support Operations</li> <li>Industrial/Warehouses (60,000 sf [5,574 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N5D	Barrigada Antenna Site	55 acres (22 ha)	Vacant communications building and four homes built by squatters exist on the north end. Remainder of land is undeveloped.	<ul style="list-style-type: none"> <li>Single-family Housing (220 units)</li> <li>Neighborhood Commercial (10,000 sf [929 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Single-family Housing (88 units)</li> <li>Neighborhood Commercial (10,000 sf [929 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Single-family Housing (440 units)</li> <li>Commercial (20,000 sf [1,858 m<sup>2</sup>])</li> <li>Motel</li> <li>Recreation Facilities</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status

Table ES-1: Proposed Action and Alternatives (continued)

Parcel No.	Name	Approx. Area	Description	Alternatives			"No Action"
				Preferred	Lower Intensity Development	Higher Intensity Development	
<b>CENTRAL REGION</b>							
N10A	Nimitz Hill Enlisted Housing	120 acres (49 ha)	Vacant housing units and recreational facilities.	<ul style="list-style-type: none"> <li>Single- or Multi-family Housing (158 units)</li> <li>Recreation Facilities (20,000 sf [1,858 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Renovate Existing Housing (78 units)</li> <li>Recreation Facilities (15,000 sf [1,394 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Single- or Multi-family Housing (302 units)</li> <li>Community and Recreation Facilities (35,000 sf [3,252 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N10B	Nimitz Hill Vacant Land	183 acres (74 ha)	Undeveloped land except for an operating Navy Public Works Center Sewage Pumping Station.	<ul style="list-style-type: none"> <li>Commercial (100,000 sf [9,290 m<sup>2</sup>])</li> <li>Conservation or Hiking Trails</li> <li>Multi-family Housing (100 units)</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (50,000 sf)</li> <li>Conservation</li> <li>Multi-family Housing (65 units)</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (197,000 sf [18,302 m<sup>2</sup>])</li> <li>Conservation</li> <li>Multi-family Housing (150 units)</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N12A	Sasa Valley	9 acres (4 ha)	Undeveloped land is steeply sloped and heavily vegetated.	<ul style="list-style-type: none"> <li>Expand Guam Veterans Cemetery</li> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Large Expansion of Guam Veterans Cemetery</li> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N12B	Tenjo Vista	559 acres (226 ha)	Undeveloped land with wetlands and areas of steep slope. Active petroleum pipelines underlie the parcel.	<ul style="list-style-type: none"> <li>Commercial (30,000 sf [2,787 m<sup>2</sup>])</li> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (20,000 sf [1,858 m<sup>2</sup>])</li> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (60,000 sf [5,574 m<sup>2</sup>])</li> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N14	Polaris Point	82 acres (33 ha)	One vacant building, paving, and concrete berms cover most of parcel's south end. Vegetation and wetlands comprise the parcel's north end.	<ul style="list-style-type: none"> <li>Agriculture or Aquaculture or Marine Facilities</li> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Industrial (100,000 sf [9,290 m<sup>2</sup>])</li> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status

Table ES-1: Proposed Action and Alternatives (continued)

Parcel No.	Name	Approx. Area	Description	Alternatives			"No Action"
				Preferred	Lower Intensity Development	Higher Intensity Development	
<b>SOUTHERN REGION</b>							
N15	New Apra Heights	102 acres (41.3 ha)	Undeveloped with steep slopes.	<ul style="list-style-type: none"> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Conservation</li> <li>Single-family Housing (320 units)</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N16	Route 2A	15 acres (6 ha)	Paved property. Parcel is leased to GovGuam for bus parking and material storage.	<ul style="list-style-type: none"> <li>Commercial/Office (32,000 sf [2,973 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (16,000 sf [1,486 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (100,000 sf [9,290 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N17	Afleje (Rizal) Beach	16 acres (6 ha)	Beachfront site is heavily vegetated. GovGuam leases the parcel for park use.	<ul style="list-style-type: none"> <li>Territorial Park with Recreation Facilities (12,000 sf [1,115 m<sup>2</sup>])</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Territorial Park</li> </ul>	<ul style="list-style-type: none"> <li>Territorial Park</li> <li>Power Plant</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status
N18	Old Apra Heights	13 acres (5 ha)	Undeveloped parcel is traversed by several access roads to neighboring residences.	<ul style="list-style-type: none"> <li>Neighborhood Commercial (5,000 sf [465 m<sup>2</sup>])</li> </ul>	<ul style="list-style-type: none"> <li>Neighborhood Commercial (2,500 sf [232 m<sup>2</sup>])</li> <li>Community Playground</li> </ul>	<ul style="list-style-type: none"> <li>Commercial (10,000 sf [929 m<sup>2</sup>])</li> </ul>	Navy Caretaker Status
N19A	Navy Ordnance Annex North (NAVMAG North)	50 acres (20 ha)	Undeveloped with steep slopes and dense vegetation.	<ul style="list-style-type: none"> <li>Youth Camp Housing and Recreation Facilities (11,000 sf [1,022 m<sup>2</sup>])</li> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Youth Camp Housing (reuse existing housing)</li> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Youth Camp Housing and Recreation Facilities (20,000 sf [1,858 m<sup>2</sup>])</li> <li>Multi-family Housing (48 units)</li> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status

Table ES-1: Proposed Action and Alternatives (continued)

Parcel No.	Name	Approx. Area	Description	Alternatives			"No Action"
				Preferred	Lower Intensity Development	Higher Intensity Development	
<b>SOUTHERN REGION (continued)</b>							
N19B	Navy Ordnance Annex North Housing (NAVMAG North)	52 acres (21 ha)	Vacant housing units are surrounded by well-maintained landscaping. Remainder of parcel is undeveloped with dense vegetation.	<ul style="list-style-type: none"> <li>Youth Camp Housing and Recreation Facilities (11,000 sf [1,022 m<sup>2</sup>])</li> <li>Conservation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Youth Camp Housing (reuse existing housing)</li> <li>Conservation and Recreation</li> <li>Roadway Improvements</li> </ul>	<ul style="list-style-type: none"> <li>Youth Camp Housing and Recreation Facilities (20,000 sf [1,858 m<sup>2</sup>])</li> <li>Conservation and Recreation</li> <li>Multi-family Housing (40 units)</li> <li>Roadway Improvements</li> </ul>	Navy Caretaker Status

Alternatives evaluated in this document include the Preferred Alternative, higher and lower intensities of development, and no action. Impacts are compared between the various alternatives and baseline conditions in 1995.

- **Preferred Alternative.** The Preferred Alternative would implement the GEDA *Reuse Plan* for the GLUP parcels. This alternative proposes redevelopment of the properties for parks and recreation, historical and conservation, residential, commercial, resort, industrial, and agricultural land uses, as well as extensive regional roadway improvements.

Five parcels totaling 824 acres (333 hectares) are located in the northern region of Guam. Proposed development includes an 18-hole golf course, 128 resort hotel rooms, and a 390-unit residential subdivision. Conservation and recreational areas would be set aside to protect cliff line natural and cultural resources. An existing building at Harmon Annex would be renovated to serve as a community center. Approximately 177,000 square feet (16,443 square meters) of commercial development would occur in the business district along Marine Drive (Route 1). Single-family houses and a neighborhood commercial complex would be constructed at the NAS Officers Housing parcel at NAS Agana. A portion of the future Laderan Tiyan Parkway would run along the NAS Officers Housing parcel's perimeter, providing alternate access across the Tiyan plateau from the A. B. Won Pat Guam International Airport. The parkway will eventually link to a proposed north-south bypass road leading to Marine Drive.

The Barrigada region parcel contains four subparcels, each with different proposed land uses. Moderate intensity development would replace the generally undeveloped 773 acres (313 hectares) of land that previously served as military communication facilities. Affordable housing, totaling 1,720 units, and neighborhood commercial centers would occupy two of the Barrigada parcels. Over 130,000 square feet (12,077 square meters) of industrial or warehouse storage would be constructed on two other parcels. The Government of Guam's (GovGuam's) Barrigada Sports Complex and agricultural activities would be expanded. Hawaiian Rock Products' quarry support operations would continue. Navy would transfer 50 acres (20 hectares) in Barrigada to the National Guard Bureau for continued use and expansion of the Guam Army National Guard facilities.

In the central region, redevelopment of five parcels totaling 953 acres (386 hectares) would be concentrated at Nimitz Hill. This alternative proposes renovation of existing housing and new residential construction to total 258 single- and multi-family units. A 100,000-square-foot (9,290-square-meter) commercial center focused on cultural activities would be constructed atop Nimitz Hill. Along Marine Drive (Route 1), the Guam Veterans Cemetery would be expanded. A small commercial center totaling less than 30,000 square feet (2,787 square meters) would be constructed along Marine Drive. An aquaculture facility is proposed at Polaris Point. Throughout all parcels, undeveloped, steeply sloped land containing wetlands and sensitive natural and cultural resources would be preserved for low-impact park or conservation use.

Six parcels consisting of 271 acres (109 hectares) are located in the southern region. Small commercial centers totaling 37,000 square feet (3,473 square meters) would be constructed. A GovGuam public beach park would continue to be used at Rizal/Aflleje Beach. A youth camp and recreational facilities would be developed at the Navy Ordnance

Annex North housing area. This alternative proposes conservation and recreational use in areas with sensitive natural resources.

- **Lower Intensity Alternative.** Under the Lower Intensity Alternative, reuse of the parcels would be similar to that proposed under the Preferred Alternative but with reduced development densities, i.e., more open space and less construction and use of the properties. Some existing facilities would be renovated rather than expanded, and fewer new buildings would be constructed.

The northern region resort would consist of 64 hotel rooms; however, a golf course would not be developed. Residential development would total 1,298 single- and multi-family housing units with the majority of units concentrated in the northern and Barrigada regions. Limited commercial development would occur in residential neighborhoods. Approximately 272,500 square feet (25,316 square meters) of commercial and warehouse facilities would be built. No industrial or aquaculture facilities would be developed at Polaris Point. The Guam Veterans Cemetery, Barrigada Sports Complex, and Barrigada agricultural activities would not be expanded.

- **Higher Intensity Alternative.** Reuse would be similar to that proposed under the Preferred Alternative but with increased development densities approaching the maximum allowed under local zoning. The Higher Intensity Alternative would involve more new construction and use of the properties.

The northern region resort would consist of a 27-hole golf course and 192 hotel rooms. Approximately 160 bed and breakfast or motel rooms would be developed on various parcels. An educational or office building or a regional community center would be built at Harmon Annex. Residential subdivisions would be developed consisting of 4,782 housing units; of these, up to 3,000 homes would be constructed in Barrigada. Over 1,360,600 square feet (126,404 square meters) of commercial and industrial facilities would be built, including 100,000 square feet (9,290 square meters) of industrial space at Polaris Point instead of aquaculture facilities. Guam Power Authority would construct a baseload-generating power plant next to the Rizal/Afilleje beach park.

- **"No Action" Alternative.** This alternative assumes that Navy would maintain ownership of the properties in caretaker status. Navy would maintain the physical conditions of the properties, provide a security force, and make repairs essential to safety. No redevelopment or roadway improvements would occur within the properties. Existing leases would continue according to their terms.

#### 4. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to reduce military infrastructure and save operation and maintenance costs to match current force structure plans. On behalf of USCINCPAC, Navy reviewed all military land requirements on the island of Guam and identified lands for retention and disposal. The resulting Guam *Land Use Plan* served as the basis for recommendations by the Secretary of Defense to the Base Closure and Realignment Commission. The proposed action implements the Presidential and Congressional decision to accept the 1995 Commission recommendation regarding disposal of the subject parcels.

## 5. SCOPE OF THE EIS

GLUP identified more than 8,081 acres (3,273 hectares) of releasable land on the island that the Department of Defense (DoD) no longer needed. Only 2,798 acres (1,132 hectares) of Navy land are included under the proposed action. Excluded from the proposed action are Air Force properties identified in GLUP which were not covered in the 1995 BRAC decision; property at Naval Air Station (NAS) Agana covered under separate environmental documentation; 50 acres (20 hectares) at Barrigada that are in the process of a federal agency transfer to the National Guard Bureau; 24 acres (9.7 hectares) of land where power plants are located; and 23 acres (9.3 ha) at New Apra Heights conveyed by the Secretary of Health and Human Services to GovGuam for construction of the Agat-Santa Rita Wastewater Treatment Plant (WWTP).

## 6. ENVIRONMENTAL CONSEQUENCES AND PROPOSED MITIGATION

Potential environmental impacts would result from development of the property by GEDA, subsequent landowners, developers, and others. The acquiring entities would be responsible for measures to mitigate those impacts following disposal of the property. Navy will consult with the Guam Historic Preservation Officer (HPO), Advisory Council on Historic Preservation (ACHP), U.S. Fish And Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS) and will continue to remediate existing areas of contamination to levels protective of human health and the environment.

With the exception of traffic and air quality impacts, no significant impacts are anticipated that cannot be mitigated through compliance with applicable regulations, adoption of standard practices to minimize construction-related impacts, development of appropriate infrastructure to accommodate projected capacity, or implementation of specific measures. No impacts would be associated with the "No Action" Alternative. However, certain roadway intersections are projected to operate at unacceptable vehicular traffic levels with or without reuse, with resulting exceedences of air quality standards for carbon monoxide (CO). Findings of the EIS are summarized below.

**Soils, Geology, and Topography.** No significant impacts are anticipated with any of the alternatives.

**Drainage.** Development under all reuse alternatives would alter drainage patterns and increase the quantity of storm water runoff on certain parcels. The quantity of storm water runoff would be most pronounced under the Higher Intensity Alternative and least under the Lower Intensity Alternative. Impacts would not be significant since runoff could be accommodated by GEPA-approved measures such as ponding basins, development of drainage structures, and proper grading.

Six parcels contain flood hazard zones. Compliance with regulations governing storm water and development in flood hazard zones would prevent significant impacts.

**Air Quality.** Proposed development is projected to increase traffic and vehicular emissions. Vehicular emissions could cause significant air quality impacts at certain intersections (exceedences of National Ambient Air Quality Standards [NAAQS] for CO) especially without implementation of mitigation. With traffic mitigation measures recommended in Section 4.4, air quality impacts due to vehicular emissions are not expected to be significant except at the intersection of Route 1 (Marine Drive) and Route 16, where 40- to 60-second delays in traffic are projected during afternoon peak hours.

**Land Use Compatibility.** No significant land use compatibility impacts are expected under any of the alternatives that cannot be mitigated. Buffers could be established between residential uses at Barrigada and existing quarry operations. In the Higher Intensity Alternative, the proposed Rizal/Afleje Beach power plant may significantly impact views from the adjacent beach park. Providing buffers or consideration of views in the facility design would avoid visual impacts. Guam Power Authority would have to address this issue under the local environmental review process. Proposed residential development at the New Apra Heights parcel under the Higher Intensity Alternative may be affected by odors from GovGuam's proposed Agat/Santa Rita Wastewater Treatment Plant (WWTP) adjacent to the parcel. Impacts would not be significant as odors could be controlled through proper WWTP design and operations.

**Noise.** No significant noise impacts would result from reuse alternatives that could not be mitigated. Residential development on the NAS Officers Housing parcel would be outside of the 60 DNL noise contour projected for the expanded Guam International Airport. Noise levels less than 65 DNL are considered compatible with all land uses by the Federal Aviation Administration. Vehicular noise from the proposed Laderan Tiyan Parkway may significantly impact residents at the NAS Officers Housing parcel. Trucks servicing warehouses at Barrigada parcels N5A and N5C and Hawaiian Rock Products quarry operations may also have significant noise impacts on residential areas. There is a potential for significant noise impacts on Rizal/Afleje Beach from the power plant and associated heavy-vehicle traffic under the Higher Intensity Alternative. Establishment of buffers between conflicting land uses and use of noise-attenuating materials would help reduce noise impacts to less than significant levels.

**Cultural Resources.** With all reuse alternatives, there is a potential for significant impacts on sites listed or eligible for listing on the National Register of Historic Places (NRHP). Historic properties are located on four parcels: Barrigada parcel N5A, Nimitz Hill parcels N10A and N10B, and Navy Ordnance Annex North (N19B). In addition, nine other parcels are assessed as being potentially high in archaeological sensitivity, i.e., having a high degree of probability of prehistoric or historic sites being present. These include the FAA Housing (N2), Marine Drive Utility (N4B), Barrigada N5B, Sasa Valley (N12A), Tenjo Vista (N12B), Rizal/Afleje Beach, Polaris Point (N14), Old Apra Heights (N18), and Navy Ordnance Annex North (N19A). Comparing effects of the reuse alternatives, impacts could be most severe with the Higher Intensity Alternative and least with the Lower Intensity Alternative. No impacts on historic properties would be associated with the "No Action" Alternative.

Disposal of NRHP eligible properties without adequate provision to protect their historic integrity could result in significant impacts. Prior to disposal, Navy, the Guam Historic Preservation Officer (HPO), and the Advisory Council on Historic Preservation (ACHP) will implement a Programmatic Agreement (PA) containing adequate provisions to protect the

historic integrity of the properties. Navy will include applicable stipulations of the PA as conditions of the conveyance.

**Terrestrial Biota and Habitats.** No protected species were observed on any of the parcels during biological surveys conducted in 1988-89 and 1998. A small wetland area on the Tenjo Vista parcel is described in the U.S. Fish and Wildlife Survey's *Moorhen Recovery Plan* (1992) as secondary habitat of the endangered Mariana common moorhen (*Gallinula chloropus guami*). Under all reuse alternatives, development in this area can be avoided to preserve the habitat. Likewise, wetlands and limestone forest areas on other parcels can be avoided through site planning. Therefore, no significant impacts are expected.

**Marine Environment.** No significant impacts on the marine environment are anticipated with the Preferred or Lower Intensity Alternatives. At Rizal/Afleje Beach, under the Higher Intensity Alternative, potentially significant localized impacts could occur on coral reefs due to construction of power plant intake and outfall structures. Marine life could also be affected by discharge of higher temperature cooling water effluent. However, proper siting and construction practices and locating the outfall in deep water with adequate circulation would avoid significant impacts.

**Roads and Traffic.** For all reuse alternatives, no significant traffic impacts are anticipated with mitigation measures identified in Chapter 4, except in the Northern region. A significant unmitigable traffic impact would occur due to unacceptable levels of service (LOS) at the intersection of Route 1 and Route 16. This intersection would operate at an unacceptable LOS with or without the proposed action.

Regional average daily trips (ADT) generated by the reuse alternatives are listed in Section 4.10. With reuse, the greatest ADT generated would be from the Higher Intensity Alternative, at about 84,222. The Preferred Alternative would generate approximately 47,752 trips. The Lower Intensity Alternative would generate about 28,956 trips. Accordingly, traffic impacts, as determined from vehicle delay estimates at specific intersections, would be greatest under the Higher Intensity Alternative. Mitigation at key intersections would include installation of traffic signals and/or turning lanes, realignment of intersection approaches, and road widening.

**Potable Water Supply and Wastewater Collection and Treatment.** No significant impacts are expected on the island-wide potable water supply under all of the alternatives. Regional WWTP capacities would not be affected by reuse except for peak flow conditions at the Agana WWTP under the Higher Intensity Alternative. Redirecting discharges to the Northern District WWTP, which has available capacities, would mitigate this potentially significant impact.

**Solid Waste Disposal.** Projected capacity of the proposed new landfill at Guatali would accommodate redevelopment under the Preferred, Lower, and Higher Intensity alternatives. The cumulative impact would be significant for the Higher Intensity Alternative, resulting in a decrease in the life span of the landfill. Implementation of the GovGuam's Integrated Waste Management Plan, including recommendations for reuse, recovery, and recycling of solid wastes and construction of a waste-to-energy conversion facility, would mitigate these impacts.

**Electrical Supply and Energy Use.** No significant impacts are expected on Guam's electrical generating capacity under any of the alternatives if necessary generation and transmission facilities are phased in with reuse of the GLUP parcels. With other planned developments on

the island, there would be significant cumulative impacts under all reuse alternatives. Guam Power Authority would need to add 60 to 80 megawatts of electrical capacity through fiscal year 2015 to avoid significant impacts on the island's electrical supply.

**Socioeconomics.** No significant impacts on Guam's socioeconomic environment would occur under all alternatives. New northern region and Barrigada housing developments, proposed under all reuse alternatives, would lead to a substantial increase in the number of people residing in these districts. Long-range planning by GovGuam is required to assure adequate public services. The commercial and industrial real estate markets would experience adverse effects under all of the redevelopment scenarios due to a surplus of inventory. These effects could be avoided by phasing development over a longer period in response to market demand. The Higher Intensity Alternative may also result in social impacts if new commercial and industrial jobs need to be filled by large numbers of off-island workers, but these impacts would not be significant and could be minimized through appropriate planning.

**Public Services.** Under all reuse alternatives, three public school districts would experience substantial increases in enrollment due to development of new affordable housing in these districts. Long-range planning and funding to build more schools would mitigate this potentially significant impact. There would be no significant impacts on parks, health care, police, fire protection, or civil defense due to reuse, but significant cumulative impacts are expected on all of these services except parks. Mitigation will involve incremental increases in services to meet additional demands as redevelopment occurs.

**Executive Order 12898, Environmental Justice.** None of the alternatives would have disproportionately high or adverse effects on minority or low-income populations. Of the impacts identified, none would disproportionately affect a particular group.

**Executive Order 13045, Protection of Children from Environmental Health and Safety Risks.** None of the alternatives create health and safety risks that would disproportionately affect children. Navy will identify and remediate areas of existing contamination to levels protective of human health and the environment and appropriate to the subsequent reuse. Potential health risks associated with development of housing in areas with radon would be avoided with compliance with the Toxic Substance Control Act (TSCA).

**Environmental Contamination.** No significant impacts are expected since onsite contamination will be identified and remediated to levels protective of human health and the environment.

In summary, with the exception of the "No Action" Alternative, the potential impacts of the various alternatives would be similar but the extent of the impacts would vary. Impacts would be most severe under the Higher Intensity Alternative and least severe under the Lower Intensity Alternative. The Higher Intensity Alternative would involve development of more than 1.2 million square feet (111,484 square meters) of commercial and industrial facilities, as well as construction of a power plant on land designated for park use. The "No Action" Alternative would be considered the environmentally preferred alternative. It would involve no development and, hence, the least disturbance to Guam's environment and infrastructure.

## 7. SIGNIFICANT UNMITIGABLE IMPACTS

Under all reuse alternatives, the Route 16 and Route 1 (Marine Drive) intersection in the northern region would operate above capacity. Mitigation such as the addition of turning lanes

and signalization would compensate for the reuse component of traffic at this intersection, which would still remain above capacity in 2010. Further mitigation (i.e., a grade-separated interchange) would not be practical. Due to traffic delays at this intersection, vehicular emissions could cause significant air quality impacts due to exceedences of National Ambient Air Quality Standards (NAAQS) for CO.

## **8. UNRESOLVED ISSUES**

No unresolved issues were identified during the development of this document.



# Chapter 1

---

PURPOSE AND NEED



# CHAPTER ONE

## PURPOSE AND NEED

---

### 1.1 OVERVIEW OF THIS EIS

This Environmental Impact Statement (EIS) evaluates the potential environmental impacts that may result from disposal and subsequent reuse of certain surplus Navy properties in the Territory of Guam. It has been prepared in accordance with Section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969, 42 U.S.C. §4332(2)(C) as implemented by regulations of the Council on Environmental Quality (CEQ) (40 C.F.R. Parts 1500-1508) and *Navy Environmental and Natural Resources Program Manual* (OPNAVINST 5090.1B, February 1998). The EIS has also been prepared in accordance with the Defense Base Closure and Realignment Act of 1990, 10 U.S.C. §2687 note, as amended by the 1995 Base Realignment and Closure (BRAC) Act. These regulations provide a framework to inform the public and decision makers of the potential impacts and reasonable alternatives of a federal action. Findings in the EIS will be used by the Secretary of the Navy to issue a Record Of Decision (ROD). The NEPA process must be completed before surplus property can be conveyed.

As required by the above-referenced regulations, this EIS identifies the proposed action, reasonable alternatives to the proposed action, potential environmental impacts, and measures proposed to avoid or minimize adverse impacts on or enhance the quality of human health and the environment. Various types of impacts (e.g., direct, indirect, and cumulative) are analyzed, and appropriate mitigation measures are identified. Direct impacts are those resulting from Navy's disposal of surplus properties (retained neither by Navy nor other federal agencies). Indirect impacts are those associated with reuse of the surplus property. Cumulative impacts are those which may result from Navy's disposal of property or the reuse of those properties when combined with the impacts of other unrelated activities in the region of influence (ROI). The majority of the impacts analyzed in this EIS are indirect impacts associated with the proposed reuse of the surplus properties.

Chapter 1 presents the purpose and need of the proposed action, along with other pertinent identifying information. Chapter 2 presents the proposed action and alternatives. Chapter 3 describes the affected environment. Information provided in Chapters 1 through 3 is used to identify the issues and potential impacts that could be significant and require further evaluation. These evaluations are provided in Chapter 4. A list of persons contributing to this EIS, references, and Draft EIS (DEIS) distribution list are provided in Chapters 5, 6, and 7, respectively.

### 1.2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the disposal of approximately 2,798 acres (1,132 hectares) of surplus Navy land and facilities in the Territory of Guam in a manner consistent with the subsequent reuse and redevelopment of the property as identified in the *Reuse Plan for GLUP '94 (Guam Land Use Plan) Navy Properties* (Guam Economic Development Authority [GEDA], October 1996). The *Reuse Plan* was approved by Governor Carl T. C. Gutierrez of Guam on January 2, 1997. The 20 parcels covered in this EIS are located in the northern, Barrigada, central, and southern regions of Guam (Figure ES-1). No longer needed for defense or other military

purposes, the properties consist of developed and undeveloped land, buildings, and infrastructure.

Nineteen of these parcels were identified as releasable in Navy's *Guam Land Use Plan (GLUP)*. This EIS also includes the Naval Air Station (NAS) Agana Officers Housing parcel which the Base Realignment and Closure (BRAC) Commission recommended for closure. The parcel was included in GEDA's *Reuse Plan* although it was not in the Navy's GLUP report. For ease of reference, all parcels will be referred to as GLUP parcels throughout this document.

GEDA, designated as the local redevelopment authority (LRA), developed a reuse plan for the GLUP Navy properties. It is a conceptual land use plan intended to provide a range of reuse options that will generate jobs and revenue and to guide GEDA in its reuse decisions. For each parcel slated for disposal, GEDA has identified a preferred reuse alternative within a range of development intensities. GEDA's alternatives are described in terms of land use, for example, residential, commercial, or industrial.

The *Reuse Plan* was received by the Department of the Navy and forwarded with the Homeless Assistance Application to the U.S. Department of Housing and Urban Development (HUD). HUD approval on December 1, 1997, ensures that homeless needs have been addressed.

This EIS evaluates the impacts of disposal and reuse of the property. Reuse alternatives include resort, residential, commercial, industrial, agricultural, parks and recreation, historical, and conservation land uses. Alternatives to be evaluated include Navy's Preferred Alternative, which is also the recommended alternative of GEDA with one exception (the Polaris Point parcel), higher and lower intensities of development, and no action. The main distinctions among the reuse alternatives are in the development intensities. A "No Action" Alternative assumes that Navy would maintain ownership of the property. The property would remain in caretaker status with Navy maintaining the physical condition of the property, providing a security force, and making repairs essential to safety. Existing leases would continue according to their terms. Impacts are compared between the various alternatives and baseline conditions in 1995 (when the decision to dispose of subject properties was approved) except where otherwise noted.

### 1.3 LOCATION OF THE PROPOSED ACTION

The 20 GLUP parcels are located on the island of Guam in Dededo, Tiyan, Tamuning, Barrigada, Nimitz Hill, Apra Heights, Naval Station, Piti, and Santa Rita.

**Island of Guam.** Guam is part of the Mariana Islands chain in the western Pacific (Figure ES-1). It became a possession of the United States as a result of the Spanish-American War in 1898, providing a strategic location for trading and defense. Under Navy administration, Guam served as a coaling station and later as a naval base. During World War II, Guam was invaded and occupied by the Japanese. The United States Marines liberated Guam from Japanese occupation on July 21, 1944.

**Government.** Guam is a territory of the United States. The Government of Guam (GovGuam) consists of a unicameral legislature, a judicial branch, and an executive branch. In addition, there are 19 municipal mayors and councils. The island also elects a representative to the U.S. Congress.

## 1.4 PURPOSE OF AND NEED FOR PROPOSED ACTION

The purpose of the proposed action is to reduce military infrastructure and save operation and maintenance costs to match current force structure plans. The proposed action implements the Presidential and Congressional decision to accept the 1995 BRAC recommendations to dispose of the subject parcels.

In 1994, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM), at the request of United States Pacific Command, drafted a land use plan for Navy and Air Force properties on the island of Guam. The *Guam Land Use Plan (GLUP)* reviewed all military land requirements on the island and identified Navy and Air Force land for retention or disposal based on foreseeable military missions and force levels. The final version of the plan, entitled *GLUP '94: Guam Land Use Plan (GLUP) Update*, was published in April 1995.

The GLUP recommended that military activities be consolidated in the northern and southern sectors of the island, resulting in more efficient operations and lower operational costs. Lands identified as unnecessary for Department of Defense (DoD) mission requirements and those outside of training areas, explosive safety zones, electromagnetic interference or hazard zones, and aircraft safety zones were recommended for release.

The proposed action is being taken as a result of recommendations by the Secretary of Defense to the Defense Base Realignment and Closure (hereafter referred to as BRAC) Commission, which was charged with reviewing proposals for the realignment or closure of military installations. (Realignment refers to the reduction, relocation, or consolidation of functions and positions.) The Commission recommended the following: "Dispose of property owned by Naval Activities declared releasable under the 1994 *Guam Land Use Plan* with appropriate restrictions." The Commission also recommended closure of the NAS Officers Housing parcel at NAS Agana. These recommendations were approved by President Clinton and accepted by the One Hundred Fourth Congress in 1995.

## 1.5 SCOPE OF EIS

The GLUP identifies more than 8,081 acres (3,273 hectares) of releasable land on the island that is no longer needed for defense purposes. Only 2,798 acres (1,131 hectares) of Navy land will be conveyed. The following land is not included under the proposed action:

- Air Force properties identified in the GLUP are not included because they were not covered in the 1995 BRAC decision and are being disposed of as separate actions.
- The GLUP included land at Naval Air Station (NAS) Agana, which was already declared surplus under the earlier 1993 BRAC recommendation to close the base. A DEIS for this disposal action was published on April 9, 1999.
- The Agana, Piti, and Tanguisson Power Plants, Navy Public Works Center (PWC) Department facilities adjacent to the Piti Power Plant, and electrical substations on Marine Drive and on Route 7 adjacent to the Old Apra Heights parcel are being disposed of as separate actions.

- Approximately 50 acres (20.2 hectares) at Barrigada parcel N5A are in the process of transfer to the National Guard Bureau for use by the Guam Army National Guard. The parcel is currently leased by the National Guard for training.
- The Secretary of Health and Human Services conveyed approximately 23 acres (9.3 hectares) of the New Apra Heights parcel to Guam Waterworks Authority for construction of the Agat-Santa Rita wastewater treatment plant (WWTP). Relative to this conveyance, the Department of Health and Human Services was responsible for ensuring compliance with NEPA.

## 1.6 BASE REALIGNMENT AND CLOSURE PROCESS

As a result of the major downsizing of national defense, the BRAC process was established to identify DoD installations for realignment and closure. This process required the Secretary of Defense to recommend specific installations for realignment and closure. These recommendations were reviewed by the BRAC Commission. Findings and recommendations of the Commission were then presented to the President and Congress and approved in 1995.

Federal law provides for a variety of conveyance methods to implement Navy property disposal decisions after completion of the NEPA process. Property disposal and reuse will comply with the Defense Base Closure and Realignment Act (DBCRA) of 1990, 10 U.S.C. §2687 note, as amended by the 1995 BRAC process; President Clinton's Five-Point Plan, "A Program to Revitalize Base Closure Communities" (July 2, 1995); the National Defense Authorization Act for Fiscal Year 1994, P. L. 103-160, Title XXIX, Subtitle A (1993); and Revitalizing Base Closure Communities and Community Assistance, 32 C.F.R. Parts 174 and 175.

The DBCRA of 1990 requires that the General Services Administration (GSA) screening process be used to dispose of properties on bases to be closed. This process begins with the consideration of other DoD requests for properties. Property remaining after DoD requests are accommodated is declared "excess" and open for consideration by other federal agency use. Transfer to the National Guard Bureau through the Department of the Army of the Barrigada Guam Army National Guard property will be handled as a federal agency to federal agency transfer action. Property remaining after the processing of federal agency requests is declared "surplus" and made available for conveyance.

After the screening of applications for excess property by federal agencies, a Determination of Surplus Property was finalized on March 18, 1999. A Notice of Surplus Determination will be published by Navy in the *Federal Register*.

On July 9, 1996, Governor Carl T. C. Gutierrez of Guam designated the Guam Economic Development Authority (GEDA) as the local redevelopment authority (LRA) under Guam Executive Order No. 96-19. The Executive Order mandated that GEDA develop and implement a reuse plan for the GLUP Navy properties. In addition, it created the GLUP '94 Reuse Planning Committee to assist GEDA in this task. A plan for the long-term reuse of GLUP Navy properties was developed by GEDA, which published notices requesting homeless providers, government agencies, private businesses, and the general public to submit expressions of interest for use of the subject lands.

After completion of its task, the Reuse Planning Committee was deactivated by Guam Executive Order No. 97-27. Subsequently, Guam Executive Order No. 97-27, signed on December 2, 1997, created the Base Realignment and Closure GovGuam (Government of Guam) Steering Committee to coordinate all planning and development of properties at NAS Agana and Naval Ship Repair Facility, GLUP '94 Navy properties, and surplus federal properties at Apra Harbor.

## 1.7 PUBLIC INVOLVEMENT PROCESS

NEPA requires that potential impacts and issues be disclosed to affected agencies and the public. The implementing rules specify public notification and review periods during EIS preparation. Public involvement starts with scoping and continues through review and comment periods for the EIS document.

### 1.7.1 Scoping Process

The objectives of the scoping phase are as follows: (1) determine the scope of issues to be addressed; (2) identify potentially significant issues related to the proposed action and alternatives; (3) invite participation by the public; (4) eliminate from detailed study matters not potentially significant or covered by prior reviews; (5) indicate any related environmental documents being prepared that are not part of the EIS; and (6) define the EIS schedule relative to project decisions.

The following activities were carried out to meet the above objectives:

- Navy published and distributed a Notice Of Intent (NOI) to prepare an EIS, which also included a public scoping workshop announcement. The NOI was published in the April 10, 1998, issue of the *Federal Register* (Appendix A) and in the April 18-20, 1998, issues of the *Pacific Daily News* on Guam. In addition, the NOI was mailed directly to 94 potentially interested parties. The publication in the *Federal Register* initiated the 30-day public comment period required by CEQ regulations.
- Navy held a scoping workshop on May 7, 1998, at the Chamorro Village in Agana, Guam. The purpose of the workshop was to provide information on the proposed action and alternatives and to receive comments on issues and concerns.

### 1.7.2 EIS Public Review Process

NEPA and implementing CEQ regulations require a minimum 45-day period for the public and government agencies to review the Draft EIS (DEIS). This period is initiated by the publication of a Notice Of Availability (NOA) of the DEIS in the *Federal Register* by the U.S. Environmental Protection Agency (US EPA). The NOA has been published in the Guam daily newspaper. A public hearing on the DEIS will be held on Guam during the comment period. A Final EIS (FEIS) incorporating and responding to comments received on the DEIS will be furnished to parties registering official comments on the draft document and to others requesting a copy. A NOA of the FEIS will be published in the *Federal Register* and will also be published in the Guam daily newspaper. There will be a 30-day no action period after the FEIS is published.

During this period, the public may comment on the adequacy of responses to comments and the FEIS. After that time, Navy can issue a ROD.

## 1.8 SUMMARY OF ISSUES, CONCERNS, AND IMPACTS

Issues raised at the scoping meeting and in writing are summarized below. Copies of comment letters are presented in Appendix A. These issues are addressed in Chapter 1, Chapter 3, and in Table 4.1-1 at the beginning of Chapter 4. Potentially significant issues germane to the proposed action and alternatives are evaluated in more detail in Chapter 4.

- Alternative use of the Tamuning Telephone Exchange for youth, crime prevention, and other community programs (see Appendix A-3 for a letter responding to this comment made by the Mayor of Tamuning).
- Original land ownership issue (This EIS does not focus on the land ownership issue but rather on the proposed land uses as described in the GEDA's *Reuse Plan*. Therefore, discussion of this issue is outside the scope of the analysis.) (Section 1.10)
- Consistency with existing master plan for parks and recreation (Section 4.16.2.6)
- Potential for contaminated runoff from the project sites to affect the northern aquifer (Table 4.1-1)
- Potential impacts on wetlands and other aquatic resources protected under Section 404 of the Clean Water Act, specifically at Polaris Point and Sasa Valley/Tenjo Vista (Section 4.3.5)
- Existing hazardous materials contamination (Section 3.17)
- Use of herbicides or pesticides during both construction and maintenance phases of projects; potential impacts and mitigation (Table 4.1-1)
- Air quality impacts and conformity with regulations and standards (Section 4.4)
- Cumulative impacts within the Region of Influence (ROI) in the context of other planned developments (Cumulative impacts subsections in Chapter 4)
- Potential impacts on local residential communities (Sections 4.5 and 4.15)
- Disproportionate environmental effects on minority and low-income populations (Sections 4.15.5 and 4.18)
- Potential impacts to fish and wildlife resources and habitats, particularly endangered and threatened species, migratory fishes and birds, and rare native species (Sections 4.8 and 4.9)
- Possible introduction of the brown tree snake (BTS) into the Commonwealth of the Northern Mariana Islands (CNMI) and the State of Hawaii (Table 4.1-1)

The comments received during scoping and the results of various investigations were evaluated in the context of the proposed action and alternatives, and specific criteria were used to determine whether issues required detailed evaluation. Those issues not related to the proposed action and alternatives were eliminated from further consideration. A comprehensive list of potential impacts and a determination of whether further analysis was required in the EIS is presented at the beginning of Chapter 4. Based on the findings from this screening process, the following issues or concerns were identified as requiring analysis for one or more of the GLUP parcels.

- Drainage
- Air emissions during operations
- Noise during operations

- Land use conflicts and impacts on nearby communities
- Visual impacts
- Cultural resources
- Protected species
- Wetlands, limestone forests, and other important habitat
- Marine resources
- Traffic congestion
- Potable water supply
- Wastewater treatment
- Solid waste disposal
- Electrical generation
- Public health and safety
- Public services

Issues and concerns that do not require detailed analysis are listed below. In certain cases, a description of existing conditions is sufficient. Several of these issues are addressed through management or regulatory requirements that would prevent such impacts from occurring. A number of management and protective actions, most of them required by law, regulation, or permit conditions, would be included in the implementation of reuse alternatives.

- Construction-related impacts: erosion, fugitive dust, traffic, noise, hazardous waste
- Topography, geology, and soils
- Telephone and cable service
- Existing on-site environmental contamination
- Release of hazardous materials during operations
- Impacts from use of pesticides and herbicides
- Explosive safety quantity distance (ESQD) arcs
- Electromagnetic radiation (EMR) or interference (EMI)
- Increased risk of BTS introduction to CNMI and Hawaii

## 1.9 RELATED LAND USE PLANNING AND ENVIRONMENTAL DOCUMENTS

In addition to the *Guam Land Use Plan* and GEDA's *Reuse Plan for GLUP '94 Navy Properties*, several other planning and environmental documents are either directly or indirectly relevant to the proposed action and alternatives. *The Draft EIS for Disposal and Reuse of NAS Agana, Guam* provides details on proposed development at Tiyan, adjacent to the NAS Officers Housing parcel. *Guam's I Tanò-ta Land Use Plan and Zoning Code* and the *2010 Highway Master Plan* were used by the GEDA to develop recommendations in its *Reuse Plan* and were also used by Navy to define the alternatives evaluated in this EIS. See Chapter 2 for more detailed descriptions of these documents.

To assess cumulative impacts, the EIS looks at other pending BRAC actions on Guam: the proposed disposal and reuse of property at NAS Agana and at the Ship Repair Facility in Apra Harbor. Reuse plans were developed by GovGuam for these surplus properties, and environmental documents are being prepared by Navy in accordance with NEPA. For cumulative socioeconomic and solid waste impacts, other planned large developments were considered as discussed in Section 4.15.4. Analyses for traffic, potable water, wastewater, and

electricity are cumulative as they include regional or island-wide population and employment growth factors from Government of Guam master plan forecasts (*Guam 2010 Highway Master Plan*, *GWA's Guam Water Facilities Master Plan Update*, *Guam Islandwide Wastewater Facilities Plan*, and *Guam Integrated Solid Waste Management Plan*).

### 1.10 ORIGINAL LAND OWNERSHIP

The return of the properties to the original landowners from whom the lands were acquired by the military is a significant local issue.

On January 2, 1997, Governor Carl T. C. Gutierrez of Guam approved Public Law (P.L.) No. 23-141, An Act to Develop Land-Use Policy and Plans for Certain Parcels of Excess Federal Properties Identified in the 1994 *Guam Land Use Plan* (GLUP). P.L. No. 23-141 directs the Department of Land Management "to identify the exact portions of the land identified in GLUP by location, acreage and ownership" and, with the exception of lands that "have been released or set aside by the federal government and the government of Guam for the construction of schools, the economic development of seaport activities, or the implementation of the Highway Master Plan of the Territory of Guam," to "transfer to the original rightful landowners and their heirs those lands."

### 1.11 GOVERNMENT PERMITS AND APPROVALS

Government permits and approvals identified during the scoping process and the development of this document are identified in Table 1.11-1. This table provides a quick reference of possible requirements for action by federal and GovGuam agencies. It is not meant to be a comprehensive listing of all permits that may eventually be required.

Most of the identified permits and approvals are discussed in Chapter 4 where the issues relating to the approval or permit are covered. Coastal Zone Management (CZM) is the exception since it addresses a wide range of issues and resources. The Coastal Zone Management Act of 1972, 15 U.S.C. §1451, established a policy to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone for this and succeeding generations." Guam's Coastal Management Program provides for review of activities for consistency with CZM policies, which guide the use, protection, and development of land and water resources within Guam's coastal zone. The coastal zone of Guam encompasses all non-federal lands, including offshore islands and the submerged land and waters extending seaward to a distance of three nautical miles. The Bureau of Planning is the lead agency responsible for conducting federal consistency reviews. No spillover effects are expected due to disposal of the GLUP parcels, but a consistency determination will be sought because of potential effects associated with their reuse.

In addition, there are numerous federal laws and regulations covering the identification, remediation, handling, and disposal of hazardous materials (Sections 3.17 and 4.17). Depending on the action or issue, the responsible agency would be either the U.S. Environmental Protection Agency (US EPA), Guam Environmental Protection Agency (GEPA), or Guam Occupational Safety and Health Administration.

**Table 1.11-1: Summary of Possible Government Permits and Approvals**

Permit or Approval	Regulatory Agency
Coastal Zone Management (CZM) consistency determination	Guam Bureau of Planning
Endangered Species Act; Section 7 consultation	U.S. Fish And Wildlife Service (USFWS), National Marine Fisheries Service (NMFS)
National Historic Preservation Act; Section 106 consultation	Guam Historic Preservation Officer (HPO), Department of Parks and Recreation, Advisory Council on Historic Preservation (ACHP)
National Pollutant Discharge Elimination System (NPDES) for construction activities equal to or greater than five acres and discharges to storm water drainage systems	Guam Environmental Protection Agency (GEPA)
Department of the Army Permit if work is planned in wetlands (Clean Water Act, Section 404)	U.S. Army Corps of Engineers (ACOE)
Clean Water Act, Section 401 water quality certification (required for a Department of the Army Permit)	GEPA
Prevention of Significant Deterioration (PSD) permit if stationary type air emission sources meet specific criteria	U.S. Environmental Protection Agency (US EPA)
Federal Operating Permit Program, required if a proposed reuse creates a major source of hazardous air pollutants or includes solid waste incinerators	US EPA
Preparation of environmental impact assessments (EIAs) for all actions considered by the Guam Land Use Commission, in accordance with Executive Order 90-10	GEPA
Various development approvals and building permits, e.g., Environmental Protection Plans (EPPs)	Various
Air permits for stationary type emission sources meeting specific criteria	GEPA



# Chapter 2

---

## PROPOSED ACTION AND ALTERNATIVES



## CHAPTER TWO

### PROPOSED ACTION AND ALTERNATIVES

---

This chapter describes the proposed disposal of Navy property and its subsequent reuse, including the Guam Economic Development Authority's (GEDA's) recommended reuse alternative and reasonable alternatives, as required by the National Environmental Policy Act (NEPA).

#### 2.1 PROPOSED ACTION

The proposed action is the disposal of approximately 2,798 acres (1,132 hectares) of surplus Navy land and facilities in a manner consistent with GEDA's *Reuse Plan for GLUP '94 Navy Properties* of October 1996. The parcels covered in this EIS are located in Dededo, Tiyan, Tamuning, Barrigada, Nimitz Hill, Apra Heights, Naval Station, Piti, and Santa Rita. For analysis, the parcels have been grouped into four regions: Northern, Barrigada, Central, and Southern with acreages and parcel descriptions as listed in Table 2-1.1. The properties consist of developed and undeveloped land, buildings, and infrastructure.

##### 2.1.1 Assumptions Used to Develop Reuse Alternatives

Land use development assumptions were made in the following areas to develop reuse alternatives based on the *Reuse Plan*: development intensities and constraints, *I Tanò-ta's* land use and zoning guidelines, and current market and economic trends.

##### 2.1.2 Development Intensities

This EIS is based on GEDA's *Reuse Plan*, in which each land use alternative is described in terms of general land use descriptions, plans, and total land use acreage. The *Reuse Plan* does not quantify development densities, such as building areas or number of dwelling units. In order to analyze potential impacts on the environment, particularly infrastructure, traffic, population change, or socioeconomic conditions, detailed land use assumptions were made for each site, such as the type of use and estimated number of hotel and residential units.

The various land use categories proposed by GEDA for the reuse alternatives include:

- Resort
- Industrial and warehouse development
- Commercial or retail
- Residential
- Agriculture
- Parks and recreation, historic and conservation

Details of each land use category are found in Appendix B.

**Table 2.1-1: Surplus Navy Properties**

Parcel No.	Name	Approx. Area	Municipality	Description
<b>NORTHERN REGION</b>				
N2	Federal Aviation Administration (FAA) Housing	698 acres (282 ha)	Dededo	89 housing units (41 duplexes and 7 single-family units) provided housing to FAA and Navy personnel and dependents until October 1995. (Housing will be demolished by 2001 due to irreparable damage from 1997's Typhoon Paka.) Remainder of land is undeveloped.
N3	Navy Print Shop (Harmon Annex)	7 acres (3 ha)	Dededo	Building 50 and a storage shed (both vacant) are surrounded by grass, paved areas, a septic tank, and leach field.
N4B	Wettengel Junction (Marine Drive Utility)	25 acres (10 ha)	Dededo	Building 691 housed the Stars and Stripes Military Newspaper operations until 1997. The parcel is flat and grassy and crossed by electrical easements.
N4C	Tamuning Telephone Exchange	2 acres (0.8 ha)	Tamuning	Two buildings, one used for storage, were vacated in 1997. Buildings are surrounded by paved areas.
	NAS Officers Housing	92 acres (37 ha)	Tamuning	Until 1995, 73 housing structures (single- and multi-family units totaling 136 units) accommodated active duty personnel. Other facilities include a pump house, a neighborhood commercial center (the Navy Post Exchange closed in 1995), and recreation areas. From 1996 to February 1997, the housing served as temporary shelter for 6,000 Kurdish refugees.
<b>BARRIGADA REGION</b>				
N5	NCTAMS Barrigada			
N5A	Barrigada Route 16	345 acres (140 ha)	Barrigada	Majority of land is undeveloped except for a Navy Pesticide Storage Unit. Subparcels are leased to GovGuam Department of Agriculture experimental station and GovGuam Barrigada sports complex (ball fields and parking). Parcel contains closed landfills.
N5B	Barrigada Route 15	358 acres (145 ha)	Barrigada	Majority of land is undeveloped except for a former FAA Communications Building (used for golf course maintenance equipment). Parcel contains closed landfills.
N5C	Barrigada Hawaiian Rock	15 acres (6 ha)	Barrigada	Hawaiian Rock Products leases 6.5 acres (2.6 ha) for quarry support operations. Remainder of land is undeveloped.
N5D	Barrigada Antenna Site	55 acres (22 ha)	Barrigada	Navy transmitter antenna (since demolished) and small communications building were vacated in the 1980s. Four homes built by squatters exist on the north end. Remainder of land is undeveloped.

**Table 2.1-1: Surplus Navy Properties** *(continued)*

Parcel No.	Name	Approx. Area	Municipality	Description
<b>CENTRAL REGION</b>				
N10A	Nimitz Hill Enlisted Housing	120 acres (49 ha)	Asan	78 housing units (Navy Enlisted Housing), swimming pool, ball field, and Quonset Hut 191 were vacated in 1995-1996.
N10B	Nimitz Hill Vacant Lands	183 acres (74 ha)	Asan	Land is undeveloped except for an operating Navy Public Works Center Sewage Pumping Station.
N12A	Sasa Valley	9 acres (4 ha)	Piti	Undeveloped land is steeply sloped and heavily vegetated.
N12B	Tenjo Vista	559 acres (226 ha)	Piti	Undeveloped land contains wetlands and areas of steep slope. Active petroleum pipelines underlie the parcel.
N14	Polaris Point	82 acres (33 ha)	Piti	Paving and concrete berms cover the majority of the parcel's south end. Building 412 (vacant) is on south end. Vegetation and wetlands comprise the parcel's north end.
<b>SOUTHERN REGION</b>				
N15	New Apra Heights	102 acres (41 ha)	Santa Rita	Undeveloped land is characterized by steep slopes.
N16	Route 2A	15 acres (6 ha)	Santa Rita	Paved property contains foundations from demolished building. Parcel is leased as temporary location for GovGuam bus parking and material storage area.
N17	Afleje (Rizal) Beach	16 acres (6 ha)	Santa Rita	Beachfront site is heavily vegetated. GovGuam Department of Parks and Recreation leases the parcel for park use. The parcel contains a concrete foundation, roadway, and partially buried pipeline extending to the ocean.
N18	Old Apra Heights	13 acres (5 ha)	Santa Rita	Undeveloped parcel parallels Route 17 and is traversed by several access roads to neighboring residences.
N19A	Navy Ordnance Annex North (NAVMAG North)	50 acres (20 ha)	Santa Rita	Undeveloped land has steep slopes and dense vegetation.
N19B	Navy Ordnance Annex North Housing (NAVMAG North)	52 acres (21 ha)	Santa Rita	17 housing units (in 9 buildings), vacated in 1994, are surrounded by well-maintained landscaping. Remainder of parcel is undeveloped with dense vegetation.
<b>TOTAL</b>		<b>2,798 acres (1,132 ha)</b>		

Over one-third of the land to be conveyed, or 1,003 acres (406 hectares), is proposed for parks and recreation, historical, and conservation use. Residential development also predominates as a proposed land use. GEDA recommends resort, industrial, commercial, and agricultural land uses for the remaining land. In addition, all alternatives incorporate regional roadway improvements as proposed by the GovGuam Department of Public Works in the *Guam 2010 Highway Master Plan*.

The alternative recommended by GEDA is Navy's Preferred Alternative. Aquaculture use of the Polaris Point parcel under the Preferred Alternative is an exception to the GEDA's recommended industrial use of the site. As the parcel is zoned low intensity (District 2) and is subject to various site constraints (potential for flooding and proximity to sensitive habitat and marine resources), industrial use was limited to the Higher Intensity Alternative.

The proposed land uses for the Preferred Alternative as well as the Higher and Lower Intensity alternatives are detailed in the tables and figures located at the end of this section.

### 2.1.3 Development Constraints

**Highway Expansion.** As most of the properties abut major roadways, each of the reuse alternatives incorporates roadway improvements. Except for approximately 23 acres (9.3 hectares) of roadway easement proposed on the NAS Officers Housing parcel, acreages for highway expansion were not estimated in GEDA's *Reuse Plan*, as the Department of Public Work's roadway layout will ultimately take into account topography, land usage, and other site specific constraints. In this EIS, highway improvements are mentioned once under the Preferred Alternative and not repeated in the text for the remaining alternatives.

**Easements.** Deeds of conveyance may contain access, utility, and other restrictions to allow continued use of the property by the U.S. government and third parties that have a real estate interest in the lands or would be land-locked by the conveyance. As required, the deeds will contain other restrictions on land use to protect future use of adjacent government lands. The conditions include easements for utilities and access, building height limits to prevent interference with the Air Force weather warning system, the Next Generation Weather Radar (NEXRAD), requirements for buffers or construction and maintenance of fence lines to adjacent military areas, and Navy's retention of certain buildings on the transferred properties.

**Site Constraints.** The GEDA *Reuse Plan* took into consideration natural and man-made constraints that would affect future use and designated appropriate land uses to match site conditions. For example, conservation or park use is proposed in areas that contain sensitive habitat, steep slopes, flood plains, or significant cultural sites. During site investigations for this EIS, additional constraints and easements were identified that may influence a property's development potential, such as roadway widening, golf course safety zones, or incompatible land use (e.g., former landfills at Barrigada).

### 2.1.4 I Tanò-ta

Development intensities for each land use alternative were derived from standards listed in Guam's *I Tanò-ta*. The *I Tanò-ta*, passed as Public Law 24-171 on April 17, 1998, is effective as of April 17, 1999. *I Tanò-ta* includes the following documents: *Final Land Use Plan*, *Zoning Code*, *Zoning Maps*, and a *Five-Year and 25-Year Land Use Map*.

**District Controls.** *I Tanò-ta: The Land Use Plan for Guam* “provides a framework to manage growth and development in the Territory of Guam” by directing development into areas served by public services (infrastructure, community resources, recreation), protecting environmentally sensitive lands, allocating land use to stimulate economic expansion and diversification, and promoting affordable housing.

*I Tanò-ta* is based on a land use intensity system of eight zoning districts.<sup>1</sup> The districts are mapped on two plans: the *Guam Five-Year Zoning Plan*, which provides for growth consistent with public service and planned capital improvements, and the *Guam 2015 Generalized Land Use Plan*, reflecting a 25-year planning horizon. Most intensity districts allow a mixture of uses and specify intensity rather than type of use within each district. The *GEDA Reuse Plan*, however, specifies land use types and refers to the *I Tanò-ta* zoning district for intensity.

In order to determine the development density for each reuse alternative, the *GEDA Reuse Plan* land uses were matched to descriptions of the corresponding uses in the designated *I Tanò-ta* Zoning District. According to the *I Tanò-ta Five Year Zoning* and *2015 Land Use* plans, the GLUP property land use designations are in the following Intensity Districts:

RESORT	District 2:	Low Intensity
	District 3:	Moderate Intensity
INDUSTRIAL	District 3:	Moderate Intensity
	District 4:	High Intensity
COMMERCIAL	District 2:	Low Intensity
	District 3:	Moderate Intensity
	District 4:	High Intensity
RESIDENTIAL	District 2:	Low Intensity
	District 3:	Moderate Intensity
AGRICULTURAL	District 2:	Low Intensity
	District 3:	Moderate Intensity
PARKS or RECREATION or HISTORIC or CONSERVATION	District 1:	Parks
	District 2:	Low Intensity
	District 3:	Moderate Intensity

In general, the districts are characterized by the following types of development:

**District 1:** Territorial parks and recreation facilities, natural and conservation reserves, and sites for preservation of historic and cultural resources on lands owned by GovGuam and the National Park Service’s War in the Pacific National Historical Park.

**District 2:** Low intensity areas which accommodate low-density residential, active and passive recreational facilities, neighborhood-oriented commercial, agriculture, aquaculture, and public services.

**District 3:** Moderate intensity areas that are serviced by current or planned public sewer and potable waterlines. This district allows larger residential subdivisions, limited office, active and passive recreational facilities, smaller-scale hotels, and community or neighborhood-oriented

<sup>1</sup> The eight zoning districts are: (1) parks; (2) low intensity or low intensity marine; (3) moderate intensity; (4) high intensity; (5) village or neighborhood centers or (5H) historic or village centers; (6) urban or district center; (7) hotel or resort; and (8) industrial or port facilities.

commercial facilities, agriculture and aquaculture, public and limited government service facilities.

**District 4:** High intensity district located primarily on arterial highways comprising higher intensity residential, hotel, and a full range of commercial, wholesale trade, public utility, and recreational activities. This district is serviced by current or planned public sewer and potable water systems.

Discrepancies between the GEDA *Reuse Plan* and *I Tanò-ta* land use designations exist for Tenjo Vista and the Navy Ordnance Annex North parcels. *The Zoning and Land Use Plans* indicate "military land" designations, which are not covered under GovGuam intensity district standards. To determine how urban quality would be controlled at these properties, descriptions of the GEDA reuse alternatives were matched to uses permitted in various *Zoning Code* districts, at which point an intensity district was assumed for the property. Intensity Districts 1 and 3 were assigned to Tenjo Vista conservation and commercial uses; low to moderate Intensity Districts 2 and 3 were assigned for the Navy Ordnance Annex North recreational and alternative residential uses.

At the Polaris Point parcel, proposed moderate to high intensity industrial use is in conflict with the *I Tanò-ta* low intensity, District 2 designation. In order to match land use densities, this EIS assumes aquaculture activity on a portion of the property, a GEDA-recommended land use option. Industrial use appears to be reasonable for the Higher Intensity Alternative given the site's proximity to the Port Authority of Guam.

**Performance Standards.** Land use performance standards are an integral component of the *I Tanò-ta Zoning Code*. The standards apply to specific types of development regardless of district. In estimating densities of the land use alternatives for this EIS, performance standards relevant to future development include guidelines for: residential development, neighborhood commercial uses, open space and recreation requirements, nonresidential site planning, parking requirements, hillside development, environmentally sensitive areas, historic and cultural conservation, protection of prime agriculture lands, storm water management and flood plain protection, and landscaping.

### 2.1.5 Market and Economic Adjustment

Current market conditions were considered in estimating the densities of each reuse alternative. Development to the maximum allowed under *I Tanò-ta* zoning would be dependent on market demand. In light of the recent downturn in Asian economies (Japan, in particular), impacts that may occur by maximum build-out are likely to be stretched out over a 20- to 25-year period or longer. Land use densities were adjusted downward from maximums allowed by zoning for the reuse alternatives.

## 2.2 ALTERNATIVES

### 2.2.1 GEDA Recommended Alternative (Navy Preferred Alternative)

The Preferred Alternative is based on GEDA's recommended land uses at densities allowed within *I Tanò-ta* zoning limits, adjusted to reasonable densities based on Guam's current development market and projected population growth.

**Northern Region.** The northern region encompasses the Dededo and Tamuning municipalities. Five GLUP properties totaling 821 acres (332 hectares) are located in the north, as indicated on Figure 2.2-1. Proposed reuse is outlined in Table 2.2-1 and illustrated in Figures 2.2-2 through 2.2-6 at the end of this chapter.

Golf-related resort development and a large residential subdivision are the preferred alternatives for the expansive, relatively undeveloped FAA Housing property. Conservation and recreation use would protect cliff line habitat, cultural resources, and limestone forests.

Building 50 at the Harmon Annex parcel would be renovated as a community center. Route 3 is proposed to expand from two lanes to three to five lanes.

Moderate- to high-intensity commercial development would be concentrated along the two Marine Drive properties. Reconstruction and the addition of sidewalks are proposed for Marine Drive.

Single-family residential development and a neighborhood commercial center are proposed for the NAS Officers Housing parcel at its north edge. The Laderan Tiyan Parkway is proposed to provide alternate access across the Tiyan plateau from the A. B. Won Pat Guam International Airport and would link to a proposed north-south bypass road leading to Marine Drive. The parkway was proposed as a Tamuning Bypass Long Range Improvement Project in Guam's *2010 Highways Master Plan*. The alignment shown in Figure 2.2-6 has been approved by GEDA. Funding has not yet been obtained for the parkway and no construction completion date has been established.

**Barrigada Region.** Moderate-intensity development would replace the generally undeveloped 773 acres (313 hectares) of land that previously served as military communication facilities. Refer to Figures 2.2-7 and 2.2-8 and Table 2.2-2 at the end of this chapter. Substantial residential development of affordable single-family housing units is planned at two Barrigada parcels. The subdivisions would occupy land south of the Navy's Admiral Nimitz Golf Course and along Route 15. The Barrigada municipality Sports Complex north of Route 8 would be expanded. Agriculture activities administered by the Guam Department of Agriculture would remain south of Route 8. Hawaiian Rock Products would continue to support their quarrying operations from a small parcel south of Route 15. New industrial warehouse storage is proposed adjacent to their facility and adjacent to the National Guard facility. Highway widening is proposed for sections of Routes 8, 15, and 16.

**Central Region.** Development in the central region, comprising 953 acres (386 hectares), would be concentrated at Nimitz Hill, as detailed in Table 2.2-3 and illustrated in Figures 2.2-9 through 2.2-13 at the end of this chapter. Commercial projects in the form of cultural activities would complement the Nimitz Hill region, while affordable and social services-related housing

is planned for existing housing areas. The majority of the central properties consist of steep slopes and contain wetlands and other sensitive natural and historic resources. Approximately two-thirds of the central region parcels would be preserved in conservation or low-impact park and recreation use. Limited commercial and industrial opportunities are present for properties fronting Marine Drive. GovGuam proposes widening portions of Route 1 (Marine Drive) and Route 6 (Halsey Drive).

**Southern Region.** The southern properties represent 248 acres (99 hectares) out of the 2,798 acres (1,132 hectares) to be conveyed. The southern region's parcels are characterized by a variety of environmental conditions, including rugged steep slopes, oceanfront location, and parcels with wetlands. Sensitive natural resources limit development on certain parcels to conservation, park, and recreational use. However, commercial use is proposed at the previously developed Route 2A parcel and adjacent residential communities at the Old Apra Heights parcel. Refer to Table 2.2-4 and Figures 2.2-14 through 2.2-19 at the end of this chapter for land uses. Roadway improvements are recommended by GovGuam for sections of Routes 5, 17, and 2A.

## 2.2.2 Lower Intensity Alternative

The Lower Intensity Alternative reduces development densities of the Preferred Alternative or eliminates certain development, reflecting potentially slower economic growth on the island. This alternative would involve less new construction and use of the property. Tables 2.2-1 through 2.2-4 at the end of this chapter outline the land use densities (number of residential and hotel units, square footage of commercial and industrial development, etc.). Land use is based on *I Tanò-ta* zoning and is similar to the Preferred Alternative for all properties, unless listed below:

**Northern Region.** The existing building on the Harmon Annex parcel would be renovated into a smaller community center or office building. Small-scale commercial development would be built at both the Marine Drive Utility and Tamuning Telephone Exchange parcels. Single-family residential subdivisions totaling approximately 265 units at the FAA Housing parcel and 52 units at the NAS Officers Housing parcel would be constructed. One resort hotel is proposed for the FAA Housing parcel. No golf course development would occur.

**Barrigada Region.** Residential subdivisions and industrial and warehouse facilities proposed for the Barrigada parcels would be reduced to half of the Preferred Alternative (approximately 800 single-family housing units and 65,000 square feet [6,084 square meters] of warehouse storage). Commercial development would be scaled back near the residential areas under the Lower Intensity Alternative. No expansion of the existing Barrigada Sports Complex would occur.

**Central Region.** No new housing would be constructed to augment renovation of existing housing at the Nimitz Hill Enlisted Housing parcel; 65 new multi-family housing units would be constructed at the Nimitz Hill Vacant Lands parcels. Proposed commercial complexes would decrease in size by 40 to 50 percent from the Preferred Alternative, to 50,000 square feet (4,645 square meters).

Rather than expanding the Guam Veterans Cemetery, the Lower Intensity Alternative for the Sasa Valley parcel would be to preserve it as open space for public hiking or recreational use or to leave it in conservation. Similarly, conservation and recreational use would be indicated

for the entire Polaris Point parcel under the Lower Intensity Alternative, rather than development of aquaculture or industrial facilities.

**Southern Region.** The Lower Intensity Alternative would eliminate all but park and recreation, historical, and conservation use of the New Apra Heights, Rizal/Afleje Beach, and Navy Ordnance Annex North parcels. A small neighborhood commercial center (2,500 square feet [232 square meters]) would be developed at the Old Apra Heights parcel, and the youth camp development at the Navy Ordnance Annex parcel would be reduced in size from the Preferred Alternative.

### 2.2.3 Higher Intensity Alternative

Development densities would increase from the Preferred Alternative under the Higher Intensity Alternative. Development in some cases would approach the maximum allowed under *I Tanò-ta* zoning limits. Industrial use of certain properties would be expanded. This alternative would involve more new construction and use of the property. Tables 2.2-1 through 2.2-4 at the end of this chapter outline the comparative land use densities. Land use based on *I Tanò-ta* is generally similar to the Preferred Alternative, except for the properties listed below.

**Northern Region.** Residential, hotel units, and golf course development would increase by approximately 30 percent from the Preferred Alternative. Over 500 single- and multi-family housing units would be developed on each of the parcels at FAA Housing and NAS Officers Housing. A higher intensity use of the Harmon Annex property would be to expand Building 50 to serve as an educational or office building or a regional community recreation center. Commercial development at the Tamuning Telephone Exchange and the Marine Drive Utility parcels would be maximized to over 255,000 square feet (23,690 square meters) combined. However, due to site constraints, higher intensity development may require relocation of existing electrical lines that cross the Marine Drive Utility parcel.

**Barrigada Region.** A higher-intensity use of the Barrigada properties than proposed under the Preferred Alternative would be to increase the number and density of residential units to 2,940 homes. Residential development would be expanded to the northern N5A parcel, adjacent to the Navy golf course. Neighborhood commercial centers, small guest houses, and community recreational facilities are included in this alternative. Industrial or warehouse space would be maximized to 460,000 square feet (42,734 square meters) and agricultural activities would expand into existing open space.

**Central Region.** Residential development would increase by 25 to 50 percent over the Preferred Alternative to 452 single- and multi-family units at the Nimitz Hills parcels. Commercial projects would increase to 207,000 square feet (19,230 square meters) at the Nimitz Hill Vacant Lands and Tenjo Vista parcels. Recreation and community facilities (such as a library and police substation) would be constructed at the Nimitz Hill Enlisted Housing parcel, and a larger expansion of the Guam Veterans Cemetery is proposed at the Sasa Valley parcel.

GEDA-recommended industrial use would be considered for the Polaris Point property under this alternative. Although not zoned for industrial use, the parcel is relatively flat and located near the Port Authority of Guam.

**Southern Region.** Introducing residential development would increase land use intensity of the New Apra Heights and Navy Ordnance Annex North properties; over 300 single-family

affordable housing units would be proposed for New Apra Heights and 72 affordable multi-family or townhouse units at the Navy Ordnance Annex North parcels. Commercial development would be maximized to 110,000 square feet (10,219 square meters) at the Route 2A and Old Apra Heights parcels. At the Rizal/Afleje Beach property, GPA has expressed interest in the site for a new baseload-generating power plant.

#### **2.2.4 “No Action” Alternative**

The “No Action” Alternative assumes that Navy would retain ownership of the properties. The properties would remain in caretaker status with Navy maintaining the physical condition of the property, providing a security force, and making repairs essential to safety. There would be no land disposal, no redevelopment of the properties, and no roadway improvements within Navy property. Existing leases to GovGuam for use of the Barrigada Sports Complex, Rizal/Afleje Beach Park, and Department of Agriculture Experimental Station in Barrigada would continue according to their terms, as well as leases with Hawaiian Rock Products. Refer to Tables 2.2-2 and 2.2-4 at the end of this chapter.

### **2.3 SUMMARY OF POTENTIAL IMPACTS**

Criteria for evaluating potential impacts and determining their significance are specified in 40 C.F.R. 1508.27. Significance is determined by the intensity or severity of the impact and the context in which it occurs. Intensity criteria are based on relative changes:

- in public health and safety;
- to unique characteristics of the geographic area, such as visual quality, prime agricultural land, archaeological sites, wetlands, and ecologically critical areas;
- in the potential for environmental or scientific controversy;
- involving unique, uncertain, or unknown risks;
- that may establish a precedent for future actions or represent a decision in principle about a future consideration;
- in cumulative impact;
- affecting sites or districts listed in or eligible for the National Register of Historic Places (NRHP) or causing loss or destruction of significant scientific, cultural, or historic resources;
- likely to have an adverse effect on threatened or endangered species or their habitat; or
- in the potential for violating federal, state, or local laws or requirements that are in place to protect the environment.

In addition, 40 C.F.R. 1508.27 states that the significance of an impact should be assessed in the context of society as a whole, affected interests, and/or the affected region and locality. The size of the area potentially affected defines the appropriate context or area of influence for each resource. Duration of impact should also be considered.

No significant direct impacts would result from Navy’s disposal of approximately 2,798 acres (1,132 hectares) of surplus property on Guam. With the exception of traffic and air quality impacts at one northern region intersection under all reuse alternatives, all indirect and cumulative impacts could be mitigated so that they are not significant. Cumulative impacts relating to housing, population, school enrollment, and infrastructure capacity would require a long-term commitment by GovGuam to fund major improvements and ongoing maintenance.

## Comparison of Alternatives

Table 2.2-5 presents a summary of potential environmental impacts for each alternative. Of those impacts identified, the following are considered potentially significant for all reuse alternatives based on the above criteria, as well as criteria specific to each type of impact. Most can be mitigated to avoid or reduce the impacts to less than significant. Mitigation of reuse-related impacts would be a local responsibility.

The following is a list of the potential reuse-related impacts.

- Increase in the quantity of storm water runoff for northern region, Barrigada residential, Nimitz Hill, and Route 2A parcels.
- Flood hazard for Tamuning Telephone Exchange, Barrigada N5A, Tenjo Vista, Polaris Point, Route 2A, and Rizal/Afleje Beach parcels.
- Infrequent carbon monoxide (CO) air quality exceedences of National Ambient Air Quality Standards (NAAQS) at one northern region traffic intersection.
- Land use conflicts at New Apra Heights, Barrigada residential, and Rizal/Afleje Beach parcels under the Higher Intensity Alternative.
- Noise impact on proposed housing at NAS Officers Housing parcel from vehicular traffic associated with Laderan Tiyan Parkway and at the Barrigada residential parcel from Hawaiian Rock Products operations.
- Impact on site eligibility for listing on the National Register of Historic Places (NHRP).
- Impact on wetland habitat for the endangered Mariana common moorhen on Tenjo Vista parcel.
- Traffic congestion at key intersections in the northern, Barrigada, and southern regions.
- Cumulative solid waste disposal impact and decrease in life span of proposed new landfill.
- Increased demand on public services in the Barrigada region associated with new affordable housing development.
- Increase in the current excess inventory in the commercial and industrial real estate markets.
- Regional increase in public school enrollment.

## Environmentally Preferred Alternative

The "No Action" Alternative has less potential for causing adverse environmental impacts. However, under this alternative, Navy would retain ownership and liability for surplus property. This alternative would not result in more efficient operations or lower operational costs. It would not foster economic development and would not create new jobs.

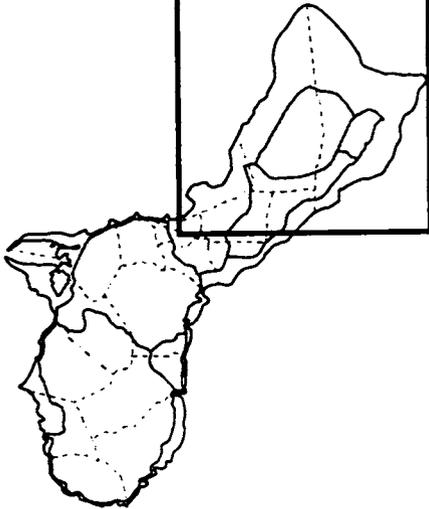
## Navy Preferred Alternative

The GEDA-recommended alternative (Section 2.2.2), approved by Governor Carl T. C. Gutierrez of Guam, is Navy's Preferred Alternative. It would be consistent with the intent of President Clinton's Five-Point Plan: "A Program to Revitalize Base Closure Communities." As stated above, traffic and air quality impacts in the northern region would be the only significant impacts that could not be mitigated to nonsignificant levels.

**LEGEND**

-  GLUP Reuse Parcels (Guam Land Use Plan '94)
-  Highway
-  Municipality Boundary
-  Main Community

**GUAM NORTHERN REGION**



Philippine Sea

FAA HOUSING (N2)

HARMON ANNEX (N3)

MARINE DRIVE UTILITY (N4B)

NAS OFFICERS HOUSING (N8)

TAMUNING TELEPHONE EXCHANGE (N4C)

Tamuning

Barrigada

Yigo

Dededo

Pacific Ocean

0 1000 2000 3000

SCALE IN METERS

0 5,000 10,000

SCALE IN FEET



NORTH

Source: Department of Navy (April 1995)  
Guam Land Use Plan Update.

**Figure 2.2-1  
NORTHERN REGION MAP**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

Table 2.2-1: Northern Region Reuse Alternatives and Land Use Assumptions

Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	Notes
N2	FAA HOUSING	LOW TO MODERATE INTENSITY ZONING DISTRICTS 2, 3	Reduce hotel rooms to 64 units.	Three hotels (guest room total of 192)	Under Zoning District 3, large resorts are not permitted. Hotels are limited to 2 acres (0.8 ha), 64 guest rooms per development.
		Two small hotels or bungalows (128 guest rooms total) Golf Course: 18-hole golf course on 225 acres (91 ha) with open space for future 9 holes	Replace golf course or clubhouse with open space.	Expand golf course to 27 holes on 337 acres (136 ha); increase golf clubhouse meeting and retail areas.	Demolition of 89 FAA housing units began in 1998. All units will be demolished by 2001 due to Typhoon Paka damage. Accordingly, expressions of interest for these units from Catholic Social Services and GHURA were not considered.
N3	HARMON ANNEX Park and Recreation	Affordable single-family housing (1,500 sf per unit [139 m <sup>2</sup> ]) phased at 100 to 200 units at a time for 390 units total	Develop first phase of affordable single-family units on larger lots or at slower rate.	Approximately 500 single-family affordable units	
		Neighborhood recreation facilities or facilities for management of historic or natural features Conservation or limited recreation at cliff side Upgrade Route 3 from 2-lane to 3 to 5 lanes.	Similar to Preferred Alternative Similar to Preferred Alternative Similar to Preferred Alternative	Similar to Preferred Alternative Similar to Preferred Alternative Similar to Preferred Alternative	
		MODERATE INTENSITY ZONING DISTRICT 3	Renovate existing 12,400 sf (1,152 m <sup>2</sup> ) Building 50 for community center or for use by government entity providing utility service.	Redevelop larger (60,000 + sf [5,574 m <sup>2</sup> ]) building for recreation, educational, or office facility.	
		Upgrade Route 3 from 2-lane to 3 to 5 lanes.	Similar to Preferred Alternative	Similar to Preferred Alternative	

Table 2.2-1: Northern Region Reuse Alternatives and Land Use Assumptions (continued)

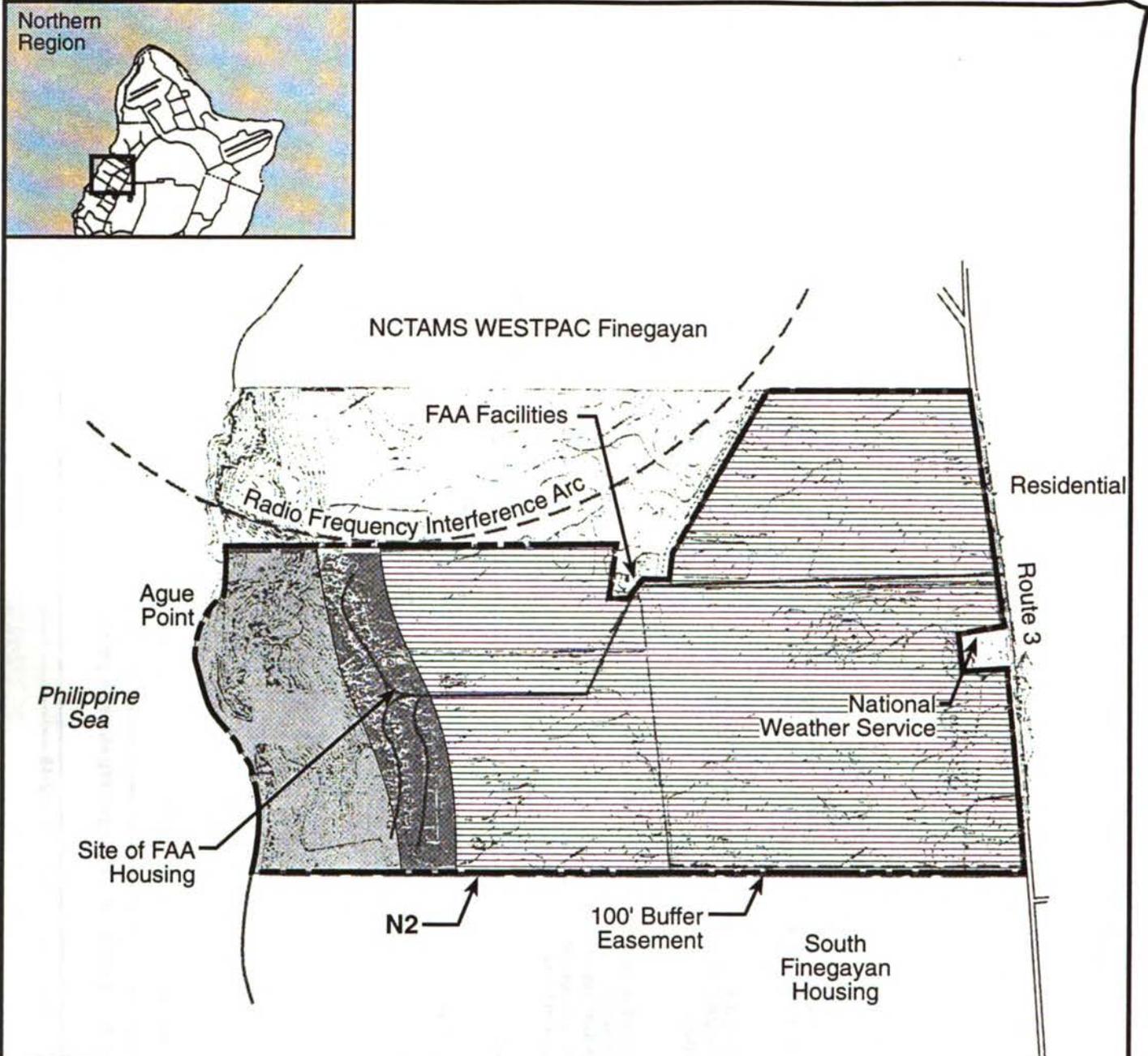
Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	Notes
N4B	MARINE DRIVE UTILITY  Commercial	MODERATE INTENSITY ZONING DISTRICT 3  Existing electrical substation will be transferred from the Navy to Guam Power Authority under a Customer Service Agreement (CSA).	Similar to Preferred Alternative	Similar to Preferred Alternative	Electrical lines or easement cross diagonally across the length of the proposed commercial development, reducing access and development area by one-third.
		Commercial development (150,000 sf (13,935 m <sup>2</sup> )) including reuse of Stars and Stripes office building  Reconstruct Route 1; add sidewalks; upgrade Route 3 from 3 lanes to 5 lanes.	Lower intensity commercial development (90,000 sf (8,361 m <sup>2</sup> ))  Similar to Preferred Alternative	Higher intensity commercial development (200,000 sf + (18,580 m <sup>2</sup> ), assuming relocation of electrical lines)  Similar to Preferred Alternative	
N4C	TAMUNING TELEPHONE EXCHANGE  Commercial	HIGH INTENSITY ZONING DISTRICT 4  Demolish existing buildings to construct new commercial development (27,000 sf (2,508 m <sup>2</sup> )).	Lower intensity (17,000 sf (1,579 m <sup>2</sup> )) commercial or office development for public agency or private company	Full range of high intensity commercial, office, hotel or motel development (55,000 sf (5,110 m <sup>2</sup> ))	

Table 2.2-1: Northern Region Reuse Alternatives and Land Use Assumptions (continued)

Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	Notes
	NAS OFFICERS HOUSING	HIGH INTENSITY ZONING DISTRICT 4			
	Residential	Demolish existing housing to construct high-value multi-family housing (anticipated selling price of \$250,000); 200 units (1,600 sf [248m <sup>2</sup> ]) total.	High-value single-family units (anticipated selling price of \$250,000) on large lots; 52 units total	Affordable multi-family town house units (anticipated selling price of \$140,000 to \$200,000); 576 units total	Building height limit imposed by FAA due to airport clearance zones
	Commercial	Renovate Navy Post Exchange building for neighborhood commercial (12,000 sf [1,115 m <sup>2</sup> ]) building and add more parking.	Similar to Preferred Alternative.	Redevelop larger commercial office center (87,000 sf [8,082 m <sup>2</sup> ]) on site of Navy Post Exchange.	
	Roadway	Construction of Laderan Tiyan Parkway (6-lane high-speed roadway serving regional traffic from Route 8 to proposed north-south bypass road leading to Marine Drive and having a design capacity of up to 40,000 vehicles per day). Right-of-way would be 120 ft (37 m) wide.	Similar to Preferred Alternative	Similar to Preferred Alternative	

Sources:

1. Based on Revised Plan for CLUP '94 Navy Properties. GEDA. October 1996.
2. I Tano-la Land Use Plan and Zoning Code. Public Law 24-171. GovGuam. April 17, 1998.
3. Guam 2010 Highway Master Plan (Short Range and Recommended Long Range Improvement Projects). GovGuam PWC. July 1992.
4. Draft EIS for the Disposal and Reuse of NAS Agana, Guam (Department of Navy), April 1999.

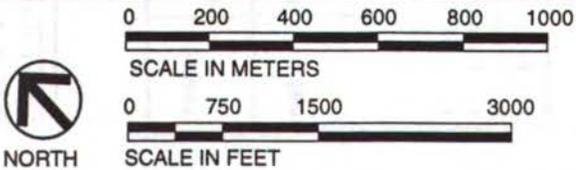


**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Residential	70 ac (28.4 ha)	Same	Same
Resort	488 ac (197.6 ha)	Same	Same
Parks/Rec./Hist./Conservation	140 ac (56.7 ha)	Same	Same
	<b>Total</b> 698 ac (282.7 ha)		

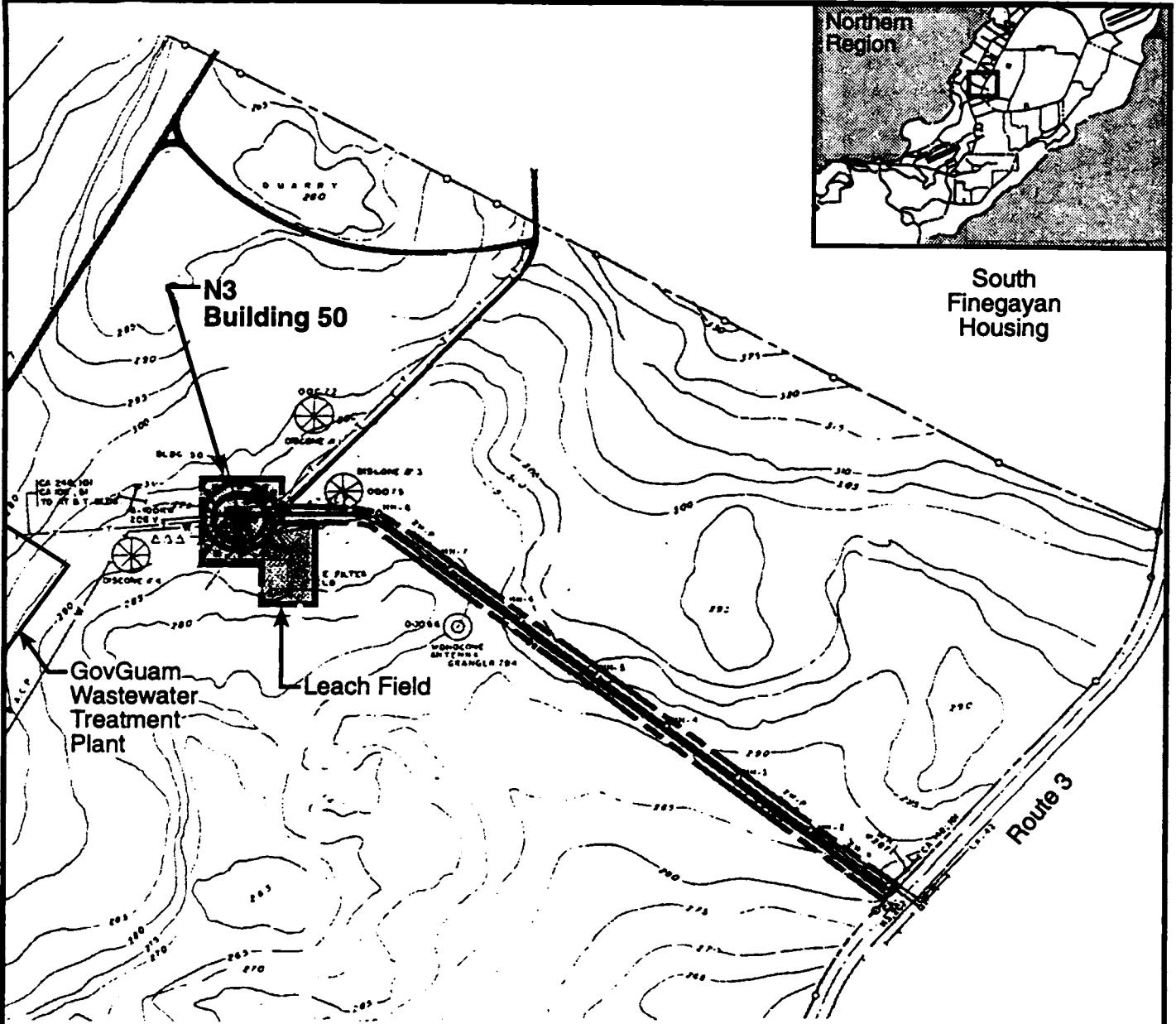
--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-2**  
**FAA HOUSING PARCEL N2**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Parks/Rec./Hist./Conserv.	7 ac (2.8 ha)	7 ac (2.8 ha)	7 ac (2.8 ha)
	Option	Lower Intensity Alternative	Higher Intensity Alternative
	Commercial	7 ac (2.8 ha)	7 ac (2.8 ha)

--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



NORTH

0 100 200 300 400 500



SCALE IN METERS

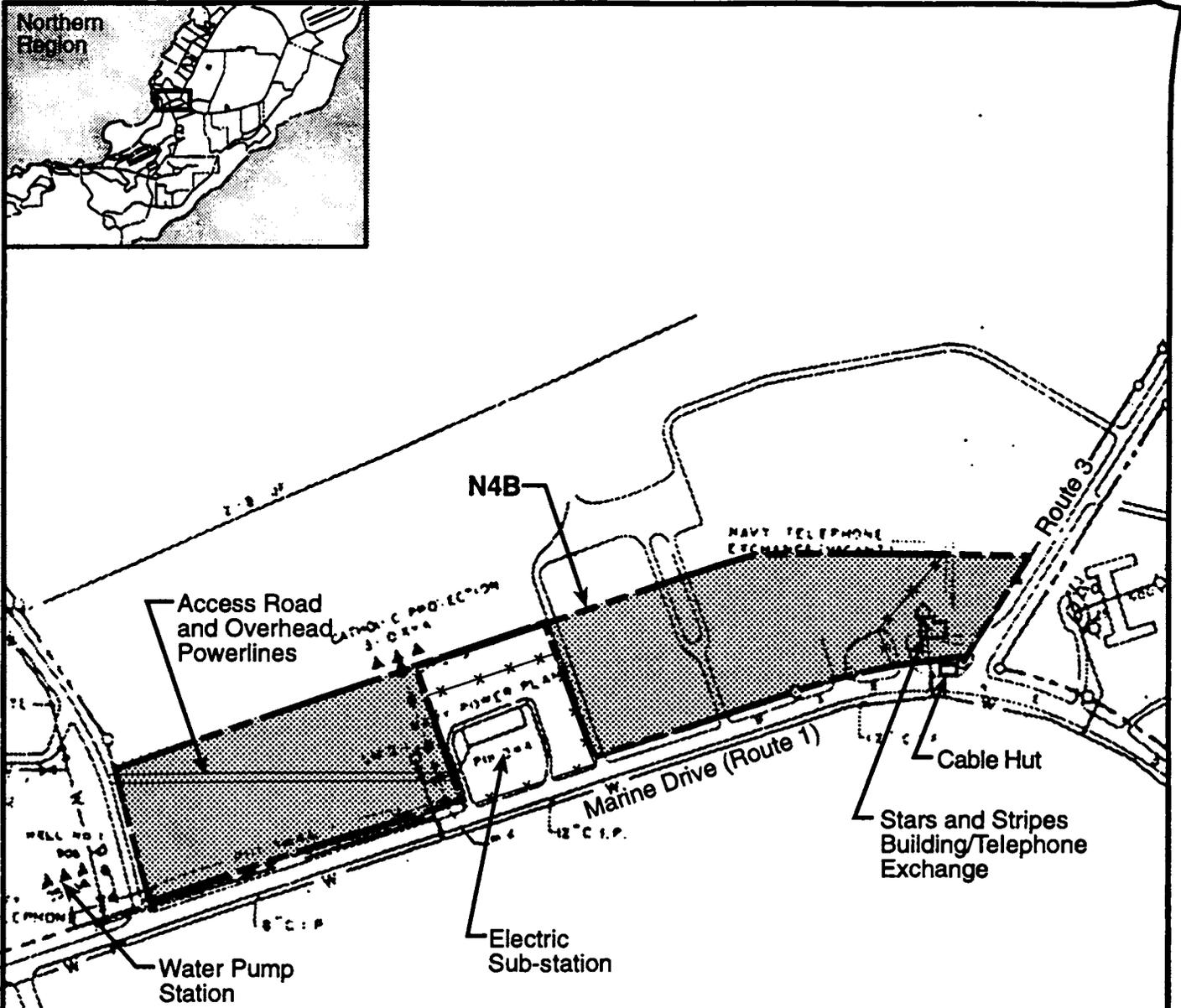
0 400 800 1600



SCALE IN FEET

**Figure 2.2-3  
HARMON ANNEX PARCEL N3  
REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

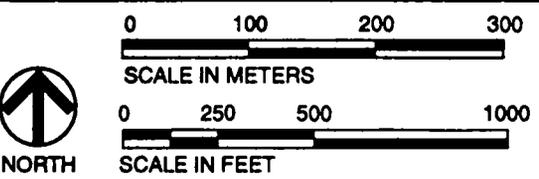


**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Commercial	25.0 ac (10 ha)	Same	Same

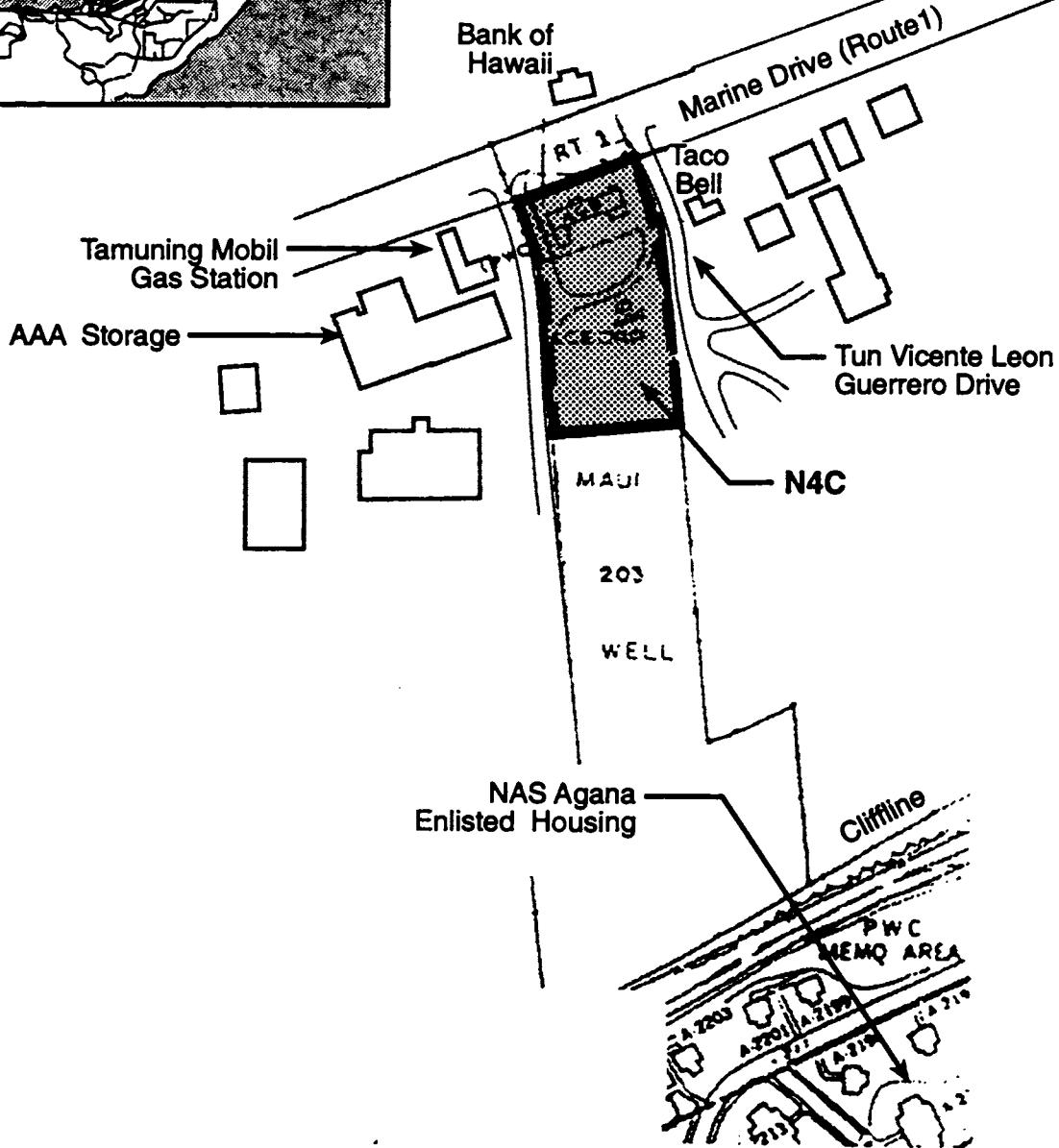
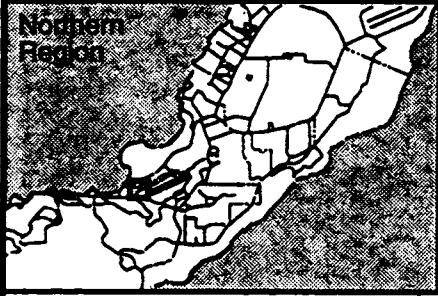
--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-4**  
**MARINE DRIVE UTILITY (WETTENGEL JUNCTION)**  
**PARCEL N4B REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



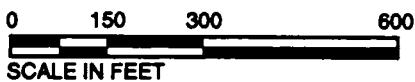
**LEGEND**

**Land Uses**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
 Commercial	2 ac (.8 ha)	Same	Same

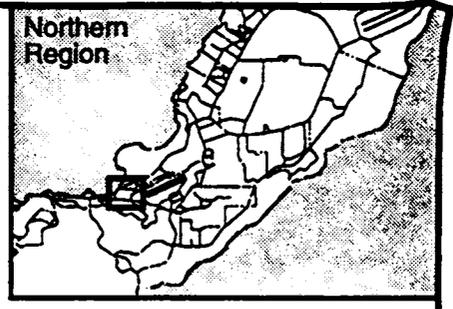
 Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-5**  
**TAMUNING TELEPHONE EXCHANGE PARCEL N4C**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

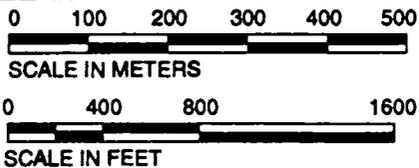
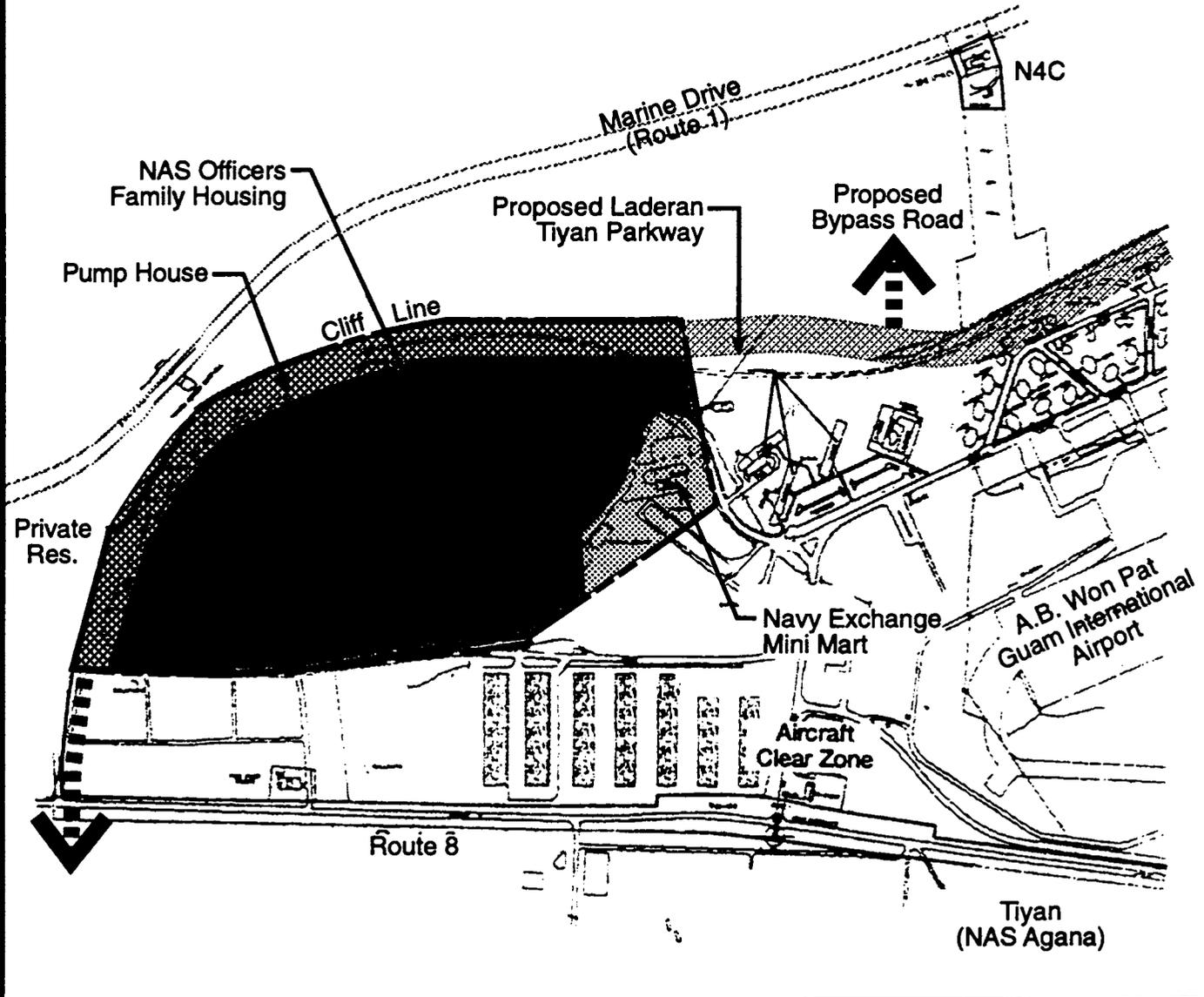


**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Residential	59 ac (24.0 ha)	Same	Same
Commercial	10 ac (4.0 ha)	Same	Same
Roadway	23 ac (9.3 ha)	Same	Same
<b>Total</b>	<b>92 ac (37.3 ha)</b>		

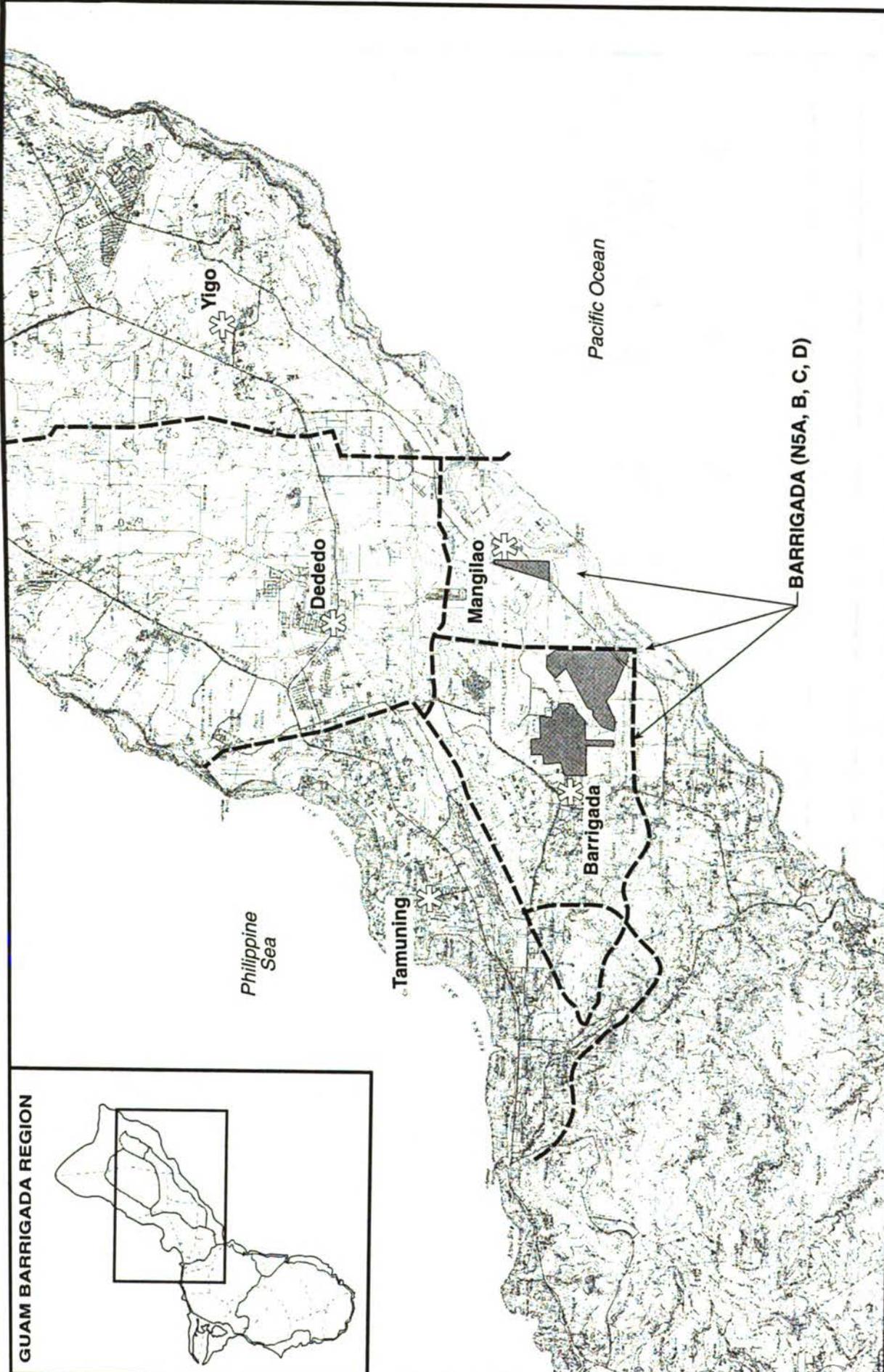
--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-6**  
**NAS OFFICERS HOUSING PARCEL**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**Figures 2.2-7**  
**BARRIGADA REGION MAP**  
 EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property on Guam

**LEGEND**

- GLUP Reuse Parcels (Guam Land Use Plan '94)
- Highway
- Municipality Boundary
- Main Community

**SCALE IN METERS**  
 0 1000 2000 3000

**SCALE IN FEET**  
 0 5000 10,000

**NORTH**

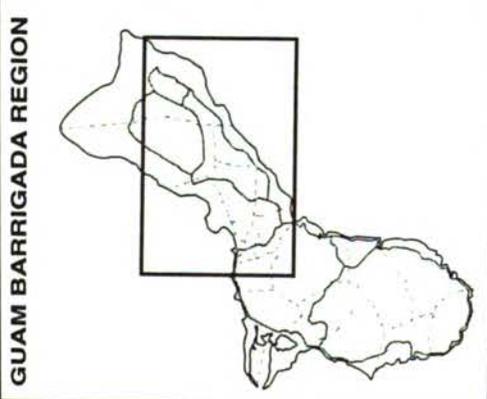


Table 2.2-2: Barrigada Region Reuse Alternatives and Land Use Assumptions

Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity	Higher Intensity	Notes
<b>BARRIGADA (NCTAMS BARRIGADA)</b>					
<b>N5</b>					
<b>NSA</b>	<b>BARRIGADA ROUTE 16</b> Industrial Agriculture Parks and Recreation	<b>LOW TO MODERATE INTENSITY ZONING DISTRICTS 1,3,4</b>	Lower intensity industrial or warehouse facilities (50,000 sf [4,654 m <sup>2</sup> ]) No expansion of existing sports complex Similar to Preferred Alternative Similar to Preferred Alternative	Higher intensity industrial or warehouse facilities (400,000 sf [37,160 m <sup>2</sup> ]) Major expansion of existing sports complex, joint Navy or GovGuam expansion of Navy golf course Agricultural use, plus 10 acres (4 ha) affordable single-family residential development. Similar to Preferred Alternative	Under "No Action," existing leases of subparcels to GovGuam Department of Agriculture, and GovGuam Department of Parks and Recreation would continue according to their terms.
		North of Route 8: industrial or warehouse (100,000 sf [9,290m <sup>2</sup> ]) Recreation use on 42 acres (17 ha) (22 acres [8.9 ha] existing and 20 acres [8.1 ha] expansion) for GovGuam Barrigada Sports Complex South of Route 8: expand Guam Department of Agriculture activities Widen Route 16 to 5 to 7 lanes. Reconstruct additional connector and reserve property for future Route 8 expansion to 5 to 6 lanes.			
		<b>MODERATE INTENSITY ZONING DISTRICT 3</b>			
<b>NSB</b>	<b>BARRIGADA ROUTE 15</b> Residential	Affordable single-family housing, 1,500 units (typical 1,500 sf per unit [139 m <sup>2</sup> per unit]) phased at 100 to 200 units at a time Widen Route 8 to 5 or 6 lanes. Widen Route 15 to 2 or 3 lanes.	Slower phased residential development; assume 1/2 of Preferred Alternative Similar to Preferred Alternative	Increase density of residential development to 10 Density Units per acre, totaling 2,000 to 2,500 housing units. Add 64-unit guest house and neighborhood commercial (20,000 sf [1,858 m <sup>2</sup> ]). Similar to Preferred Alternative	Preferred Alternative: residential development to accommodate projected 3% annual population growth rate in Barrigada and Mangilao

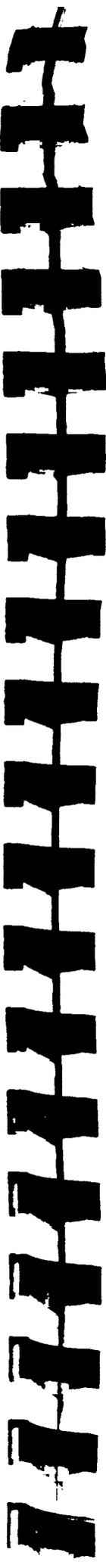
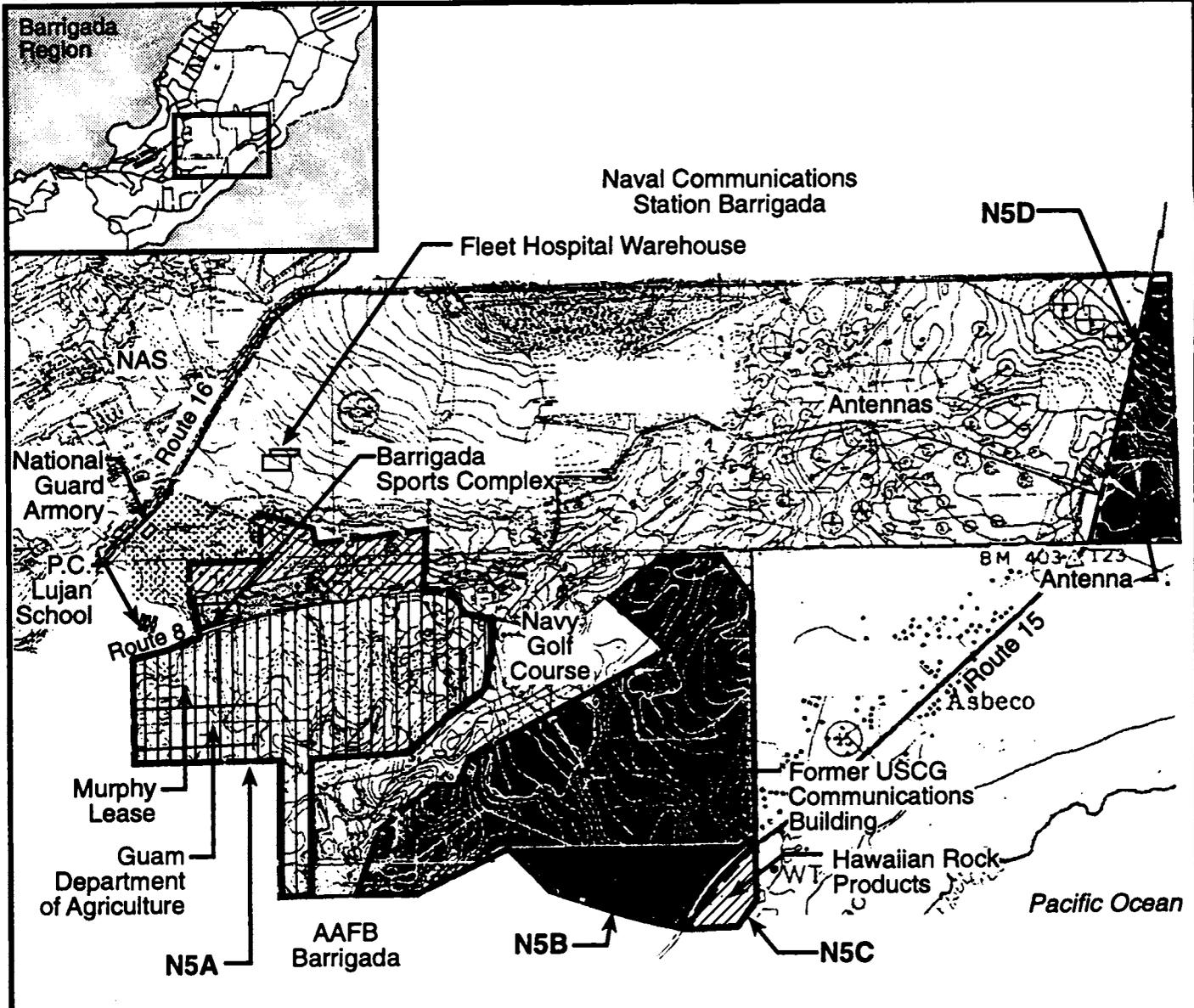


Table 2.2-2: Barrigada Region Reuse Alternatives and Land Use Assumptions (continued)

Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity	Higher Intensity	Notes
NSC	BARRIGADA HAWAIIAN ROCK  Industrial	MODERATE TO HIGH INTENSITY ZONING DISTRICT 3			
		Continue Hawaiian Rock Products quarry support operations on 6.5 acres (2.6 ha). Industrial (warehouse) facilities on remainder of property (30,000 sf [2,787 m <sup>2</sup> ]) Widen Route 8 to 5 or 6 lanes. Widen Route 15 to 2 or 3 lanes.	Similar to Preferred Alternative  Reduce industrial facilities to 15,000 sf (1,393 m <sup>2</sup> ).  Similar to Preferred Alternative	Similar to Preferred Alternative  Increase industrial use to 60,000 sf (5,574 m <sup>2</sup> ).  Similar to Preferred Alternative	Under no action, existing lease to Hawaiian Rock Products would continue according to their terms.
NSD	BARRIGADA ANTENNA SITE  Residential	Moderate Intensity Zoning District 3			
		Single-family affordable housing (220 units) at 100 units per phase Small-scale neighborhood commercial development (10,000 sf [929 m <sup>2</sup> ]) Widen Route 8 to 5 or 6 lanes. Widen Route 15 to 2 or 3 lanes.	Lower density affordable single-family housing (88 units)  None  Similar to Preferred Alternative	Double residential development to 440 units.  Increase neighborhood or limited commercial to 20,000 sf (1,858 m <sup>2</sup> ); add small-scale motel or guest house and community recreation facilities.  Similar to Preferred Alternative	Preferred Alternative: residential development accommodates projected 3% annual population growth rate in Barrigada/Mangilao.

Sources:

1. Based on Revised Plan for GLUP '94 Navy Properties. GEDA. October 1996.
2. I Tanò-ta Land Use Plan and Zoning Code. Public Law 24-171. GovGuam. April 17, 1998.
3. Guam 2010 Highway Master Plan (Short Range and Recommended Long Range Improvement Projects). GovGuam PWC. July 1992.
4. Draft EIS for the Disposal and Reuse of NAS Agana, Guam (Department of Navy), April 1999.



**LEGEND**

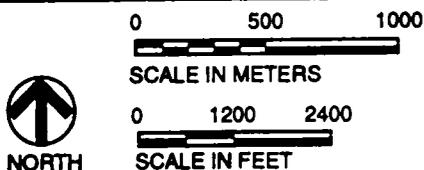
 Retained Federal Land (National Guard Bureau): 50 ac (20 ha)

**Land Uses**

	N5A	Preferred Alternative N5B	N5C	N5D	Lower Intensity Alternative N5A - N5D	Higher Intensity Alternative N5A - N5D
 Residential	-	358 ac (145.0 ha)	-	55 ac (22.3 ha)	Same	Same, add commercial (neighborhood or office)
 Parks/Rec./Hist./Conserv.	40 ac (16.2 ha)	-	-	-	Same	Same
 Industrial	60 ac (24.2 ha)	-	15 ac (6.1 ha)	-	Same	Same
 Agriculture	245 ac (99.2 ha)	-	-	-	Same	Same
<b>Total</b>	<b>345 ac (139.6 ha)</b>	<b>358 ac (145.0 ha)</b>	<b>15 ac (6.1 ha)</b>	<b>55 ac (22.3 ha)</b>		

 Parcel Boundary

Source: Guam Land Use Plan Update, DOD, Department of Navy (April 1995); GEDA Reuse Plan for GLUP '94 Navy Properties, (October 1996)



**Figure 2.2-8  
BARRIGADA PARCELS N5A, B, C, D  
REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

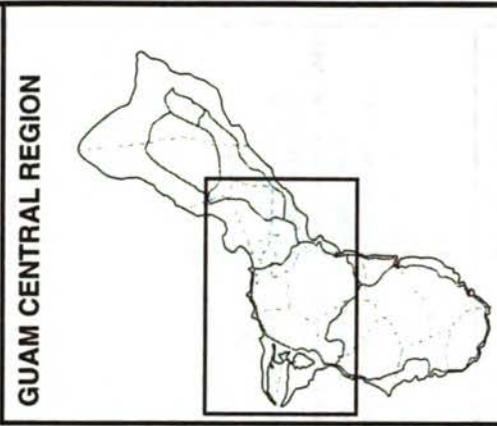
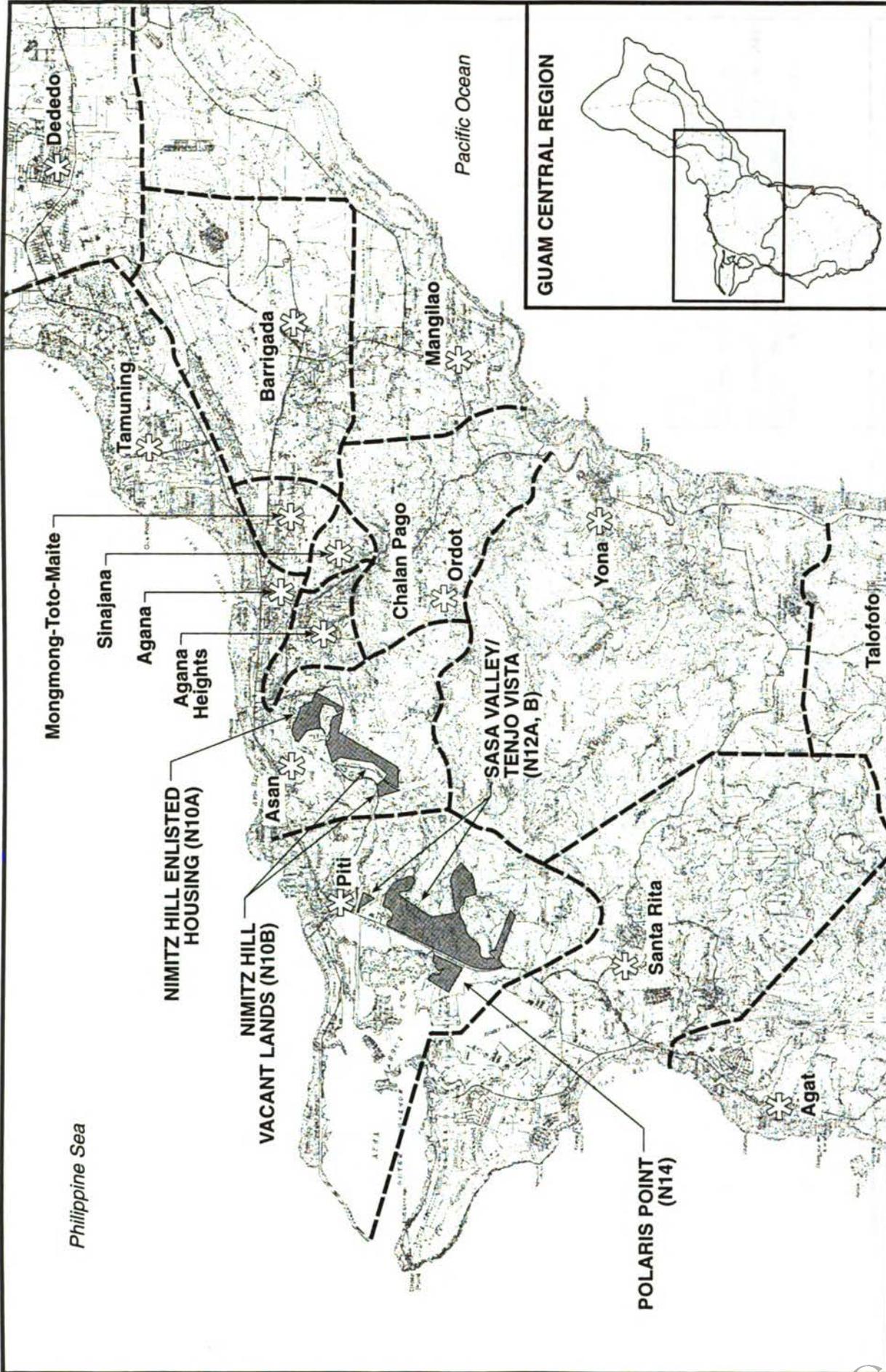


Figure 2.2-9  
CENTRAL REGION MAP

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

**LEGEND**

- GLUP Reuse Parcels (Guam Land Use Plan '94)
- Highway
- Municipality Boundary
- Main Community

NORTH

0 1 2 3  
SCALE IN KILOMETERS

0 5,000 10,000  
SCALE IN FEET

Table 2.2-3: Central Region Reuse Alternatives and Land Use Assumptions

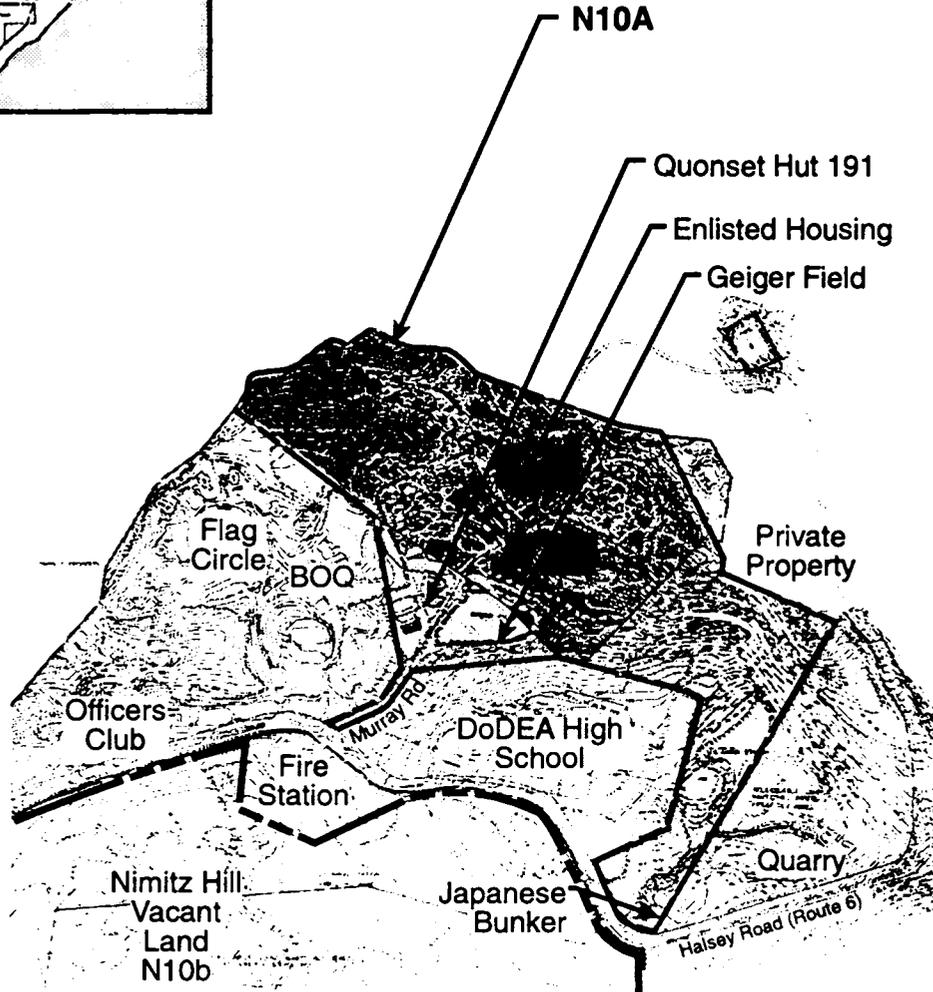
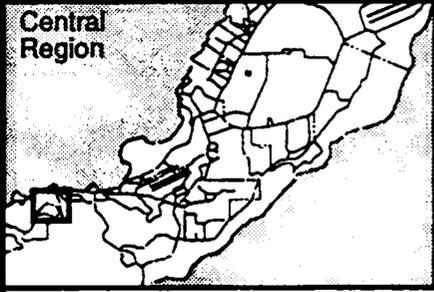
Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity	Higher Intensity	Notes
N110A	NIMITZ HILL ENLISTED HOUSING Residential Recreation Historic and Conservation	MODERATE INTENSITY ZONING DISTRICT 3	Renovate existing housing units with no new construction.	Retain existing housing and construct additional 224 single- and multi-family affordable units.	Remaining land for historic and conservation use (steep slopes and historic features)
		Renovate existing (78) housing units for affordable housing and construct 80 additional single- or multi-family units.	Develop lower intensity sports and recreation facilities (15,000 sf (1,393 m <sup>2</sup> )).	Develop community facilities (library, recreation center, police substation, snack shop) using existing facilities and building an additional 35,000 sf (3,251 m <sup>2</sup> ).	
		Retain existing pool and sports fields for public recreation, estimated at 20,000 sf (1,858 m <sup>2</sup> ) of facilities.			
		Widen Halsey Road to 5 lanes.			
N10B	NIMITZ HILL VACANT LANDS Residential Commercial or Parks and Recreation Historic and Conservation	PARK & MODERATE INTENSITY ZONING DISTRICTS (2), 3			
		Community, cultural, and commercial development (100,000 sf (9,290 m <sup>2</sup> )) along Route 6, including modest hotel, community shopping centers, theaters, museum, and art galleries	Reduce commercial development to 1/2 of Preferred Alternative.	Increase commercial development to 147,000 sf (13,656 m <sup>2</sup> ).	
		Recreational hiking trails and conservation use in middle one-third of property	Similar to Preferred Alternative	Similar to Preferred Alternative	
		Affordable townhouse development (< 100 units) on each side of Mount Alutom Road	Reduce townhouse development to 65 units.	Increase townhouse development to 150 units.	
		Widen Route 6. Widen Halsey Road to 5 lanes. Widen portions of Mount Alutom Road.	Similar to Preferred Alternative	Similar to Preferred Alternative	
N12A	SASA VALLEY Parks and Recreation Conservation	PARK & LOW INTENSITY ZONING DISTRICTS 1,2			
		Expand Guam Veterans Cemetery. Conservation land on steep, highly vegetated areas	Conservation use or open space, hiking trails, parking lot	Increase expansion of Guam Veterans Cemetery.	
		Widen Marine Drive to 5 lanes (Polaris Point access to Route 2A).	Similar to Preferred Alternative	Similar to Preferred Alternative	

Table 2.2-3: Central Region Reuse Alternatives and Land Use Assumptions (continued)

Property	Zoning and Proposed Land Use	Preferred Alternative	Lower Intensity	Higher Intensity	Notes
N12B	TENJO VISTA	CONSERVATION & MODERATE INTENSITY ZONING DISTRICTS 8 (1,3)			
	Commercial Conservation	Commercial (small retail centers of 30,000 sf (2,787 m <sup>2</sup> ) fronting Marine Drive Conservation use of majority of site due to wetlands, steep slopes, wildlife habitats, and historic sites Widen Marine Drive to 5 lanes (Polaris Point access to Route 2A).	Reduce to 20,000 sf (1,858 m <sup>2</sup> ) commercial center. Similar to Preferred Alternative Similar to Preferred Alternative	Increase to 60,000 sf (5,574 m <sup>2</sup> ) commercial center. Similar to Preferred Alternative Similar to Preferred Alternative	
N14	POLARIS POINT	CONSERVATION & LOW INTENSITY ZONING DISTRICTS 2, 8			
	Industrial or Parks or Recreation or Conservation	Low intensity use such as agriculture or aquaculture or marine facilities (in keeping with I Tano-ta Zoning District 2: Low Intensity). Assume 20-acre (8-ha) commercial aquaculture farm. Park or recreation or conservation use of eastern half of property north of Polaris Point Road due to presence of wetlands Widen Marine Drive to 5 lanes (Polaris Point access to Route 2A).	Preserve entire site for conservation and recreation facilities with pavilion, picnic areas, hiking trails, parking. Similar to Preferred Alternative Similar to Preferred Alternative	Full industrial use (100,000 sf (9,290 m <sup>2</sup> )) due to proximity to Port Authority of Guam Similar to Preferred Alternative Similar to Preferred Alternative	

Sources:

1. Based on Revised Plan for GLUP '94 Navy Properties. GEDA. October 1996.
2. I Tano-ta Land Use Plan and Zoning Code. Public Law 24-171. GovGuam. April 17, 1998.
3. Guam 2010 Highway Master Plan (Short Range and Recommended Long Range Improvement Projects). GovGuam PWC. July 1992.
4. Draft EIS for the Disposal and Reuse of NAS Agana. Guam (Department of Navy). April 1999.



**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Residential	50 ac (20.3 ha)	Same	Same
Parks/Rec./Hist./Conservation	70 ac (28.3 ha)	Same	Same, add commercial (neighborhood or office)
	<b>Total</b> 120 ac (48.6 ha)		

Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
 GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.

0 100 200 300 600

SCALE IN METERS

0 300 600 1200

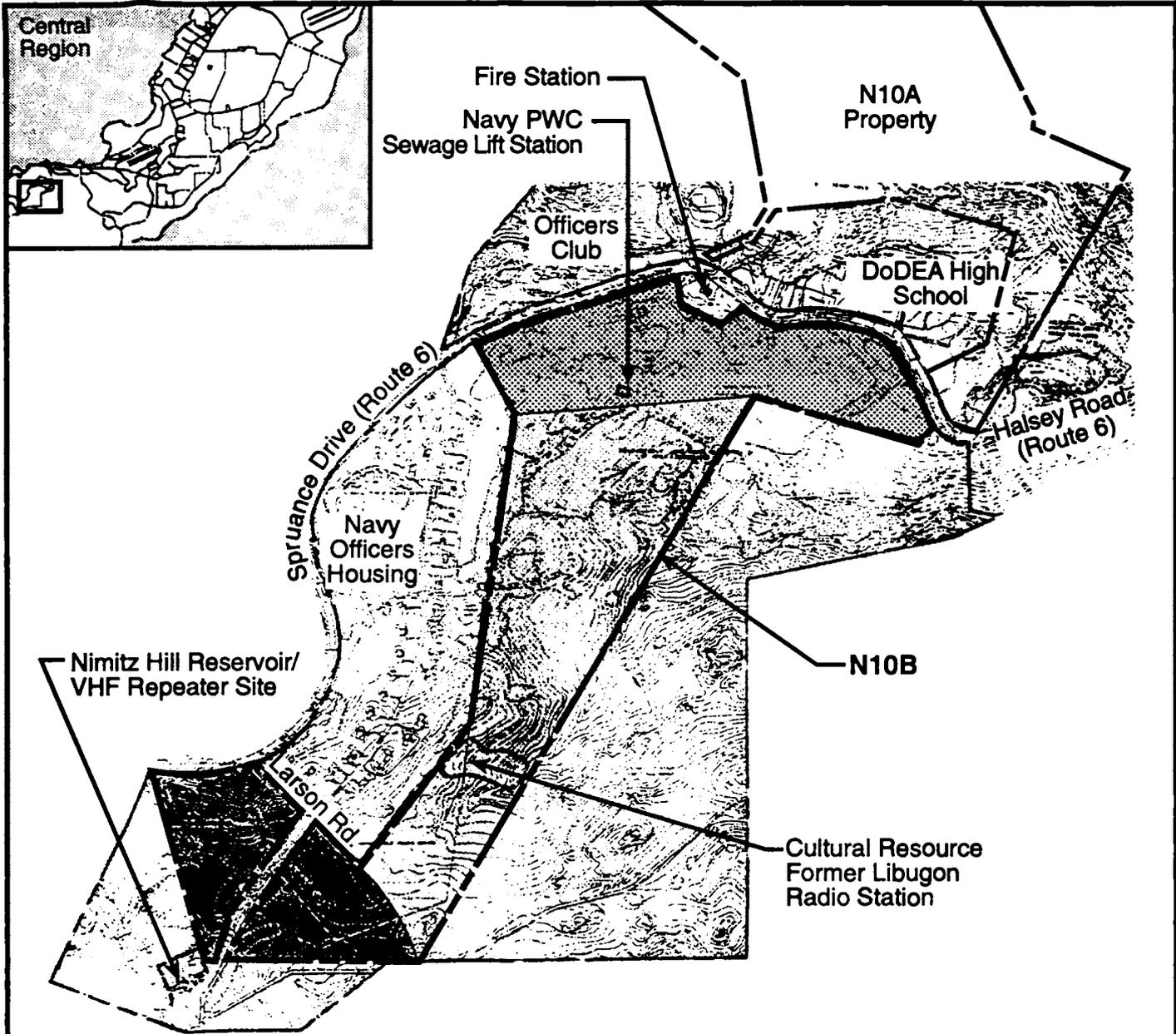
SCALE IN FEET



NORTH

**Figure 2.2-10**  
**NIMITZ HILL ENLISTED HOUSING PARCEL N10A**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property on Guam

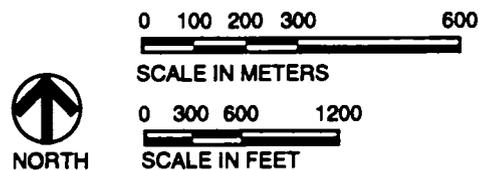


**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Residential	20 ac (8.1 ha)	Same	Same
Parks/Rec./Hist./Conservation	133 ac (53.8 ha)	Same	Same
Commercial	30 ac (12.1 ha)	Same	Same
	<b>Total</b>	<b>183 ac (74.0 ha)</b>	

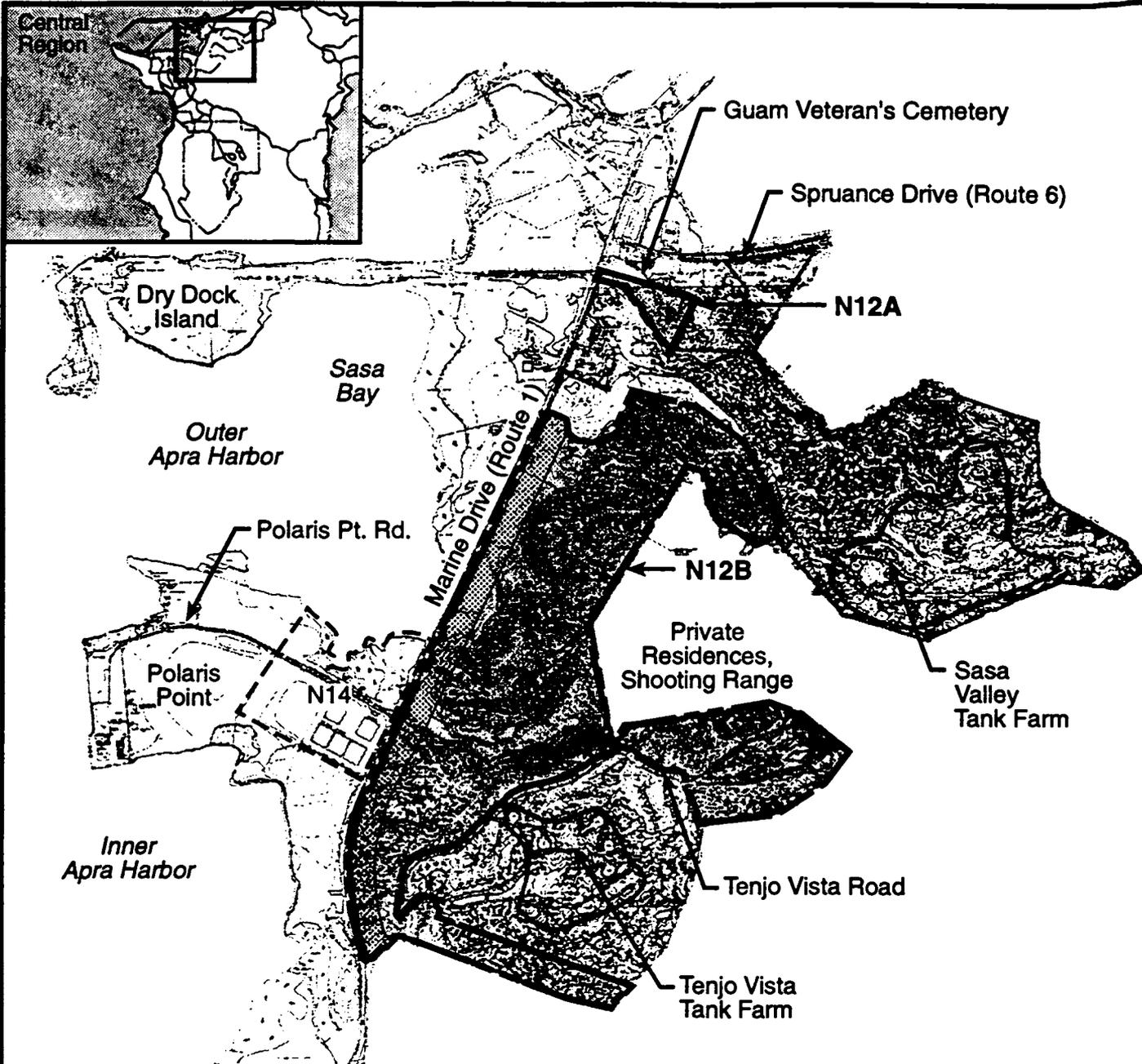
--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-11**  
**NIMITZ HILL VACANT LANDS PARCEL N10B**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**LEGEND**

**Land Uses**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
 Park/Rec./Hist./Conserv.	480 ac (194.4 ha)	Same	Same
 Commerical	70 ac (28.4 ha)	Same	Same
	<b>Total</b>	<b>550 ac (222.8 ha)</b>	

--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



NORTH

0 300 600 1200

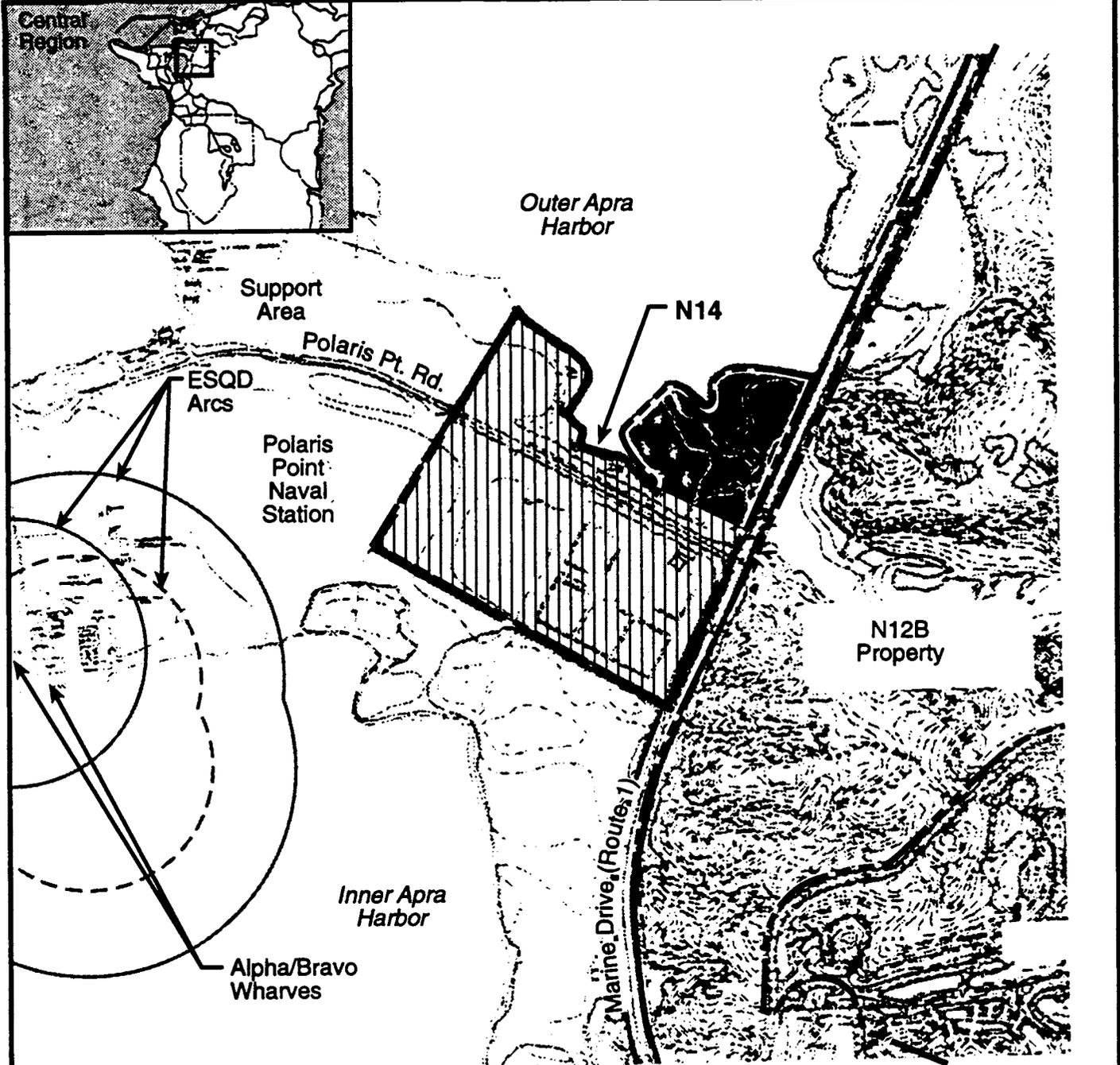
SCALE IN METERS

0 1200 2400 4800

SCALE IN FEET

**Figure 2.2-12**  
**SASA VALLEY/TENJO VISTA PARCEL N12**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



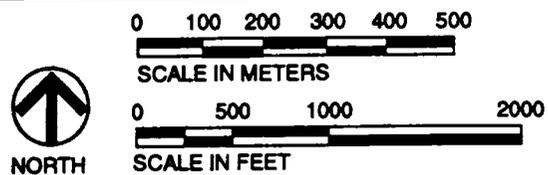
**LEGEND**

**Land Uses**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
Low Intensity (Aquaculture)	67 ac (27.1 ha)	None	67 ac (27.0 ha) Industrial
Conservation	15 ac (6.1 ha)	82 ac (33.0 ha)	15 ac (6.0 ha)
	<b>Total</b>	<b>82 ac (33.2 ha)</b>	

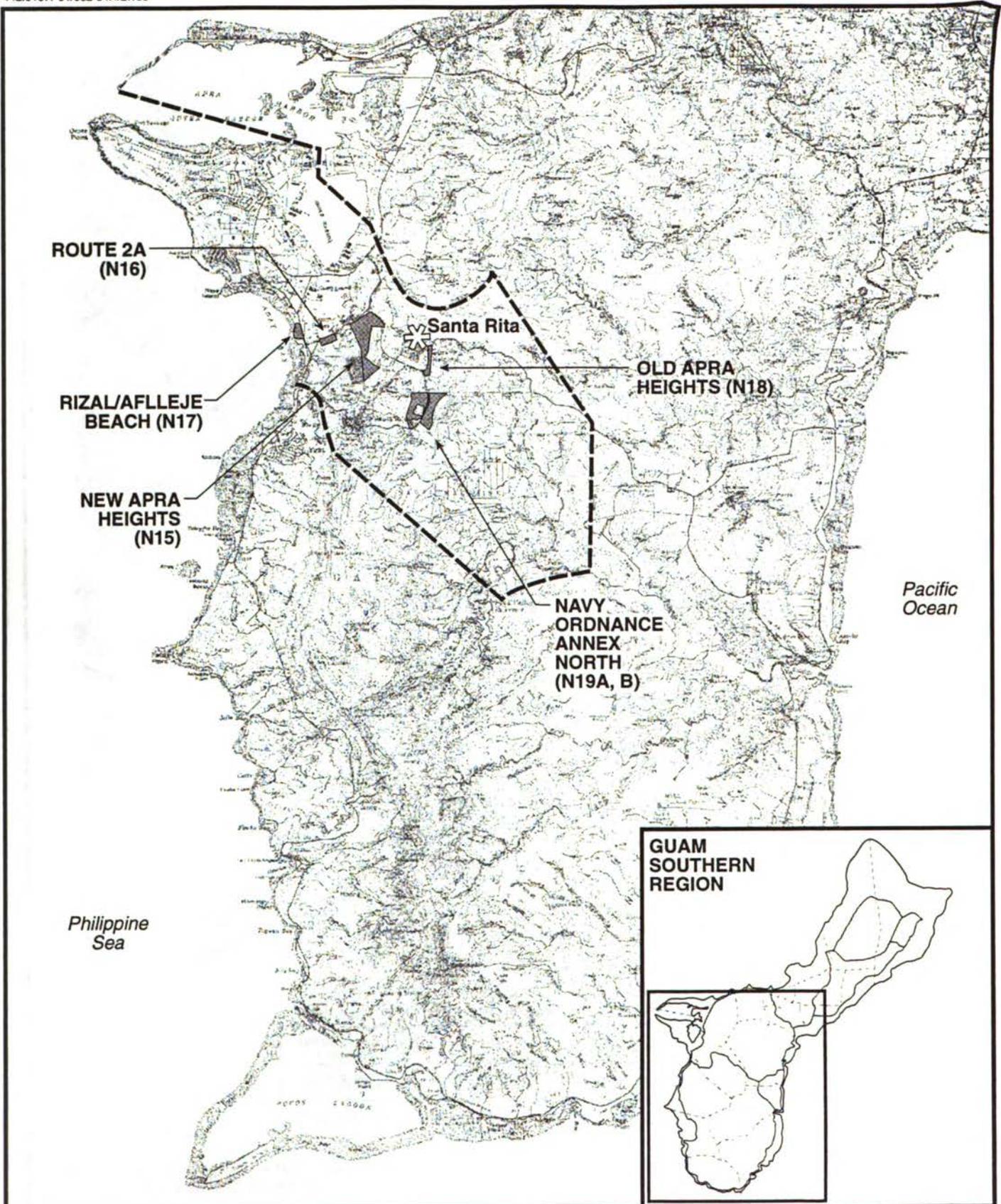
Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.

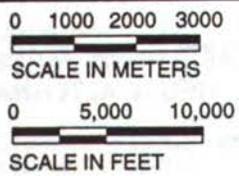


**Figure 2.2-13**  
**POLARIS POINT PARCEL N14**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



NORTH



**LEGEND**

-  GLUP Reuse Parcels (Guam Land Use Plan '94)
-  Highway
-  Municipality Boundary
-  Main Community

**Figure 2.2-14  
SOUTHERN REGION MAP**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

Table 2.2-4: Southern Region Reuse Alternatives and Land Use Assumptions

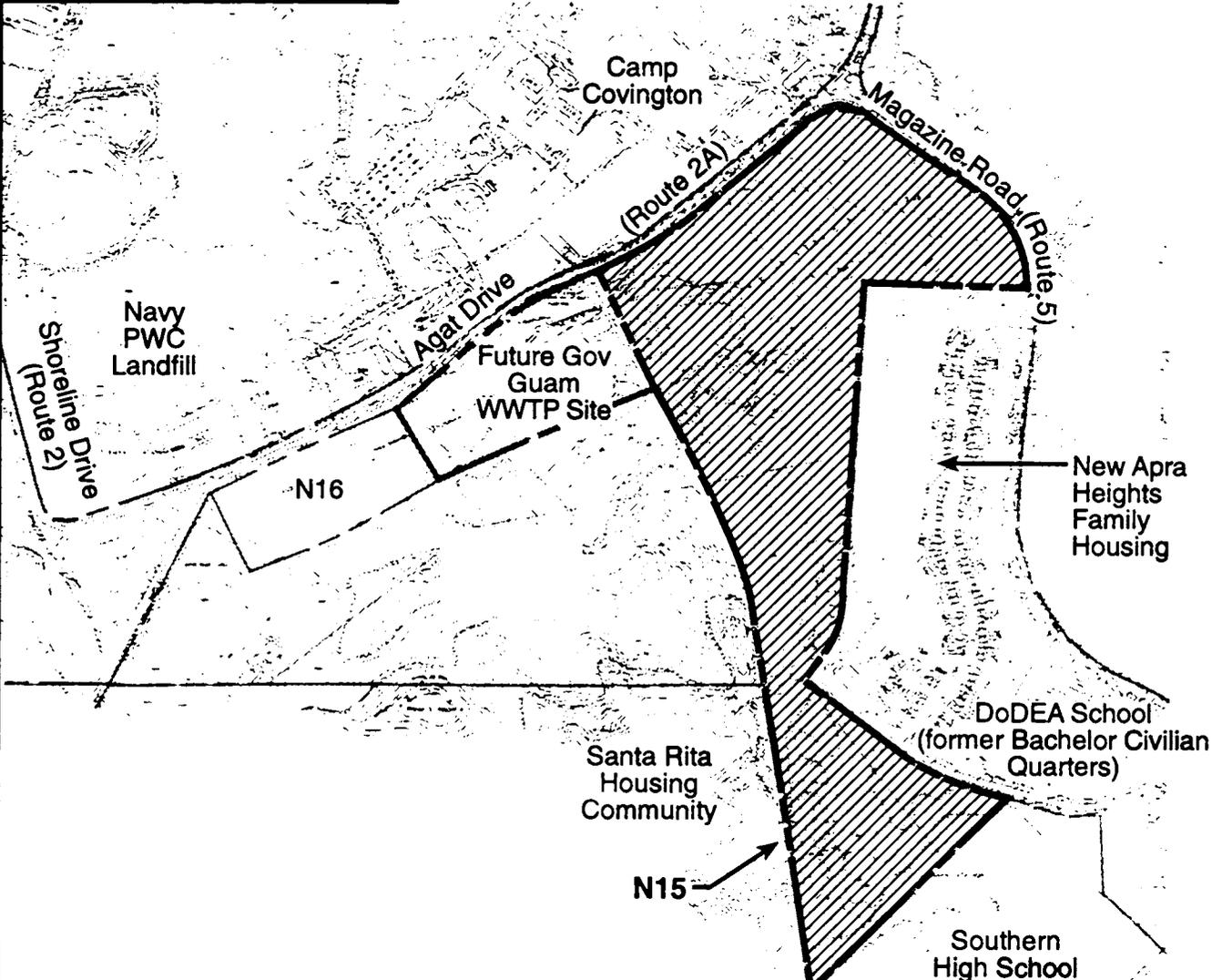
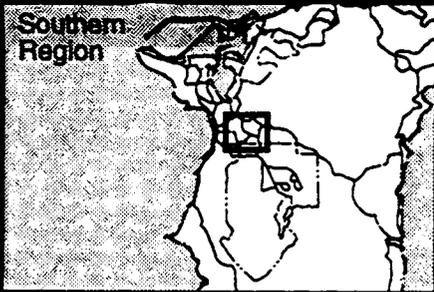
Property	Recommended Land Use	Preferred Alternative	Lower Intensity	Higher Intensity	Notes
N15	NEW APRA HEIGHTS Industrial Conservation	INDUSTRIAL & CONSERVATION ZONING DISTRICTS 3 (8)	Conservation use of entire site due to steep slope and potential for wetlands. No WWTP.	Construct 320 single-family affordable housing units.	
		Widen Route 5 to 5 lanes (from Route 2A [Agate Drive] to Route 17).	Similar to Preferred Alternative	Similar to Preferred Alternative	
N16	ROUTE 2A Commercial	MODERATE INTENSITY ZONING DISTRICT 3			
		Commercial or office development with services such as banking, retail, convenience stores (32,000 sf [2,973 m <sup>2</sup> ])	Reduce commercial development to 16,000 sf (1,486 m <sup>2</sup> ).	Full range of higher intensity commercial development (100,000 sf [9,290 m <sup>2</sup> ]).	Under no action, existing leases for bus parking and storage would continue.
N17	RIZAL/AFLLEJE BEACH Parks and Recreation or Conservation	Widen Route 2A [Agate Drive] to 3 lanes.	Similar to Preferred Alternative	Similar to Preferred Alternative	
		PARK ZONING DISTRICT 3 (2)	Conservation or public park for entire site. Retain existing pavilion and recreation facilities with little expansion.	GPA base load generating power plant on portion of site, park use on remaining area	Under "No Action," existing Recreation would continue according to its terms.
N18	OLD APRA HEIGHTS Commercial Industrial	Widen Route 2A [Agate Drive] to 3 lanes.	Similar to Preferred Alternative	Similar to Preferred Alternative	
		LOW TO MODERATE INTENSITY ZONING DISTRICT 3 (2)	One small neighborhood commercial or retail outlet at 2,500 sf (232 m <sup>2</sup> ), remainder for community park or playground	Increase commercial development to 10,000 sf (929 m <sup>2</sup> ).	Development area limited due to private housing access easement
N18		Small neighborhood commercial business (5,000 sf [465 m <sup>2</sup> ])	Similar to Preferred Alternative	Similar to Preferred Alternative	
		Existing electrical substation at south end of site to be transferred to GPA by Customer Service Agreement	Similar to Preferred Alternative	Similar to Preferred Alternative	
		Widen Route 5 to 5 lanes (from Route 2A [Agate Drive] to Route 17).	Similar to Preferred Alternative	Similar to Preferred Alternative	

Table 2.2-4: Southern Region Reuse Alternatives and Land Use Assumptions

Property	Recommended Land Use	Preferred Alternative	Lower Intensity	Higher Intensity	Notes
N19A	NAVY ORDNANCE ANNEX NORTH (West Parcel)  Parks or Recreation or Conservation	LOW TO MODERATE INTENSITY ZONING DISTRICTS 2, 3	Conservation use of entire property, with public access for recreation.	Recreation or youth camp facilities to the south, limited multi-family or townhouse residential development in north section	Development of northern end of property limited due to steep slopes
		Reconstruct Route 5 to modern design standards (2 lanes and passing lanes).	Similar to Preferred Alternative	Similar to Preferred Alternative	
N19B	NAVY ORDNANCE ANNEX NORTH (East Parcel)  Parks or Recreation or Conservation	LOW TO MODERATE INTENSITY ZONING DISTRICTS 2, 3			
		Reuse existing housing units for youth camp and construct community recreation facilities (11,000 sf [1,022 m <sup>2</sup> ]).	Conservation use and development of youth camp by renovating existing buildings	Expanded youth camp and community recreation facilities (20,000 sf [1,958 m <sup>2</sup> ]), limited multi-family or townhouse residential development in north section	Development of northern end of property limited due to steep slopes
		Reconstruct Route 5 to modern design standards (2 lanes and passing lanes).	Similar to Preferred Alternative	Similar to Preferred Alternative	

Sources:

1. Based on Revised Plan for CLUP '94 Navy Properties. GEDA. October 1996.
2. I Tanb-ta Land Use Plan and Zoning Code. Public Law 24-171. GovGuam. April 17, 1998.
3. Guam 2010 Highway Master Plan (Short Range and Recommended Long Range Improvement Projects). GovGuam PWC. July 1992.
4. Draft EIS for the Disposal and Reuse of NAS Agana, Guam (Department of Navy). April 1999.

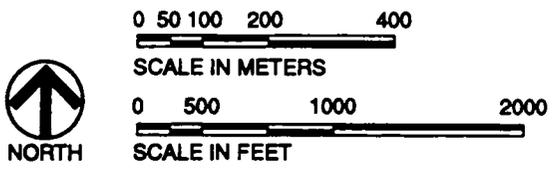


**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
 Industrial	102 ac (41.3 ha)	102 ac (41.3 ha) Conservation	102 ac (41.3 ha) Res. & Industrial

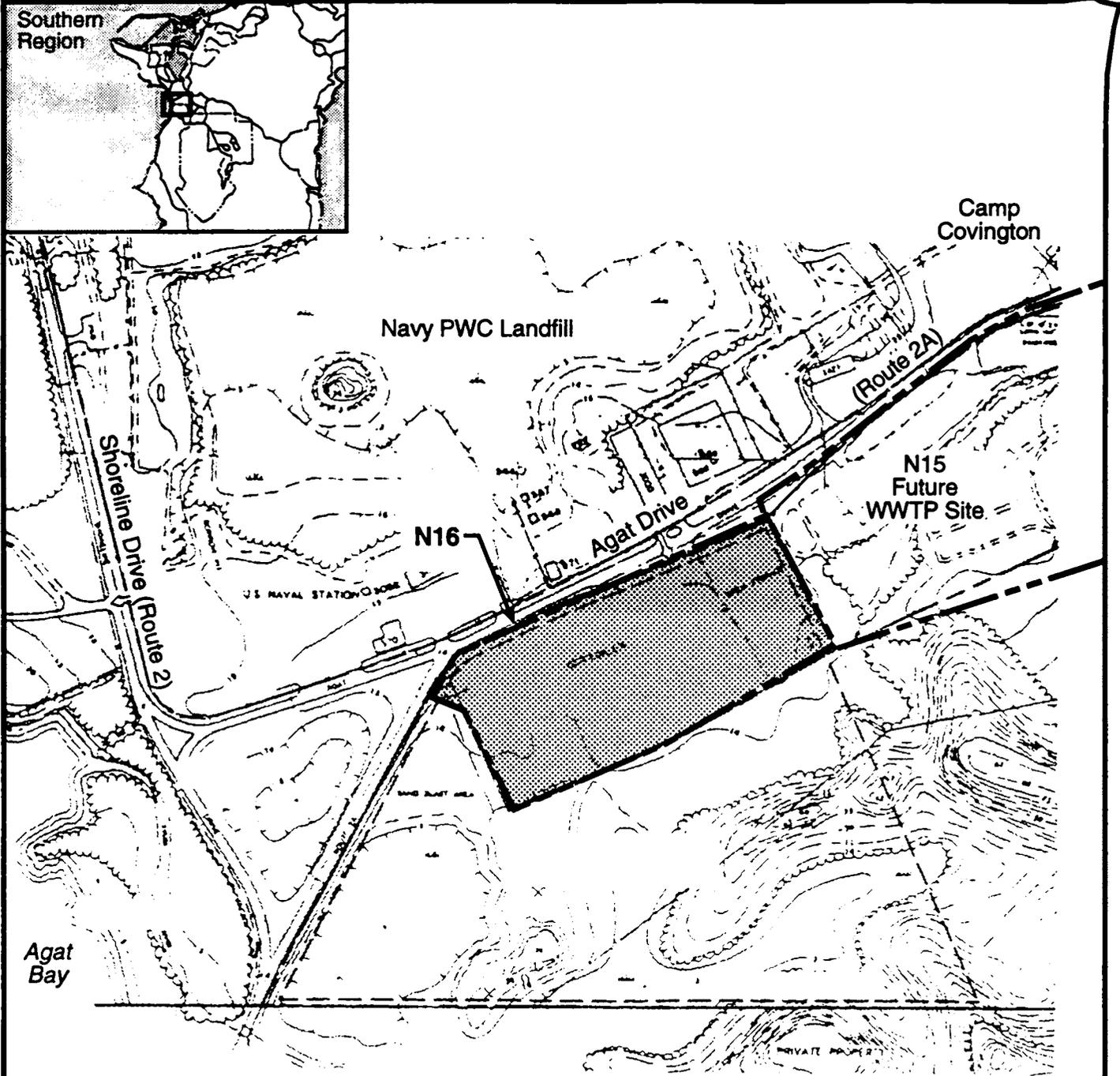
--- Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-15**  
**NEW APRA HEIGHTS PARCEL N15**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

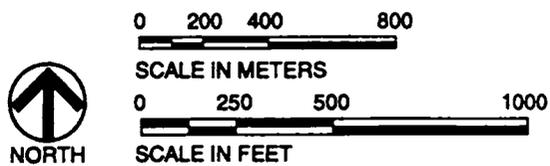


**LEGEND**

Land Uses	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
 Commercial	15 ac (6.1 ha)	Same	Same

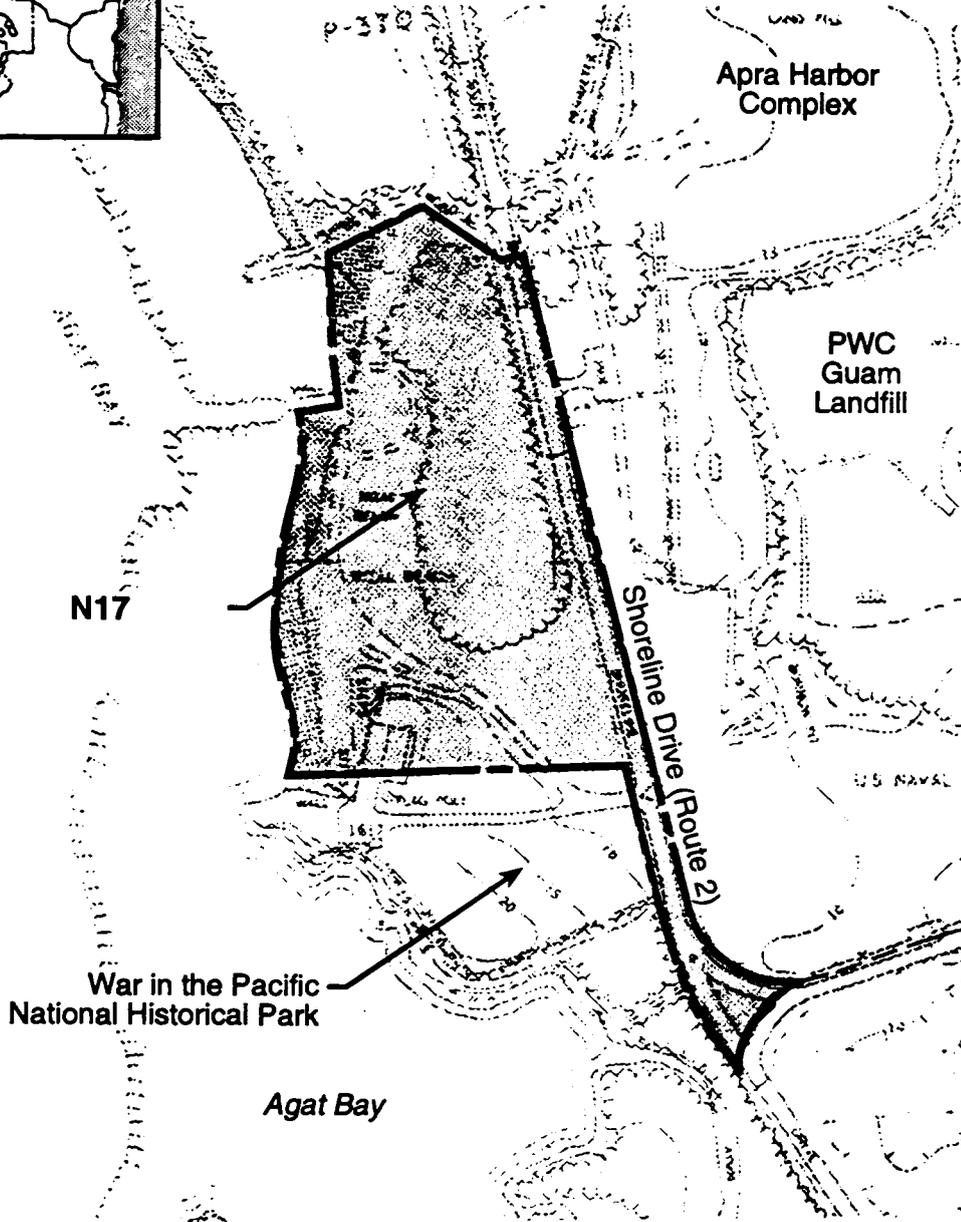
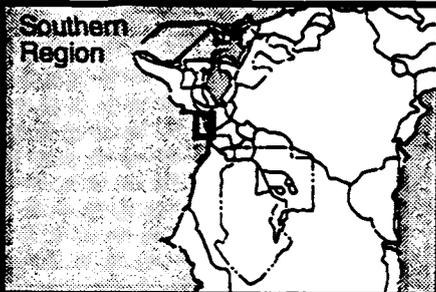
 Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-16**  
**ROUTE 2A PARCEL N16**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**LEGEND**

**Land Uses**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
	Parks/Rec./Hist./Conserv.	16 ac (6.5 ha)	Same
	Parcel Boundary		* 5 ac (2.0 ha) Industrial (powerplant)

\* Personal communication with Guam Power Authority

Source: Guam Land Use Plan Update, DoD, Department of Navy (April 1995); GEDA Reuse Plan for GLUP '94 Navy Properties, (October 1996)



NORTH

0 20 40 60 80 100 200



SCALE IN METERS

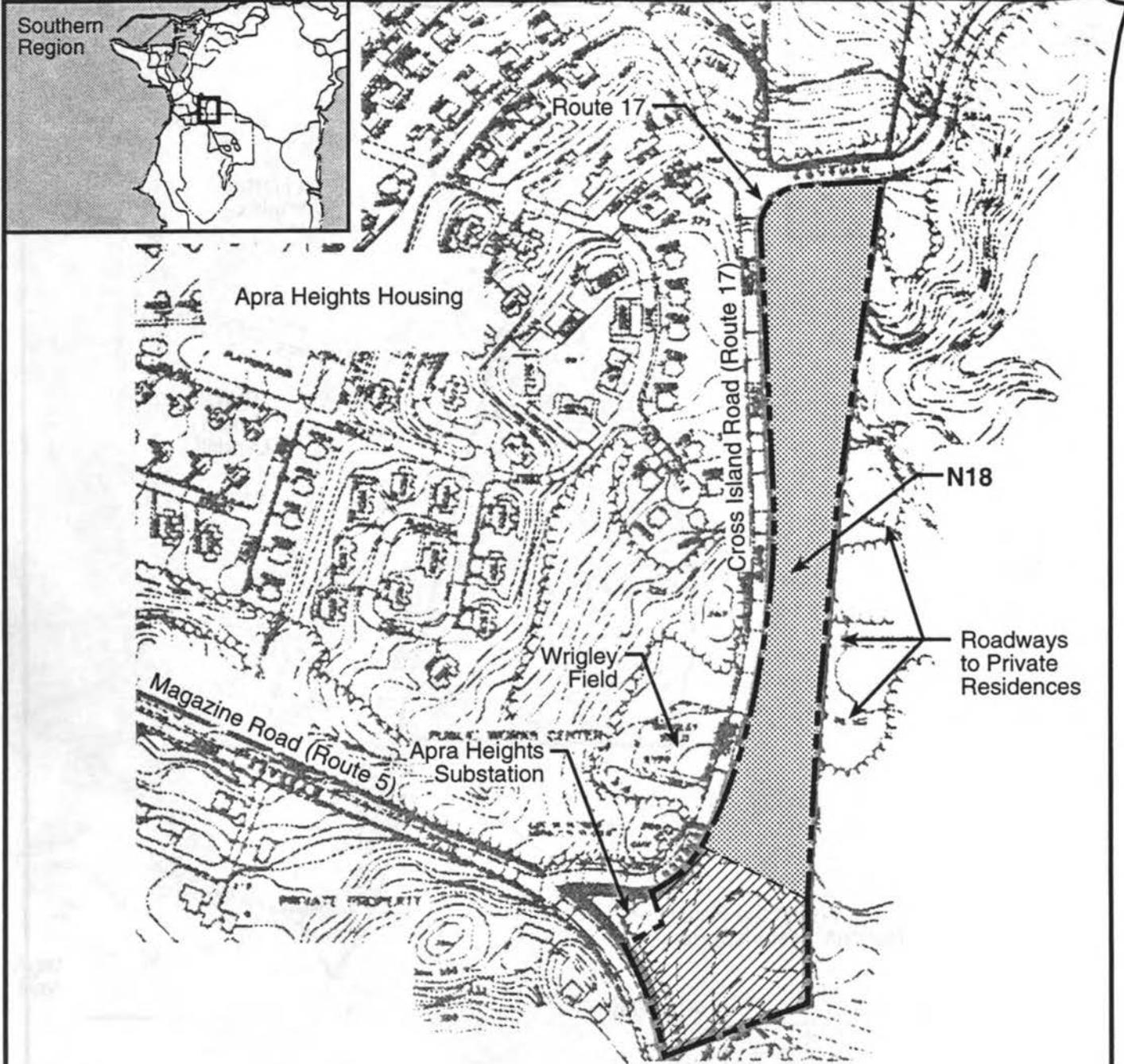
0 200 400 800



SCALE IN FEET

**Figure 2.2-17**  
**RIZAL/AFLEJE BEACH PARCEL N17**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



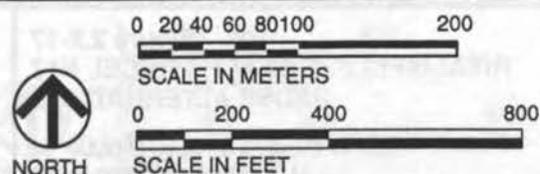
**LEGEND**

**Land Uses**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative
 Industrial	4.5 ac (1.8 ha)	Same	Same
 Commercial	8 ac (3.2 ha)	Same	Same
	<b>Total</b>		
	12.5 ac (5.0 ha)		

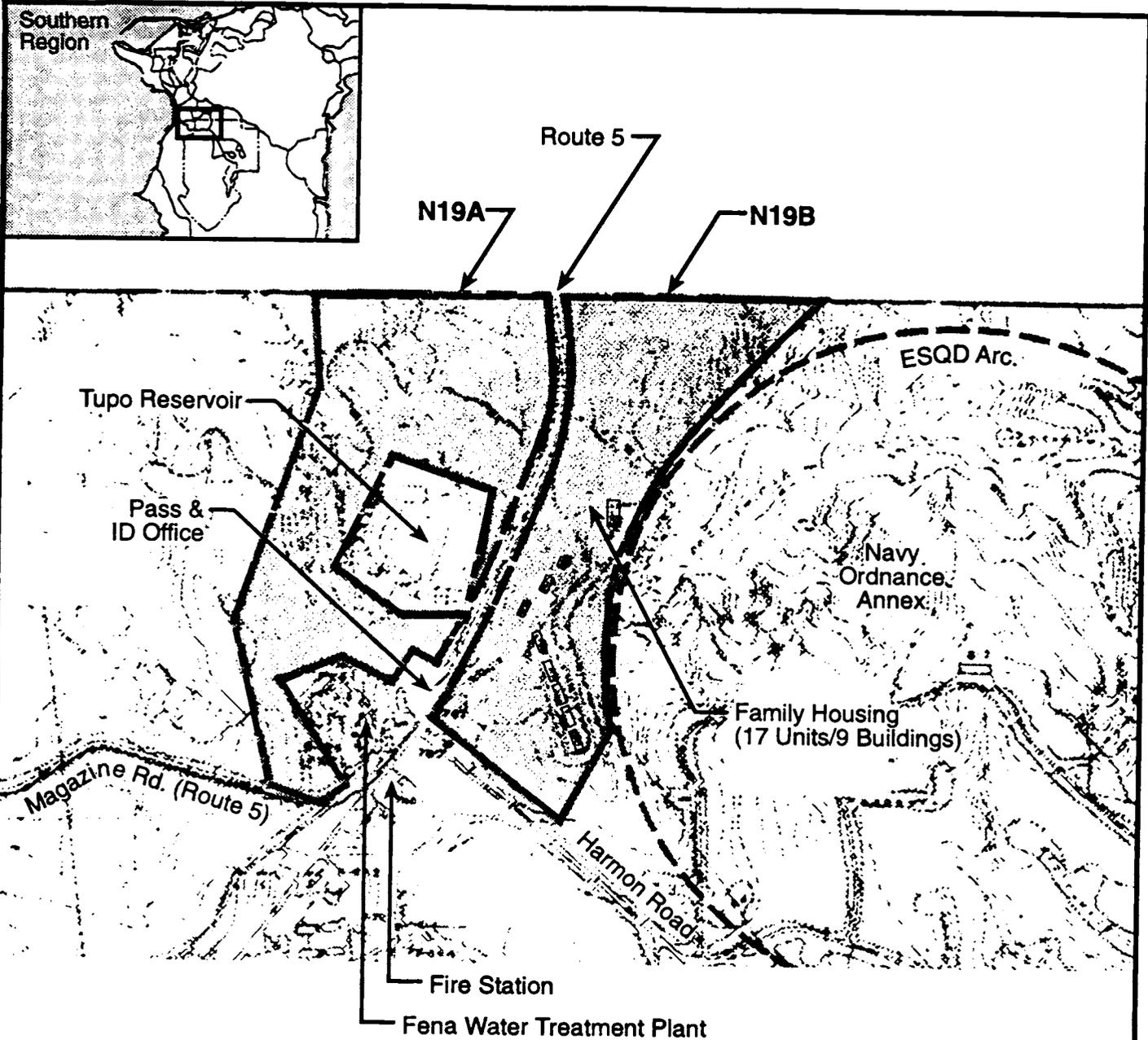
 Parcel Boundary

Source: Department of Navy (April 1995) *Guam Land Use Plan Update*.  
GEDA (October 1996) *Reuse Plan for GLUP '94 Navy Properties*.



**Figure 2.2-18**  
**OLD APRA HEIGHTS PARCEL N18**  
**REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

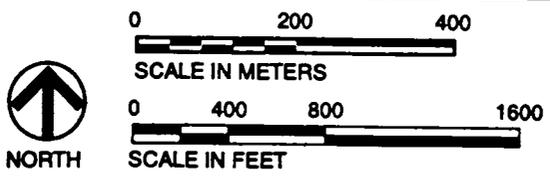


**LEGEND**

**Land Uses**

	<b>Preferred Alternative N19A</b>	<b>Preferred Alternative N19B</b>	<b>Lower Intensity Alternative N19A &amp; N19B</b>	<b>Higher Intensity Alternative N19A &amp; N19B</b>
Parks/Rec./Hist./Conserv.	50 ac (20.3 ha)	52 ac (21.1 ha)	102 ac (41.4 ha)	89 ac (36.1 ha)
Parcel Boundary				13 ac (5.3 ha) Recreation and Residential

Source: Guam Land Use Plan Update, DoD, Department of Navy (April 1995); GEDA Reuse Plan for GLUP '94 Navy Properties, (October 1996)



**Figure 2.2-19  
NAVY ORDNANCE ANNEX NORTH PARCEL N19  
REUSE ALTERNATIVES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<b>Soils, Geology, and Topography</b>	No significant impacts. Structures would have to comply with seismic design code (Zone 4) and erosion control requirements.	No significant impacts. Structures would have to comply with seismic design code (Zone 4) and erosion control requirements.	No significant impacts. Structures would have to comply with seismic design code (Zone 4) and erosion control requirements.	No impacts.
<b>Drainage Additional Storm Water Runoff</b>	Substantial increase in storm water runoff on nine parcels. No significant impact as GEPA-approved methods (drainage infrastructure, ponding basins, and/or infiltration galleries) can be developed to accommodate increase.	Substantial increase in storm water runoff on four parcels. No significant impact as GEPA-approved methods (drainage infrastructure, ponding basins, and/or infiltration galleries) can be developed to accommodate increase.	Substantial increase in storm water runoff on 16 parcels. No significant impact as GEPA-approved methods (drainage infrastructure, ponding basins, and/or infiltration galleries) can be developed to accommodate increase.	No impacts.
<b>Drainage Surface and Coastal Water Quality</b>	No significant impacts anticipated given compliance with GEPA and ACOE regulations regarding runoff and discharge to surface waters.	No significant impacts anticipated given compliance with GEPA and ACOE regulations regarding runoff and discharge to surface waters.	No significant impacts anticipated given compliance with GEPA and ACOE regulations regarding runoff and discharge to surface waters.	No impacts.
<b>Flood Hazard</b>	Six parcels are in flood hazard zones: Tamuning Telephone Exchange, Barrigada N5A, Tenjo Vista, Polaris Point, Route 2A, and Rizal/Afilleje Beach. Compliance with regulations governing storm water discharge and development in flood hazard zones would prevent significant impacts.	Six parcels are in flood hazard zones: Tamuning Telephone Exchange, Barrigada N5A, Tenjo Vista, Polaris Point, Route 2A, and Rizal/Afilleje Beach. Compliance with regulations governing storm water discharge and development in flood hazard zones would prevent significant impacts.	Six parcels are in flood hazard zones: Tamuning Telephone Exchange, Barrigada N5A, Tenjo Vista, Polaris Point, Route 2A, and Rizal/Afilleje Beach. Compliance with regulations governing storm water discharge and development in flood hazard zones would prevent significant impacts.	No impacts.

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<p><b>Air Quality</b></p>	<p>No significant air quality impacts from stationary sources; possible significant air quality impacts from vehicular sources at certain intersections during peak-hour traffic.</p> <p><b>MITIGATION:</b>                      Implement measures to improve traffic conditions at these intersections. (Traffic and associated air quality impacts cannot be mitigated at the intersection of Routes 1 and 16.)</p>	<p>No significant air quality impacts from stationary sources; possible significant air quality impacts from vehicular sources at certain intersections during peak-hour traffic (less likely compared to preferred alternative).</p> <p><b>MITIGATION:</b>                      Implement measures to improve traffic conditions at these intersections. (Traffic and associated air quality impacts cannot be mitigated at the intersection of Routes 1 and 16.)</p>	<p>No significant air quality impacts from stationary sources; possible significant air quality impacts from vehicular sources at certain intersections during peak-hour traffic.</p> <p><b>MITIGATION:</b>                      Implement measures to improve traffic conditions at these intersections. (Traffic and associated air quality impacts cannot be mitigated at the intersection of Routes 1 and 16.)</p>	<p>No significant impacts; however, certain intersections are projected to operate at unacceptable Level of Service (LOS) with or without reuse, resulting in possibly significant air quality impacts.</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<p><b>Land Use Compatibility</b></p>	<p>Potentially significant impacts on proposed housing at Barrigada; existing Hawaiian Rock Products operations would be incompatible with housing.</p> <p>MITIGATION: Provide adequate buffers between housing and quarry operations.</p>	<p>Potentially significant impacts on proposed housing at Barrigada; existing Hawaiian Rock Products operations would be incompatible with housing.</p> <p>MITIGATION: Provide adequate buffers between housing and quarry operations.</p>	<p>Potentially significant impacts on:</p> <ul style="list-style-type: none"> <li>• Proposed housing at Barrigada; existing Hawaiian Rock Products operations would be incompatible with housing.</li> <li>• Rizal/Afleje Beach Park visual environment from adjacent power plant.</li> </ul> <p>Residential development at New Apra heights may be affected by odors from proposed Agat/Santa Rita WWTP, but odors can be controlled through proper design and operations.</p> <p>MITIGATION:</p> <ul style="list-style-type: none"> <li>• Provide adequate buffers between housing and quarry operations.</li> <li>• Provide buffers between power plant and beach park. GPA would be required to address visual impacts during local environmental review process for the power plant.</li> </ul>	<p>No impacts.</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<p><b>Noise</b></p>	<ul style="list-style-type: none"> <li>• Potentially significant noise impacts on proposed Barrigada housing from existing Hawaiian Rock Products operations.</li> <li>• Potentially significant noise impacts on NAS Officers Housing parcel from proposed Laderan Tiyan Parkway.</li> </ul> <p>MITIGATION: Adequately buffer housing from noise sources and use noise attenuating construction.</p>	<ul style="list-style-type: none"> <li>• Potential significant noise impacts on proposed Barrigada housing from existing Hawaiian Rock Products operations.</li> <li>• Potentially significant noise impacts on NAS Officers Housing parcel from proposed Laderan Tiyan Parkway.</li> </ul> <p>MITIGATION: Adequately buffer housing from noise sources and use noise attenuating construction.</p>	<ul style="list-style-type: none"> <li>• Potential significant noise impacts on proposed Barrigada housing from existing Hawaiian Rock Products operations.</li> <li>• Potentially significant noise impacts on NAS Officers Housing parcel from proposed Laderan Tiyan Parkway.</li> <li>• Proposed power plant at Rizal/Alleje Beach may have significant noise impacts on adjacent beach park.</li> </ul> <p>MITIGATION:  <ul style="list-style-type: none"> <li>• Adequately buffer housing from noise sources and use noise attenuating construction.</li> <li>• Provide adequate buffers between power plant and park facilities.</li> </ul> </p>	<p>No impacts.</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<b>Cultural Resources</b>	<p>Disposal of NRHP eligible properties without adequate provisions for protection of historic integrity could result in significant impacts. There are NRHP listed or eligible sites on four parcels: Barrigada N5A, Nimitz Hill N10A and N10B, and Navy Ordnance Annex North N19B. There is a high potential for historic or prehistoric sites on nine other parcels: FAA Housing, Marine Drive Utility, Barrigada N5B, Sasa Valley, Tenjo Vista, Polaris Point, Rizal/Afleje Beach, Old Apra Heights, and Navy Ordnance Annex North N19A.</p> <p>MITIGATION:                      Navy, Guam HPO, and ACHP will implement a Programmatic Agreement (PA) with provisions to protect the integrity of historic properties. Navy will include protective deed covenants as conditions of the conveyance.</p>	<p>Similar to Preferred Alternative, but lower intensity development may result in less impact.</p> <p>MITIGATION:                      Navy, Guam HPO, and ACHP will implement a Programmatic Agreement (PA) with provisions to protect the integrity of historic properties. Navy will include protective deed covenants as conditions of the conveyance.</p>	<p>Similar to Preferred Alternative, but higher intensity development may result in more impact.</p> <p>MITIGATION:                      Navy, Guam HPO, and ACHP will implement a Programmatic Agreement (PA) with provisions to protect the integrity of historic properties. Navy will include protective deed covenants as conditions of the conveyance.</p>	<p>No impacts.</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<p><b>Terrestrial Biota and Habitats</b></p>	<p>No significant impacts.</p> <p>No protected species observed on any of the parcels during biological surveys. Potential impact on Tenjo Vista wetland identified as secondary habitat of endangered Mariana common moorhen can be prevented by avoiding development in this area.</p> <p>Wetlands and limestone forest areas on other parcels can be avoided through site planning.</p>	<p>No significant impacts.</p> <p>No protected species observed on any of the parcels during biological surveys. Potential impact on Tenjo Vista wetland identified as secondary habitat of endangered Mariana common moorhen can be prevented by avoiding development in this area.</p> <p>Wetlands and limestone forest areas on other parcels can be avoided through site planning.</p>	<p>No significant impacts.</p> <p>No protected species observed on any of the parcels during biological surveys. Potential impact on Tenjo Vista wetland identified as secondary habitat of endangered Mariana common moorhen can be prevented by avoiding development in this area.</p> <p>Wetlands and limestone forest areas on other parcels can be avoided through site planning.</p>	<p>No impacts.</p>
<p><b>Marine Environment</b></p>	<p>No significant impacts.</p>	<p>No significant impacts.</p>	<p>Potentially significant localized impacts on coral reefs due to construction of power plant intake and outfall structures at Rizal/Añleje Beach. Impact on marine life due to discharge of higher temperature cooling water effluent.</p> <p><b>MITIGATION:</b>                      Avoiding impacts through proper siting and construction practices and locating the outfall in deep water with adequate circulation.</p>	<p>No impacts</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<b>Roads and Traffic</b>	<p>Average Daily Trips (ADT) on typical weekday: 47,752</p> <p>Unacceptable Level of Service (LOS E or F) at key intersections in the northern, Barrigada, and southern regions. No significant impacts that cannot be mitigated except at Route 1/Route 16 intersection in the northern region.</p> <p>MITIGATION: Install traffic signals; install new or additional turning lanes; widen roads; realign roads and intersection approaches.</p>	<p>Average Daily Trips (ADT) on typical weekday: 28,956</p> <p>Unacceptable Level of Service (LOS E or F) at key intersections in the northern, Barrigada, and southern regions. No significant impacts that cannot be mitigated except at Route 1/Route 16 intersection in the northern region.</p> <p>MITIGATION: Install traffic signals; install new or additional turning lanes; widen roads; realign roads and intersection approaches.</p>	<p>Average Daily Trips (ADT) on Typical Weekday: 84,222</p> <p>Unacceptable Level of Service (LOS E or F) at key intersections in the northern, Barrigada, and southern regions. No significant impacts that cannot be mitigated except at Route 1/Route 16 intersection in the northern region.</p> <p>MITIGATION: Install traffic signals; install new or additional turning lanes; widen roads; realign roads and intersection approaches.</p>	<p>No impacts, although certain intersections are projected to operate at unacceptable LOS with or without reuse.</p>
<b>Potable Water Supply</b>	<p>No significant impact on island-wide potable water supply.</p>	<p>No significant impact on island-wide potable water supply.</p>	<p>No significant impact on island-wide potable water supply.</p>	<p>No impacts.</p>
<b>Wastewater Treatment</b>	<p>No significant impact on regional WWTP available capacities.</p>	<p>No significant impact on regional WWTP available capacities.</p>	<p>Significant impact on Agana WWTP under peak flow conditions.</p> <p>MITIGATION: Redirect discharges to Northern District WWTP.</p>	<p>No impacts.</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<b>Solid Waste Disposal</b>	No significant impact on projected landfill capacity.	No significant impact on projected landfill capacity.	No significant impact on projected landfill capacity. Adding other proposed developments would result in a significant cumulative impact and decrease in the lifespan of the proposed new landfill.  <b>MITIGATION:</b> GovGuam needs to implement its Integrated Waste Management Plan, including reuse, recovery, and recycling of solid wastes and construction of a waste-to-energy conversion facility.	No impacts.
<b>Electrical Generation and Energy Use</b>	<ul style="list-style-type: none"> <li>No significant impact on Guam's electrical generating capacity if necessary generation and transmission facilities are phased in with reuse plans.</li> <li>Significant cumulative impact on Guam's electrical generating capacity.</li> </ul> <b>MITIGATION:</b> GPA would need to add 60-80 MW of electrical capacity through FY 2015 to avoid significant cumulative impacts.	<ul style="list-style-type: none"> <li>No significant impact on Guam's electrical generating capacity if necessary generation and transmission facilities are phased in with reuse plans.</li> <li>Significant cumulative impact on Guam's electrical generating capacity.</li> </ul> <b>MITIGATION:</b> GPA would need to add 60-80 MW of electrical capacity through FY 2015 to avoid significant cumulative impacts.	<ul style="list-style-type: none"> <li>No significant impact on Guam's electrical generating capacity if necessary generation and transmission facilities are phased in with reuse plans.</li> <li>Significant cumulative impact on Guam's electrical generating capacity.</li> </ul> <b>MITIGATION:</b> GPA would need to add 60-80 MW of electrical capacity through FY 2015 to avoid significant cumulative impacts.	No impacts.

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<p><b>Socioeconomics</b></p>	<p>No significant impacts.</p> <ul style="list-style-type: none"> <li>Substantial increase in northern region and Barrigada population associated with housing development. Long-range planning by GovGuam will be required to avoid impacts on public services.</li> <li>Adverse impacts on commercial and industrial real estate markets due to surplus inventory can be avoided by phasing development over longer period in response to market demand.</li> </ul>	<p>No significant impacts.</p> <ul style="list-style-type: none"> <li>Substantial increase in northern region and Barrigada population associated with housing development. Long-range planning by GovGuam will be required to avoid impacts on public services.</li> <li>Adverse impacts on commercial and industrial real estate markets due to surplus inventory can be avoided by phasing development over longer period in response to market demand.</li> </ul>	<p>No significant impacts.</p> <ul style="list-style-type: none"> <li>Substantial increase in northern region and Barrigada population associated with housing development. Long-range planning by GovGuam will be required to avoid impacts on public services.</li> <li>Adverse impacts on commercial and industrial real estate markets due to surplus inventory can be avoided by phasing development over longer period in response to market demand.</li> <li>Possible social impacts (not significant) if new commercial and industrial jobs need to be filled by large numbers of off-island workers. Long-range planning by GovGuam and phased development would minimize impacts.</li> </ul>	<p>No impacts.</p>
<p><b>Environmental Justice</b></p>	<p>No disproportionately high or adverse effects on minority or low-income populations.</p>	<p>No disproportionately high or adverse effects on minority or low-income populations.</p>	<p>No disproportionately high or adverse effects on minority or low-income populations.</p>	<p>No disproportionately high or adverse effects on minority or low-income populations.</p>

Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<b>Public Services</b>	<ul style="list-style-type: none"> <li>Substantial increase (significant impact) in public school enrollment in three districts.</li> <li>Significant cumulative impacts on health care, police, fire protection, and civil defense services.</li> </ul> <p>MITIGATION:</p> <ul style="list-style-type: none"> <li>Long-range planning and funding to build more schools.</li> <li>Provide for incremental increases in public services to meet additional demand as redevelopment occurs.</li> </ul>	<ul style="list-style-type: none"> <li>Substantial increase (significant impact) in public school enrollment in three districts.</li> <li>Significant cumulative impacts on health care, police, fire protection, and civil defense services.</li> </ul> <p>MITIGATION:</p> <ul style="list-style-type: none"> <li>Long-range planning and funding to build more schools.</li> <li>Provide for incremental increases in public services to meet additional demand as redevelopment occurs.</li> </ul>	<ul style="list-style-type: none"> <li>Substantial increase (significant impact) in public school enrollment in three districts.</li> <li>Significant cumulative impacts on health care, police, fire protection, and civil defense services.</li> </ul> <p>MITIGATION:</p> <ul style="list-style-type: none"> <li>Long-range planning and funding to build more schools.</li> <li>Provide for incremental increases in public services to meet additional demand as redevelopment occurs.</li> </ul>	No impacts.
<b>Impacts on Health and Safety of Children</b>	<p>No environmental health and safety risks that may disproportionately affect children.</p> <p>Potential health risks associated with development of housing in areas with radon. However, no significant impact with compliance with Toxic Substance Control Act (TSCA).</p>	<p>No environmental health and safety risks that may disproportionately affect children.</p> <p>Potential health risks associated with development of housing in areas with radon. However, no significant impact with compliance with Toxic Substance Control Act (TSCA).</p>	<p>No environmental health and safety risks that may disproportionately affect children.</p> <p>Potential health risks associated with development of housing in areas with radon. However, no significant impact with compliance with Toxic Substance Control Act (TSCA).</p>	No impacts.

**Table 2.2-5: Summary of Potential Impacts and Mitigation Measures for All Alternatives**

Issue or Resource	Preferred Alternative	Lower Intensity	Higher Intensity	No Action
<p><b>Environmental Contamination</b></p>	<p>No significant impacts on public health and the environment due to on-site contamination as parcels will be identified and remediated to levels protective of human health and the environment and appropriate to subsequent reuse.</p> <p>Potential health risks associated with development of housing in areas with radon. However, no significant impact with compliance with Toxic Substance Control Act (TSCA).</p>	<p>No significant impacts on public health and the environment due to on-site contamination as parcels will be identified and remediated to levels protective of human health and the environment and appropriate to subsequent reuse.</p> <p>Potential health risks associated with development of housing in areas with radon. However, no significant impact with compliance with Toxic Substance Control Act (TSCA).</p>	<p>No significant impacts on public health and the environment due to on-site contamination as parcels will be identified and remediated to levels protective of human health and the environment and appropriate to subsequent reuse.</p> <p>Potential health risks associated with development of housing in areas with radon. However, no significant impact with compliance with Toxic Substance Control Act (TSCA).</p>	<p>No impacts.</p>

# Chapter 3

---

AFFECTED ENVIRONMENT



## CHAPTER THREE

### AFFECTED ENVIRONMENT

---

#### 3.1 OVERVIEW

This chapter describes the affected environment and establishes the baseline conditions used to conduct the impact analyses in Chapter 4. Except as otherwise noted, baseline conditions are those that reflect *Guam Land Use Plan* (GLUP) parcel activities in October 1995, just prior to the Base Realignment and Closure (BRAC) decision. Current conditions, which may vary from 1995, are also described.

Regions of influence (ROI) are defined and the GLUP parcels are briefly described to provide context for the discussion of the affected environment and evaluation of environmental consequences.

##### 3.1.1 Physical Environment

Guam is approximately 32 miles (51 kilometers) in length and has a total area of about 212 square miles (485 square kilometers) (Figure ES-1). The northern half of Guam is covered by a limestone plateau. Rainwater easily percolates through the limestone, recharging Guam's only drinking water aquifer. In southern Guam, bedrock is mostly volcanic rock with clay soils on top. Streams have carved this half of the island into a rugged mountainous region. Between these two regions is a transitional area of hilly terrain with mixed limestone and volcanic rock.

Guam's climate is generally warm and humid throughout the year, with average temperatures ranging between 85° to 89° F (29° to 32° C) in the afternoon and 70° to 75° F (21° to 24° C) in the evening. Wet and dry seasons are separated by periods of transitional weather. The dry season (mid-January through July) is characterized by very little rainfall and consistent trade winds predominantly from the northeast. May, June, and July are the driest months of the year. The rainy season (August through mid-January) features heavy winds and rains with occasional typhoons and tropical storms.

##### 3.1.2 Population

In 1995, Guam's population was estimated by the Guam Department of Commerce to be approximately 150,000 (based on the 1990 U.S. Census and a 2.31 percent annual growth rate). About 40 percent of the population reside in the villages of the central region, Guam's economic and urban center. Approximately 34 percent live in the northern villages of Dededo and Yigo. The remainder—26 percent—resides in the southern part of the island. Guam's ethnic composition in 1990 was 38 percent Chamorro or part-Chamorro, 29 percent Asian (mostly Filipino), 14 percent Caucasian, 5 percent other Pacific Islanders, and 14 percent other groups.

### 3.1.3 Economy

Until a recent slowdown, Guam's economy had experienced rapid growth, particularly in its major industries of tourism and construction. From 1988 through 1995, Guam's gross island product (presently over \$3 billion) increased approximately 10 percent annually.

During 1995, the United States military contributed an estimated \$472 million to the island's economy, decreasing from a high in 1990 of \$686 million. Military personnel stationed on Guam bring additional disposable income to the economy. Due to military downsizing and base consolidation, several installations and activities have been closed or are scheduled for closure. The number of active duty personnel decreased from approximately 10,000 in 1990 to approximately 7,000 in 1995.

### 3.1.4 Military Installations

Active military installations include Andersen Air Force Base (AFB), Naval Computer and Telecommunication Area Master Station Western Pacific (NCTAMS WESTPAC) at communications annexes Barrigada and Finegayan, Waterfront Annex in the Apra Harbor area (formerly known as Naval Station), Nimitz Hill officers housing and support facilities, Naval Hospital, and Ordnance Annex (formerly referred to as Naval Magazine). All Navy activities are under Commander, United States Naval Forces, Marianas (COMNAVMARIANAS).

NAS Agana is situated in central Guam, northeast of the village of Agana, or Hagatna. It is slated for disposal under the 1993 BRAC Act and was operationally closed on March 31, 1995. The A. B. Won Pat Guam International Airport remains in operation under an existing joint use agreement between Navy and Guam International Airport Authority (GIAA).

### 3.1.5 Biological Environment

Guam is highly developed in certain areas, but natural habitat still exists on the island, especially on Navy and Air Force lands. Today, less than 40 percent of Guam is forested; much of the native limestone forest has been converted to brush and grassland, dominated by the weedy tangantangan (*Leucaena leucocephala*). Remaining limestone forest areas occur most frequently in northern Guam, particularly at Andersen AFB, and in southern Guam at Orote Point within the Waterfront Annex. Native limestone forest is an important refuge for endangered birds and bats. Wetlands provide habitat for the endangered Mariana common moorhen (*Gallinula chloropus guami*) and other waterfowl.

The introduced brown tree snake (*Boiga irregularis*) is a serious pest species on Guam. It has caused the decline and, in some cases, extinction of many of the island's fauna. Currently, three plant, three mammal, 10 reptile, four invertebrate, and 18 bird species are listed as threatened or endangered by the federal and/or Guam governments, with nine of these species possibly extinct.

Aquatic habitats include rivers, wetlands, and marine waters. Estuarine wetlands, including mangrove swamps, provide nursery grounds for numerous marine and estuarine animals. Coral reefs surround at least three-quarters of the island.

### 3.1.6 Cultural Environment

The presence of the native Chamorro can be traced back approximately 4,000 years. Significant historic and prehistoric sites from these inhabitants remain; sets of *latte stones*<sup>1</sup> are the most notable artifacts. The decline of the Chamorro population began with the introduction of European civilization, marked by Ferdinand Magellan's arrival in 1521. In 1668, the lives of the Chamorro were significantly altered with Spain's establishment of a Jesuit mission on Guam. Religion became a focal point in the resettled communities as evidenced by the presence of a church within the geographic center of each village.

### 3.1.7 Regions of Influence

Geographic areas that may be affected by the proposed disposal and reuse are referred to as regions of influence. These areas vary depending upon the issue or resource being evaluated. Some impacts may be localized, while others may be regional or island-wide. For example, cultural resource effects would generally be site-specific, while additional electrical demand would affect the island-wide power grid.

For purposes of the EIS analysis, the GLUP parcels have been divided into four geographic regions (northern, Barrigada, central, and southern). In many cases, the impacts are being evaluated on either a regional or an island-wide basis. It is recognized that impacts associated with the disposal and reuse of individual parcels may be minor, but collectively the proposed action and alternatives could result in significant cumulative effects. Following is a list of each potentially significant issue and the corresponding region of influence (i.e., site-specific, regional, island-wide):

**Table 3.1-1: Potentially Significant Issues and Regions of Influence**

Potentially Significant Issue	Region of Influence
Soils, geology, and topography	Site specific
Drainage and hydrology	Regional
Air emissions during operations	Site specific, regional
Land use conflicts	Site-specific
Noise during operations	Site-specific
Cultural resources	Site-specific
Protected species	Site-specific
Wetlands, limestone forests, other sensitive habitat	Site-specific
Marine resources	Site-specific
Traffic congestion	Regional
Potable water supply	Regional, island-wide
Wastewater treatment	Regional
Solid waste disposal	Island-wide
Electrical generation	Island-wide
Environmental contamination	Site-specific, regional
Impacts on nearby communities	Site-specific, regional
Environmental justice	Regional, island-wide
Impacts on health and safety of children	Site-specific, regional

<sup>1</sup> Upright stone pillars topped by semispherical capstones and set in two parallel rows in groups of 6 to 12 stands.

## 3.2 SOILS, GEOLOGY, AND TOPOGRAPHY

### 3.2.1 Introduction

Despite the small land area of the island (212 square miles [549 square kilometers]), Guam's geology is diverse. The northern portion of the island is covered by limestone plateau with elevations ranging from 295 feet (90 meters) to 590 feet (180 meters) above mean sea level (MSL), dropping to the shoreline in steep cliffs. The southern portion of the island is characterized by volcanic rock with clay soils on top. The northern and southern regions are joined by a transitional region of hilly terrain, mixed limestone, and volcanic rock. These diverse geological conditions contribute to wide-ranging soils, seismic and topographic conditions for each of the GLUP parcels.

Since the soils, geology, and topography of the GLUP parcels vary depending on their location, a description of each characteristic is provided for each region or parcel based on the United States Department of Agriculture Soil Conservation Service's *Soil Survey of Guam*. The soils are described in terms of their structural and drainage characteristics.

The seismic fault zones on Guam are those areas that divide the island's geologic structure. The proximity of these seismic zones to GLUP parcels is illustrated in Figure 3.2-1 and described in the following subsections.

### 3.2.2 Northern Region

The five GLUP parcels in the northern region are located on the northern Guam limestone plateau. Along its western border, the FAA Housing parcel is a coastal lowland with alluvial valley floor.

Soils on these parcels are very shallow and well drained, with undulating slopes of 0 to 3 and 3 to 7 percent (Guam-urban land complex and Guam cobbly clay loam). Permeability of these soils is moderately rapid. The soil units are moderately suited to structural development; the main limitation is depth to bedrock, which makes excavation difficult.

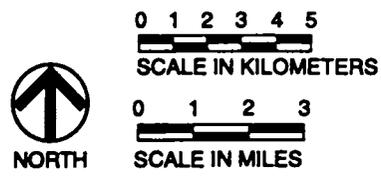
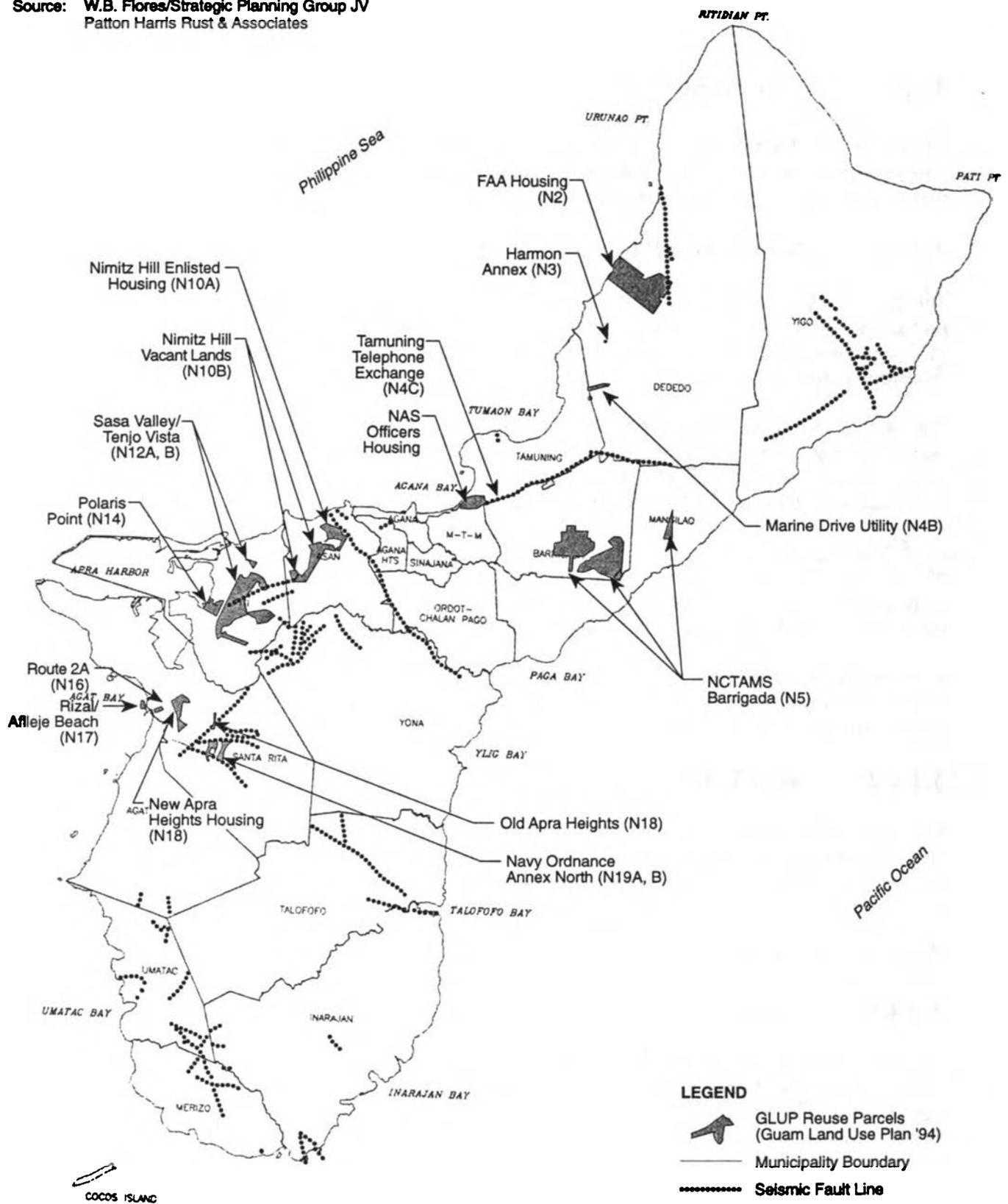
On the FAA Housing parcel, a minor seismic fault zone runs through the northeast corner. Between the Tamuning Telephone Exchange and the NAS Officers Housing parcels, there is a seismic fault line along the cliff line separating the Tamuning and Mongmong-Toto-Maite municipalities. This fault line is known as the Tamuning-Yigo Fault Zone.

### 3.2.3 Barrigada Region

The four parcels in the Barrigada region are located on the northern Guam limestone plateau. The topography is relatively flat with gentle slopes. Developed areas are Guam cobbly clay loam with undulating slopes of 3 to 7 percent, while undeveloped areas are predominantly Pulantat-Kagman clays with 3 to 7 percent slopes. The soil is well drained with slow permeability. Runoff is medium, and the hazard of water erosion is medium. These soil units are moderately suited for building development. The main limitations are shallow depth to limestone, which interferes with excavation as well as high shrink-swell potential and low soil strength.

There are no seismic fault zones in the vicinity of the GLUP parcels in the Barrigada region.

Source: W.B. Flores/Strategic Planning Group JV  
 Patton Harris Rust & Associates



**Figure 3.2-1  
 SEISMIC FAULT ZONES**

EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property on Guam

### **3.2.4 Central Region**

Parcels in the central region are located in the transition area of hilly terrain and mixed limestone and volcanic rock. Since the soil characteristics vary so widely, a description of each parcel is provided in the following sections.

#### **3.2.4.1 Nimitz Hill Parcels**

The Nimitz Hill Enlisted Housing parcel is situated on well-drained soils on the limestone plateau of Nimitz Hill. The housing units are located on terraces cut into the limestone with 0 to 7 percent slopes. Undeveloped areas are well-drained soils with moderate permeability on limestone plateau with steep undulating slopes of 3 to 15 percent.

The Nimitz Hill Vacant Lands parcel is situated on volcanic uplands of silty clay soils with slopes varying from 7 to 30 percent. At the foot of the valley, very steep, poorly drained soil occurs along the Fonte River stream channels, with short, steep drop-offs and ravines. Permeability of this clay is slow, runoff is rapid, and the hazard of water erosion is severe.

As indicated in Figure 3.2-1, there is a major seismic fault zone along the northwest boundary of the Nimitz Hill Enlisted Housing parcel. This fault zone extends from Adelup on the western coast of the island across Agana Heights and Chalan Pago to an area inland of Yona on the east coast of the island. The fault zone nearly bisects the island diagonally across the mid-section.

A seismic fault zone begins near the southernmost tip of the Nimitz Hill Vacant Lands parcel. It extends from the south of the parcel through the mountains surrounding the Masso and Sasa rivers towards the Aguada river basin.

#### **3.2.4.2 Sasa Valley**

The Sasa Valley parcel is situated on well-drained soil (Pulantat clay) on the dissected plateaus and hills between the Sasa and Masso rivers. The slopes are 15 to 30 percent, plane to convex. Soils are poorly suited to development due to steepness of slope, erosion hazard, and the depth to bedrock.

There are no seismic fault zones running through the Sasa Valley parcel.

#### **3.2.4.3 Tenjo Vista**

The Tenjo Vista parcel is typical of a transitional region with hilly terrain and mixed limestone and volcanic rock. A majority of the parcel consists of very deep, poorly drained soils (Inarajan clay) with 0 to 4 percent slopes along Marine Drive and at the Sasa and Aguada River mouths. Permeability of this soil is slow, runoff is very slow, and the hazard of water erosion is slight. Surface cracks extend to a depth of about 20 inches (51 centimeters) during the dry season.

At the Laguas River basin running east to west at the center of the parcel, the soil is also very deep and very poorly drained (Inarajan Variant mucky clay) with 0 to 3 percent slopes. This soil type occurs at valley bottoms and coastal plains. Runoff is very slow and the hazard of

water erosion is slight. The soil is poorly suited to development; the main limitations are short periods of flooding during the rainy season, ponding, and a seasonally high water table.

The same seismic fault zone that begins near the Nimitz Hill Vacant Lands parcel ends at the mid-section of the Tenjo Vista parcel, as indicated on Figure 3.2-1.

#### **3.2.4.4 Polaris Point**

The Polaris Point parcel is divided into two distinct soil types. The former hazardous materials storage lot (referred to as the "drum lot") south of the Polaris Point access road is urban land coastal fill similar to areas at Agana and Apra Harbor. Slope is 0 to 3 percent; elevation is 0 to 50 feet (0 to 15 meters). The soil type is quarried fill material of commonly crushed coral gravel and cobbles and a few pockets of very gravelly clay and clay loam. Permeability is moderately rapid, runoff is slow, and the hazard of water erosion is slight.

The portion of the Polaris Point parcel north of the access road is Inarajan clay along the Marine Drive border and Inarajan Variant mucky clay between the access road and the shoreline. These soils are poorly suited to development due to occasional flooding and seasonally high water table. These soils are very deep and poorly drained with a mucky surface. Permeability is slow, runoff is very slow, and the hazard of water erosion is slight. The soil floods during the rainy season and is subject to surface cracks extending to 20 inches (51 centimeters) during the dry season.

There are no seismic fault zones running through the Polaris Point parcel.

#### **3.2.5 Southern Region**

In Guam's southern region, the bedrock is mostly volcanic rock; clay soils occur on the surface. Streams have carved this half of the island into a rugged mountainous region. Since the soil characteristics vary so widely, a description of each parcel is provided in the following sections.

##### **3.2.5.1 New Apra Heights**

The undeveloped portion of the New Apra Heights parcel fronting Route 5 (the lower "handle" of the parcel) consists of a combination of Agfayan clay at 15 to 30 percent slopes, Akina-Urban land complex at 0 to 7 percent slopes, and Ritidian-Rock outcrop at 15 to 60 percent slopes.

The Agfayan clay is very shallow, well-drained soil on volcanic uplands. Permeability of the soil is slow, runoff is rapid, and the hazard of water erosion is severe. The soil is poorly suited to site development; the main limitations are the steep slopes and the depth to bedrock.

The disturbed (i.e., developed) portions of the parcel consist of the Akina-Urban soil unit, which is very deep and well drained. Permeability is moderate, runoff is medium, and the hazard of water erosion is slight. The urban areas are covered with roads, building slabs, and parking lots. Coral gravel is used as a base under these structures. This unit is suitable for site development; the main limitation is low soil strength.

A Ritidian-Rock outcrop is situated along the western edge of the lower "handle" of the parcel. The Ritidian soil unit is very shallow and well drained. Permeability is moderately rapid, runoff is very slow and the hazard of water erosion is slight. The Ritidian-Rock outcrop is an area of exposed white, porous, coralline limestone with a jagged and irregular surface. Permeability is rapid. This soil is not suited for site development. The main limitations are steep slopes and the areas of jagged, uneven limestone rock.

The developed portion of this parcel along Route 2A frontage, adjacent to the parcel consists of Urban land-Ustorthents, nearly level. Most of the developed area is covered by roads and former building pads. Ustorthents consists of quarried fill material, commonly crushed coral gravel and cobbles. Permeability of this soil is moderately rapid, runoff is slow, and the hazard of water erosion is slight. The soil is suitable for site development.

There are no seismic fault zones running through the New Apra Heights parcel.

### **3.2.5.2 Route 2A**

This parcel has been previously developed. A building pad and parking lot remain on the site. The parcel consists of Urban land-Ustorthents, nearly level. Soil characteristics are stated above.

There are no seismic fault zones running through the Route 2A parcel.

### **3.2.5.3 Rizal/Afilleje Beach**

The soil unit on this parcel is Pulantat clay at 3 to 7 percent slopes. The soil is shallow and well drained on limestone plateaus. Permeability is slow, runoff is medium, and the hazard of water erosion is slight. The unit is moderately suited for site development. The main limitation is the shallow depth to limestone, which interferes with excavation.

There are no seismic fault zones running through the Rizal/Afilleje Beach parcel.

### **3.2.5.4 Old Apra Heights**

This parcel consists of Akina-Badland complex on volcanic uplands at 7 to 15 percent slopes. Slopes are generally long and plane, but short, steep drop-offs and ravines are present. The Akina soil is very deep and well drained. Permeability is moderately slow, runoff is medium, and the hazard of water erosion is moderate. Permeability of the Badland soil is moderately slow. Runoff is rapid and the hazard of water erosion is severe. This unit mainly occurs as watershed and wildlife habitat. Its main limitation for site development is erosion hazard.

A seismic fault zone extends diagonally through the northern half of the Old Apra Heights parcel.

### **3.2.5.5 Navy Ordnance Annex North (West Parcel)**

The parcel consists of Akina silty clay at 15 to 30 percent slopes and steep Akina-Agfayan mix. This very deep, well-drained soil is on volcanic uplands. Permeability of the Akina soil is moderately slow, runoff is rapid, and the hazard of water erosion is severe. This unit occurs as watershed and wildlife habitat. It is poorly suited for site development due to slope limitations.

There are three different fault zones in the vicinity of this parcel. One fault line passes east-west along the southern border of the parcel and extends to the village of Santa Rita. The second fault zone cuts east-west across the northern border of the parcel. The third fault zone is a few miles west of the parcel and passes through the first two fault zones.

### 3.2.5.6 Navy Ordnance Annex North Housing (East Parcel)

The housing area consists of Akina-Urban land at 0 to 7 percent slopes. This unit is on volcanic uplands. Most of the area has been disturbed; the parcel is almost entirely covered by roads, housing, and parking pavements. The Akina soil is very deep and well drained. Permeability is moderately slow, runoff is medium, and the hazard of water erosion is slight. This unit is moderately suitable for development. The main limitation is low soil strength.

The same fault zone that passes along the southern border of the Navy Ordnance Annex North (N-19A) parcel runs along the southern border of this parcel. The other two fault zones on or near the west parcel are within the vicinity of this parcel.

## 3.3 DRAINAGE

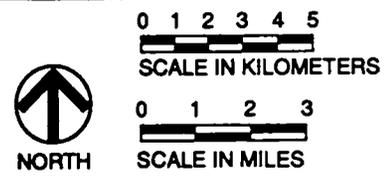
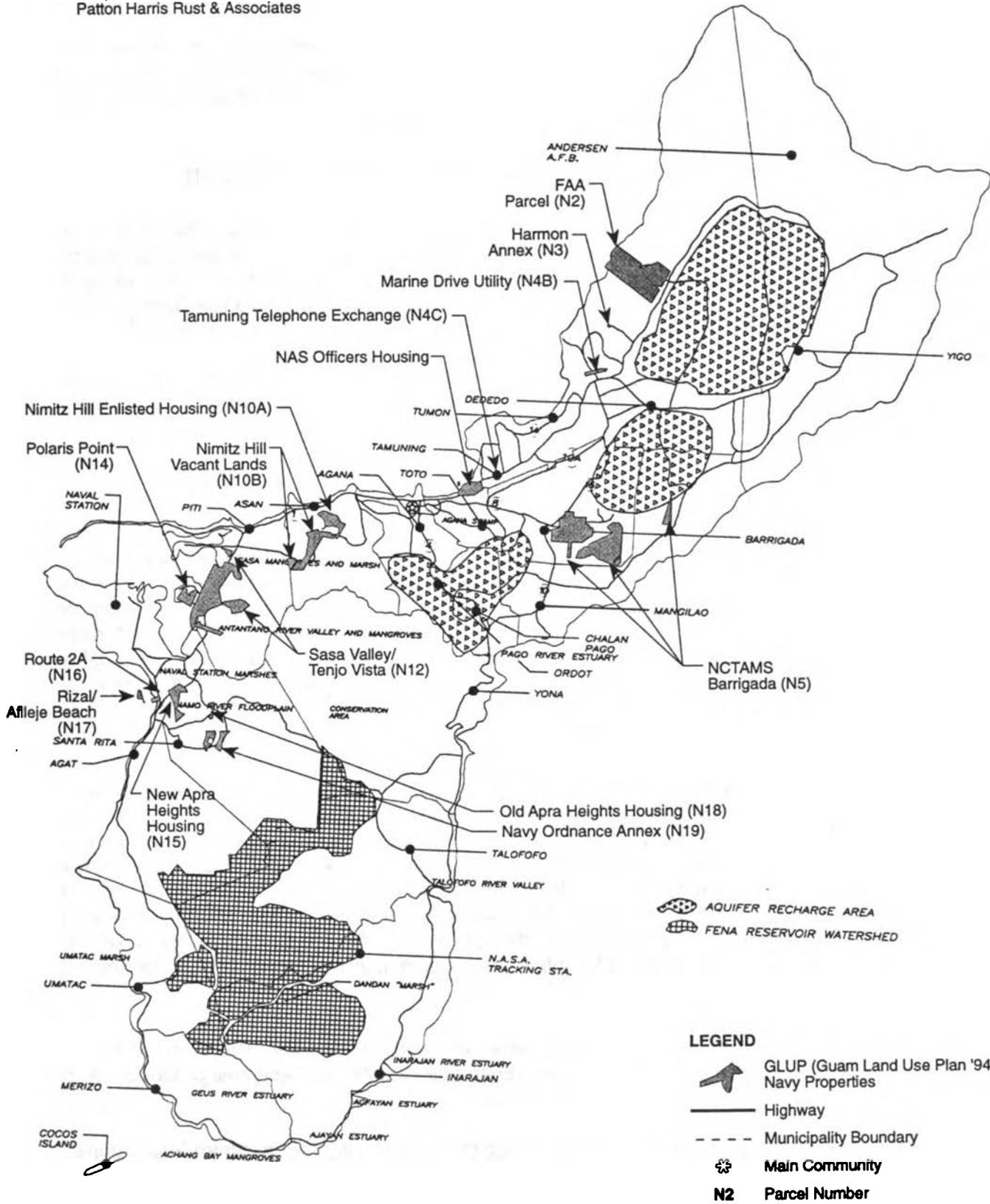
The hydrology, drainage, and water quality conditions of the subject parcels are described in this section. Hydrological conditions and natural drainage characteristics are described in terms of precipitation, surface water bodies, and groundwater aquifers as well as the presence or absence of aquifer recharge areas and flood hazards. In addition, existing drainage infrastructure (if any) is described. This section also identifies applicable water quality classifications, as defined in the *Revised Guam Water Quality Standards* (Guam Environmental Protection Agency [GEPA], January 1992). Only three parcels are adjacent to marine water bodies: FAA Housing, Polaris Point, and Rizal/Afilleje Beach.

**Precipitation.** Guam's mean annual precipitation ranges from slightly more than 100 inches (254 centimeters) at the northern tip and in higher mountain areas of the south to approximately 85 to 95 inches (216 to 241 centimeters) along the central and southern coasts. This is distributed throughout distinct wet and dry seasons. In the central area, total monthly precipitation averages range from less than 2 inches (5 centimeters) during the dry season peaking in March to over 13.6 inches (35 centimeters) during the wet season peaking in September. The climate is warm and mild throughout the year. Guam lies within a known typhoon belt. The island is periodically subjected to heavy rain and winds from these tropical cyclones.

**Hydrology and Drainage.** Aquifer recharge areas and surface area watersheds are shown in Figure 3.3-1. None of the GLUP parcels lies over an open aquifer recharge area or Government of Guam (GovGuam) Groundwater Protection Zone.

The principal source of groundwater for the island of Guam is from the "northern lens" aquifer, situated within the limestones of the northern hydrogeologic area. This aquifer is recharged from rainfall that percolates through surface soils to the underlying cavernous limestone. Water table levels increase from sea level at the shore to roughly 10 feet (3.0 meters) above sea level towards the interior of the island (Ward, Porter, Stuart Hoffard, and Dan Davis, 1965). The northern lens aquifer serves as the primary source of drinking water for the island of Guam.

Source: Adapted from W.B. Flores/Strategic Planning Group JV  
 Patton Harris Rust & Associates



**Figure 3.3-1**  
**AQUIFER RECHARGE AREAS AND**  
**SURFACE AREA WATERSHEDS**  
 EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property in Guam

In the southern portion of the island, water quickly drains from sloped surfaces into natural surface drainage channels that comprise part of the fresh water resources of southern Guam. A relatively small amount of rainfall soaks into underlying rock strata. More than 40 rivers and streams form a surface drainage pattern that dissects the volcanic region. These rivers flow into the sea through estuarine areas typified by floodplains and wetlands.

The central transitional zone features a mix of drainage characteristics. Relief features are characterized by sloping hills, intersected by low-lying basins that are periodically flooded during the wet season. They appear as grassy flats and are important for recharge of the central aquifer. This aquifer reaches the surface at Agana Springs and disperses water into the Agana Swamp, which eventually flows into Agana Bay via Agana River—the northernmost river on Guam. (ACOE, September 1980).

**Flood Hazard.** All of the parcels were reviewed against the Flood Insurance Rate Maps (FIRM), which designate flood hazard areas throughout Guam. Within each flood hazard area, the FIRM have designated flood zones. Table 3.3-1 describes the FIRM zone designations.

**Table 3.3-1: FIRM Zone Designations**

Zone	Definition
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between 1 and 3 ft (0.3 to .91 m); average depths of inundations are shown, but no flood hazards factors determined.
AH	Areas of 100-year shallow flooding where depths are between 1 and 3 ft (0.3 to .91 m); base flood elevations provided, but no flood hazards factors determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors are determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than 1 ft (0.3 m) or where the contributing drainage area is less than 1 sq mi (2.59 km <sup>2</sup> ); or areas protected by levees from base flood.
C	Areas of minimum flooding.
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

Source: National Flood Insurance Program (November 1985).

As shown in Table 3.3-2, flood hazard designations exist on the following parcels:

- The Tamuning Telephone Exchange is located along the banks of the Tamuning drainageway. This natural basin runs parallel to the foot of the Tiyan cliff line and empties into Agana Bay in the vicinity of Dungca's Beach. The designated flood zone at the Tamuning Telephone Exchange is A27 – A32, which means the base flood elevation is 27 to 32 feet (8.2 to 9.8 meters) (referenced to National Geodetic Vertical Datum of 1929).

**Table 3.3-2: Flood Hazard Areas by Parcel**

Parcel	FIRM Flood Hazard Designation
<b>Northern Region</b>	
FAA Housing	None
Harmon Annex	None
Marine Drive Utility	None
Tamuning Telephone Exchange	Zone A27-32 (Tamuning Drainageway)
NAS Officers Housing	None
<b>Barrigada Region</b>	
N5A	Pockets of zone B
N5B	None
N5C	None
N5D	None
<b>Central Region</b>	
Nimitz Hill Enlisted Housing	None
Nimitz Hill Vacant Lands	None
Sasa Valley	None
Tenjo Vista	Zone A (Laguas River basin) Zone B (Aguada River banks) Zone B (Gautali River banks)
Polaris Point	Zone A (Aguada River basin)
<b>Southern Region</b>	
New Apra Heights	None
Route 2A	Zone A (Namo River basin)
Rizal/Afleje Beach	Zone A (coastline)
Old Apra Heights	None
Navy Ordnance Annex North (West)	None
Navy Ordnance Annex North Housing (East)	None

- The Barrigada N5A parcel contains small pockets of Zone B, which in this case are certain areas subject to 100-year flooding with average depths less than 1 foot (0.3 meter).
- The Tenjo Vista parcel, with three river crossings in addition to a large wetland, has flood hazard zones. Where the Laguas River drains into Apra Harbor, the wetland at the mouth of the river is all within a flood hazard zone A, which indicates areas of 100-year flood where the base flood elevations have not been determined. At the Aguada and Guatali crossings, the river banks are designated flood zone B, which in this case represent the areas between the 100-year and 500-year floods. Again, no base flood elevations have been determined.
- The Polaris Point parcel is located in the Aguada River Basin. Approximately 80 percent of the parcel is within Zone A, including the wetlands in the conservation area of the parcel, which indicates areas of 100-year flood where the flood elevations have not been determined.
- At the Route 2A parcel, the flood hazard associated with the Namo River extends into the southwest boundary of the site. It is designated Zone A, on an area of 100-year flood where flood elevations are undetermined.

- Situated along the coastline, the Rizal/Afleje Beach parcel has a flood hazard zone designated as flood hazard zone A, as an area of 100-year flood where the base elevation has not been determined.

**Water Quality.** Similar to soils and seismicity characteristics, water quality classifications for each parcel differ based on their location. The *Revised Guam Water Quality Standards* classify Guam's water quality into marine, surface, and groundwater. For each GLUP parcel, the GEPA water quality classification is described. Guam's surface waters are vulnerable to contamination from sewage disposal overflows and animal wastes carried into streams during periods of heavy rain. Inland surface water bodies are of highest quality, whereas coastal regions contain surface water bodies of medium to low quality. Guam's groundwater is relatively free from point source pollution discharges that are usually associated with larger land masses. This results in groundwater quality remaining at a consistently high level island wide.

### 3.3.1 Northern Region

**Groundwater.** The three northernmost parcels in this region are located on the west or coastal side of the northern plateau. The northern aquifer recharge area is circumscribed by the Route 3-Route 1-Route 9 "hub." The three parcels are located on the west side of Route 3, outside the recharge area. Although permeability of the soil on these parcels is rapid, their proximity to the coastline eliminates them from contributing to the aquifer recharge zone.

**Surface and Marine Water.** No wetlands or streams are located on any of the northern parcels. The Philippine Sea is located adjacent the FAA Housing parcel. This ocean area is used for fishery, recreational activities, and waterborne transportation.

**Water Quality.** According to the *Revised Guam Water Quality Standards*, the Philippine Sea within 2 miles (3.2 kilometers) of this parcel is categorized as excellent water quality (M-1) (also refer to Section 3.9).

**Flood Hazard.** The Harmon Annex, Marine Drive Utility, Tamuning Telephone Exchange, and NAS Officers Housing parcels do not include any coastal lowlands.

**Existing Drainage System.** The only existing storm water drainage system on the FAA Housing parcel is in the housing area. The system consists of concrete-lined swales along the paved roads that eventually discharge flow near the cliff line away from the housing sites. There is no existing storm water drainage system in place at the Harmon Annex parcel. The building on the Harmon Annex parcel has gutter downspouts to discharge rainwater away from the building, as there is no system in which to discharge the water.

The Tamuning Telephone Exchange parcel is located on urban soil in the central Tamuning area along Marine Drive. This area of Marine Drive is drained by an underground storm water collection system that discharges into Agana Bay.

The northwest corner of the NAS Agana, including approximately half of the NAS Officers Housing parcel along the cliff line and a small portion of the airfield, drains via a piped, subsurface collection system to Agana Bay. There may also be some drainage discharges at the base of the cliff below the housing area. Flooding problems have been reported as a result of

the suspected drainage discharges along the base of the cliff, and localized flooding has occurred along Routes 8 and 16 adjacent to Tiyan.

### 3.3.2 Barrigada Region

**Groundwater.** The Guam Water Authority's (GWA's) *Guam Water Facilities Master Plan Update*, GWFMPU, has identified two potential groundwater management zones (GMZs) within the vicinity of the Barrigada Route 16 parcel. Neither of these GMZs has been developed, as they remain on military lands.

**Surface Water.** There are no delineated wetlands or streams located on the Barrigada parcels.

**Water Quality.** Not applicable.

**Flood Hazard.** No flood hazard areas occur on these parcels. The Barrigada N5A parcel contains small pockets of flood zone B, which in this case are certain areas subject to 100-year flooding with average depths of less than 1 foot (0.3 meter).

**Existing Drainage System.** The four parcels in the Barrigada region do not have existing storm water collection systems.

### 3.3.3 Central Region

The four parcels in the central region are located in the transition zone of mixed limestone and volcanic rock. Since the hydrologic characteristics vary among the five parcels, a description of each parcel is provided below.

#### 3.3.3.1 Nimitz Hill Parcels

**Groundwater.** According to the GWFMPU, all of the parcels in the central region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** No rivers cross the Nimitz Hill Enlisted Housing parcel. The Fonte River brushes along the eastern boundary of the Nimitz Hill Vacant Lands parcel.

**Water Quality.** According to the *Revised Water Quality Standards*, the Fonte River adjacent to this parcel is categorized as medium water quality (S-2).

**Flood Hazard.** No flood hazard areas exist on these parcels.

**Existing Drainage System.** The developed area of the Nimitz Hill Enlisted Housing parcel is mostly paved and has a combination gutter and lined swale drainage collection system. The drainage collection system discharges into Geiger Field. There is no drainage collection system on the undeveloped areas of this parcel.

The Nimitz Hill Vacant Lands parcel is undeveloped with no existing drainage features. Route 6, fronting the parcel, is designed for sheet flow runoff. Culverts are located at the roadway low points to carry storm water to the downhill side.

### 3.3.3.2 Sasa Valley

**Groundwater.** According to the GWFMPU, all of the parcels in the central region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** No surface water bodies exist on this parcel. The surface water bodies within 2 miles (3.2 kilometers) of the Sasa Valley parcel are the Masso River, Sasa River, Apra Harbor, and Piti Bay. The Masso and Sasa rivers do not cross the parcel, but pass north and south of the parcel, respectively. The Masso River passes east to west, north of the parcel and eventually discharges into Piti Bay, part of the Apra Marine Complex. The river supports minor fishing activities, but not recreational activities. Piti Bay supports fishing, waterborne transportation, and recreational activities. The Sasa River meanders along the southern border of the parcel and discharges into the Apra Complex Surface Water Network (Water Monitoring Strategy, GEPA, 1998). The river itself supports minor fishing activities, but not recreational activities. The Apra Complex Surface Water Network supports large-scale navigation, small craft operations, industrial, fishing, and recreational activities.

**Water Quality.** According to the *Revised Guam Water Quality Standards*, the Sasa and Masso Rivers are categorized as low quality (S-3) and the Apra Marine Complex where the rivers discharge is categorized as good quality (M-2).

**Flood Hazard.** No flood hazard areas exist on this parcel.

**Existing Drainage System.** The Sasa Valley parcel is undeveloped; there are no existing drainage features on the site. Drainage from the site discharges towards the Sasa and Masso rivers.

### 3.3.3.3 Tenjo Vista

**Groundwater.** According to the GWFMPU, all of the parcels in the central region are outside GWA's Northern Guam Water Lens and any GMZs. A permanent high water table fluctuates between 20 inches (51 centimeters) above the surface to 23 inches (60 centimeters) below the surface.

**Surface Water.** Three rivers cross this parcel: the Sasa, Lagus, and Aguada rivers. Marine Drive runs parallel to the west border of the parcel. Existing culverts cross under Marine Drive to allow the Sasa, Laguas, and Aguada Rivers to drain into Apra Harbor. There are no flooding hazards associated with the Sasa River culvert crossing. A large wetland occurs at the parcel's western edge alongside Marine Drive. The Laguas River discharges into this wetland on both sides of Marine Drive which in turn discharges into Apra Harbor.

**Water Quality.** The streams on the parcel are categorized as low quality (S-3) according to the *Revised Guam Water Quality Standards*. The Apra Marine Complex where the rivers discharge is categorized as good quality (M-2).

**Flood Hazard.** According to the FIRM, there is a 100-year flood hazard associated with the Laguas River basin and wetlands (zone A). Base flood elevations and flood hazard factors have not been determined. The FIRM identify the area along the banks of the Aguada River as flood hazard zone B, which is between areas of 100-year flood and 500-year flood. Due to previous

flooding, the elevation of Marine Drive was raised during reconstruction or widening projects to alleviate the problem.

**Existing Drainage System.** The Tenjo Vista parcel is undeveloped with no on-site drainage features.

### 3.3.3.4 Polaris Point

**Groundwater.** According to the GWFMPU, all of the parcels in the central region are outside GWA's Northern Guam Water Lens and any GMZs.

A seasonal high water table fluctuates between depths of 20 and 40 inches (51 centimeters and 100 centimeters) during the rainy season, and it gradually recedes during the dry season.

**Surface Water.** The undeveloped area on the north side of the access road consists of wetlands. The Aguada River drains into Apra Harbor through these wetlands.

**Water Quality.** The streams on the parcel are categorized as low quality (S-3) according to the *Revised Guam Water Quality Standards*. The Apra Marine Complex where the rivers discharge is categorized as good quality (M-2).

**Flood Hazard.** Located in the Aguada River Basin approximately 80 percent of the parcel (including the wetlands) is within zone A, which indicates areas of 100-year flood where flood elevations have not been determined.

**Existing Drainage System.** No existing drainage facilities are located on this parcel. The flat area adjacent to Marine Drive, formerly used as a hazardous material drum storage lot, is cleared of most vegetation with crushed gravel and berms around the segregated storage areas.

### 3.3.4 Southern Region

The parcels in the southern region are located where bedrock is volcanic and soils are primarily clay. Since the drainage characteristics of each parcel vary, individual and/or sub-paired descriptions are provided in the following sections.

#### 3.3.4.1 New Apra Heights and Route 2A

**Groundwater.** According to the GWFMPU, all the parcels in the southern region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** There are no streams or wetlands on the site. The natural topography slopes southwesterly toward the Namu River flood basin.

**Water Quality.** According to GEPA's *Revised Guam Water Quality Standards*, (the Namu River is categorized as low quality (S-3).

**Flood Hazard.** No flood hazards are associated with the New Apra Heights parcel. The flood hazard associated with the Namo River extends into the southwest boundary of the site. It is designated zone A, on an area subject to 100-year floods where flood elevations are undetermined.

**Existing Drainage System.** There are no known drainage facilities located on these parcels.

### 3.3.4.2 Rizal/Afilleje Beach

**Groundwater.** According to the GWFMPU, all the parcels in the southern region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** A small creek crosses the Rizal/Afilleje Beach parcel from the southeast corner to the northwest corner and discharges at the shoreline. The creek is not a listed or named river basin.

**Flood Hazard.** The Rizal/Afilleje Beach parcel is designated flood hazard zone A, as an area of 100-year flood where the base elevation has not been determined.

**Existing Drainage System.** There are two small headwalls at each end of the creek to direct surface runoff.

**Water Quality.** According to GEPA's *Revised Guam Water Quality Standards*, Agat Bay is categorized as good water quality (M-2). As the on-site stream is close to the coast, it is classified as low water quality category (S-3) (GEPA, January 1992).

### 3.3.4.3 Old Apra Heights

**Groundwater.** According to the GWFMPU, all the parcels in the southern region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** There are no streams or wetlands in the site.

**Water Quality.** Not applicable.

**Flood Hazard.** No flood hazard areas exist on this parcel.

**Existing Drainage System.** There are no known drainage facilities on this parcel. The land slopes toward the east.

### 3.3.4.4 Navy Ordnance Annex North (West Parcel)

**Groundwater.** According to the GWFMPU, all the parcels in the southern region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** Surface runoff from the Annex West parcel flows west towards two valleys. At the base of each of these valleys is a river that eventually join to flow into the Namo River and Agat Bay. Agat Bay is a coastal marine water with tributaries from 10 rivers and creeks, including the Namo River. Agat Bay supports fishing, recreational, and marine small craft activities.

**Water Quality.** According to GEPA's *Revised Guam Water Quality Standards*, the Namu River is classified as low quality (S-3) and the Agat Bay Marine Complex where the Namu River discharges is categorized as good quality (M-2). Recent GEPA microbiological monitoring of the Namu River indicates violations of water quality standards. However, GEPA has not identified the source of contamination.

**Flood Hazard.** No flood hazard areas exist on this parcel.

**Existing Drainage System.** No known drainage facilities are located on this parcel. The land slopes toward the west.

### 3.3.4.5 Navy Ordnance Annex North Housing (East Parcel)

**Groundwater.** According to the GWFMPU, all the parcels in the southern region are outside GWA's Northern Guam Water Lens and any GMZs.

**Surface Water.** Based on the topography around the parcel, surface runoff from the Annex East parcel flows east towards the Maemong River and south towards the Talisay River. The Talisay River joins the Maemong River and converges with the Bonya River, which then discharges into Morrow Lake. These rivers support minor fishing activities.

**Water Quality.** According to GEPA's *Revised Guam Water Quality Standards*, the Bonya, Talisay, and Maemong rivers and Fena Lake are categorized as high quality (S-1).

**Flood Hazard.** No flood hazard areas exist on this parcel.

**Existing Drainage System.** The existing housing area is developed with a combination of paved and grass areas. Grass and concrete lined swales throughout the development carry runoff from the paved areas to low points that serve as ponding basins for positive drainage.

## 3.4 AIR QUALITY

US EPA has established National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter, ozone (O<sub>3</sub>), and lead (Pb). These standards, summarized in Table 3.4-1, are used to designate all air regions within the U.S., including its territories, into the following categories: attainment, nonattainment, and unclassified. Regions in compliance with the NAAQS are considered in attainment. Emissions exceeding a given NAAQS put the region into nonattainment for that contaminant. Regions are categorized as unclassified when there is a lack of monitoring data or known emission sources.

For the most part, the island of Guam is designated as an attainment area with respect to the NAAQS. Two 1.4-mile (3.5-kilometer) radial areas around the Piti and Tanguisson Power Plants are nonattainment areas for SO<sub>2</sub>. GEPA plans to obtain US EPA redesignations from nonattainment to attainment in the near future (Memorandum for the Record, July 23, 1998). Of the 20 parcels considered in this DEIS, the following seven parcels are in one of the two nonattainment areas:

- FAA Housing
- Harmon Annex

- Marine Drive Utility
- Nimitz Hill Vacant Lands
- Sasa Valley
- Tenjo Vista
- Polaris Point

Major contributors to the island-wide pollutant emissions and resulting impacts to air quality include vehicles, aircraft, and stationary sources such as power generating facilities.

**Table 3.4-1: Summary of National Ambient Air Quality Standards**

POLLUTANTS	SAMPLING PERIOD	NATIONAL PRIMARY STANDARDS $\mu\text{g}/\text{m}^3$ (ppm)	NATIONAL SECONDARY STANDARDS $\mu\text{g}/\text{m}^3$ (ppm)
Particle with an Aerodynamic Diameter Less Than or Equal to a Nominal 10 Micrometers (PM-10)	Annual	50	50
	Maximum Average in Any 24 Hours	150	150
Particle with an Aerodynamic Diameter Less Than or Equal to a Nominal 2.5 Micrometers (PM-2.5)	Annual	15	15
	Maximum Average in Any 24 Hours	65	65
Sulfur Dioxide (SO <sub>2</sub> )	Annual Arithmetic Mean	80 (0.03)	-
	Maximum Average in Any 24 Hours	365 (0.14)	-
	Maximum Average in Any 3 Hours		1,300 (0.5)
Nitrogen Dioxide (NO <sub>2</sub> )	Annual Arithmetic Mean	100 (0.053)	100 (0.053)
Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10,000 (9)	-
	Maximum Average in Any 1 Hour	40,000 (35)	-
Ozone (O <sub>3</sub> )	Maximum Average in Any 1 Hour	235 (0.12)	235 (0.12)
	Maximum Average in Any 8 hours	157 (0.08)	157 (0.08)
Hydrogen Sulfide (H <sub>2</sub> S)	Maximum Average in Any 1 Hour	-	-
Lead (Pb)	Maximum Average in Any Calendar Quarter	1.5	1.5

Note:  $\mu\text{g}/\text{m}^3$  = micrograms per cubic meter of air  
ppm = parts per million  
Source: 40 C.F.R. 50.

### 3.5 LAND USE COMPATIBILITY

Island-wide and regional land use characteristics relating to compatibility with adjacent land uses, visual characteristics, and the noise environment are discussed in this section.

#### 3.5.1 Existing On-site and Surrounding Land Uses

The GLUP properties are no longer occupied or used for Navy mission-related activities except for Building 99 on Barrigada parcel N5B. All properties are maintained by the Navy Caretaker Site Office (CSO). The figures in Chapter 2 illustrate the property boundaries, significant features, and adjacent land uses.

##### 3.5.1.1 Northern Region

The northern region of Dededo is characterized by low intensity residential subdivisions, open space, and military communications facilities. Towards Tamuning, higher intensity urban use and commercial complexes, including the Micronesian Mall, line Marine Drive. The Tiyan plateau, site of NAS Agana, consists of the A. B. Won Pat Guam International Airport and related maintenance facilities, housing, and recreational areas.

**FAA Housing.** The largely undeveloped site is covered with degraded limestone forest and open grass fields around the family housing units (which are undergoing demolition). At the coastline, a steep cliff line is covered with limestone forest and coconut palm groves. Trails lead down to the shoreline characterized by rock ledges with one small cove but no beaches. There is evidence of hunting and low-intensity shoreline use. A two-lane paved road leads directly from Route 3, which served the former government housing area at the top of the cliff. Water, sewer, power, and telephone easements service the housing area previously occupied by FAA and Navy families.

North of the FAA Housing area is Communications Annex Finegayan, a Navy communications station assigned to NCTAMS WESTPAC. To the south, open space extends to the ocean; South Finegayan military housing and recreation areas are adjacent to Route 3. A GovGuam-Chamorro Land Trust single-family residential community is located across Route 3.

**Harmon Annex.** Building 50, a 12,400-square-foot (1,153-square-meter), two-story concrete structure constructed in the early 1950s, occupies the 7-acre (2.8-hectare) site. The building is in fair to poor condition and requires environmental remediation. The grass-, coconut palm-, and pavement-covered property is generally flat, surrounded by a chain-link fence. A 0.6-mile (0.96-kilometer)-long paved road leads to the building from Route 3. Building 50 served as an Air Force communications site, the Navy Publication and Printing Service, and most recently, as the Navy Public Works Center's satellite maintenance shop. Water and electrical power are available; the building connects to a septic tank or leach field system.

Harmon Annex is surrounded by the Harmon Communication Annex No. 1, which is undeveloped except for utility easements. South Finegayan military housing lies further north; the Northern District Sewage Treatment Facility and a GovGuam sewer pump station are to the west and south, respectively. Agricultural and low-density residential uses are east and across from Route 3.

**Marine Drive Utility.** The 25-acre (10-hectare) flat site is covered in part with scrub and degraded limestone forest, and the Navy Telephone Exchange Stars and Stripes Military Newspaper and distribution and administration center (Building 691) is located at the eastern end. The concrete, one-story building was constructed in the early 1950s. To the south of Building 691 is a separately fenced telephone cable hut to be retained by Navy. The property was formerly a part of the Air Force Andersen (Harmon) VOR (very high frequency omnidirectional radio range) Annex prior to its use as a Navy power and telephone facility. The Harmon electrical substation lies between the two Marine Drive Utility sub-parcels. The property is easily accessible, bordered by Route 1 (Marine Drive), Route 3, and Beach Road. Water, sewer, overhead power, and telephone easements run through and alongside the site.

Commercial and medium-density residential developments are south of Marine Drive Utility. A Navy water booster pump station exists to the west, and undeveloped federal land to the north and east.

**Tamuning Telephone Exchange.** This 2-acre (0.8-hectare), level site fronts Marine Drive. Access is via a small lateral road to the east; there is no direct roadway access or curb-cut into the site. Two buildings occupy the site: Building 405, a one-story, 4,867-square-foot (453-square-meter), windowless concrete building constructed in 1949, and a 504-square-foot (47-square-meter) temporary storage shed (Building 406) constructed in 1963. Both structures are in fair condition and require environmental remediation. The property is surrounded by chain-link fencing. The Navy formerly used the site as a telephone exchange and vehicle parking, storage, and refueling station.

The Tamuning Telephone Exchange is bounded on the north by Marine Drive, to the east by a fast food restaurant, to the south by the Automotive Construction Engineering Operations Repair Plant (ACEORP) Tunnel, and to the west by a gas station and storage facility. GovGuam agency offices, occupying the Enlisted Housing, lie on the plateau above the tunnel.

**NAS Officers Housing.** The NAS Officers Housing parcel is situated atop a plateau with commanding views of Agana Bay. The property drops from the higher southern boundary to northern boundary at an approximate 15 percent slope. A cliff sharply descends 100 feet (30 meters) from the parcel's northern boundary to the East Agana business district. The 92-acre (37-hectare) parcel contains 136 one- and two-story housing units constructed in the 1950s and 1960s. The units were previously occupied by the military in association with NAS Agana. Also sited on the parcel are a 12,000-square-foot (1,115-square-meter) convenience store (now closed), built in the 1970s, and a small pump house. The facilities are in good condition. The property is accessed via West Sunset Boulevard, which connects to Central Avenue. Utility services are available.

The NAS Officers Housing parcel is bordered on the west by an exclusive residential neighborhood. To the north and down the steep cliff line is the East Agana business district. To the east is the NAS Agana Bachelors Officers Quarters and NAS Enlisted Housing, consisting of one- and two-story housing units. These facilities are being used for office space by GovGuam agencies pending future Tiyan redevelopment. Approximately 1 mile (1.6 kilometers) east of the parcel is the A. B. Won Pat Guam International Airport. An open area or aircraft "clear zone" lies directly to the south of the parcel.

### 3.5.1.2 Barrigada Region

Located less than 1 mile (1.6 kilometers) from Guam's eastern coastline, the four Barrigada parcels are relatively undeveloped and previously served as military communications sites. Past development consisted of widely spaced antennas and associated clearings.

The largest parcel, N5A at 345 acres (140 hectares), is accessed by Route 16 and Route 8, which splits the parcel north and south. The Navy leases sub-parcels to the Guam Army National Guard for training and maintenance facilities, to the Barrigada municipality for ball fields and a sports complex, and to GovGuam's Department of Agriculture for experiment station operations. Structures on the parcel include the National Guard's 17,700-square-foot (1,646-square-meter) United States Property Fiscal Office and Warehouse and a 700-square-foot (93-square-meter) storage unit on concrete slab, serving as a Navy Pesticide Storage Unit for fertilizer, herbicides, and pesticides for the adjacent Navy golf course. Three closed landfills and two abandoned dumps are contained on this parcel. The remainder of the parcel is undeveloped. Water, sewer, power, and telephone easements cross the site.

The 358-acre (145-hectare), relatively undeveloped N5B parcel is vacant except for Navy use of the former United States Coast Guard (USCG) Communications Building 99 for small motor repair and debris storage. The building will be vacated prior to conveyance. Building 99 is a one-story warehouse in good condition, constructed in 1982. Two closed landfills are situated on this parcel. Access to N5B is from its southeast boundary along Route 15; an unpaved road leads to the parcel from Route 8. No paved roadways cross the site. Water, sewer, power, and telephone easements service the communications building.

Across Route 15 from N5B lies the 15-acre (6-hectare) N5C parcel. Hawaiian Rock Products leases the property in support of their adjacent quarry operation. They maintain two rock crushers, conveyors and rock storage piles, a maintenance shop (constructed in 1991), and a groundwater well on 6.5 acres (2.6 hectares) of the parcel's north end. Water and power service the Hawaiian Rock Products facility. The remaining land is undeveloped. There is no known prior use of this parcel for DoD activities

The fourth Barrigada parcel, N5D, occupies 55 acres (22 hectares). It is relatively undeveloped. Existing structures include an unused transmitter antenna, a concrete communications structure, and four temporary homes. The remainder of the property is open, flat, undeveloped land. Vegetation along Route 15 blocks views into a majority of the parcel. Access into the parcel is from Route 15. Water, power, and telephone easements are situated along Route 15.

Land uses surrounding the Barrigada property consist of (1) undeveloped military land, communication transmitter antennas, and the Air Force Global Communications Station to the north and south; (2) residences along Route 15, cliffs leading to the Pacific Ocean, and the Mangilao Golf Course to the east; and (3) Barrigada residential communities and Tiyan further west. A Navy golf course lies between parcels N5A and N5B.

### 3.5.1.3 Central Region

**Nimitz Hill Parcels.** Located in the municipality of Asan at elevations of 400 to 600 feet (122 to 183 meters) are Nimitz Hill parcels N10A (120 acres [49 hectares]) and N10B (183 acres [74 hectares]). The sites are characterized by steep slopes and dense tropical vegetation. Nimitz Hill Enlisted Housing (N10A) contains 78 housing units constructed in the early 1950s, which

range in size from 2,038 to 2,135 square feet (190 to 199 square meters). The unoccupied concrete duplexes are in fair to good condition. Other on-site structures consist of Quonset Hut 191, a swimming pool, and Gieger Field. Prior to residential use in the 1950s, the Navy conducted farming and animal breeding here. Access to N10A is from Route 6 (which is known as Halsey Road in Asan municipality and Spruance Drive in Piti) to Murray Road. At Nimitz Hill Vacant Lands (N10B), the only modern on-site structure is a Navy Public Works Center (PWC) sewage lift station, Building 1033, entered at the top of Halsey Road. Access to N10B's southern end is along Halsey Road by way of Larson Drive to Turner Drive, which splits this portion of the site.

The Nimitz Hill releasable parcels are part of the larger undeveloped lands of the United States Naval Station, Nimitz Hill Annex, extending southeast of the parcels. The residential community of Maina lies to the northeast; steep slopes drop northwest towards the oceanfront Marine Drive in Asan. Y Punta at Nimitz Hill, military officer family housing, is immediately adjacent to N10B's western boundary. Private residences line Ocean View Drive west of Y Punta. Between N10A and N10B along Halsey Road is the DoDEA High School (former COMNAVMARIANAS headquarters), Nimitz Hill Fire Station, and the Top of the Mar Navy Officers Club. The Navy's Flag Circle housing and bachelor's quarters are also in this area. Naval Telecommunication Center (NTCC), Naval Pacific Meteorology and Oceanography Center West Joint Typhoon Warning Center, located in the DoDEA High School, was decommissioned in April 1999. An abandoned 5- to 10-acre (2- to 4-hectare) military borrow pit used as a disposal site in the 1940s and 1950s lies to the northeast of N10B. A DoD Nimitz Hill reservoir Very High Frequency (VHF) repeater site cuts a small portion of N10B's southernmost tip. A Navy petroleum, oil, and lubricant (POL) pipeline transverses the site's south end.

**Sasa Valley/Tenjo Vista.** These two parcels in the municipality of Piti are bordered on the west by Marine Drive. Sasa Valley, a heavily vegetated, 9-acre (3.6-hectare) parcel, steeply slopes from west to east. The parcel, previously managed by Navy Fleet and Industrial Supply Center (FISC), was part of a Navy tank farm which stored automotive gasoline but is no longer in use. No structures remain on site. Sasa Valley accesses Marine Drive by way of a narrow frontage. Tenjo Vista, a 559-acre (226-hectare) parcel, contains areas of excessive slope (greater than 60 percent), dense tropical vegetation, and wetlands. The parcel is vacant aside from abandoned pipelines and active underground fuel pipelines operated by the Navy and Shell Oil, Guam. The parcel's central portion was formerly developed as a tank farm. Access to Tenjo Vista is by the long western Marine Drive frontage, Tenjo Vista Road at the southern boundary, and Sasa Valley Tank Farm Road that defines a portion of the northern boundary. An unimproved road off of Marine Drive cuts through the parcel, leading to private residences and a shooting range east of the parcel.

The Guam Veterans Cemetery borders Sasa Valley to the north. To the east is the Sasa Valley tank farm and to the west is Route 18 (Causeway Road) leading to Dry Dock Island, Apra Harbor. Between the two parcels, which are separated by distances of 150 to 600 feet (46 to 183 meters), is the Sasa Valley POL administrative building and pump station. Other Tenjo Vista neighboring land uses include private residence, a shooting range, and Tenjo Vista Tank Farm. Across Marine Drive are Outer Apra Harbor and Polaris Point.

**Polaris Point.** This 82-acre (33-hectare) parcel was constructed of fill material and has an elevation approximately 20 feet (6.5 meters) above MSL. The parcel is located on opposite sides of Polaris Point Road at the intersection of Marine Drive in the municipality of Piti.

Structures exist only on the southern side of Polaris Point Road: Building 412 (an approximately 100-square foot [93-square meter], windowless concrete structure), concrete berms, and asphalt paving. Between 1945 and 1970, the Navy used the site for the Naval Supply Depot (NSD) Drum Storage Lot and Solid Waste Management Unit (SWMU) No. 49 for storing, filling, transporting, and cleaning drums which contained gasoline, diesel fuel, oils, lubricants, solvents, and other petroleum products. The northern portion of the site is covered in dense wetland vegetation.

Apra Harbor Complex is located just over 1 mile (1.6 kilometers) to the west of the Polaris Point parcel between the Inner and Outer Apra Harbor. A Navy-owned wetland site (Apra Harbor Parcel 6) is located to the north of the site. Undeveloped, marshy land is southwest of the parcel abutting Inner Apra Harbor. The Tenjo Vista N12B parcel is across Marine Drive to the east.

### 3.5.1.4 Southern Region

**New Apra Heights.** Parcel N15, adjoining parcel N16, is located in the Santa Rita municipality on the south side of Agat Drive/Route 2A. New Apra Heights is a 102-acre (41-hectare) parcel characterized by steep slopes and rugged terrain. It is mostly forested and contains a small wetland at the eastern perimeter. An existing GovGuam wastewater pumping station is located on the western end of the property. No prior DoD use of the parcel is known. The parcel is easily accessed from Agat Drive or Route 5.

**Route 2A.** Route 2A is a 15-acre (6-hectare) parcel. The flat asphalt and concrete-paved Route 2A parcel to the west of New Apra Heights is fenced around its perimeter. GovGuam uses a portion of the Route 2A parcel for school bus parking and washing and maintains a small temporary building and storage container on site. The parcel is easily accessed from Agat Drive. Prior Navy use of the parcel was for vehicle and heavy equipment maintenance and repair.

A Navy PWC landfill and Camp Covington are located north of these parcels on Agat Drive. DOD's New Apra Heights family housing development and a new DoDEA combination elementary-middle school are east of N15's boundary. Southern High School abuts the southern end of New Apra Heights; residential subdivisions are to the southwest. Vacant DoD land is directly south of the Route 2A parcel.

**Rizal/Afleje Beach.** In the municipality of Santa Rita, this 16-acre (6.5-hectare) parcel is on Agat Bay. GovGuam leases a portion of the parcel for park use. A park pavilion, scenic lookout, and barbecue areas are located at the higher southern end. Sloping down to the north and towards the beach, the parcel is covered with dense vegetation. A roadway and various abandoned drainage structures (walls and pipeline) are found at the shoreline. Shoreline Drive provides access to the site and continues to the Navy's Waterfront Annex back gate entrance. The parcel served as military housing during the 1940s and 1950s, and was then converted to recreation use.

Rizal/Afleje Beach is located south of the military Naval Exchange Garage Waste Oil Tank and west of the Navy's PWC Guam Landfill. Further southeast is the DoD's Camp Covington and Route 2A property. Directly south of the parcel is the Apaca Point unit of the War in the Pacific National Historical Park. Several commercial establishments are located beyond the National Park.

**Old Apra Heights.** The 13-acre (5.3-hectare) Old Apra Heights parcel parallels Route 17. This linear parcel slopes eastward and is vegetated with ironwood trees, sword grass, and savanna-type flora. The site is mostly vacant. An existing fenced-in power substation exists off-property at the southern end. Access to the parcel is from Route 17 and Route 5. No prior DoD use of the site is known. Several paved and unimproved roads leading to private residences east of the property traverse the site. One residence appears to be located on the parcel's southeast boundary.

The property is surrounded by residences and secondary roadways: Apra Heights, Talisay, and Lower Talisay communities; several private residences directly east; and Wrigley Field recreation area to the west. Vacant DoD land is to the north.

**Navy Ordnance Annex North.** In the Santa Rita municipality, the property is split into two parcels on the west and east sides of Route 5: N19A, a 50-acre (20-hectare) parcel to the west, and N19B, a 52-acre (21-hectare) parcel to the east. Both sites have steep slopes and dense vegetation at elevations ranging from 400 (122 meters) down to 250 feet (76 meters) MSL. Parcel N19A, wrapping around the DoD's Tupo Reservoir, is mostly vacant. Seventeen housing units in nine concrete buildings, constructed in 1952, line a hilltop drive on N19B, surrounded by well-maintained landscape and perimeter fencing. The duplex units range from 1,605 to 2,705 square feet (149 to 233 square meters) and are in fair to good condition. The parcels represent the northern portion of the Navy Ordnance Annex North, a military ordnance storage facility. Both parcels are accessed by Route 5; N19B is bordered on the south by Harmon Road. Prior use of the site other than for Navy ordnance storage was for military housing, small arms cleaning, fuel storage, and hazardous waste storage.

Surrounding land uses include the Navy Ordnance Annex and administrative and personnel support facilities to the southeast, vacant land and private residences to the north and west, and the Tupo Reservoir and Fena Water Treatment Plant to the west of Route 15. The reservoir and treatment plant is surrounded by but not included in the N19A boundary. The Fena Valley Watershed lies south of the parcels and the Tolaeyuus River Watershed lies to the north.

### 3.5.2 Visual Resources

Significant visual resources include scenic vistas, scenic overlooks, scenic highways, unique topography, or visual landmarks having scenic value. Designated scenic resources are listed below for each region as identified in *Guam Comprehensive Outdoor Recreation Plan* (GovGuam Department of Parks and Recreation, 1990). Historic places listed on the Guam and National Register of Historic Places (NRHP) or those potentially eligible for listing may also have scenic value and are discussed in Section 3.7.

#### 3.5.2.1 Northern Region

No significant, designated visual resources are visible from most of the northern GLUP sites. However, at the NAS Officers Housing parcel sited atop the Tiyan plateau, there are unobstructed views of Agana Bay and the Philippine Sea to the west, and from the west end of the FAA Housing parcel, there are views of the Philippine Sea. The general appearance of properties in the Dededo region is that of rural residential developments and open space. Views from public roadways across the generally flat sites do not extend to the ocean and consist of housing, overhead utilities, and scrub vegetation. Vegetation and structures were

severely damaged by Typhoon Paka in December 1997; some areas have not fully recovered. The northern parcels are characterized by views of vegetation, open fields, and paving; many buildings are in disrepair and lack remarkable design features. The exceptions are views from on site at the NAS Officers Housing parcel sited atop the Tiyan Plateau, from which there are unobstructed views of Agana Bay and the Philippine sea to the west, and the west end of the FAA Housing Parcel, from which there are views of the Philippine Sea.

**FAA Housing.** Views from the public highway into the FAA Housing site are limited due to vegetation.

**Harmon Annex.** This parcel is not visible from a public roadway as it is set back over 0.5 mile (0.8 kilometer) from Route 3.

**Marine Drive Utility/Tamuning Telephone Exchange.** The Marine Drive properties are highly visible due to their immediate proximity to public roadways. Marine Drive Utility is visually dominated by the electrical substation and overhead utility lines running along the front of Marine Drive and crossing its western end. Overhead utilities also run along the Tamuning Telephone Exchange's Marine Drive frontage. Chain-link fencing surrounds the perimeter. On-site buildings block views into the Tamuning Telephone Exchange from Marine Drive, although the entire property is visible from the Tiyan plateau 150 feet (45.8 meters) above and south of the property. Officers Housing units at Tiyan, now GovGuam offices, have views directly down to the Tamuning Telephone Exchange parcel and to Marine Drive.

**NAS Officers Housing Area.** The housing units, set on open grass lawns, are visible from public roadways to the south and from housing and office developments on each side. Overhead utility lines run through the property.

### 3.5.2.2 Barrigada Region

Along the relatively flat Barrigada plateau, there are no significant visual resources visible from the GLUP sites. A scenic overlook at Barrigada Hill is located approximately 2 miles (1.2 kilometers) north of the property. Views from the overlook encompass the N5A and N5B parcels. Views into the sites from adjacent roadways are generally limited due to perimeter vegetation, although there are restricted views from adjacent properties such as P.C. Lujan School and a few private residences east of N5B. On three of the four parcels (N5A, N5B, and N5C), scrub vegetation and expansive grass areas around dismantled antenna farms characterize the properties' general landscape. Distant views of the Air Force Global Communications Station antenna towers are distinguishable to the north and south. The Navy's Admiral Nimitz Golf Course is visible from adjacent parcels N5A and N5B. Panoramic views of the ocean can only be seen from a cliff-side hill at the eastern boundary of N5D.

Structures on the site are low-rise concrete buildings or sheds with no distinguishing design characteristics. The National Guard facility (United States Property Fiscal Office and Warehouse) at N5A is a one-story, 17,700-square-foot (1,646-square-meter) industrial-office structure in good condition fronted by a landscaped parking area. Temporary, dilapidated housing or farming compounds with signs of domestic dumping are seen on site (N5B and N5D). Overhead utilities run to several of these compounds. Natural vegetation has been highly disturbed at the Hawaiian Rock Products storage facility on N5C; paved areas, conveyors, rock storage piles, and industrial structures dominate the view. The remainder of the parcel is vegetated.

### 3.5.2.3 Central Region

**Nimitz Hill Parcels.** Route 6 (Halsey Road or Spruance Drive) is designated as a Guam scenic highway. At elevations over 500 feet (152.5 meters) above MSL, picturesque views of the ocean and the island's western coast are visible from the roadways lining the top of Nimitz Hill. The panorama from the top of Nimitz Hill across parcel N10B is of a densely vegetated valley extending to Mount Tenjo, 3 miles (4.8 kilometers) to the south. A scenic overlook directed towards Mount Tenjo and ocean views is located on the west side of Halsey Road (Route 6) across from Y Punta military family housing at Nimitz Hill. On site (N10A), the enlisted housing units step down from the hillside, surrounded by open lawns and palms trees, preserving scenic views from higher roadways, sidewalk, and between units.

**Sasa Valley/Tenjo Vista.** Although both parcels have natural visual attributes, they are not listed by local or federal agencies as significant visual resources. The parcels are characterized as natural, forested areas. Vegetation blocks views to and from the Sasa Valley parcel from Marine Drive, although Apra Harbor would be visible to the east from on site above the tree line. Tenjo Vista's steep terrain is covered in dense vegetation. Along the length of Marine Drive, views into Tenjo Vista open up to grassy wetlands and drainage ways.

**Polaris Point.** This parcel has two distinct but insignificant visual attributes visible from adjacent roadways: marsh and thick vegetation on the northern half (and portions to the southwest), and cleared, paved areas to the south of Polaris Point Road. Views to Inner and Outer Apra Harbor are blocked by vegetation.

### 3.5.2.4 Southern Region

The southern region, east of the coast and Marine Drive, is characterized by less development, hilly terrain, and the restricted Navy Ordnance Annex. The parcels in this region are surrounded by pockets of residential developments and secondary roads. There is one shoreline property at Agat Bay.

**New Apra Heights/Route 2A.** No significant visual resources are present on site. The terrain at New Apra Heights is covered in dense vegetation with little visibility into the parcel. The N16 parcel is entirely visible from Route 2A. It was previously developed, although only paved areas remain.

**Rizal/Afleje Beach.** On this beachfront parcel, Agat Bay is visible from the higher southern end of the property, which is leased to GovGuam for park use. Thick vegetation blocks the ocean views from Shoreline Drive. The southern end of the parcel can be seen from the adjoining War in the Pacific National Historical Park.

**Old Apra Heights.** Paralleling Route 17, this narrow parcel is clearly visible from both the roadway and adjoining private residences. Ironwood, tangantangan, and grasses dominate the landscape. The fenced-in power station is prominent at the southeast end.

**Navy Ordnance Annex North.** The primary view from the parcels is of landscaped hillsides. From the top of N19B at the housing area, views extend to the surrounding hillsides. No significant visual resources are contained on the site.

## 3.6 NOISE

**Introduction.** Former activities at the GLUP parcels did not generate significant noise. The GLUP properties are outside of industrialized zones and are at great distances from high-noise environments. The exceptions are parcels adjacent to busy highways, subject to traffic noise, and the NAS Officers Housing parcel near the A. B. Won Pat Guam International Airport, subject to aircraft noise. However, aircraft noise at the parcel does not exceed noise standards for residential use. Therefore, noise measurements and modeling were not conducted for existing or future redevelopment for this EIS. Additionally, noise impacts are usually determined on a site-specific basis; the GLUP *Reuse Plan* specifies generalized land use and does not illustrate building placement or development details. Generally, activities within 0.5 mile (0.8 kilometer) of each parcel have been taken into consideration in the assessment of potential noise impacts, as noise levels decrease as the distance from the noise source increases. Noise levels may vary based on how sound travels over local topography, wind direction, adjacent structures, and vegetation.

**Noise Terminology.** Noise impacts are dependent upon (1) the sound pressure being generated, measured in decibels (dB) and usually based on an A-weighted scale (dB)A, which simulates the range of sound that is audible by the human ear; (2) the distance to the affected individual; (3) the medium present between the source and the affected individual; and (4) the period of exposure.

The day-night average sound level (or DNL) is commonly used for measuring environmental noise in general and for relating the acceptability of the noise environment for various land uses. The DNL represents the 24-hour average sound level for an average day, with nighttime noise levels (10:00 p.m. to 7:00 a.m.) increased by 10 decibels (dB) prior to computing a 24-hour average.

Sensitive noise receptors are land uses such as residences, libraries, hospitals, and churches. There are no on-site sensitive receptors or no current use of sensitive receptors (residences) on any GLUP properties. Off-site sensitive receptors in the vicinity of the reuse properties are identified below.

### 3.6.1 Northern Region

The predominant source of noise surrounding the northern properties is vehicular traffic along Route 3 and Marine Drive and aircraft overflights from A. B. Won Pat Guam International Airport. Noise level data associated with vehicular traffic or within community and commercial areas is not measured and is not available from GovGuam.

**FAA Housing.** Sensitive off-site receptors include the Finegayan, Astumbo, and Astumbo Gardens residential communities directly across Route 3 and the Naval Communications Station South Finegayan residences directly south of the property.

**Harmon Annex.** This parcel is set back over 0.5 mile (0.8 kilometer) from Route 3 in the uninhabited Harmon Annex; there are no noise-sensitive receptors nearby.

**Marine Drive Utility.** No noise sensitive receptors are located in this commercialized urban corridor. The property is surrounded on three sides by public roadways and the remaining side by undeveloped land.

**Tamuning Telephone Exchange.** Along the highly developed Marine Drive, the closest noise-sensitive receptor is the Evangelical Church, approximately three blocks to the northwest of the property.

**NAS Officers Housing.** Approximately 1 mile (1.6 kilometers) to the east of the parcel is the A. B. Won Pat Guam International Airport. Noise contours presented in the Guam International Airport Authority's (GIAA's) *Master Plan* indicate that in 1995, aircraft departure and arrival noise at the eastern half of the parcel measure at 60 to 65 DNL, maximum. Due to the elevation difference, traffic noise from Marine Drive, below and to the north of the parcel, is negligible. Noise-sensitive receptors include residences directly west of the parcel.

### 3.6.2 Barrigada Region

The open, generally vacant Barrigada parcels have relatively low ambient noise levels; noise is primarily generated by vehicular traffic on the highways surrounding the property (Route 16, Route 8, and Route 15). Although the A. B. Won Pat Guam International Airport lies to the northwest of Barrigada, noise contours presented in the *Master Plan* indicate that in 1995, aircraft departure and arrival noise at the eastern half of the parcel measure at less than 60 DNL.

Noise sensitive receptors in the area include the P. C. Lujan Elementary School directly south of parcel N5A's National Guard facility. The Barrigada Library, Untalan Middle School, and Church of God are located along Route 10, just over 0.5 mile (0.8 kilometer) west of N5A. Surrounding residential communities include Antonio, Lalo, and Barrigada Heights.

### 3.6.3 Central Region

As in the northern regions, the Nimitz Hill and Piti properties are surrounded mainly by residences and secondary roadways. The topography is typified by steep hills and open countryside. The principal noise source surrounding the properties is from vehicular traffic along Halsey Road, on Nimitz Hill, and along Marine Drive in Piti.

**Nimitz Hill Parcels.** Sensitive off-site noise receptors include the Nimitz Hill Chapel, DoDEA school (former CONMAVMARIANAS headquarters), private residences to the north of parcel N10A, and Navy Officers Housing east of Halsey Road.

**Sasa Valley/Tenjo Vista/Polaris Point.** These parcels are located on either side of Marine Drive and to the east of Apra Harbor. Sensitive noise receptors include the chapel at the Guam Veterans Cemetery bordering the Sasa Valley property and several private residences adjacent Tenjo Vista. No specific noise information is available for a private shooting range located east of the Tenjo Vista parcel. However, Navy has received no resident or public complaints regarding noise from the shooting range.

### 3.6.4 Southern Region

The principal noise source adjacent to the southern reuse parcels is local vehicular traffic on Route 2A, Shoreline Drive, Route 17, and Route 5.

**New Apra Heights/Route 2A.** Agat Drive (Route 2) serves as the northern boundary of these properties. Camp Covington military residences are directly north of the parcels. The Santa Rita and Bordallo residential subdivisions border the New Apra Heights property's southwest boundary; New Apra Heights Family military housing and a DoDEA school border the east; and the Apra Heights community lies approximately 0.5 mile (0.8 kilometer) farther east. Southern High School and the Harry S Truman Elementary School are located to the southeast and south.

**Rizal/Afleje Beach.** At the northern end of the War in the Pacific National Historical Park, GovGuam leases this federal property for park use. Other than the National Park, there are no noise-sensitive receptors in the area.

**Old Apra Heights.** This property is situated in the middle of the Apra Heights community. Approximately four or five homes parallel the parcel, a few hundred feet to the east.

**Navy Ordnance Annex North.** At the northwest boundary of the Ordnance Annex, there are few noise sensitive receptors nearby. The small neighborhoods of Talisay and Lower Talisay are 0.5 mile (0.8 kilometer) north of the parcels. Harry S Truman Elementary School is situated just over 0.5 mile (0.8 kilometer) to the west.

## 3.7 CULTURAL RESOURCES

### 3.7.1 Introduction

The term "cultural resources" is broadly defined to include cultural uses of the natural environment, religious and sacred sites, places of traditional cultural importance, historic and archaeological resources, historic objects and documents, and community values. Guam's diverse past has given it a rich cultural heritage. Archaeological sites remain from the island's past, which can be generally divided into the prehistoric period—prior to European contact—and historic period, marked by the arrival of Ferdinand Magellan in 1521. The prehistoric period consists of the earlier *pre-latte* period and the *latte* period, the latter primarily distinguished by the appearance of *latte* stone pillars. Between 1521 and the present, Guam experienced heavy Spanish, Japanese, and American influences.

### 3.7.2 Archaeological Investigations

Archaeological field investigations conducted in June 1998 selectively covered various portions of the parcels, depending on whether they were previously surveyed, the presence of known sites, and variations in terrain and surface conditions. An effort was made to validate whether identified sites are potentially representative of other sites in the area or of sites that once existed. The investigations were directed toward development of a predictive model of site presence and distribution.

The results of the investigations, summarized in Table 3.7-1, disclosed the following information on the subject parcels:

- Whether the site is presently listed on either the National Register of Historic Places (NRHP) or the Guam Register (GRHP) of Historic Places.
- Whether the site has been recommended as eligible for the NRHP in previous survey reports or historic reviews.
- For those sites not presently listed, an assessment of possible significance, i.e., whether the site is potentially eligible for the NRHP.
- Assessment of the parcel in terms of archaeological sensitivity, i.e., the degree of probability (high, medium, low, or no probability) of prehistoric or historic sites being present (Table 3.7-2). The assessment was based on field inspections of the parcel and an analysis of previous construction activities that would have disturbed any remains.

Eligibility for listing on the NRHP as shown in Table 3.7-1 has been evaluated in accordance with the criteria established in 16 U.S.C. §470 and 36 C.F.R. Part 60.4. The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that (a) are associated with events that have made a significant contribution to the broad patterns of our history; or (b) are associated with the lives of persons significant in our past; or (c) embody the distinctive characteristics of a type, period, or method of construction, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) have yielded, or may be likely to yield, information important in prehistory or history.

**Table 3.7-1: Summary of Known Historic Sites**

Parcel	Site Number	Name and Description	Status NRHP/ GRHP
N2	08-0066	Rockshelter; deposit; latte period ceramics on surface	und
N2	GL-1	Communication camp: remnants of officers housing area	und
N2	GL-2	Rockshelter w/ pottery	und
N2	GL-3	Pottery scatter	und
N2	GL-4	Rockshelter w/ pottery	und
N2	GL-5	Cave w/ paintings	und
N2	GL-12	Sherds, burned limestone, partially disturbed cultural deposit	und
N3	Building 50	Two story concrete structure, built in early 1950s	RNE
N4B	GL-13	20th century debris: concrete footing blocks, broken concrete, concrete slabs	-
N4C	Building 405	Tamuning Telephone Exchange, 1949	RNE
N5A	04-1059	World War II (WW II) Barrigada Battlefield (and Barrigada Well)	RE
N5A	GL-14	Officers' Country Gates (and additional remains); possibly built by Japanese prisoners of war (POWs) in 1945	RE
N5A	GL-6	Concrete structure, probably WW II	und

**Table 3.7-1: Summary of Known Historic Sites** (continued)

Parcel	Site Number	Name and Description	Status NRHP/GRHP
N10A	01-1057	WW II Fonte Plateau Battlefield, location of a major post-invasion battle	NRHP, GRHP
N10A	-	Quonset Hut 191	RE
N10A	-	Geiger Field, WW II-era baseball field	RE
N10A	01-1063	Japanese bunker	GRHP
N10A	1A	Possible WW II mass grave	und
N10A	NHT-15	Naval Station Annex, foundations	und
N10A	NHT-16	Japanese last-holdout depression	und
N10A	GL-15	Rockshelter, prehistoric deposit, WW II use	und
N10A	GL-16	Rockshelter, prehistoric deposit, WW II use	und
N10A	GL-17	Three caves, prehistoric pottery, WW II use, one is Japanese tunnel	und
N10B	01-1057	Fonte Plateau Battlefield; location of the major post-invasion battle	NRHP, GRHP
N10B	01-1157	Libugon Radio Station, 1917	und
N10B	01-1159	Libugon Japanese caves, WW II	und
N10B	A9-1	Chert nodule and flake scatter	und
N10B	GL-19	Chert nodule and flake scatter	und
N10B	NHT-4	Caves of Japanese Field Hospital	und
N10B	GL-20	Pre-WW II penal farms, possible remains	und
N12B	01-1337	Leeper's Loop; chert and basalt flakes and cores, foxholes	und
N12B	A8-1, 2, 3	3 isolated prehistoric pottery scatters	und
N12B	-	COMNAVBASE dependent housing, remnants	und
N12B	GL-9	Concrete structure, curved roof, WW II?	und
N12B	GL-10A	Shell midden and pottery layer	und
N12B	GL-21	Pottery and shell midden scatter	und
N12B	GL-22	Concrete structure; Japanese power plant?	und
N12B	GL-23	Historic remains, part of former NSC diesel oil tank farm?	und
N14	GL-10B	Rockshelters, pottery, midden, mortar, capstone(?); Japanese tunnel	und
N14	GL-24	Fuel containment berms; possible buried prehistoric deposits under fill	und
N15	TN-15	Drain, bridge	RNE
N15	TN-16	Concrete pads	RNE
N15	TN-17	Sherds	RNE
N17	GL 25	Midden and pottery deposit	und
N17	GL 26	Modified limestone cave, Japanese defense	und
N18	GL 27	WW II-era military activity, combat? dug-out defensive features	und
N19A	GL-28	Japanese defensive complex	und
N19B	-	Abandoned magazines	RE

**Site Number:** Site numbers are Guam Register numbers or temporary numbers assigned in survey reports. GL numbers are sites identified in the 1998 assessment.

**Status:**

- NRHP/GRHP - listed on the National Register of Historic Places (NRHP) or Guam Register (GRHP)  
 RE - recommended eligible for the NRHP in previous survey report or historic review  
 RNE - recommended not eligible for the NRHP in previous survey report or historic review  
 und - undetermined, no record of eligibility recommendation or determination

**Source:** International Archaeological Research Institute, Inc. (IARII) (June 1998)

### 3.7.3 Assessment of Known Historic Properties

Based on the archaeological assessment, a total of 12 parcels were classified as having high archaeological sensitivity: two in the northern region, two in Barrigada, five in the central region, and three in the southern region (Table 3.7-2).

#### Northern Region

In the northern region, two parcels were assessed as having high sensitivity areas for cultural remains. Much of the level plateau of the FAA Housing parcel (N2) may be undisturbed and may contain prehistoric and World War II sites. Numerous prehistoric sites exist in the cliff and beach areas; there are no records of eligibility recommendations or determinations for these sites. There is a possible World War II complex on the Marine Drive Utility parcel (N4B) but a low potential for prehistoric remains. No sites in the region are listed on either the NRHP or GRHP. Building 50 on the Harmon Annex parcel (N3) and Building 405 on the Tamuning Telephone Exchange parcel (N4C) have been previously recommended as not eligible for the NRHP.

#### Barrigada

Two of the Barrigada parcels, N5A and N5B, have high sensitivity areas with the potential for World War II resources in overgrown or jungle areas but a limited potential for prehistoric remains. The World War II Barrigada Battlefield, Barrigada Well (Site 04-1059), and Officer's Country Gates and additional remains (Site GL-14) on parcel N5A have been recommended as eligible for the NRHP in previous survey reports or historic reviews.

#### Central Region

In the central region, five parcels are classified as high sensitivity. The World War II Fonte Plateau Battlefield (Site 01-1057) on the Nimitz Hill parcels (N10A and N10B) is listed on both the NRHP and GRHP. This was the location of a major post-invasion battle. One site on the Nimitz Hill Enlisted Housing parcel (N10A), Quonset Hut 191, has been previously recommended as eligible for the NRHP. Another site on the same parcel—a Japanese bunker (Site 01-1063)—is listed on the GRHP but not on the NRHP. Parcel N10A has the potential for World War II and prehistoric sites in undeveloped areas, including additional caves and rock shelters and mass graves. Nimitz Hill Vacant Land (N10B) has high potential for historic and prehistoric sites in vegetated areas. The site of the Libugon Radio Station, caves, and chert scatters are found here.

Also in the central region, the Sasa Valley, Tenjo Vista, and Polaris Point parcels all have high sensitivity areas. Sasa Valley (N12A) has a high potential for prehistoric sites in undeveloped areas. There is high potential for both prehistoric and World War II sites in the undeveloped hill slopes and ridges of Tenjo Vista (N12B). On this parcel the critical areas for prehistoric sites include the finger ridges, gulches, and stream mouth. Polaris Point (N14) is the site of prehistoric and historic cultural remains; buried prehistoric deposits possibly exist under fill. The parcel also has a potential for prehistoric sites and possible burials in the limestone coastline and wetland. No sites in the central region are currently listed on either the NRHP or GRHP.

**Table 3.7-2: Archaeological Sensitivity**

Parcel		Archaeological Sensitivity			
		High	Medium	Low	None
<b>Northern Region</b>					
N2	FAA Housing: prehistoric sites in cliff area	cliff area and plateau	former antenna complex		housing area
N3	Harmon Annex				Building 50
N4B	Marine Drive Utility: possible WW II complex	most of parcel			electrical substation
N4C	Tamuning Telephone Exchange				developed parcel
	NAS Officers Housing				developed parcel
<b>Barrigada Region</b>					
N5A	Barrigada: site of the Battle of Barrigada and remains of Officers Country in overgrown area	overgrown areas		farmed and developed areas	
N5B	Barrigada: potential for WW II remains	jungle areas			abandoned antenna fields and buildings
N5C	Barrigada				Hawaiian Rock Products
N5D	Barrigada				abandoned antenna field
<b>Central Region</b>					
N10A	Nimitz Hill Enlisted Housing: WW II and prehistoric sites (caves, rock shelters, mass graves, paleoenvironmental sediment data)	undeveloped areas		developed areas	
N10B	Nimitz Hill Vacant Land: high potential for historic and prehistoric sites; Libugon Radio Station.	sloping, vegetated areas		developed areas	
N12A	Sasa Valley: high potential for prehistoric sites	sloping terrain, mostly undeveloped			
N12B	Tenjo Vista: high potential for WW II and prehistoric sites	undeveloped hill slopes, finger ridges, gulches, stream mouth			
N14	Polaris Point: prehistoric and historic cultural remains; potential for additional prehistoric sites and possible burials	limestone coastline and wetlands		developed areas	modern fill

Table 3.7-2: Archaeological Sensitivity (continued)

Parcel		Archaeological Sensitivity			
		High	Medium	Low	None
<b>Southern Region</b>					
N15	New Apra Heights				intensive survey and testing confirm no cultural resources
N16	Route 2A				completely developed
N17	Rizal/Afleje Beach: midden and pottery; potential for extensive burial deposits; potential for additional Japanese features and prehistoric deposits in modified limestone cave	vegetated coastal zone		roads and concrete structures	
N18	Old Apra Heights: potential for WW II sites	partially disturbed and vegetated areas	partially disturbed and vegetated areas	disturbed areas	
N19A	Navy Ordnance Annex North (West Parcel): WW II sites and some possibility of prehistoric sites	undeveloped, overgrown areas			
N19B	Navy Ordnance Annex North (East Parcel): possibility of WW II and prehistoric sites	undeveloped, high grass, and open areas		housing complex	

Source: IARII (June 1998)

### Southern Region

Four southern region parcels are classified as high sensitivity. Rizal/Afleje Beach parcel contains midden and pottery and has potential for both prehistoric and historic deposits. Old Apra Heights (N18) has existing historic period remains of undetermined status and the potential for other World War II sites in partially disturbed, vegetated areas. Navy Ordnance Annex North (N19A) is the locale of World War II Japanese and American military sites and has some possibility of prehistoric features in undeveloped, overgrown areas. Navy Ordnance Annex North Housing (N19B) has existing historic period remains of undetermined status and the possibility of prehistoric and World War II features in undeveloped, vegetated, and open areas. No sites in this region are listed on either the NHRP or GRHP.

## 3.8 TERRESTRIAL BIOTA AND HABITAT

The following is a summary description of terrestrial biological resources on the GLUP properties. This section is based on information contained in natural resources survey reports prepared in 1988 and 1989, a 1998 report of botanical surveys on selected GLUP parcels, and a 1998 report of bird and mammal surveys. No substantive changes in the biological environment are known to have occurred between 1995 (baseline year) and the date of the

surveys, so the findings of the surveys characterize baseline conditions. While Typhoon Paka in 1997 caused alterations in Guam's physical environment, no direct impacts of the typhoon on biota were noted in either of the 1998 biological survey reports. Also, while major typhoons impacted Guam during the 1989-1995 interval (between the time of the natural resources surveys and the baseline year), again no substantial alterations on biota are known to have occurred. Biological resources of concern are threatened and endangered species and are identified herein.

The 1988-1999 natural resources surveys of Navy activities on Guam include the following GLUP parcel areas:

- Naval Communications Area Master Station (NAVCAMS) Guam (including the Barrigada parcels);
- Naval Station (NAVSTA), Naval Supply Depot (NSD), and Public Works Center (PWC), Guam (including Sasa Valley/Tenjo Vista, Route 2A, and Nimitz Hill Enlisted Housing Vacant Lands parcels);
- Navy Ordnance Annex (including Navy Ordnance Annex North parcels); and
- Naval Air Station Agana (including the NAS Officers Housing parcel).

The flora and fauna surveys covered six GLUP sites, selected on the basis of their potential for having flora and fauna resources present: FAA Housing and Marine Drive parcels, both in Dededo; Polaris Point parcel located north of Apra Harbor; New Apra Heights parcel in Santa Rita; Rizal/Aflleje Beach parcel on Agat Bay; and Old Apra Heights parcel located in Santa Rita. The fully developed Tamuning Telephone Exchange parcel was not surveyed.

### 3.8.1 Vegetation Types

The occurrence of the various vegetation types on the GLUP parcels is summarized in Table 3.8-1. There may be considerable overlap in the actual species compositions between the different named categories of vegetation communities. Key aspects of the vegetational composition on each of the GLUP parcels are described in the following paragraphs. Vegetation community types are defined in Appendix C.

#### 3.8.1.1 Northern Region

**FAA Housing.** A total of 159 species of plants was recorded for this parcel. Three of the vegetation types found here—managed vegetation, abandoned fields, and disturbed forest—are highly altered. Two other communities—limestone forest and littoral strand—represent natural plant associations. Disturbed forest dominates the site, with *Vitex parviflora*, an introduced tree, being the most abundant species on the parcel.

Within the native limestone forest community, fago (*Neisosperma oppositifolium*) and a cycad (*Cycas circinnalis*) are the two prominent species. The littoral strand is dominated by nigas (*Pemphis acidula*). A narrow zone of littoral forest, also present here, is almost entirely dominated by the fish-poison tree (*Barringtonia asiatica*).

**Marine Drive Utility.** Vegetation on this site is highly disturbed, with no intact native plant community present. Much of the site is being actively maintained through mowing of lawn

Table 3.8-1: Occurrence of Vegetation Types on GLUP Properties

Vegetation Types	PARCELS														
	N2 FAA Housing	N3 Harmon Annex	N4B Marine Drive Utility	N4C Tamuning Tel Exchange	NAS Officers Housing	N5 (A,B,C,D) Barrigada	N10A Nimitz Hill Housing	N10B Nimitz Hill Vacant Lands	N12 (A,B) Sasa Valley/Tenjo Vista	N14 Polaris Point	N15 New Apra Heights	N16 Route 2A	N17 Rizal/Afleje Beach	N18 Old Apra Heights	N19 (A,B) Navy Ordnance Annex North
Freshwater Wetland						X		X							
Estuarine Wetland								X							
Savanna							X	X							X
Ravine Forest							X	X							
Limestone Forest	X					X									
Degraded or Introduced Mixed Limestone Forest	X		X			X	X	X							
Tangantangan ( <i>Leucaena</i> ) Forest			X			X			X	X				X	
Cultivars						X									
Cleared Abandoned Fields	X					X									
Weeds or Scattered Shrubs						X									
Littoral Strand	X												X		
<i>Casuarina</i> Woodland									X	X				X	
<i>Hibiscus</i> Thicket										X		X			
Managed Vegetation	X	X	X		X				X	X		X	X		
Mixed Grassland										X				X	
<i>Phragmites/Saccharum</i> Grassland												X			
Coral Marsh (Wetland)									X						
Mangrove Scrub (Wetland)									X						
Swamp Forest (Wetland)									X	X					
None				X							X				

Sources: Whistler (1998), BioSystems Analysis, Inc. (1988-1989)

areas. In addition, thickets of tangantangan (*Leucaena leucocephala*) scrub are present on the site, with small trees up to 16 feet (4.9 meters) in height found at the western side of the parcel. The least disturbed vegetation occurs on the eastern side of the parcel. The secondary forest in this area contains some native plant species, including aghao (*Premna serratifolia*), ironwood (*Casuarina equisetifolia*), Vitex parviflora, Indian mulberry (*Morinda citrifolia*), Manila tamarind (*Pithecellobium dulce*), beach hibiscus (*Hibiscus tiliaceus*), chosga (*Glochidion marianum*), and coconut (*Cocos nucifera*).

**NAS Officers Housing.** The parcel has been highly altered from its natural state. No native vegetation or important habitats are found on the parcel. It is possible that some native plant species may be found on the adjacent steep cliff face beyond the property line. Even there, the vegetation appears to be highly disturbed, with the introduced tangantangan being dominant.

The site is being actively maintained by mowing of lawn areas. Other than grass, a number of the more prominent landscaping plants include coconut, breadfruit (*Artocarpis altilis*), banyan (*Ficus elastica*), royal poinciana (*Delonix*), red hibiscus (*Hibiscus*), ironwood, croton (*Croton* sp.), and Manila palm (*Vietschia* sp.).

### 3.8.1.2 Barrigada Region

Principal vegetation types occurring on the Barrigada parcels include cleared fields, cultivars, weeds and shrubs, tangantangan, wetlands, limestone forests, and degraded limestone forest. Much of the site has been developed. The limestone forest has been altered by construction of roadways, hunting trails, and slope erosion. Dominant plants in the Barrigada limestone forest include *Artocarpus mariannensis*, *Neisosperma oppositifolia*, *Cycas circinalis*, and *Guamia mariannae*. Other prominent species include *Jasminum marianum*, *Triphasia trifolia*, *Ficus prolixa*, *Pandanus dubius*, and *P. tectorius*.

The weed plants represented at Barrigada include tangantangan, *Cassia occidentalis*, *Operculina ventricosa*, *Ipomoea triloba*, *I. indica*, *Momordica charantia*, *Eupatorium odoratum*, *Mimosa pudica*, *Stachytarpheta jamaicensis*, *Mikania scandens*, *Bidens alba*, and grasses such as *Pennisetum polystachyon*, *Saccharum spontaneum*, *Panicum maximum*, and *Sorghum halepense*.

### 3.8.1.3 Central Region

**Nimitz Hill Enlisted Housing and Vacant Lands.** On these parcels introduced mixed limestone forest, ravine forest, and savanna can be found. The limestone forest at Nimitz Hill is thoroughly altered; trees originally introduced for agricultural or ornamental purposes are naturalized. These include allspice (*Pimenta racemosa*), flame tree (*Delonix regia*), orchid tree (*Bauhinia monandra*), custard apple (*Anona reticulata*), and coconut. The ravine forest, part of the Fonte Plateau, is dominated by palma brava (*Heterospathe elata*). The Nimitz Hill savanna has all the major savanna sub-communities represented—*Miscanthus*, *Dimeria*, *Phragmites*, and erosion-scar communities, with the *Dimeria*-type community dominant.

**Sasa Valley/Tenjo Vista.** The main types of vegetation occurring on this land include ravine forests, introduced mixed limestone forest, wetlands, and savanna. The ravine forests are dominated by the palm, *Heterospathe elata*. Ferns, including *Davallia solida*, *Thelypteris* spp., and *Angiopteris evecta*, are abundant in the lower reaches of the ravines. Where streams approach sea level, ravines are dominated by bamboo and other introduced species such as mango, breadfruit, betel nut palm, and kamachile. Borders of the ravines are covered in tangantangan, savanna species such as swordgrass, and ironwood.

**Polaris Point.** Much of the Polaris Point parcel was apparently built on filled land. The principal vegetation types are managed vegetation, *Leucaena* scrub, *Casuarina* woodland, coastal marsh, swamp forest, and mangrove scrub. Because the site is highly disturbed, most of the vegetation is non-native. However, some exceptions do occur. A small area of coastal

marsh between Polaris Point Road and the mangrove forest to the north is relatively undisturbed. The dominant plant is a native bulrush, *Scirpus littoralis*. The swamp forest is a mixture of native and introduced species. In the mangrove scrub on the seaward margin of the swamp forest are found plants adapted to brackish and saline water conditions. Mangrove covers a large area on the seaward side of the parcel. The mangrove species are mangle (*Rhizophora apiculata*), *Avicennia alba*, nypa palm (*Nypa fruticans*), and ufa (*Heritiera littoralis*).

#### 3.8.1.4 Southern Region

**New Apra Heights.** Vegetation on this parcel is characterized as managed vegetation, mixed grassland, *Leucaena* scrub, *Hibiscus* thicket, *Casuarina* woodland, and swamp forest, with a great deal of intergradation among the various types. There is evidence of considerable disturbance of natural plant communities, although a mixture of native and introduced species is found here. In addition to the *Leucaena*, *Hibiscus*, and *Casuarina* which are representative of their respective vegetation community types, other dominant species include rat-tail dropseed (*Sporobolus fertilis*) and bermuda grass (*Cynodon dactylon*) on managed land; wild sugarcane (*Saccharum spontaneum*), mission grass (*Pennisetum polystachyon*), *Dichantium bladhii*, *Phragmites karka*, and California grass (*Brachiaria mutica*) in the mixed grassland; and wetland indicators (both facultative and obligate wetland species) including beach hibiscus (*Hibiscus tiliaceus*), screw pine (*Pandanus tectorius*), *Phragmites karka*, swamp fern (*Acrostichum aureum*), *Fimbristylis littoralis*, and mile-a-minute vine (*Mikania scandens*) in the swamp forest.

**Route 2A.** This parcel is paved and has no apparent vegetation.

**Rizal/Afileje Beach.** With a long history of disturbance, very few native plants remain here. The only area still in a somewhat natural condition is a band of littoral strand vegetation along the shore. Managed vegetation, *Saccharum-Phragmites* grassland, and *Hibiscus* thicket are the other plant communities present. Within the native plant assemblage which comprises the littoral strand vegetation, the most common species are beach morning-glory (*Ipomoea pes-caprae*) and beach sunflower (*Wollastonia biflora*). Other species of fairly common occurrence in this zone are sea bean (*Canavalia rosea*), las-gan (*Thuarea involuta*), beach dropseed (*Sporobolus virginica*), and spider lily (*Hymenocallis pedalis*). Inland from the strand is a zone of shrubs dominated by gasoso (*Colubrina asiatica*). Still further inland is a littoral forest zone, comprised mostly of Pacific rosewood (*Thespesia populnea*), beach hibiscus, and ironwood.

**Old Apra Heights.** Very little remains of any natural vegetation assemblages that may have existed here. At the time of the flora survey, recent burning had cleared the northern end of the parcel of virtually all vegetation. Managed vegetation, grassland, *Leucaena* scrub, and *Casuarina* woodland are the principal types observed. Despite the high degree of disruption of natural plant community structure, there are still more than two dozen native species found on this site.

**Navy Ordnance Annex North.** The principal vegetation type found here is savanna. It occurs where fires or other disturbances have removed ravine forest.

### 3.8.2 Protected Plant Species

No species listed for protection by the federal government or GovGuam have been found on any of the GLUP parcels included within the proposed action. Only nine species of plants are threatened, endangered, or candidates for listing on Guam. The fire tree (*Serianthes nelsonii*) is Guam's only federally-listed endangered species. Two other species have been designated by GovGuam as endangered under Guam's Endangered Species Regulation No. 7 (Draft). These are the tsatsa or tree fern (*Cyathea lunulata*) and the ufa halomtano (*Heritiera longipetiolata*). A complete listing of the status of protected plants is provided in Table 3.8-2.

**Table 3.8-2: Endangered, Threatened, and Candidate Plant Species of Guam**

Chamorro Name	English Name	Scientific Name	Status	
			GovGuam	Federal
Tsatsa	Tree-Fern	<i>Cyathea lunulata</i>	Endangered	
Hayun-lago	No common name	<i>Serianthes nelsonii</i>	Endangered	Endangered
Ufa-halomtano	No common name	<i>Heritiera longipetiolata</i>	Endangered	
	No common name	<i>Coelogyne quamensis</i>		Species of concern
	Discipina	<i>Lycopodium phlegmaria</i> var. <i>longifolium</i>		Species of concern
	No common name	<i>Nervilia jacksoniae</i>		Species of concern
	No common name	<i>Tabernaemontana rotensis</i>		Candidate of listing
	No common name	<i>Thelypteris warburgii</i>		Species of concern
	No common name	<i>Tinosperma homosepela</i>		Species of concern

- Sources:
1. Government of Guam, Department of Agriculture (N.D.), *Endangered Species Regulation No. 7 (Draft)*.
  2. U.S. Fish And Wildlife Service, Honolulu Office (November 1, 1996), *Pacific Island Listed, Proposed, or Candidate Species, as designated under the U.S. Endangered Species Act*.

The survey indicates that it would be possible for one of these, *Heritiera longipetiolata*, to occur in the limestone forest of the FAA Housing parcel. However, if found there, it would only occur on steep cliffs that would be protected as conservation land.

Several plants that are not threatened or endangered species but are considered rare (seldom occurring or found) have been found on or near several of the surveyed GLUP parcels. Additional information on the occurrence of these plants is found in the survey reports.

### 3.8.3 Important Habitats

Important habitats are those that support threatened or endangered flora or fauna, or that are considered rare (seldom occurring or found) within the region. On Guam, such habitats

include native limestone forests, ravine forests, and wetlands. Table 3.8-3 identifies GLUP parcels containing protected species and important habitats.

Limestone forests (and ravine forests, which serve similar ecological functions) provide habitat for many threatened or endangered plant and animal species, particularly forest birds and fruit bats. A number of the GLUP parcels still contain limestone forest or ravine forest that represent diverse plant communities that could potentially provide habitat for wildlife. These include the FAA Housing, Barrigada, Nimitz Hill Vacant Lands, and Sasa Valley/Tenjo Vista parcels. The cliffline area at the FAA Housing parcel and the Sasa Valley/Tenjo Vista parcels were designated as part of the Guam National Wildlife Refuge in a 1994 Cooperative Agreement and 1993 Memorandum of Understanding between GovGuam, Navy, Air Force, and USFWS. While possibly none of these sites contains truly pristine limestone forest, at least these remaining forest remnants still retain a degree of biodiversity. In addition, while Guam's wildlife, and particularly its avian fauna, have been adversely impacted due to predation by the brown tree snake (BTS), (*Boiga irregularis*), it is possible that eventually this problem will be brought under control. The remaining limestone and ravine forest on Guam could then serve as habitat for the reestablishment of populations of native birds, bats, and other wildlife, either through reintroduction programs or by natural means. The ravine forest "corridors" at the Tenjo Vista parcel have been identified as offering potentially important wildlife habitat.

On Guam, wetlands provide important habitat for the endangered Mariana common moorhen (*Gallinula chloropus guami*). A number of the small wetlands at Tenjo Vista, although subjected to a variety of human disturbances (including an oil spill at one site), are listed in the *Moorhen Recovery Plan* (U.S. Fish And Wildlife Service, September 1992) as secondary moorhen habitat.

**Table 3.8-3: GLUP Parcels Containing Protected Species and Important Habitats**

Parcel	Parcel Name	Occurrence of Federally Listed Threatened or Endangered Species	Occurrence of Important Habitats
N2	FAA Housing	None observed.	Limestone forest present.
N5	Barrigada	None present.	Wetlands present on N5A and N5B; limestone forest present on N5B and N5D.
N10B	Nimitz Hill Vacant Lands	None present.	Limestone forest present on N10B.
N12B	Tenjo Vista	None observed; habitats suitable to support presence of endangered species (birds and bats).	Ravine forests found in narrow gullies; wetland areas occur along Marine Drive; small wetlands are designated as secondary habitat for endangered common Mariana moorhen ( <i>Gallinula chloropus guami</i> ).
N14	Polaris Point	None present.	Coastal marsh, mangrove scrub, and swamp forest wetlands occur here.
N15	New Apra Heights	None present.	Swamp forest wetland area on the site.

Mangrove swamp, another type of wetland habitat, is found at the Polaris Point parcel. Mangroves serve as breeding and nursery grounds for numerous species of fish, reduce deposition of terrigenous silt in coastal waters, and stabilize shorelines. Thus, mangroves serve several critical ecological functions, and their preservation is important if these functions are to be maintained.

With the exception of the wetlands designated as secondary moorhen habitat mentioned above, none of the habitats found on the GLUP parcels are considered critical habitat as defined by the Endangered Species Act of 1973, as amended.

### 3.8.4 Wildlife

The following sections provide brief descriptions of the wildlife observed on the subject GLUP parcels. Mammalian, avian, and other forms of fauna are described, as well as threatened or endangered species that may occur on the various parcels. In general, the occurrence of native wildlife is closely linked to the presence of suitable habitat. The habitats on Guam that typically support native terrestrial fauna include wetlands and limestone and ravine forests. Parcels omitted from further discussion are those where wildlife has not been observed and is not expected to occur.

#### 3.8.4.1 Mammals

The Mariana fruit bat (*Pteropus mariannus mariannus*), one of the only native mammalian species that could occur on any of the GLUP parcels, is an endangered species and is further discussed in Section 3.8.4.4, below.

The larger mammals found on Guam consist almost entirely of introduced species. Populations of smaller mammals, including introduced rodents, have been kept in check due to predation by the BTS. The mammals recorded or that may occur on GLUP parcels include the following introduced species: Guam deer (*Cervus unicolor*), feral pig (*Sus scrofa*), water buffalo (*Bubalus bubalis*), musk shrew (*Suncus murinus*), feral dog (*Canis familiaris*), feral cat (*Felis catus*), rat (*Rattus* spp.), and mouse (*Mus musculus*). One sighting of goats (*Capra hircus*) has been reported at the FAA Housing parcel (Whistler, 1998).

#### 3.8.4.2 Birds

Populations of most species of native birds on Guam, especially forest birds, have been either extirpated or severely decimated due in large part to predation by the BTS. Most of the birds observed during the 1998 faunal survey are introduced species. A summary of the birds observed during these surveys is found in Table 3.8-4.

Besides the Pacific golden plover, observed in 1998, no other migratory or seabird species were seen. The 1988-1989 natural resources surveys reported other migratory birds and seabirds on Navy properties, some of which may have included sightings on the GLUP parcels. The migratory species reported and their preferred habitats were the white-tailed tropicbird (*Phaethon lepturus* [coastal cliffs]), brown noddy (*Anous stolidus* [coastal islands]), white tern (*Gygis alba* [coastal areas]), common greenshank (*Tringa nebularia* [wetlands]), and whimbrel (*Numenius phaeopus* [mowed grasslands]). In addition to these species, the faunal survey also

mentions that ruddy turnstone (*Arenaria interpres*) would be expected to occur, along with Pacific golden plover and whimbrel, on open lawn areas at the FAA Housing parcel.

**Table 3.8-4: Bird Species Recorded on GLUP Parcels During 1998 Field Surveys**

Common Name	Scientific Name	N2 FAA Housing	N4B Marine Drive Utility	N14 Polaris Point	N15 New Apra Heights	N17 Affleje /Rizal Beach	N18 Old Apra Heights
Pacific Reef Heron	<i>Egretta sacra</i>					●	
Yellow Bittern	<i>Ixobrychus sinensis</i>				●	●	
Black Francolin	<i>Francolinus francolinus</i>	●		●	●		
Blue-breasted Quail	<i>Coturnix chinensis</i>	●					
Pacific Golden Plover	<i>Pluvialis fulva</i>	●					
Philippine Turtle Dove	<i>Streptopelia bitorquata</i>	●	●	●	●	●	●
Black Drongo	<i>Dicrurus macrocercus</i>	●			●	●	●
Eurasian Tree Sparrow	<i>Passer montanus</i>	●	●	●	●	●	●

● - Species observed on site

Source: Bruner (1998)

### 3.8.4.3 Other Wildlife

Although not observed during surveys, two predatory reptile species, BTS and monitor lizards (*Varanus indicus*), occur on Guam and may be present on several of the parcels. The BTS has been responsible for the decimation of large numbers of native birds and other species. Measures are underway to control this serious pest animal on Guam and to prevent its spread from Guam to other areas.

Other vertebrates of widespread occurrence on Guam include the blue-tailed skink (*Emoia weneri*), brown skink (*Carlia fuscata*), and giant neotropical toad (*Bufo marina*). Occurrence of these species is possible on the GLUP parcels.

### 3.8.4.4 Protected Animal Species

No threatened, endangered, or candidate animal species were observed on any of the parcels during the surveys. Further information concerning the status of Guam's threatened and endangered animal species is summarized in Table 3.8-5.

Much of Guam's native bird population has been extirpated or has become extinct through the direct or indirect actions of man. Hunting and egg-gathering in the early part of the century led to the extinction of the Micronesian megapode, while introduction of the BTS caused the rapid decline of virtually the entire avian fauna on the island. As a result, many of Guam's native forest birds, as well as selected species occurring in wetlands, are presently afforded protected status under GovGuam and United States federal laws.

Table 3.8-5: Threatened and Endangered Animals of Guam

Chamorro Name	English Name	Scientific Name	Status	
			GovGuam	Federal
<b>Birds</b>				
Nganga	Mariana Mallard	<i>Anas platyrhynchos oustaleti</i>	Endangered	Endangered; possibly extinct
Sasangat	Micronesian Megapode	<i>Megapodius laperouse</i>	Endangered	Endangered; possibly extinct
Koko	Guam Rail	<i>Gallirallus owstoni</i>	Endangered	Endangered; possibly extinct
Pulattat	Mariana Common Moorhen	<i>Gallinula chloropus guami</i>	Endangered	Endangered
Tottot	Mariana Fruit-Dove	<i>Ptilinopus roseicapilla</i>	Endangered	
Pullman apaka /Puluman fache	White-throated Ground-Dove	<i>Gallicolumba xanthonura</i>	Endangered	
Yayaguak	Mariana (Island) Swiftlet	<i>Collocalia bartschi</i>	Endangered	Endangered
Sihek	Micronesian Kingfisher	<i>Halcyon cinnamomina</i>	Endangered	Endangered; possibly extinct
Aga	Mariana Crow	<i>Corvus kubaryi</i>	Endangered	Endangered
Gakarisu	Nightingale Reed-Warbler	<i>Acrocephalus luscini</i>	Endangered	Endangered; possibly extinct
Chuguanguang	Guam Flycatcher	<i>Myiagra freycinetti</i>	Endangered	Endangered; possibly extinct
Chichirika	Rufous Fantail	<i>Rhipidura rufifrons uraniae</i>	Endangered	
Sali	Micronesian Starling	<i>Aplonis opaca guami</i>	Endangered	
Egigi	Micronesian Honeyeater	<i>Myzomela rubrata saffordi</i>	Endangered	
Nossa	Bridled White-eye	<i>Zosterops conspicillatus</i>	Endangered	Endangered; possibly extinct
<b>Mammals</b>				
Fanihi	Mariana fruit bat	<i>Pteropus mariannus mariannus</i>	Endangered	Endangered
Fanihi	Little Mariana fruit bat	<i>Pteropus tokudae</i>	Endangered	Endangered; possibly extinct
Payesyes	Pacific Sheath-tailed Bat	<i>Emballonura semicaudata rotensis</i>	Endangered	Species of concern; possibly extinct
	Dugong	<i>Dugong dugon</i>	Endangered	
<b>Reptiles</b>				
Haggan	Green Sea Turtle	<i>Chelonia mydas</i>	Threatened	Threatened
Haggan Karai	Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>	Endangered	Endangered
	Leatherback Sea Turtle	<i>Dermochelys coriacea</i>	Endangered	Endangered
Achiak	Oceanic Gecko	<i>Gehyra oceanica</i>	Endangered	
Guali'ek	Micronesian Gecko	<i>Perochirus ateles</i>	Endangered	
Guali'ek	Pacific Slender-toed Gecko	<i>Nactus Pelagicus</i>	Endangered	
Guali'ek Halom Tano'	Snake-eyed Skink	<i>Cryptoblepharus poecilopleurus</i>	Endangered	

**Table 3.8-4: Threatened and Endangered Animals of Guam (continued)**

Chamorro Name	English Name	Scientific Name	Status	
			GovGuam	Federal
<b>Reptiles (continued)</b>				
<i>Guali'ek Kantum Tasi</i>	Tide-pool Skink	<i>Emoia atrocostata</i>	Endangered	
<i>Guali'ek Halom Tano'</i>	Azure-tailed Skink	<i>Emoia cyanura</i>	Endangered	
<i>Guali'ek Halom Tano'</i>	Slevin's Skink	<i>Emoia slevini</i>	Endangered	
<i>Guali'ek Halom Tano'</i>	Moth Skink	<i>Lipinia noctua</i>	Endangered	
<b>Molluscs</b>				
<i>Akaleha'</i>	Mt. Alifan Tree Snail	<i>Partula salifana</i>	Endangered	Species of concern
<i>Akaleha'</i>	Humped Tree Snail	<i>Partula gibba</i>	Threatened	Candidate for listing
<i>Akaleha'</i>	Guam Tree Snail	<i>Partula radiolata</i>	Endangered	Candidate for listing
<i>Akaleha'</i>	Fragile Tree Snail	<i>Samoana fragilis</i>	Endangered	Candidate for listing
		<i>Succinea guamensis</i>		Species of concern
		<i>Succinea piratarum</i>		Species of concern
		<i>Succinea quadrasi</i>		Species of concern

- Sources: 1. Government of Guam, Department of Agriculture (N.D.), *Endangered Species Regulation No. 7 (Draft)*.  
2. U.S Fish And Wildlife Service, Honolulu Office (November 1, 1996), *Pacific Island Listed, Proposed, or Candidate Species, as designated under the U.S. Endangered Species Act*.

The *Guam Forest Birds Recovery Plan* addresses the needs of five species for recovery: the Guam flycatcher (*Myiagra freycineti*), Guam rail (*Rallus owstoni*), Micronesian kingfisher (*Halcyon cinnamomina*), Guam bridled white-eye (*Zosterops c. conspicillata*), and Mariana crow (*Corvus kubaryi*). Separate recovery plans address the requirements for two other endangered species, the Mariana common moorhen and the island swiftlet (*Collocalia bartschi*). One of the primary areas of emphasis for recovery of these species is protection of their preferred habitats, including native limestone forest, ravine forest, and wetlands.

Federally endangered or threatened mammal species with known or historic occurrence on Guam are limited to three species of bats. The little Mariana fruit bat (*Pteropus tokudae*) is thought to be extinct, and the sheath-tailed bat (*Emballonura semicaudata*) has probably been extirpated from Guam. Only the endangered Mariana fruit bat (*Pteropus mariannus mariannus*) is still known to exist on Guam, with one major colony roosting in cliff line limestone vegetation at Andersen Air Force Base. Long-standing hunting of the bats, considered a popular local food delicacy, has greatly reduced their population.

The Mariana fruit bat was not observed during any surveys, but potentially usable habitat for bats is found in the areas of ravine forest on the FAA Housing parcel and on Tenjo Vista parcel. Provided that the BTS problem is brought under control, these habitats could eventually be used for re-establishing populations of the bat.

The Mariana common moorhen, a federally endangered species endemic to the Mariana Islands, is the only remaining wetland-dependent non-migratory bird species on Guam. A small wetland area on the Tenjo Vista parcel is described as a secondary moorhen habitat in the *Moorhen Recovery Plan*.

Two tree snail species, *Partula gibba* and *P. radiolata*, are known to exist in limestone forest at Hilaan and Haputo on either side of the FAA Housing parcel. It is possible that these species could also occur on the FAA Housing parcel. *P. gibba* is listed as endangered and *P. radiolata* as threatened by GovGuam. Both species are presently considered as candidates for federal listing.

### 3.9 MARINE ENVIRONMENT

Three of the GLUP parcels—FAA Housing, Polaris Point, and Rizal/Aflleje Beach—border the coast and thus have marine resources present. This section briefly describes the marine environment of Guam and the three coastal parcels.

#### 3.9.1 Marine Habitats

Guam's tropical coastal waters support a diversity of marine life. Three tropical coastal habitats of particular importance include mangrove swamps, sea grass beds, and coral reefs.

- Mangrove swamps are a type of wetland habitat transitional between shallow ocean waters and dry land. Mangroves serve important ecological functions in shore protection, filtration of surface runoff, and as habitat for many species of fishes and invertebrates. The importance of mangroves has already been mentioned in Section 3.8.
- Sea grass beds, which are communities of marine aquatic vascular plants and seaweeds, occur in sandy or mud-bottom areas. The sea grasses provide food and shelter and serve as nursery grounds for many species of fishes and invertebrates.
- Coral reefs are formations created by living marine organisms. The living reef is a highly complex community of interdependent organisms, dominated by corals, algae, crustaceans, mollusks, other invertebrates, and fishes. Much of Guam's shoreline is surrounded by well developed reef areas that vary from broad reef flats to smaller, scattered patch reefs. The reefs not only provide habitat for a wide variety of organisms but also are instrumental in minimizing beach erosion, replenishing beach sand, and attenuating storm waves.

The habitats described above are important as aesthetic, scientific, and educational resources. In addition, they contribute to Guam's economy, either as a resource for tourism (e.g., coral reefs as the basis for the local scuba diving industry) or as a source of fish and other marine products.

At the FAA Housing parcel, the nearshore area is fringed by a narrow coral reef. Extensive mangrove stands are found at the Polaris Point parcel. It is likely that sea grass beds, typically associated with mangroves, also occur here. In addition, maps prepared by the GovGuam Bureau of Planning (1982) show the presence of a coral reef flat just north of the parcel. The Rizal/Aflleje Beach parcel, at the southern end of Agat Bay, has a fairly broad reef flat that protects the shoreline.

### 3.9.2 Protected Marine Species

Two federally protected species of sea turtles occur in Guam, the threatened green sea turtle (*Chelonia mydas*) and endangered hawksbill turtle (*Eretmochelys imbricata*). Both species lay their eggs on undisturbed sand beaches around the island. It is likely that turtles may swim along the shore in the vicinity of the FAA Housing and Rizal/Afleje Beach parcels. While it is less likely that turtles would venture into the enclosed mangrove embayment fronting the Polaris Point parcel, this still might occur occasionally, and turtles could possibly use any sea grass areas near the site for foraging. No nesting of turtles on the shore of any of the three coastal parcels has been reported.

## 3.10 ROADS AND TRAFFIC

### 3.10.1 Introduction

This section summarizes a traffic study prepared for this EIS. The study describes existing traffic conditions in the project area at the time of the study (February 1999) and provides the baseline traffic conditions used for comparison with future conditions that are described in Section 4.10. The 20 separate parcels have been grouped into four areas to describe existing conditions and evaluate subsequent traffic impacts. These groupings are made so that parcels for which traffic effects are related because of proximity or roadway connections are evaluated together. These four regions are labeled North, including four parcels along Route 3 leading down to Route 1 (Marine Drive); Barrigada, including four parcels located along or between Routes 15 and 8 and the NAS Officers Housing parcel; Nimitz Hill, including two parcels along Route 6 (Halsey Road); and Central/South, including nine parcels along Routes 1, 2A, 2, and 5. Traffic presently generated at these parcels is negligible as the parcels are generally undeveloped, unoccupied, or in low intensity use.

Key regional roadway segments and intersections interconnecting reuse parcels within each region are identified for evaluation. Evaluation of present conditions makes use of the following indicators:

- Average Daily Trips (ADT): The average number of vehicles per day using a roadway segment.
- Vehicle to Capacity Ratio (V/C): The ratio of the number of vehicles using an intersection to the theoretical maximum capacity of the intersection; a ratio of one is maximum capacity.
- Level of Service (LOS): A qualitative description of the ease of traffic flow through an intersection based on the amount of delay experienced by a vehicle, denoted with a letter designator of "A" to "F", with "A" being no delay and "F" being intersection failure.
- Average Delay Per Vehicle (ADPV): The average time delay experienced by a vehicle using an intersection, measured in seconds.

For purposes of evaluating traffic, the four groups of parcels as defined have been modified to consider the regional traffic effects of reuse. The central region for traffic purposes includes only the Nimitz Hill parcels. The Sasa Valley/Tenjo Vista and Polaris Point parcels are included with the southern region because of the traffic interactions along the main north-south roadways of Routes 1 and 2.

### 3.10.2 Northern Region

The four parcels in the northern region or study area are located along the major north-south roadways of Route 1 and Route 3. None of the parcels have previously been high traffic generators.

The key roadways and average daily traffic loads in the northern region are shown in Figure 3.10-1. Route 1 is the principal roadway connecting and serving traffic from Agana north to Dededo and on to Andersen Air Force Base (AFB). It is also a busy commercial street with numerous curb cuts and signalized and unsignalized intersections. Route 3 intersects with Route 1 near Dededo and proceeds north on the western side of the island. Route 16 connects with Route 1 from the south near the Micronesian Mall, carrying traffic from the airport and Barrigada. Routes 28 and 34 are roadways that provide local service to residential and industrial areas off of the main highways.

Key intersections in the northern region include Route 3 with Route 28, Route 3 with Coral Tree Drive, Route 1 with Route 3, Route 1 with Route 34, and Route 1 with Route 16. None of these intersections presently function within capacity at both morning and afternoon peak hours. Table 3.10-1 shows the present functioning of each of these intersections.

**Table 3.10-1: Existing Conditions at North Study Area Key Intersections**

Intersection	Morning Peak Hour			Afternoon Peak Hour		
	V/C	ADPV	LOS	V/C	ADPV	LOS
Route 3 & Route 28	*	52.2	F	*	25.3	D
Route 3 & Coral Tree Drive	*	30.8	E	*	12.4	C
Route 1 & Route 3	1.015	41.8	E	0.875	24.2	C
Route 1 & Route 34	*	**	F	*	**	F
Route 1 & Route 16	0.969	38.9	D	1.084	**	F

- V/C - Ratio of the traffic volume to the theoretical capacity of the intersection.
- ADPV - Average delay per vehicle, in seconds.
- LOS - Level of service.
- \* - V/C is not calculated for intersections with STOP sign controls.
- \*\* - Delay not calculated since unreliable where traffic substantially exceeds capacity.

Source: Wilbur Smith Associates (November 1998)

### 3.10.3 Barrigada Region

Five parcels proposed for reuse are located in or near the Barrigada region but presently do not affect traffic along the primary regional roadways: Route 10, Route 15, and Route 8. These parcels are presently in low intensity use that generate negligible traffic. Of the major roadways in the region, Route 8 is a major thoroughfare that connects the urban center of Agana with the A. B. Won Pat Guam International Airport and Tiyan redevelopment. Route 10 intersects with Route 8 and connects the airport and Barrigada with areas east. Route 15 intersects with Route 10 and serves the northeast coastal region, eventually intersecting with Route 1 near Andersen

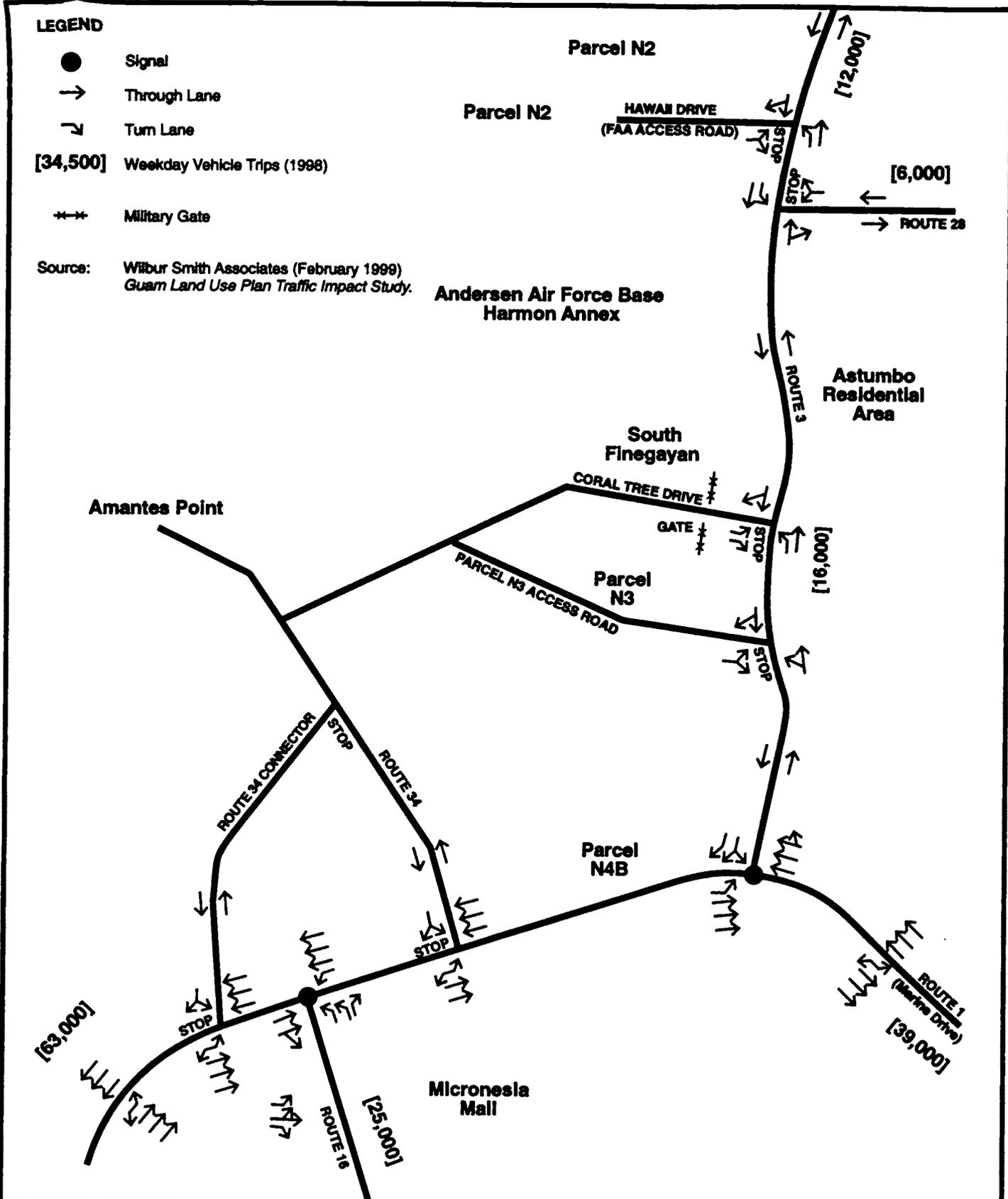
**LEGEND**

- Signal
- Through Lane
- ↘ Turn Lane

[34,500] Weekday Vehicle Trips (1998)

✖✖ Military Gate

Source: Wilbur Smith Associates (February 1999)  
Guam Land Use Plan Traffic Impact Study.



**Figure 3.10-1  
EXISTING TRAFFIC LANES AND CONTROLS  
NORTH STUDY AREA**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



NORTH NOT TO SCALE

AFB. Route 16 intersects with Route 8, passes east of the airport, and connects with Route 1 near the Micronesian Mall. In addition to serving airport traffic, Route 16 also serves the Post Office. See Figure 3.10-2.

Routes 8, 10, and 16 are heavily traveled roadways serving Barrigada, the airport, and the Tiyan area, as well as through traffic. Key intersections along Routes 8 and 10 pass traffic from Agana in the south to Tamuning and areas to the north via Route 16. These key intersections and their present conditions under morning and afternoon peak traffic hours are shown in Table 3.10-2. All of the major intersections function within acceptable limits with the exception of the Route 8 and 10 intersection, which is marginal at 86 percent of capacity and an average delay of 23 to 27 seconds, the Route 8 and 16 intersection, for which traffic exceeds its designed vehicle capacity, and the Central Avenue and Route 8 intersection (West Gate from Tiyan), which is unsignalized and functions at LOS F for morning and afternoon peak hours.

**Table 3.10-2: Existing Conditions at Barrigada Study Area Key Intersections**

Intersection	Morning Peak Hour			Afternoon Peak Hour		
	V/C	ADPV	LOS	V/C	ADPV	LOS
Route 8 & Route 10	0.865	27.1	D	0.838	22.7	C
Route 8 & Route 16	*	**	F	*	**	F
Route 16 & Post Office Driveway	0.502	3.0	A	0.620	4.9	B
Route 10 & Route 15	0.730	21.2	C	0.676	20.5	C
Central Avenue & Route 8	*	**	F	*	**	F

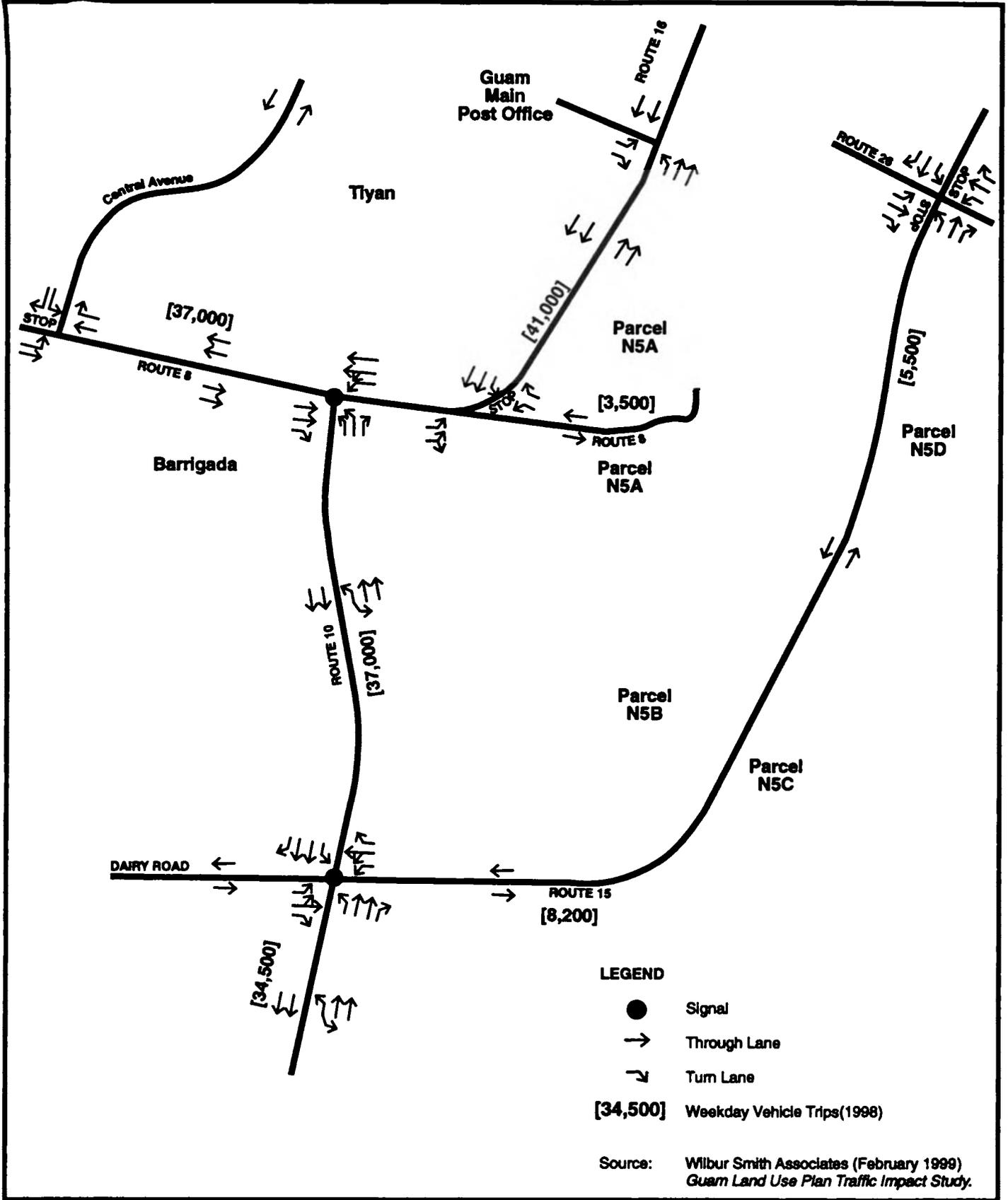
- V/C - Ratio of the traffic volume to the theoretical capacity of the intersection.  
 ADPV - Average delay per vehicle, in seconds.  
 LOS - Level of service.  
 \* - V/C is not calculated for intersections with STOP sign controls.  
 \*\* - Delay not calculated since unreliable where traffic substantially exceeds capacity.

Source: Wilbur Smith Associates (November 1998)

### 3.10.4 Central Region (Nimitz Hill)

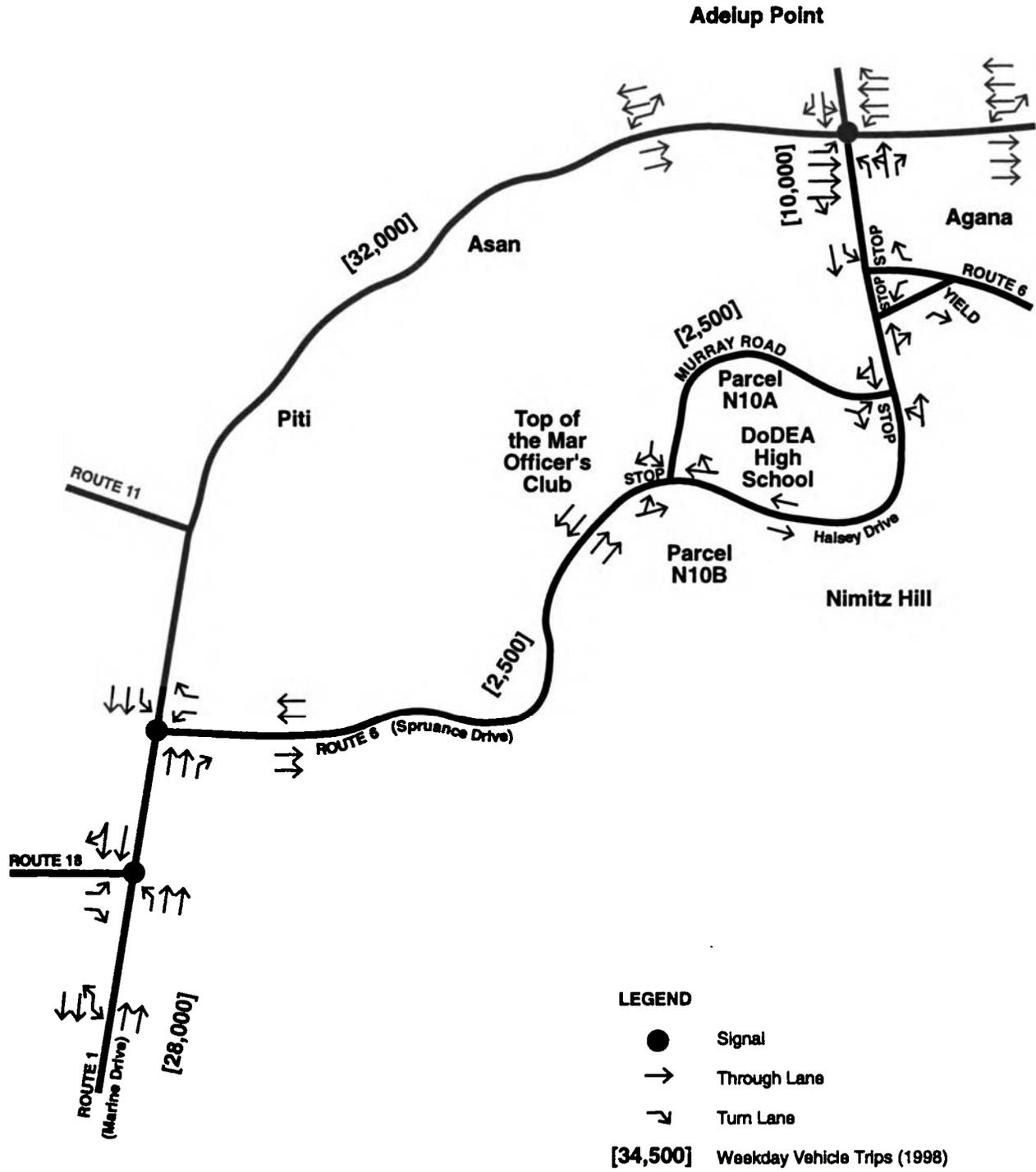
The central region for traffic evaluation includes the two parcels on Nimitz Hill. These two parcels are connected by Route 6 to Route 1 at both its north and south ends. Murray Road is a loop off of Route 6, connecting the Nimitz Hill Enlisted Housing parcel to Route 6. Route 1 is a major roadway serving through and local traffic along the western coast. Route 6 serves Nimitz Hill. While the Nimitz Hill Enlisted Housing parcel is moderately developed with 78 single-family and duplex units previously used for enlisted housing, the Nimitz Hill Vacant Lands parcel is largely undeveloped. Only the Nimitz Hill Enlisted Housing parcel generated traffic in its former use. Figure 3.10-3 depicts the roadways and average daily traffic volumes in the traffic region.

Key Nimitz Hill intersections are the connections of Route 6 with Route 1 at Adelup and south of Piti. The Murray Road intersections with Route 6 primarily serve local traffic. As summarized in Table 3.10-3, all intersections are presently functioning within acceptable limits.



**Figure 3.10-2**  
**EXISTING TRAFFIC LANES AND CONTROLS**  
**BARRIGADA STUDY AREA**

EIS for Disposal & Reuse of GLUP '84  
U.S. Navy Property on Guam



**LEGEND**

- Signal
- Through Lane
- ↘ Turn Lane
- [34,500] Weekday Vehicle Trips (1998)

Source: Wilbur Smith Associates (February 1999)  
Guam Land Use Plan Traffic Impact Study.

**Figure 3.10-3  
EXISTING TRAFFIC LANES AND CONTROLS  
NIMITZ HILL STUDY AREA**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**NORTH** NOT TO SCALE

**Table 3.10-3: Existing Conditions at Central (Nimitz Hill) Study Area Key Intersections**

Intersection	Morning Peak Hour			Afternoon Peak Hour		
	V/C	ADPV	LOS	V/C	ADPV	LOS
Route 1 & Route 6 (Adelup)	0.568	7.3	B	0.757	15.7	C
Route 1 & Route 6 (Piti)	0.559	4.9	A	0.589	4.5	A
Route 6 & Route 7	*	5.0	A	*	5.3	B
Route 6 & Murray Rd. East	*	5.0	A	*	4.9	A
Route 6 & Murray Rd. West	*	4.9	A	*	4.5	A

- V/C        - Ratio of the traffic volume to the theoretical capacity of the intersection.  
ADPV      - Average delay per vehicle, in seconds.  
LOS        - Level of service.  
\*            - V/C is not calculated for intersections with STOP sign controls.

Source: Wilbur Smith Associates (November 1998)

### 3.10.5 Southern Region

For traffic evaluation purposes, the Southern Region encompasses nine parcels along or directly adjacent to Routes 1 and 2, and those in the Santa Rita-Aprá Heights area served by Routes 5 and 12 that connect westward to Route 2. Route 2A connects with Route 1 in the vicinity of the Naval Station Main Gate and provides through traffic to communities in the South. Routes 5 in the north and 12 in the south form a loop from Route 2A through Aprá Heights and Santa Rita, reconnecting to Route 2 in the south. Route 17 departs this loop eastward toward Talafofo.

While Routes 2 and 2A are heavily traveled thoroughfares, Routes 5 and 12 serve a primarily rural and residential region. Figure 3.10-4 reflects the principal roadways serving the region and average daily traffic volumes for each.

All of the reuse parcels in the region are relatively undeveloped with the exception of the Navy Ordnance Annex North (East) parcel, which has 19 multi-family housing units (unoccupied), and average daily traffic volumes in the Rizal/Afleje Beach Park parcel. None of the parcels is a major traffic generation source. Traffic volumes are heaviest on Routes 1 and 2A, as these are main west coast roadways, which provide access to the Naval Station, Public Works Center, Camp Covington, and the Ship Repair Facility, as well as points north and south. Traffic on Route 5 serves the Aprá Heights area and experiences moderate loading, while Routes 12, 17, and 5 east of Aprá Heights have lower traffic volumes. Southern High School, DoDEA Middle School, and Harry S Truman Elementary School in the Aprá Heights area contribute further to the traffic volumes when school is in session.

Key intersections in the region are those of Route 1 with Route 6 in the north, and Route 1 with Route 18, which provides access to the Polaris Point and Route 2A parcels. The intersection of Route 2A with Route 5 serves the New Aprá Heights and Navy Ordnance Annex North parcels along the Route 5 and Route 12 loop. The intersection of Route 5 with Route 17 occurs east of Aprá Heights, and the intersection of Route 12 with Route 2 occurs near Agat in the south. All

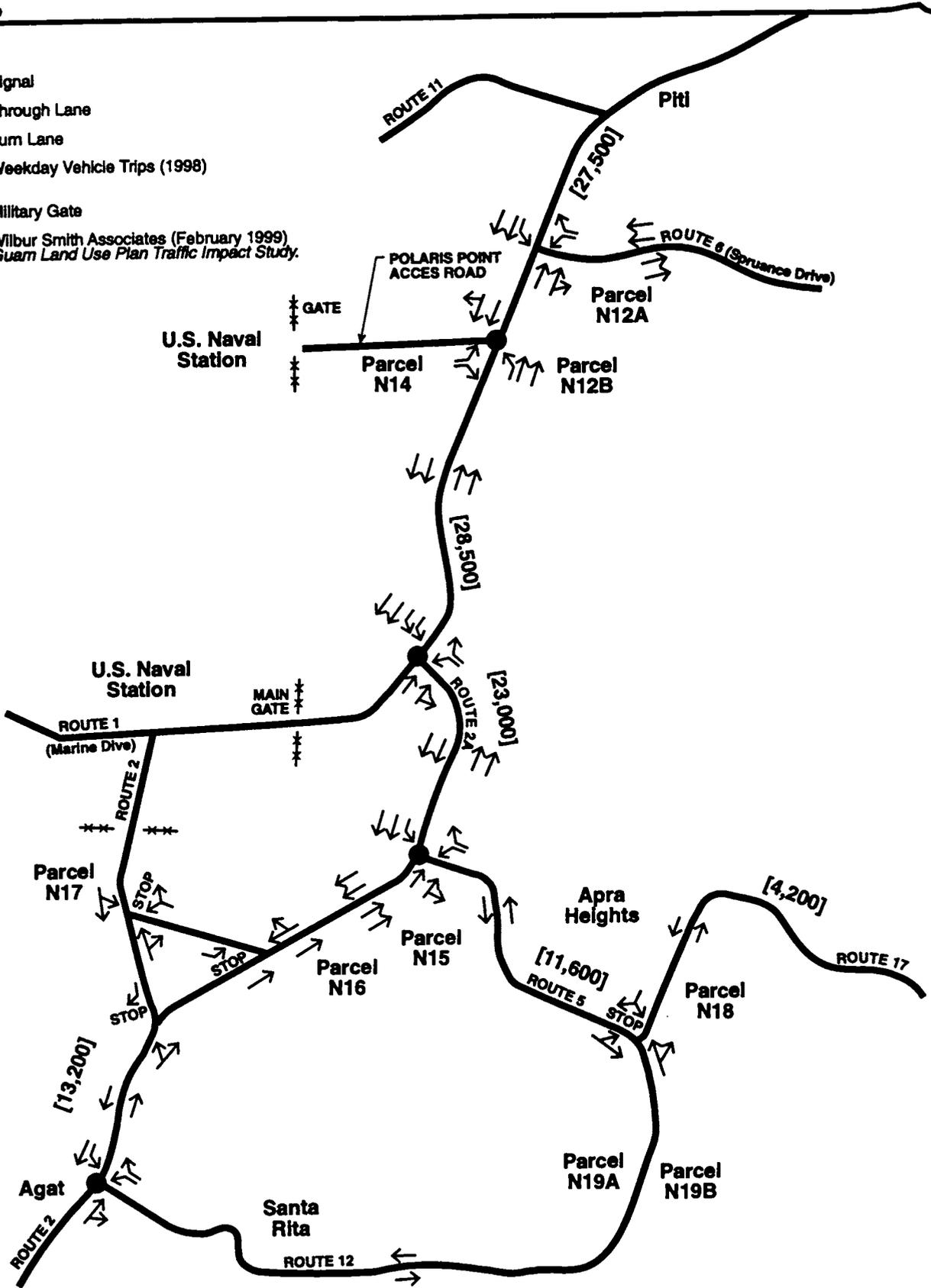
**LEGEND**

- Signal
- Through Lane
- ↘ Turn Lane

[34,500] Weekday Vehicle Trips (1998)

\*\*\* Military Gate

Source: Wilbur Smith Associates (February 1999)  
Guam Land Use Plan Traffic Impact Study.



**Figure 3.10-4**  
**EXISTING TRAFFIC LANES AND CONTROLS**  
**SOUTH STUDY AREA**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



NORTH NOT TO SCALE

of these intersections presently function acceptably at both morning and afternoon peak hours as noted in Table 3.10-4.

**Table 3.10-4: Existing Conditions at South Study Area Key Intersections**

Intersection	Morning Peak Hour			Afternoon Peak Hour		
	V/C	ADPV	LOS	V/C	ADPV	LOS
Route 1 & Route 6 (Piti)	0.559	4.9	A	0.589	4.5	A
Route 1 & Route 18	0.649	6.3	B	0.668	7.4	B
Route 1 & Route 2A	0.437	8.4	B	0.696	13.2	B
Route 2A & Route 5	0.814	18.1	C	0.555	12.1	B
Route 2 & Route 12	0.669	11.0	B	0.569	7.4	B
Route 7 & Route 17	*	5.1	B	*	8.3	B

- V/C - Ratio of the traffic volume to the theoretical capacity of the intersection.
- ADPV - Average delay per vehicle, in seconds.
- LOS - Level of service.
- \* - V/C is not calculated for intersections with STOP sign controls.

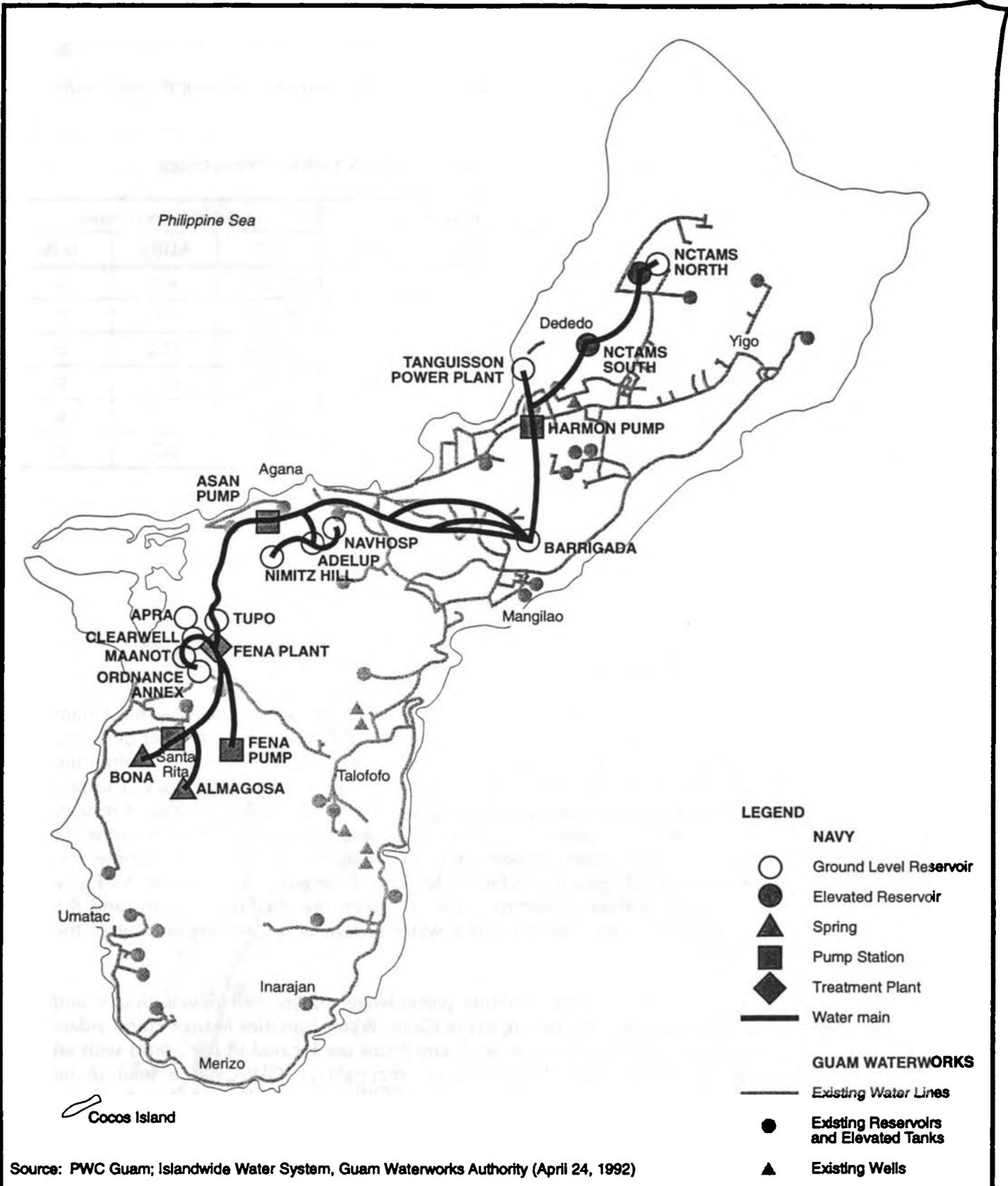
Source: Wilbur Smith Associates (November 1998)

### 3.11 POTABLE WATER SUPPLY

There are two major potable water distribution systems in Guam: one owned by the Guam Waterworks Authority (GWA, formerly Public Utility Agency of Guam), and the other by Navy. The GWA system supplies water to the majority of civilian users across the island, while the Navy system serves most of the military facilities as well as some civilian facilities. The two systems are interconnected at approximately 55 locations (Barrett Consulting Group, February 1992). Figure 3.11-1 provides a schematic of the GWA and Navy distribution systems. In addition to the GWA and Navy water systems, the Air Force has its own water supply and distribution system, which serves mainly Andersen Air Force Base and a few off-base Air Force facilities. There are no major interconnection points between the Air Force system and the GWA or Navy systems. For clarity, the Air Force water system is not shown on any of the figures in this report.

GWA's current sources of water supply include groundwater (deep well development) and surface water (Ugum River intake). According to the *Guam Water Facilities Master Plan Update* (GWFMPU), there are 117 production wells on Guam (most are located in the north) with an average withdrawal rate of 28 mgd (106,000 cubic meters/day). GWA has a total of 86 producing wells and 10 not in operation. The remaining 21 wells belong to either Air Force (nine wells), Navy (three wells), or private entities. Since the publication of the GWFMPU, in February 1992, GWA has issued contracts to drill additional exploratory wells.

Navy's water supply system supports most naval operations, facilities, and military housing on Guam. In addition, various civilian communities depend on water supplied by Navy. Navy's water source is primarily surface water from the Fena Reservoir, located in the Navy Ordnance Annex, Santa Rita. Navy's total water production is approximately 13.6 mgd (51,500 cubic



Source: PWC Guam; Islandwide Water System, Guam Waterworks Authority (April 24, 1992)

**Figure 3.11-1**  
**NAVY/GWA WATER DISTRIBUTION SYSTEMS**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



0 1.5 3 6  
SCALE IN KILOMETERS

0 1 2 4  
SCALE IN MILES

meters/day). This total consists of 9.5 mgd (36,000 cubic meters/day) from Fena Reservoir, 1.9 mgd (7,200 cubic meters/day) from well production, and 2.2 mgd (8,300 cubic meters/day) from natural springs. Navy's Fena Water Treatment Plant capacity is 13.5 mgd (51,100 cubic meters/day) maximum (sustained). During the dry season, the Fena Reservoir capacity drops below demand as the reservoir level declines.

### **3.11.1 Northern Region**

The three northernmost parcels— FAA Housing, Harmon Annex, and Marine Drive Utility—are supplied with water from Navy's main water transmission line along Route 3. This transmission line starts at the Barrigada Reservoir atop Mt. Barrigada and travels along Route 16 to the Harmon Booster Pump Station. The water is then pumped to two separate transmission lines: one toward Naval Computer and Telecommunications Activity Master Station (NCTAMS) and the other toward Tanguisson Power Plant. The three parcels are supplied from the NCTAMS waterline.

#### **3.11.1.1 FAA Housing**

The FAA Housing area is supplied by water from Navy's water system via a metered 6-inch (150-millimeter) diameter waterline from the existing 10-inch (250-millimeter) diameter water main on Route 3. The 6-inch waterline runs along Hawaii Drive, the main access road to the housing area. The housing units (under demolition) had been unoccupied for a number of years, so the 6-inch waterline was unused during this period.

#### **3.11.1.2 Harmon Annex**

The Navy print shop at Harmon Annex is supplied by a 2-inch (50-millimeter) diameter metered water lateral connected to Navy's 12-inch (300-millimeter) diameter water main along Route 3.

#### **3.11.1.3 Marine Drive Utility**

The site at Wettengel Junction is not specifically served with a waterline and meter. An existing 12-inch (300-millimeter) Navy water main runs along the Marine Drive (Route 1) and Route 3 frontages of the parcel. This same water main supplies water to NCTAMS facilities as well as the FAA Housing and Harmon Annex parcels.

#### **3.11.1.4 Tamuning Telephone Exchange**

The Tamuning Telephone Exchange is located on Marine Drive in front of the former Tamuning Maui Well. The Tamuning Telephone Exchange can be supplied with water from a 16-inch main along Marine Drive.

#### **3.11.1.5 NAS Officers Housing**

The NAS Officers Housing area is serviced by the Navy water system by a 16-inch (400-millimeter) waterline located along Route 8 and Route 16. Since the pipeline will be retained

by the Navy, GWA intends to purchase water from Navy to supply the NAS Officers Housing redevelopment. A water meter would be placed at the lateral that services this area. GovGuam or the land developer would be responsible for maintenance, capital improvements, or repairs to the water lines. There are 6- and 8-inch (150- and 200-millimeter) water distribution lines serving the housing units.

### **3.11.2 Barrigada Region**

Two of the Barrigada parcels straddle Navy's Admiral Nimitz Golf Course (parcels N5A and N5B). In this area, Navy provides water to the golf course, Navy housing, and nearby Navy facilities via a 12-inch (300-millimeter) waterline from the Barrigada Reservoir. Parcel N5A straddles the Route 8 extension, where a GWA waterline serves the civilian houses and public school west of the parcel.

The southeast corner of Barrigada parcel N5B fronts Route 15, along which there is a GWA 24-inch (600-millimeter) waterline. Barrigada parcels N5C and N5D are both on the east side of Route 15. Water is available to all three of these parcels from the GWA waterline.

### **3.11.3 Central Region**

The central region parcels are all served by Navy-owned water facilities.

#### **3.11.3.1 Nimitz Hill Parcels**

The Nimitz Hill parcels (N10A and N10B) are both served by Navy's water system. The enlisted housing parcel has waterlines serving each house as well as recreational facilities such as a swimming pool and baseball field. Navy waterlines exist in the vicinity of the Vacant Lands parcel at the Y Punta at Nimitz Hill officers family housing and along Halsey Road on the northern boundary. In addition, a Navy-owned/civilian use waterline serves civilian residents south of the parcel.

#### **3.11.3.2 Sasa Valley/Tenjo Vista**

The Sasa Valley and Tenjo Vista parcels are in the vicinity of a Navy-owned 24-inch (600-millimeter) water main that runs along Marine Drive. The Sasa Valley site is not currently served with a waterline, as it has never been developed. The west boundary of the Tenjo Vista site runs parallel to the 24-inch Navy water main along Marine Drive. Along the south border of the parcel, a 12-inch (300-millimeter) waterline supplies water to the Tenjo Vista fuel tank farm.

#### **3.11.3.3 Polaris Point**

The Polaris Point parcel is on the corner of Marine Drive and the Polaris Point access road. Along the access road, a 12-inch (300-millimeter) Navy waterline taps off the Navy transmission main along Marine Drive. Inactive water distribution lines within the Polaris Point parcel are associated with former Navy use of the parcel.

### **3.11.4 Southern Region**

Most of the southern region parcels are served by or in close proximity to Navy-owned water facilities.

#### **3.11.4.1 Old Apra Heights**

The Old Apra Heights parcel is located east of the Old Apra Heights area, across the Cross Island Road (Route 17). A Navy-owned 10-inch (250-millimeter) water main crosses the southern tip of the parcel near the GPA substation located on the site. To the south, along Route 5 (Magazine Road), a 6-inch (150-millimeter) water meter off Navy's 10-inch diameter main provides water to the GWA system.

#### **3.11.4.2 New Apra Heights and Route 2A**

The New Apra Heights and Route 2A parcels are adjacent to each other. Along Route 2A, fronting the parcels, a 24-inch (600-millimeter) Navy-owned water main serves as the main waterline to Apra Harbor facilities. The source for this 24-inch main, known as the "Apra Harbor waterline," is the Apra Heights Reservoir.

#### **3.11.4.3 Rizal/Afilleje Beach**

The Rizal/Afilleje Beach parcel is located on the beach side of Shoreline Drive, south of the Navy back gate. Along Shoreline Drive fronting the parcel is the 24-inch (600-millimeter) Navy-owned Apra Harbor waterline, reduced to 18 inches (450 millimeters) near the south border of this parcel. A 6-inch (150-millimeter) lateral with a 2-inch (50-millimeter) meter provides water to the park pavilion located at the southwest tip of the parcel.

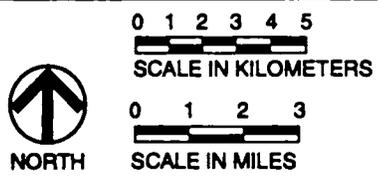
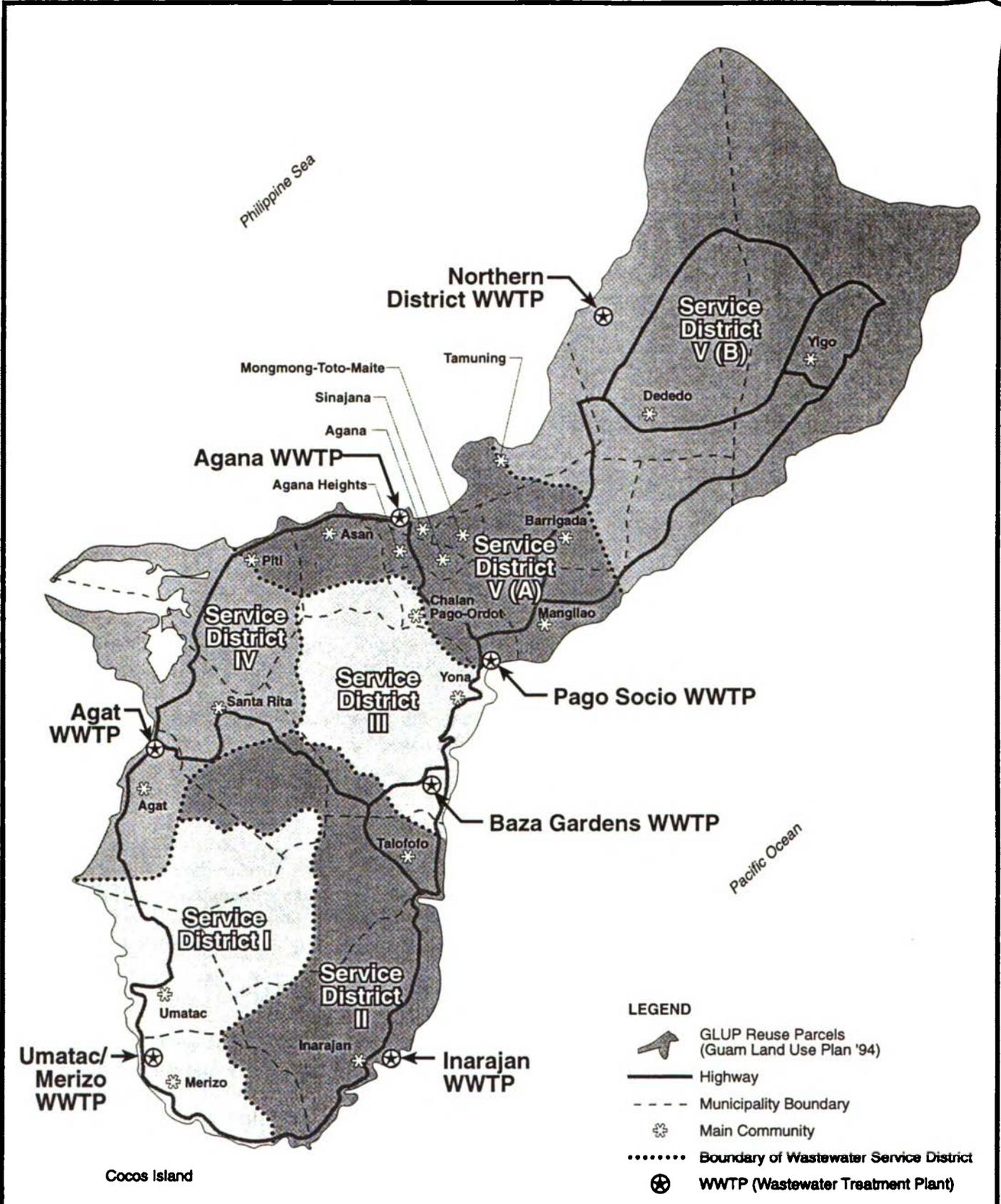
#### **3.11.4.4 Navy Ordnance Annex North**

The two Navy Ordnance Annex North parcels are located on either side of Route 5 (Magazine Road) just outside the Ordnance Annex sentry gate. Parcel N19A surrounds Navy's Tupo Reservoir parcel and borders the west side of Route 5. Two main water transmission lines cross the parcel from the Fena Water Treatment Plant to the Navy's two main reservoirs. The former housing on Parcel N19B was served by 8- and 6-inch (200- and 150-millimeter) waterlines.

## **3.12 WASTEWATER COLLECTION AND TREATMENT**

The GWA manages the public wastewater collection and treatment facilities on Guam. The *Guam Islandwide Wastewater Facilities Plan* partitions Guam into six wastewater service districts. There are currently seven operating wastewater treatment plants (WWTPs) that receive and treat wastewater from these districts. The wastewater service districts and WWTPs are shown in Figure 3.12-1. The treatment plants owned and operated by the GWA are listed as follows:

- Northern District WWTP
- Agana WWTP
- Baza Gardens WWTP
- Inarajan WWTP



**Figure 3.12-1**  
**WASTEWATER SERVICE DISTRICTS**  
EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

- Umatac/Merizo WWTP
- Agat WWTP
- Pago Socio WWTP

The overall wastewater system includes a network of wastewater collection and transmission facilities that serves the more developed areas of the island. Most of the collection and transmission system is located in central and northern Guam. The Agana and Northern District WWTPs are the two largest plants on the island. In addition to the civilian wastewater system, the Navy has a wastewater collection and treatment system that serves almost all military facilities in the Apra Harbor, Apra Heights, and Ordnance Annex areas. Wastewater from these areas is conveyed to the Apra Harbor Wastewater Treatment Plant (WWTP) through a network of collector and interceptor sewer lines and lift stations.

The GLUP parcels are located in several different wastewater service districts. Existing wastewater facilities serving each parcel are described in the following sections.

### **3.12.1 Northern Region**

#### **3.12.1.1 FAA Housing, Harmon Annex, and Marine Drive Utility**

These three parcels are in Service District V(B), which is served by the Northern District WWTP located in the Old Harmon Village area above the Tanguisson Power Plant. The "Northern Link" sewer line starts at Andersen AFB, runs west along Route 9, and then south along Route 3. It picks up wastewater flows from the NCTAMS station, passes through the FAA Housing parcel along the east boundary, and eventually conveys all flows to the Northern District WWTP. This sewer trunk line varies in diameter from 18 to 36 inches (450 to 900 millimeters). An 18-inch gravity line serving the area west of Route 3, including the Harmon Annex and Marine Drive Utility parcels, discharges to the trunk line north of the FAA Housing parcel.

#### **3.12.1.2 Tamuning Telephone Exchange**

The Tamuning Telephone Exchange is in Service District V(A), which is served by the Agana WWTP. It is served by a gravity sewer line along Marine Drive that collects wastewater flows from Ypao Road, Chalan San Antonio, Camp Watkins Road, and the surrounding areas on its way to the Agana Pump Station and the Agana WWTP. The parcel is located on the south side of Marine Drive between Chalan San Antonio and Camp Watkins.

#### **3.12.1.3 NAS Officers Housing**

The NAS Officers Housing areas is also in Service District V(A), which is served by the Agana WWTP. The existing houses and the commissary building are serviced by a combination of 8-inch (200-millimeter) gravity collector lines, lift station, and 4-inch (100-millimeter) force main to eventually discharge into a GWA-owned 18-inch (450-millimeter) gravity line along Route 8. This GWA gravity line eventually discharges into the Agana WWTP.

### **3.12.2 Barrigada Region**

According to the service district designation map, the four parcels in the Barrigada Region are split between Service Districts V(A) and V(B). The scale of the service district map makes it

difficult to determine actual service district designations. A cursory analysis of the map indicates that the Route 16 parcel (N5A) is in Service District V(A); the Route 15 parcel (N5B) is split between both Service District V(A) and Service District V(B); and parcels N5C and N5D are in Service District V(B).

For the Route 16 parcel (N5A), there is an 8-inch (200-millimeter) gravity collector along the northeast boundary and along the Route 8 extension road (in front of the sports field). This 8-inch gravity line collects wastewater from Naval facilities in this vicinity and continues west along Route 8 where it joins GWA collectors. The wastewater eventually flows to the Main Agana Pump Station and is pumped to the Agana WWTP.

There are no sewer collector lines within parcels N5B, N5C, and N5D, as they have never been developed. In addition, there is no GWA sewer collector along the portion of Route 15 that fronts each of these parcels.

### **3.12.3 Central Region**

The five parcels in the central region are also split between service districts. A separate description of the wastewater services for each is provided in the following sections.

#### **3.12.3.1 Nimitz Hill Parcels**

The two Nimitz Hill parcels are in Service District V(A). The Enlisted Housing parcel is served with 8-inch (200-millimeter) gravity collectors running along the rear yards of the housing units. The collectors merge with collectors from other Naval facilities on Nimitz Hill and convey wastewater to a single 12-inch (300-millimeter) gravity line, which follows Route 6 to Marine Drive. At the Marine Drive/Route 6 (Adelup) intersection, the 12-inch gravity line and other gravity collectors discharge to a 24-inch (600-millimeter) sewer trunk line. This line eventually discharges into the Agana Pump Station, which pumps to the Agana WWTP.

An existing 8-inch gravity line meanders through the northern half of the Nimitz Hill Vacant Lands parcel. This line serves Navy's Y Punta officer family housing, located along the west edge of the parcel, and discharges into a sewage lift station located on the parcel. The lift station pumps the sewage to a manhole behind the Navy Fire Station on Route 6 (at the north boundary of the parcel). Gravity lines carry sewage from this manhole and the Enlisted Housing parcel to Marine Drive and eventually to the Agana Pump Station, which pumps to the Agana WWTP.

#### **3.12.3.2 Sasa Valley/Tenjo Vista**

These two parcels in Service District IV are undeveloped and not sewered. There are currently no GWA sewer collection facilities located near these two parcels. At the time the *Guam Islandwide Wastewater Facilities Plan* was written, comments from the mayor of Piti were submitted requesting that sewer collection facilities for the Tenjo Vista area be included in the recommended improvements. This request was studied but not included as a recommended improvement. The planners felt that since no developments were expected to occur, this area was not a priority for sewer infrastructure. It was recommended, however, that GWA monitor the area and reassess the need for sewer lines if substantial growth occurs to justify connection to the Agat sewer collection system.

### **3.12.3.3 Polaris Point**

Geographically, the Polaris Point parcel is located in Service District IV. The dryland portion of the parcel was used at one time by Navy for the storage of oil barrels. The parcel has never been sewerred. West of the parcel, a Navy-owned wastewater collection system discharges to a sewage pump station (SPS) located near the Polaris Point guard station. A Navy-owned force main from this SPS travels along the southern border of the parcel to Marine Drive, follows Marine Drive to the south, and eventually connects to the Navy's Apra Harbor WWTP.

### **3.12.4 Southern Region**

The six parcels in the Southern Region are in Service District IV. Navy sewer collectors exist in the vicinity of all the parcels. Separate descriptions of the sewer collection facilities are provided in the following sections.

#### **3.12.4.1 New Apra Heights**

Navy gravity sewer lines exist within the boundaries of the New Apra Heights parcel. One set of sewer lines carries flows from the adjacent New Apra Heights and Jumbo Quonset areas. A second gravity line was installed to carry discharge from the former Naval facilities on the parcel. Both gravity lines eventually discharge into the Navy's Apra Harbor WWTP. There are no GWA sewer lines in the vicinity of the parcel.

#### **3.12.4.2 Route 2A**

There are neither Navy sewer lines within this parcel nor GWA sewer lines in the vicinity of this parcel, located adjacent to the New Apra Heights parcel. As described above, a Navy sewer line within the adjacent parcel eventually discharges into the Navy's Apra Harbor WWTP.

#### **3.12.4.3 Rizal/Aflleje Beach**

There are neither Navy nor GWA sewer lines within or fronting the Rizal/Aflleje Beach parcel. The nearest sewer line is a Navy line at Route 2, approximately 200 feet (61 meters) from the parcel.

#### **3.12.4.4 Old Apra Heights**

No Navy sewer lines exist within the boundaries of this parcel. At the southern tip of the parcel, fronting the electrical substation, a Navy gravity sewer line along Route 5 (Magazine Road) serves the Navy Ordnance Annex facilities. There are no GWA sewer lines in the vicinity of the parcel.

#### **3.12.4.5 Navy Ordnance Annex North (West Parcel)**

A Navy gravity sewer line along Route 5 (Magazine Road) fronts the parcel. It carries wastewater from the Navy Ordnance Annex facilities to the Navy's Apra Heights WWTP. There are no GWA sewer lines in the vicinity of the parcel.

### 3.12.4.6 Navy Ordnance Annex North Housing (East Parcel)

Navy gravity sewer lines within the boundaries of this parcel discharge wastewater from the Navy housing units. There are no GWA sewer lines in the vicinity of the parcel.

## 3.13 SOLID WASTE DISPOSAL

Municipal refuse on Guam is collected by the Department of Public Works (DPW) and private haulers and transported to the Ordot Sanitary Landfill. No tipping fee is collected, and individuals are allowed to use the landfill for private refuse disposal. Industrial and demolition/construction wastes are also disposed of at the site.

Solid wastes from Navy facilities are disposed of at the Navy Public Works Center (PWC) sanitary landfill at the Apra Harbor complex. Solid wastes from Air Force facilities are disposed of at the Andersen Sanitary Landfill.

Guam currently has two commercial recycling operations. These operations offer collection, drop-off, and buy-back of paper, cardboard, and aluminum. In addition to these facilities, there are several commercial scrap metal and material recovery operations on Guam. There is currently no composting operation conducted on the island.

The major components of typical solid waste include municipal (composed of domestic, institutional, and commercial solid wastes), industrial, and demolition and construction wastes. Minor components include solid wastes from landscaping activities, street cleanings, parks storm drainage structures, and dewatered sludge from wastewater treatment plants. Although the relative contribution of each component varies greatly from one area to another, typical contributions are provided in Table 3.13-1.

Table 3.13-1: Typical Solid Waste Contribution by Category

Source	Percent Contribution	
	Range	Typical
Municipal	30-80	50
Industrial	15-50	30
Demolition/Construction	2-13	9
Other	2-14	11

Source: Tchobanogious, George, Hilary Theisen, and Rolf Eliassen (1977). *Solid Wastes: Engineering Principles and Management Issues*.

The 47-acre (19-hectare) Ordot Landfill has no effective excess capacity at this time. In 1982, it was recognized as one of 418 sites labeled as the nation's worst toxic waste dumps targeted for cleanup. Two years later the landfill made the list of 28 sites eligible for priority action under the US EPA Superfund program. Discharges of pollutants from the landfill into the Lonfit River were observed from July 1985 to June 1990. A local legislative mandate required the closure of the landfill by April 1997, but the deadline passed without a new site being selected. Subsequently, US EPA filed a suit for the landfill's closure.

Guam Public Law (P.L.) 24-139, enacted in March 1998, required that dumping at the Ordot Landfill cease on July 31, 1998, that Ordot Landfill be closed, and that a new municipal solid waste landfill be opened six months from the date of enactment of the law. US EPA has levied fines against GovGuam DPW because the Ordot Landfill is still in operation. In May 1998, DPW issued a schedule that indicated the closure of Ordot Landfill and the opening of a new Municipal Solid Waste Landfill Facility (MSWLF) by the year 2002.

In 1996, Guam P.L. 23-95 designated a new landfill site at Guatali in the municipality of Santa Rita. The law stipulated the Guatali site to be the primary site and another site, known as Mala'a (in Piti), to be the secondary site should the Guatali site prove to be infeasible. The site selection consultant recommended the Mala'a site as the preferred site, but this was voted down by the Legislature due to a rejection by the residents of Piti. The Guatali site has been selected as the new MSWLF site. In August 1998, GEPA released *Phase I Report-Integrated Solid Waste Management Plan for the Island of Guam* (ISWMP). The ISWMP includes an objective that the Guatali Landfill be open for operations by January 1, 2001.

The ISWMP Phase I Report estimates the municipal solid waste (MSW) generation rate for Guam using population figures and DPW's landfill records from 1993. After accounting for adjusted population, alien labor force, civilian work force (at military bases), and a diversion factor, the 1993 Civilian MSW Generation Rate was determined to be 4.65 pounds per capita per day (pcd) (2.11 kilograms per capita/day).

The ISWMP Phase I Report calculated total MSW generation rates using projected population for target years multiplied by low and high generation rates (determined within the report). For 1998, the projected total MSW generation rate ranged from 394 to 406 tons per day (t/d) (357 to 368 metric tons/day). For target year 2003, the generation rate would range from 479 to 500 t/d (435 to 454 metric tons/day). For target year 2008, the generation rate would range from 572 to 601 t/d (519 to 545 metric tons/day).

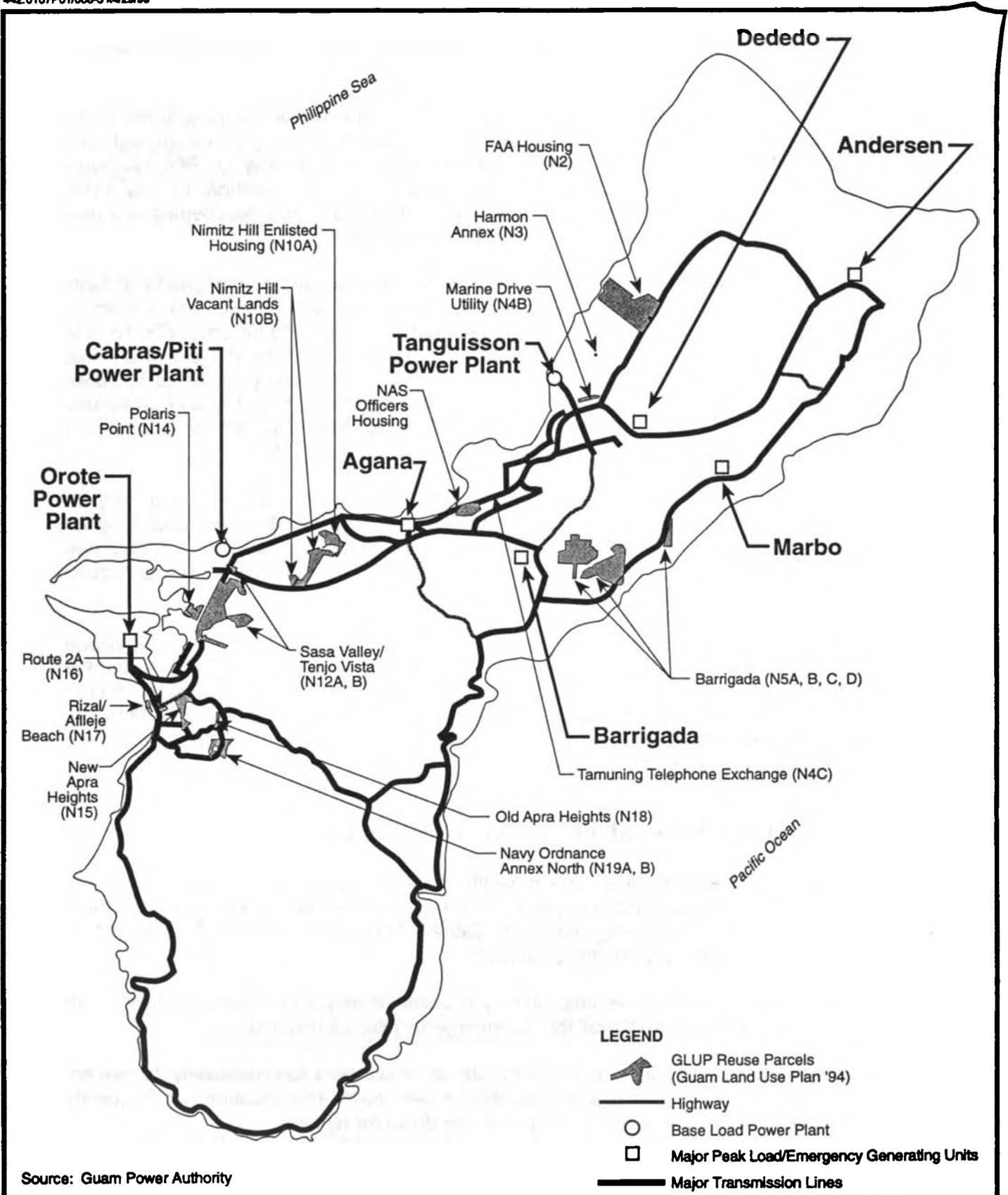
### **3.14 ELECTRICAL SUPPLY AND ENERGY USE**

Electrical power is supplied to all island facilities by the Guam Power Authority (GPA) electrical generation and distribution system. GPA's primary sources of electricity are three base load steam-electric generating stations at Cabras, Tanguisson, and Piti (Figure 3.14-1). Cabras is the largest source of generating capacity.

The existing gross base load generating capacity is approximately 300 megawatts (MW), with approximately 60 additional MW available for emergency/peaking demand.

The electrical demand on Guam has grown rapidly in recent years (approximately 12 percent per year) and the supply has often not been able to keep pace. This situation has frequently resulted in power rationing when generation units are down for repair.

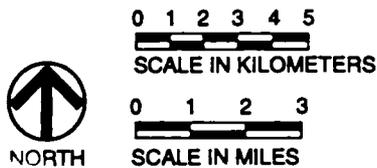
The housing facilities and former Tamuning Telephone Exchange are the only GLUP parcels that have electricity demand records. The remaining parcels are as yet undeveloped; therefore, electrical demand records do not exist.



Source: Guam Power Authority

**LEGEND**

- GLUP Reuse Parcels (Guam Land Use Plan '94)
- Highway
- Base Load Power Plant
- Major Peak Load/Emergency Generating Units
- Major Transmission Lines



**Figure 3.14-1  
MAJOR ELECTRICAL DISTRIBUTION FACILITIES**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

## **3.15 SOCIOECONOMICS**

### **3.15.1 Overview**

Guam is the largest and most populated island in the Marianas. A key advantage is its central location relative to Pacific Rim countries, being only three to four hours flying time from Japan, China, Taiwan, South Korea, the Philippines, and Hong Kong. Guam's private sector is dominated by the tourism industry, although Gov Guam is the single largest employer on the island. Recent economic turmoil in neighboring Asian countries has resulted in a downturn in Guam's tourism industry.

### **3.15.2 Population and Income**

Guam's resident population increased 2.2 percent annually in the 1970s, with comparable growth in the 1980s, resulting in a 1990 population of 133,152 according to the U.S. census. Estimates place the population of the island during the baseline year of 1995 at approximately 150,000 (United States Department of Interior, 1995). A majority of the population resides in the central and northern regions of the island, 40 and 34 percent, respectively. The largest ethnic group is Chamorro residents (38 percent of the total population) who are considered indigenous to the island. The next largest group is Asian (29 percent), of which Filipinos dominate as 76 percent of that group's total. Pacific Islanders represent 5 percent of Guam's population. These groups are considered minority populations in the United States. There is a higher concentration of Chamorro in the central villages and in the south. With a median age of 25 years, Guam's population is relatively young. Median ages for the island's villages range from 19 years for the southern village of Umatac to 30 years for the capital village of Agana.

Total personal income has grown from \$1.3 billion in 1988 to \$2.3 billion in 1996. The latest census (1990) indicated that the median household income was \$30,755 with per capita income at \$9,928. Per capita income ranges from a low of \$7,453 for Inarajan to a high of \$14,473 for Piti. The village with the highest median household income is also Piti (\$42,182), while the northern village of Yigo has the lowest at \$27,069. For the three primary regions of the island, per capita income was \$8,688 in the north, \$11,248 in the central villages, and \$8,889 in the south. The distribution of either population or income is not expected to have changed significantly since the last census. It is estimated that up to 2,000 people on Guam are classified as "homeless."

### **3.15.3 Employment**

Since the late 1980s, Guam's labor force was almost fully employed with unemployment recorded at 2.1 percent in 1989, 2.6 percent in 1990, and 3.0 percent in 1991. After the baseline year, however, the unemployment rate has exceeded 6.0 percent (September 1996). This rate further increased to above 9 percent in December 1997 due to the detrimental effects of Typhoon Paka. Additionally, several of the island's largest employers have furloughed up to 10 percent of their work force. This is primarily attributable to the decrease in visitor arrivals to the island since 1996.

Employment in the private sector has decreased since the baseline year, while GovGuam has increased employment. Job losses in the private sector include construction, wholesale/retail,

and services. These industries comprise more than 52 percent of the island's total work force. The number of civilians employed in Guam by the federal government has decreased since the baseline year due to the closure of several military installations and overall federal budgetary cutbacks.

### **3.15.4 Guam's Economy**

The service, retail, and transportation industries dominate the private sector. These industries are reflective of the expansion that has occurred in Guam's tourism, which was most dramatic in the 1980s when arrivals increased from 300,000 in 1980 to 770,000 in 1990. However, arrivals subsequently decreased as a result of the Persian Gulf Conflict (1991), numerous tropical storms and typhoons (1992), and a major earthquake (1993). As a result, Guam's resort hotels experienced lower occupancy levels and decreased room rates. During 1994 and 1995, the downward trend in occupancy levels and room rates was reversed. However, since the baseline year, a downturn in Asian economies (particularly Japan) has led to a decline in tourism arrivals. It is reported that retail sales are lower than expected due to deterioration of the yen. Tourism officials cite a strong U.S. dollar, government restrictions on travel abroad, and worsening economic conditions in Asia as major factors attributable to the recent decline.

Construction activity on Guam has remained relatively static. In 1995, 1,769 building and construction permits were issued, for a total of \$387 million. Since 1995, the value of construction permits annually has declined.

#### **3.15.4.1 Hotels**

Hotel room rates at major hotels on Guam are being maintained at a slightly lower level than in 1995. It has also been noted by the local hospitality industry that economy hotels are experiencing higher occupancy rates. The Japanese yen-U.S. dollar exchange rate and competition from other Asia-Pacific destinations, such as Hawaii and Bali, have been major influences. With the recent worsening of the exchange rate, domestic destinations are becoming more popular.

Since 1995, several new hotels have recently opened, including the Westin Resort Guam (420 rooms), Grand Plaza Hotel (100 rooms), Sherwood Resort Guam (335 rooms), and Imperial Suites Hotel (142 rooms). Construction is nearing completion on the 600-room Outrigger Resort, 300-room Royal Riviera Hotel, 120-room Santa Fe on the Bay in Tamuning, and 150-room (phase 1) Accion Hotel Guam in Yona. The Pacific Islands Club has begun construction of a 292-room expansion. Other announced projects include Tomen Development, a 120-room business hotel in Agana; Pacific Hacienda, a 77-room all-suites hotel in Tumon; and Sky City Marianas, a 160-room three-star hotel in upper Tumon.

#### **3.15.4.2 Golf Courses**

There are currently seven non-military golf courses on Guam, two with 27 holes and five with 18 holes. Much of the golf course development on the island occurred during the early 1990s. With the economic downturn and decline in the number of Japanese visitors, several of the courses have experienced difficulties. One course was recently transferred in a foreclosure sale, while other courses have reported decreases in number of rounds played and revenues. A total of 11 additional golf course projects have been approved by the Guam Land Use Commission, but none of these have proceeded with development. Demand for new courses is expected to

remain low over the short term. Long-term recovery of the golf industry is possible if the Japanese and other Asian economies improve.

### 3.15.4.3 Housing

The following table summarizes Guam Board of Realtors data from 1992 to 1995.

**Table 3.15-1: Housing Data**

Year	Single Family Units Sold			Condominiums Sold		
	Total Value	Average Value	Number of Transactions	Total Value	Average Value	Number of Transactions
1992	\$21,177,000	\$246,243	86	\$9,555,000	\$170,625	56
1993	11,570,000	236,115	49	4,194,000	182,348	23
1994	5,577,000	223,076	25	2,982,000	156,947	19
1995	8,335,000	213,075	39	2,230,000	159,286	14

These data indicate a significant sales decline in the number of single-family homes and condominiums in the early 1990s. There was a 13 percent decline in the average price of a single-family dwelling during the 1992-95 period, primarily due to a significant decrease in demand by nonresident Asian investors. The downward trend has continued following baseline year. During the late 1980s and early 1990s, prices for single-family units and condominiums often doubled within a one- to two-year period. With the economic downturn of Japan and other Asian economies, demand for housing units on Guam is generated by the resident population.

Demand is highest for single-family "affordable" housing units, generally ranging in price from \$140,000 to \$200,000. In 1991, legislation was passed to enable the governor of Guam to transfer 46 acres (18.6 hectares) of government property to the Guam Housing Corporation for the purpose of developing affordable housing for first-time home buyers. The project, Lada Estates, consists of approximately 400 units in Dededo. Funding for the project is provided by a \$50 million mortgage revenue bond issue. Projected cost of the project is \$48 million, including \$10.5 million for infrastructure improvements.

Under guidelines of the program, 30 percent of the Lada Estates homes is set aside for families with incomes equal to the median household income for Guam, 50 percent for families with incomes of 100 to 130 percent of median household income, while the remaining 20 percent is set aside for families with incomes between 130 and 150 percent of the median household income. Of the more than 1,000 prospective home buyers applying for Lada Estates units, approximately 800 met these criteria. The U.S. Department of Housing and Urban Development (HUD) is responsible for establishing the median income.

In the private sector, Laquina Estates, a subdivision under development in Talofofu, includes 78 two- to four-bedroom units in the first phase. Prices range from \$145,000 to \$200,000. Goring Villa Estates in Yigo has plans for a total of 56 units, with prices starting at \$159,000.

#### 3.15.4.4 Commercial Property and Activities

During the economic boom of the late 1980s and early 1990s, commercial rental space peaked near 100 percent occupancy levels. As a result, numerous projects were undertaken by local and off-island investors. However, Guam is now overbuilt, and very few projects are currently in progress.

Commercial buildings have traditionally been centered in the more populous northern and central Guam regions. Development in the south has been limited, primarily confined to small, one- to two-story structures housing grocery stores, restaurants, and other small retail outlets. Guam's commercial buildings can be characterized as follows:

- Large tourist-oriented stores or shopping centers. These typically offer designer luxury goods, and approximately 90 percent of the customers are Japanese. The majority of the large stores and centers are located in Tumon near the hotels. Occupancy appears to remain relatively high.
- Community shopping centers. Several shopping malls on Guam have gross leasable space ranging from 100,000 to 500,000 square feet (9,290 to 46,468 square meters). The largest is Micronesia Mall in Dededo, which is under expansion. Others include Compadres Mall in Dededo, Guam Premium Outlets in Tamuning, and Agana Shopping Center. Occupancy rates have varied. Two "mega-stores" opened in the early 1990s, but one of them has since closed. The other, K-Mart, has about 100,000 square feet (9290 square meters) of retail space.
- Smaller mixed-use shopping centers. These centers, which offer both office and retail space to a variety of tenants, generally have gross leasable space of 20,000 square feet (1,858 square meters) or less, although some of the newer buildings are larger. Many of them are located in Yigo, Dededo, Harmon, Tamuning, and Barrigada. Most of the buildings are less than 50 percent occupied, so rental rates have remained low, averaging \$2.00 per square foot.
- Office buildings. Larger properties providing mainly office space have also been overbuilt. In 1991, occupancy levels were approaching 100 percent, but this trend was quickly reversed due to several factors: (1) the economic downturn of Japan's economy and closure of several branch offices of Japanese companies; (2) the addition of square footage with the completion of new buildings; and (3) the relocation of many local government agencies to Tiyan after closure of NAS Agana. In the near term, office building demand is expected to remain low.

#### 3.15.4.5 Industrial Property and Activities

Guam has no heavy industry and only an extremely small light industry sector. Industrial space is comprised primarily of warehouse storage. Occupancy levels have dropped significantly since the early 1990s. Current data indicate warehouse rental rates are averaging approximately \$.50 per square foot. The market is not expected to recover over the short term.

### **3.15.4.6 Agriculture**

Agriculture is a relatively small industry on Guam, employing an annual average of 300 individuals in the 1990s. Total dollar value of the island's agricultural products was less than half the value in 1993, when the total was \$12,015,125. The largest category is fruits and vegetables. Larger volume crops include eggplant, long beans, banana, cucumber, bittermelon, and watermelon.

Large-scale commercial farming has been mostly absent on Guam due to poor soil conditions and the preponderance of typhoons and tropical storms. In the 1980s, an attempt was made to raise and market pineapples, but the poor quality of the fruit and adverse weather conditions resulted in abandonment of the venture. No significant increases in farming activity are expected in the near future.

## **3.16 PUBLIC SERVICES**

When Navy actively occupied the GLUP properties, public services were primarily provided by Navy for military personnel. No military schools, police, or fire stations are located on the properties to be released.

### **3.16.1 Schools**

In 1995, education from kindergarten through grade 12 was provided to the general public by the GovGuam Department of Education (DOE), the Catholic Archdiocese, the Episcopal Church in Micronesia, and several smaller religious institutions. On January 1, 1995, the Guam DOE administered 35 schools in four districts with a total enrollment of approximately 31,711 students in kindergarten through grade 12. The 24 public elementary schools on Guam generally offer instruction from kindergarten through grade 5. Six middle schools have grades 6 through 8, while five public high schools serve grades 9 through 12. Since 1995, Southern High School has been constructed in the Santa Rita municipality. The Northern region has a high school and there are two high schools in the Central region, which includes Barrigada.

Higher education is available at the Guam Community College and the University of Guam. While the University of Guam has historically concentrated on training teachers for Guam and Micronesian area schools, it does offer a variety of other liberal arts and science courses. Guam Community College has provided vocational and technical training to its students, in addition to high school equivalency and university preparatory education. Recently, it has expanded into the tourism education area and currently offers a program that provides both technical training and experience in the hospitality industry.

There is demand for expanded public education facilities for Guam. Current facilities are considered to be in poor condition with several schools recently condemned. In 1997, the United States Department of Defense Education Activity (DoDEA) opened four schools for approximately 2,600 military dependents. A significant portion of the students at the DoDEA schools formerly attended Guam's public schools with a small number transferring from the island's private schools. While the establishment of DoDEA schools helped to ease the overcrowding situation in Guam's public schools, the problem remains. The issue is not only a matter of exceeding classroom capacity (which is governed by the teacher union contract of

student-teacher ratio) but also of the physical size of the schools and overcrowding of hallways and other public areas. Traditionally, Guam's DOE has responded to overcrowding by constructing temporary classrooms and staggering school schedules.

Existing public schools that have the potential for increased enrollment due to the reuse alternatives are highlighted below. Enrollment and school district information was provided by Guam DOE (Research and Planning Office, 1997-1998 enrollment). Recently enacted Guam Public Law 24-73 legislates capacity levels for construction of new schools. The law sets an "ideal capacity" for elementary, middle, and high schools of 550, 700, and 1,200 students, respectively. Although the law does not apply to existing schools, no other specific data was available on school capacity. The majority of existing schools in all districts is at or exceeds "ideal enrollment capacity" for new school construction.

### **3.16.1.1 Northern Region**

Three schools in the Lagu District serve the region around the FAA Housing parcel: Finegayan Elementary School, Dededo Middle School, and Simon Sanchez High School. Enrollment data for these schools indicate that all schools are operating over the "ideal enrollment capacity," with Finegayan Elementary School at more than double "ideal capacity" for new schools. Overcrowding is a problem for Simon Sanchez High School, the only high school for the Northern villages of Dededo and Yigo. There have been discussions concerning the construction of a second high school for the region, but no funding sources have been identified. Certain government officials have also indicated that a third high school could be added to the Tiyan reuse area; however, no funding sources have been identified. Four DOE schools in the Kattan District would serve the NAS Officers Housing parcel residents: P. C. Lujan Elementary School, B. P. Carbullido Elementary School, Untalan Middle School, and George Washington High School. Enrollment data indicates that all schools are over Guam DOE's "ideal enrollment capacity" for new schools.

### **3.16.1.2 Barrigada Region**

The five schools in the Kattan District also serve the Barrigada Region. As indicated, enrollment data shows all schools operating above Guam DOE's "ideal enrollment capacity" for new schools.

### **3.16.1.3 Central Region**

The three Guam DOE schools in the Luchan District of Asan that serve Nimitz Hill are Tamuning Elementary School, Agueda Johnston Middle School, and John F. Kennedy High School. Both Tamuning Elementary School and John F. Kennedy High School are operating over the "ideal enrollment capacity" for new schools, with the high school in excess of 1,200 students over ideal enrollment capacity. It is particularly acute for the central region, where Piti Middle School, with an enrollment of 628, was almost destroyed by Typhoon Paka in December 1997. These students were moved to Agueda Johnston Middle School, which is holding double sessions.

### **3.16.1.4 Southern Region**

In the Haya District, four Guam DOE schools serve both the New Apra Heights and Navy Ordnance Annex areas: Harry S Truman Elementary School, J.P. Torres Elementary School, Ocean Middle School, and Southern High School. Southern High School was completed in 1997 and would be expected to accommodate the population demands of that region for the next five years.

### **3.16.2 Parks and Recreation**

GovGuam has a variety of beach parks and other facilities that fall under the responsibility of the Department of Parks and Recreation. One of the more significant recreational facilities on Guam is the Paseo Stadium, which is used primarily as a baseball park and was previously the venue for pre-spring training by professional teams from Japan. Its seating is extremely limited. Other parks include facilities on Tumon Bay, former Spanish fort sites, and various historical sites in the capital of Agana.

#### **3.16.2.1 Northern Region**

Recreational facilities in the vicinity of northern GLUP properties include the Dededo Sports Complex on 40 acres (16 hectares) with baseball/softball and soccer fields. Smaller neighborhood parks at Fern Terrace, Astumbo Gardens, and Wettengel contain a variety of sport fields, playground equipment, restrooms, and parking.

#### **3.16.2.2 Barrigada Region**

The Barrigada Sports Complex, a 20-acre (8.1-hectare) parcel leased by GovGuam from the Navy, consists of sports fields and parking. All other recreational facilities are outside of the Barrigada municipality. These include the Pagat baseball field in Mangilao, the Francisco (Gonga) Perez Beach Park and picnic facility in Chalan Pago-Ordot, and larger parks in the neighboring eastern municipalities of Agana and Tamuning (Agana Central Park, Paseo de Susana, Puntan dos Amantes, Tanguisson Beach, and Governor Joseph Flores Beach Park). These parks offer a variety of facilities and activities, including swimming, tennis, historical sites, lighted baseball fields, picnic tables, jogging trails, beach activities, and restrooms.

#### **3.16.2.3 Central Region**

In the Asan municipality, recreational facilities are limited to the Asan Memorial Beach Park. The Libungon Vista, a scenic overlook, is along Spruance Drive (Route 6) to the west of the Nimitz Hill Vacant Lands parcel. In the neighboring Piti municipality, the 2-acre (0.8-hectare) Nimitz Hill Park includes a volleyball court, playground, and sheltered picnic and barbecue areas. The Masso Reservoir is an undeveloped natural area with a man-made lake.

#### **3.16.2.4 Southern Region**

Rizal/Afleje Beach Park, located on a portion of Parcel N17, offers swimming, snorkeling, and beach activities. GovGuam Department of Parks and Recreation constructed a pavilion on the site. The War in the Pacific National Historical Park is located directly south of Afleje Beach Park. Facilities include historical features, exhibit panels, and a walk path. To the south in Agat

municipality is the Old Agat Family Beach Park and several historical sites. No inland or hillside recreational areas exist near the southern GLUP properties.

### 3.16.3 Health Care

At present, health care is offered by several physician groups' clinics, a clinic operated by a health maintenance organization (HMO), a clinic operated by a not-for-profit organization (Seventh-Day Adventists), the Naval Hospital, and the Guam Memorial Hospital (GMH), an autonomous GovGuam agency.

GMH is a 192-bed facility that provides acute care for an estimated 10,000 patients annually and outpatient services to approximately 25,000 patients per year. As the territory's only public hospital, it cannot deny services to indigent patients. It is estimated that 41 percent of its patients have no health insurance. Expansion of services in the next few years is considered unlikely. With the downsizing of the military on Guam and related base closure, the Naval Hospital which serves military personnel (active and retired) and their dependents would play a decreasing role in the future.

The Guam Health Planning and Development Agency indicates that there are 103 private, for-profit health care entities with approximately 20 private clinics providing multi-specialty health care services to the civilian population through out-patient facilities. It is estimated that the private clinics have a ratio of 1,400 patients per doctor, while the overall Guam average is 900. The U.S. average has been estimated at 448 patients per doctor. Demand for private health care services has been high in recent years, resulting in expansion of private medical centers and clinics.

### 3.16.4 Public Safety: Police, Fire Protection, and Civil Defense

**Police.** Security and public safety for the island as a whole is the responsibility of the Guam Police Department. In recent years, the department budget has had few or no increases, resulting in the elimination of overtime and reductions in work force. The Department headquarters is centrally located at Tiyan. There are staffed precincts in the Northern and Southern regions, as well as several small police stations. These smaller stations are staffed by one or two individuals.

**Fire Protection.** The Guam Fire Department is responsible for providing fire protection services for the island. As with the police department, its budget has also received minimal or no increases over the past several years. In addition, there is reportedly a shortage of emergency vehicles.

**Civil Defense.** The Civil Defense Agency is a line agency of GovGuam's executive branch. It is the lead agency in coordinating police, fire, Coast Guard, DPW, weather service, and federal agencies in an emergency situation.

## **3.17 ENVIRONMENTAL CONTAMINATION**

### **3.17.1 On-Site Contaminated Areas/Hazardous Substances**

The management of potentially contaminated areas, including the process for identifying these areas, is dictated by specific regulatory programs. Regulatory programs for hazardous materials are described below.

#### **3.17.1.1 Overall Process Used to Identify Contamination and Description of Contaminated Areas**

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. §9601 *et seq.*, existing areas of contamination must be identified and remediated to levels protective of human health and the environment (or have a proven, effective remediation under way). Compliance activities, remediation plans, and remediation activities in the reuse areas are described in the *Draft BRAC Cleanup Plan for FISC, NAVACTS, PWC Guam Sites (Navy, January 1998)* and *BRAC Cleanup Plan for NAS Officer Housing Area, Tamuning Telephone Exchange, and Agana Power Plant, Guam (Navy, October 1996)*. Areas of existing contamination could constrain the proposed reuse of the property.

Potentially contaminated areas were identified under one of two processes and are named accordingly. Potentially contaminated areas identified under the Community Environmental Response Facilitation Act of 1992 (CERFA), P.L. 102-426, are referred to as points of interest (POIs); areas identified under the Defense Environmental Restoration Program are called Installation Restoration Program (IRP) sites. The purpose of the IR program is to identify, assess, characterize, and clean up or control contamination from past hazardous waste disposal operations and hazardous material spills at Navy and Marine Corps facilities in accordance with CERCLA.

CERFA amended CERCLA and requires the identification and documentation of uncontaminated real property at installations undergoing closure or realignment. To comply with these laws, environmental baseline surveys were performed at the GLUP parcels to identify contaminated and uncontaminated areas. Activities included extensive documentation reviews, regulatory agency record reviews, current and historic aerial photograph evaluations, physical reconnaissance, and personnel interviews. Findings were documented in the 1998 Environmental Baseline Survey (EBS) Report and addendum listed in Chapter 6.

Five sites have been identified as IRP sites, or sites that may pose a threat to human health and the environment. In addition, 19 potentially contaminated Points of Interest (POIs) were identified as a result of the CERCLA/CERFA process (Table 3.17-1). Environmental condition of property (ECP) is established to delineate between areas suitable for conveyance and areas not suitable. Locations of IRP and POI sites are shown in Figures 3.17-1 through 3.17-4. Areas classified as ECP category levels 1-4 are acceptable for conveyance by deed.

Due to World War II activities on Guam, unexploded ordnance (UXO) is potentially present on all parts of the island. Redevelopment and construction activities on Guam have evolved such that construction can proceed safely despite the presence of UXO.

Table 3.17-1 summarizes potential environmental contamination that may be present at each of the properties. Possible contamination sources are discussed in more detail in the following subsections, and any specific land use development constraints associated with these sources are also identified. Properties containing IRP or POI sites are also identified in Table 3.17-1. The IRP and POI sites are described in more detail in the corresponding subsections.

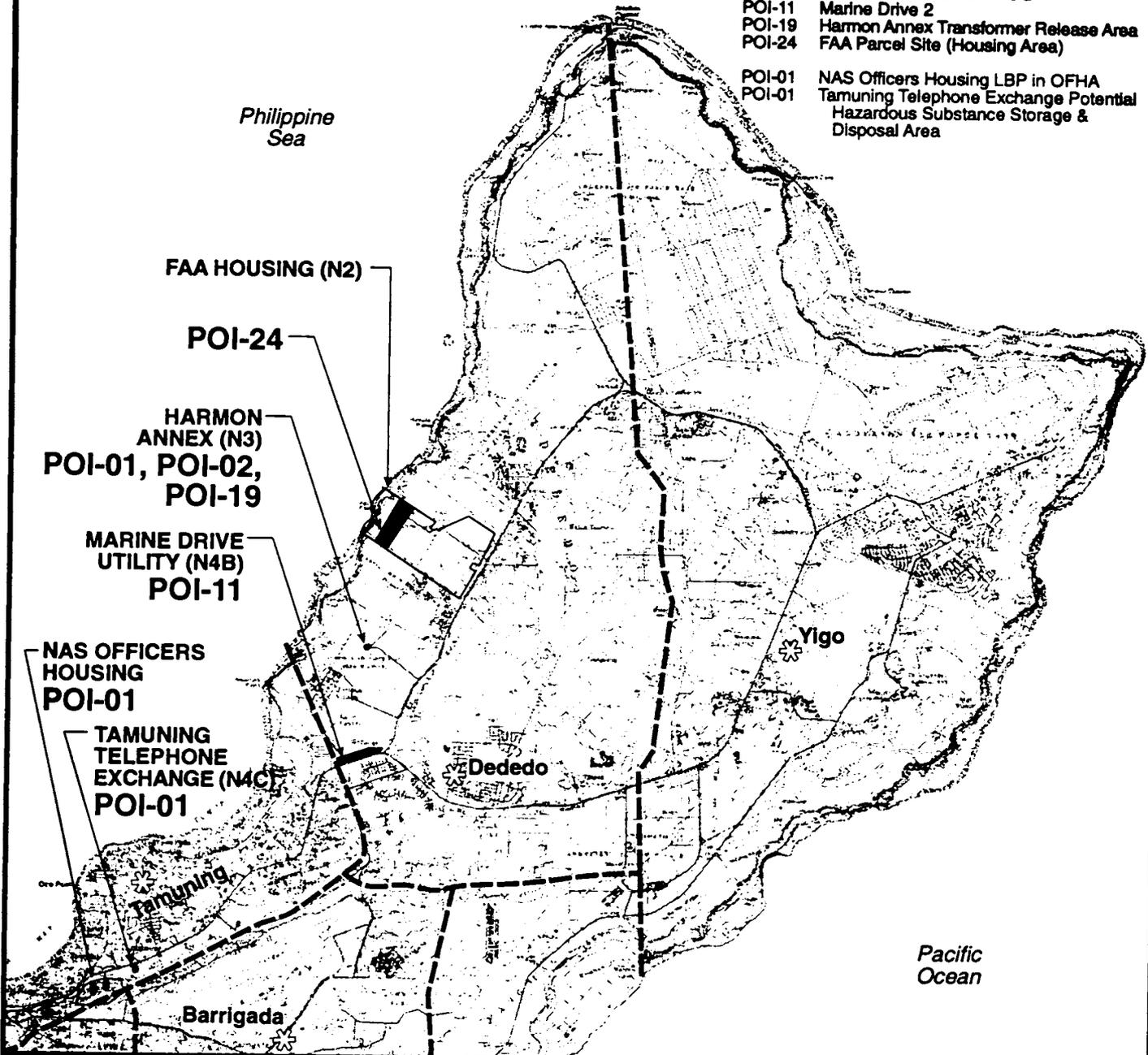
The properties summarized in Table 3.17-1 and described in the following sections include some properties where investigation and/or remediation activities are ongoing. In all cases, the investigation and remedial activities will be completed in accordance with the above-cited statutes and associated regulations and guidance documents. These statutes and Navy policy require that the activities be completed such that health-based clean-up goals consistent with the planned future use of the property are achieved.

**LEGEND**

-  GLUP Reuse Parcels (Guam Land Use Plan '94)
-  Highway
-  Municipality Boundary
-  Main Community

**SITE INDEX**

-  IRP/POI Sites
- POI-01 Harmon Annex Former UST Location
- POI-02 Harmon Annex Leach Field
- POI-11 Marine Drive 2
- POI-19 Harmon Annex Transformer Release Area
- POI-24 FAA Parcel Site (Housing Area)
- POI-01 NAS Officers Housing LBP in OFHA
- POI-01 Tamuning Telephone Exchange Potential Hazardous Substance Storage & Disposal Area



Philippine Sea

FAA HOUSING (N2)

POI-24

HARMON ANNEX (N3)  
POI-01, POI-02,  
POI-19

MARINE DRIVE UTILITY (N4B)  
POI-11

NAS OFFICERS HOUSING  
POI-01

TAMUNING TELEPHONE EXCHANGE (N4C)  
POI-01

Tamuning

Barrigada

Dededo

Yigo

Pacific Ocean



NORTH

0 1000 2000 3000

SCALE IN METERS

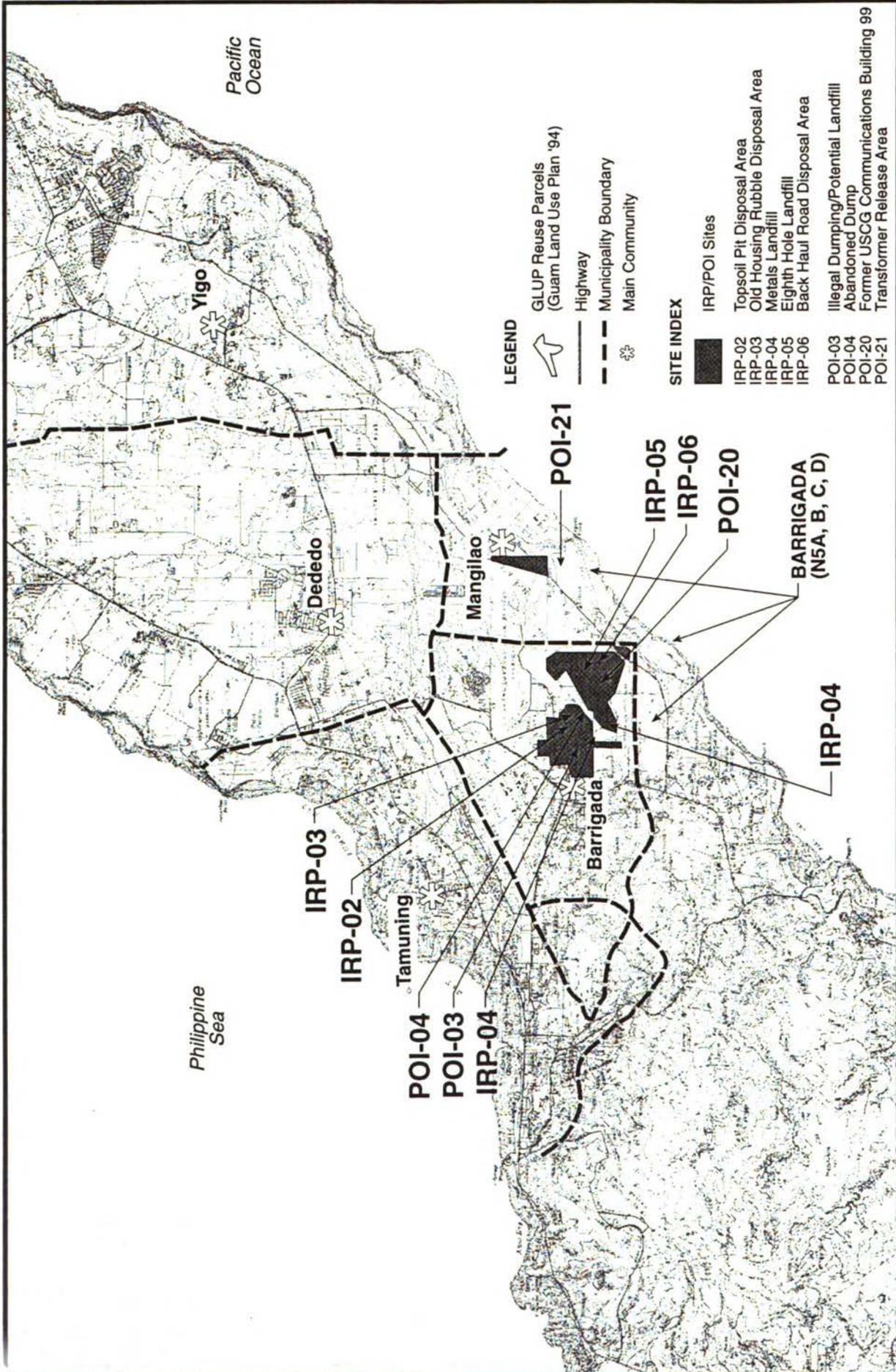
0 5,000 10,000

SCALE IN FEET

Source: Ogden Environmental and Energy Services Co., Inc. (January 1998) Base Realignment and Closure (BRAC) Cleanup Plan #1 for FISC, NAVACTS, PWC, Guam Sites (Draft).

**Figure 3.17-1  
NORTHERN REGION  
AREAS OF EXISTING  
CONTAMINATION**

EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**3.17-2  
BARRIGADA REGION  
AREAS OF EXISTING CONTAMINATION**

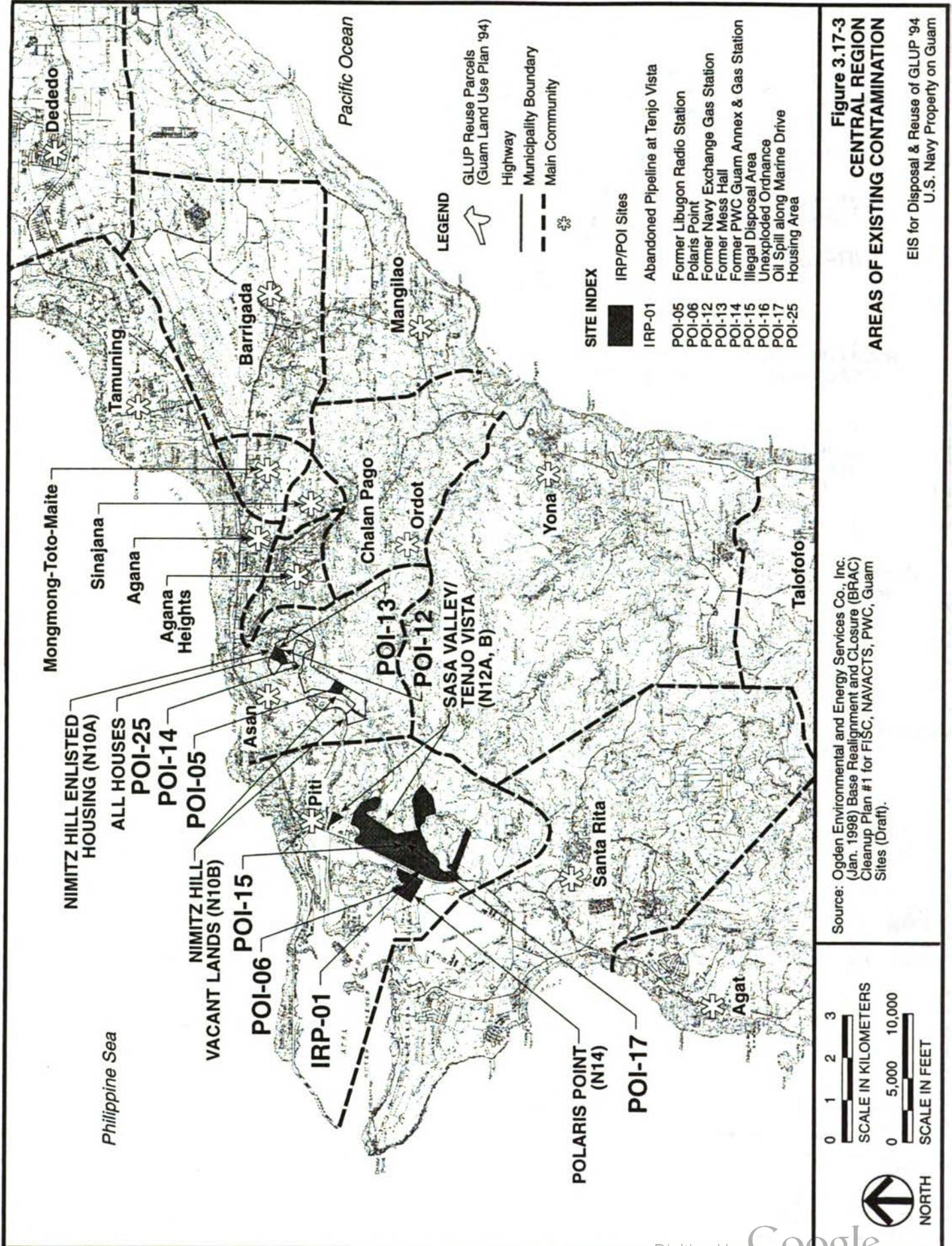
EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam

Source: Ogden Environmental and Energy Services Co., Inc.  
(Jan. 1998) Base Realignment and Closure (BRAC)  
Cleanup Plan #1 for FISC, NAVACTS, PWC, Guam  
Sites (Draft).

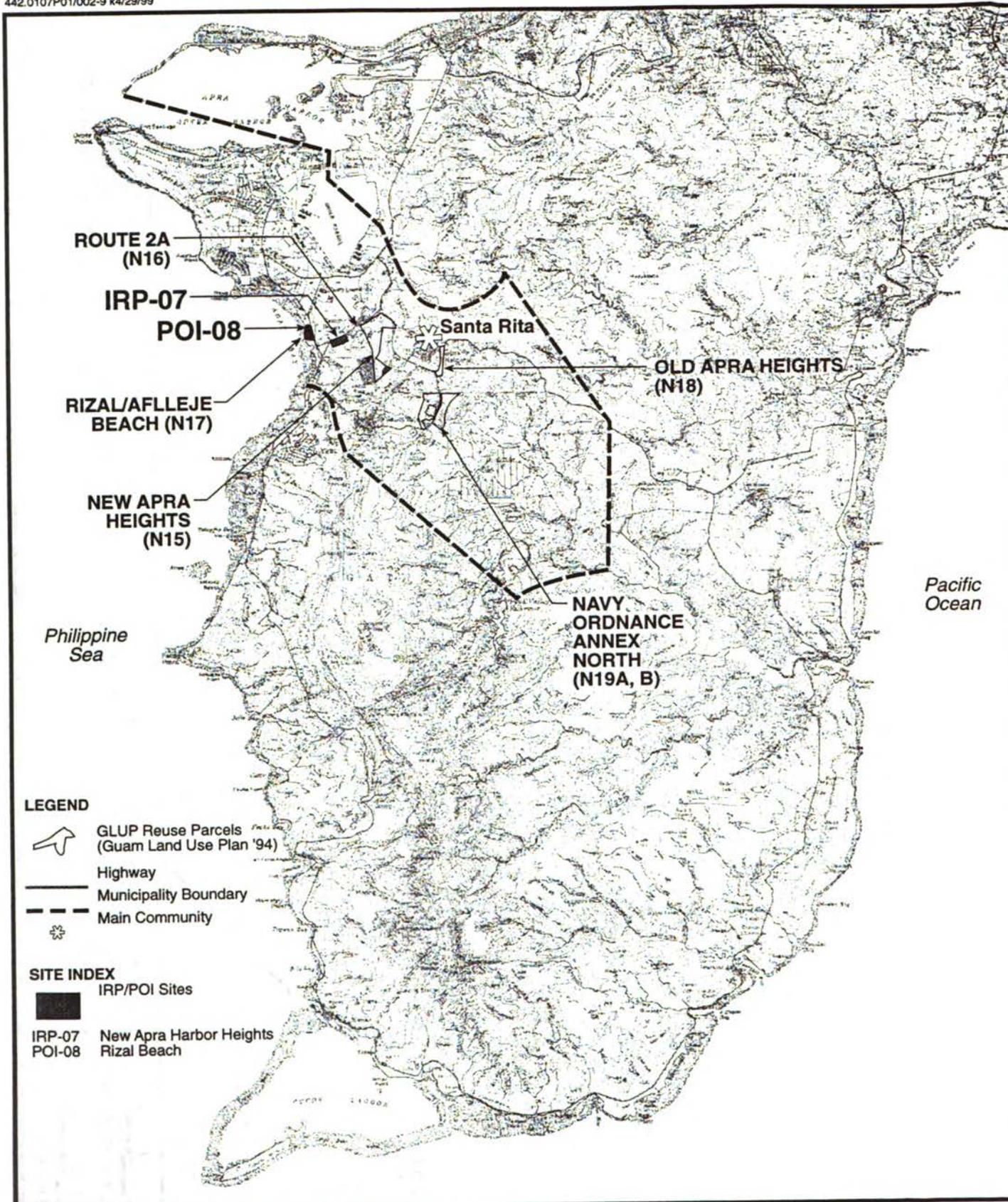
0 1000 2000 3000  
SCALE IN METERS

0 5000 10,000  
SCALE IN FEET

NORTH



**Figure 3.17-3**  
**CENTRAL REGION**  
**AREAS OF EXISTING CONTAMINATION**  
EIS for Disposal & Reuse of GLUP '94  
U.S. Navy Property on Guam



**Figure 3.17-4**  
**SOUTHERN REGION**  
**AREAS OF EXISTING**  
**CONTAMINATION**

EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property on Guam

Source:  
 Ogden Environmental and Energy  
 Services Co., Inc. (January 1998) Base  
 Realignment and Closure (BRAC)  
 Cleanup Plan #1 for FISC, NAVACTS,  
 PWC, Guam Sites (Draft).



0 1000 2000 3000  
 SCALE IN METERS  
 0 5,000 10,000  
 SCALE IN FEET

DISPOSAL AND REUSE OF SURPLUS NAVY PROPERTY ON GUAM  
 DRAFT ENVIRONMENTAL IMPACT STATEMENT

Table 3.17-1: Possible Environmental Contamination

**Table 3.17-1: Possible Environmental Contamination, IRP Sites, and POI Sites**

Property	Subsection	Possible Source of Environmental Contamination										IRP Sites	POI Sites			
		Storage Tanks & Pipelines	Asbestos	Hazardous Materials/Waste Management Sites	Lead-based Paint	Medical/Biohazardous Wastes	Ordnance	Pesticides	Polychlorinated Biphenyls (PCBs)	Radon	Radioactive Material/Mixed Waste					
<b>NORTHERN REGION</b>																
FAA Housing	3.17.1.1	-	✓	-	✓	-	-	-	✓	-	-	✓	-	-	✓	
Harmon Annex	3.17.1.2	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-	✓
Marine Drive Utility	3.17.1.3	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	✓
Tamuning Telephone Exchange	3.17.1.4	✓	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
NAS Officers Housing	3.17.1.5	✓	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
<b>BARRIGADA REGION</b>																
Barrigada	3.17.2	-	-	✓	-	-	-	-	✓	-	-	-	-	-	-	✓
• Parcel N5A		✓	?	✓	-	-	-	-	-	-	-	-	-	-	-	✓
• Parcel N5B		-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-
• Parcel N5C		-	-	✓	-	-	-	-	-	-	-	-	-	-	-	-
• Parcel N5D		-	?	-	-	-	-	-	-	-	-	-	-	-	-	✓
<b>CENTRAL REGION</b>																
Nimitz Hill Properties	3.17.3.1	✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-
• Nimitz Hill Enlisted Housing		✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-
• Nimitz Hill Vacant Lands		✓	✓	-	✓	-	-	-	-	-	-	-	-	-	-	✓
Sasa Valley/Tenjo Vista	3.17.3.2	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	✓
• Sasa Valley Parcel		✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	✓
• Tenjo Vista Parcel		✓	-	✓	-	-	-	-	✓	-	-	-	-	-	-	✓
Polaris Point	3.17.3.3	✓	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
<b>SOUTHERN REGION</b>																
Old Apra Heights <sup>2</sup>	3.17.4.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Apra Heights/Route 2A <sup>2</sup>	3.17.4.2	✓	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
• New Apra Heights		✓	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	✓
• Route 2A		✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	✓
Rizal/Añilje Beach	3.17.4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓
Navy Ordnance Annex North	3.17.4.4	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	✓
• West Parcel (19A)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	✓
• East Parcel (N19B)		-	✓	-	✓	-	-	-	-	-	-	-	-	-	-	✓

- Notes:
- = Based on recent and historical information, it is believed that this material or item is not currently, nor has it historically been present, used, generated, stored, or disposed of on this property.
  - ✓ = See corresponding subsection for more details.
  - 1 = Ordnance may be present as a result of World War II battles on Guam.
  - 2 = A portion of the property was not included in the available EBS, but were covered as an adjacent property. Therefore, an EBS is needed to properly assess the presence of possible sources of environmental contamination.

Source: Ogden (1996, 1997, 1998)

### 3.17.2 Northern Region

#### 3.17.2.1 FAA Housing

**Asbestos-Containing Material (ACM).** The DoD BRAC policy on ACM is to repair or remove only friable, accessible, and damaged ACM. Friable asbestos is defined by the US EPA as any material containing more than one percent asbestos that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. Friable asbestos is regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 C.F.R. §61.141). NESHAP requires that all friable materials be removed prior to building demolition or renovation. Navy will not perform remediation if: (1) the buildings are scheduled for demolition by the transferee; (2) the transfer document prohibits occupation of the buildings prior to demolition; and (3) the transferee assumes responsibility for the management of any ACM in accordance with applicable laws. Demolition of housing units that occupied the FAA Housing parcel due to irreparable damage from Typhoon Paka began in 1998; demolition is anticipated to be completed by 2001.

**Lead-based Paint (LBP).** The DoD BRAC policy is to manage LBP in a manner protective of human health and the environment and to comply with all federal, state, and local laws and regulations governing LBP and LBP hazards. Current standards for LBP address risks by focusing on the impact of LBP on children from dwellings and surrounding soil. The Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X of Public Law 102-550), which pertains to conveyance of federal property for residential use, is only applicable to "target housing" as defined by the Act. All of the houses at this parcel are being demolished. If conveyance occurs before demolition is completed, the conveyance document will prohibit occupancy of the houses. These structures will not be used as target housing.

Twenty-four soil samples were collected in the vicinity of the housing. The sample results were compared to Housing and Urban Development (HUD) criteria. No action is required when lead concentrations in soil are less than 400 milligrams per kilogram (mg/kg); interim controls are recommended for concentrations between 400 and 2,000 mg/kg; and abatement is required for concentrations greater than 2,000 mg/kg. Two samples had concentrations greater than the no action criterion (410 mg/kg and 420 mg/kg).

**Pesticides.** The Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. §135 *et seq.*, and the Guam Pesticide Regulations regulate the formulation and use of pesticides. Department of the Navy policy indicates that a property is considered "uncontaminated" if contamination concerns are due solely to the "normal" application of pesticides and herbicides. Pesticides have been applied to DoD properties on Guam according to DoD policies. Chlordane was used for termite control at the FAA housing area from the 1950s until it was banned in 1987 by US EPA. Until 1980, (2,4,5-Trichlorophenoxy) acetic acid (2,4,5-T) was used for weed control

along power lines and power substations and p,p'-dichlorophenyltrichloroethane (DDT) was used for mosquito control. Mosquitoes are currently controlled through the use of 57 percent and 80 percent malathion. Pesticides have not been stored, mixed, or disposed of at this property, and there is no evidence of improper use of pesticides on the property.

**Radon.** Radon is a naturally occurring radioactive gas that may pose a risk to human health. It is regulated by the Toxic Substance Control Act (TSCA), Subtitle III, 26 U.S.C. §2661-2671. Radon surveys are required to be conducted on all federal buildings to determine the extent of radon contamination. It is DoD policy that disclosure of potential elevated radon concentrations prior to conveyance meets the disclosure/action requirements of the indoor radon abatement provisions. Since housing is being demolished, there will be no enclosed space for radon to accumulate.

**POI Sites.** This property is considered a POI site (POI-24) because lead-based paint was identified in the housing. Since housing will be demolished, no further action is planned for this parcel.

### 3.17.2.2 Harmon Annex

**Storage Tanks and Pipelines.** Navy manages underground fuel storage tank compliance activities in accordance with 40 C.F.R. §280. Above-ground storage tanks (ASTs) are regulated under 40 C.F.R. §112. In 1993, three underground storage tanks (USTs) (Tanks 50-1, 50-2, and 50-3) were removed from the ground and stored on the southeastern part of the property. These tanks were observed on site during the EBS physical reconnaissance. The two larger tanks have an estimated capacity of 5,000 gallons (18.9 cubic meters) each, and the capacity of the smaller was estimated to be less than 1,000 gallons (3.79 cubic meters). These tanks were reported to contain diesel fuel and the two larger tanks were removed from the site in 1997. The contents have since been removed. Preliminary site assessment performed in 1997 recommended site closure. No information was available regarding the extent of possible diesel fuel contamination, and no evidence of releases was observed.

Two unused ASTs are located on the first floor of Building 50. The tanks were used for water storage. The larger tank has an estimated capacity of less than 3,000 gallons (11.4 cubic meters), while the capacity of the smaller tank is thought to be less than 500 gallons (1.9 cubic meters).

**Asbestos.** Friable ACM has been reported in portions of Building 50. Partial abatement of the east wall of the building and the ceiling of the first floor have taken place.

**Hazardous Substances/Waste Management Sites.** Hazardous substances and hazardous wastes are regulated under various environmental laws and regulations including CERCLA, RCRA, and Guam Hazardous Waste Regulations. Evidence of hazardous substances storage or waste management has been noted in several areas in and around the building. Oil stains were reported in the vicinity of the ASTs and apparent air conditioning equipment. Absorbent material was also reported spread over the floor in one area of the second floor. No information was available regarding the nature of possible spills on the second floor.

The Navy Publications and Printing Services Office was transferred to Building 50 in 1979, and chemicals associated with printing operations are known to have been used on the property. Small quantities of photo developer, offset etch, photo fixers, solvents, and lead-free ink were

purchased and stored in containers of 1-gallon (3.79-liter) size or less. According to Navy personnel, printing inks and solvents were used so that any remaining liquid would evaporate. Spent photo developer and fixer chemicals were taken off-site for disposal or recycling. Except for small spills occurring inside of Building 50, no chemicals have reportedly been spilled on the property. The physical reconnaissance report indicated no evidence of releases.

A fiberglass shed, which may have served as a hazardous substances area, was located within a second shed southeast of Building 50. A rusty 5-gallon (18.9-liter) drum labeled "Waste Lube Oil" was located within the shed and appeared to be intact. No evidence of leakage was observed. An empty 5-gallon gasoline container was found next to the 5-gallon drum. Empty storage lockers labeled "F-3" and "Flammable" were also found inside the shed. An underground structure or vault with a metal cover fitted with handles was located southeast of the building. No information regarding the use, contents, or capacity of this structure was available.

A 1-gallon (3.79-liter) container labeled "4-1015 Offset Etch" was found on shelving located southwest of Building 50. No other chemicals, dyes, or inks related to printing operations were reported to be present and no information regarding the use of such materials on site was available. A trash-dumping area was also found southwest of Building 50. The soil in this area did not appear discolored although several 33.8-fluid ounce (1-liter) plastic containers with hazard rating labels littered the area. The actual hazard rating was not visible on the labels. Other miscellaneous trash was also scattered around this area.

**Lead-based Paint.** Because of the building's age, it is possible that lead-based paint may be present on the interior or exterior of the structure. Exterior areas where the paint was weathered or had deteriorated were reported. A lead-based paint survey has not been conducted and is not planned since the on-site structures have not been proposed for use as housing.

**Polychlorinated Biphenyls (PCBs).** Control of PCBs and PCB-contaminated materials is legislated by TSCA. TSCA generally bans the use, manufacturing, processing, and distribution in commerce of PCBs. PCB-contamination or PCB-containing equipment is identified as such if 50 parts per million (ppm) of PCB is measured. Three 75-kilovolt-ampere transformers are known to contain PCBs at a maximum concentration of 23 ppm. No other oil-containing electrical equipment is known to contain PCBs.

**Radon.** Building 50 has not been tested for the presence of radon. Previous radon surveys of the South Finegayan housing area located 4,800 feet (1.46 kilometers) northwest of Building 50 indicate levels ranging from 2.1 to 23 pCi/l. Therefore, the radon potential within Building 50 may be greater than the action level of 4 pCi/l. The underlying geologic material (Mariana Limestone) is known to contribute to elevated radon levels.

**POI Sites.** This property contains three POI sites that are listed in the *BRAC Cleanup Plan* as POI-01, POI-02, and POI-19. POI-01 is a former UST location and petroleum contamination may have occurred. The three USTs have been removed and site assessment activities have been completed. The BRAC Cleanup Team (BCT) has concurred with the no further action recommendation.

POI-02 is the leach field southeast of Building 50. It is possible that chemicals associated with printing operations may have been discharged to the soil via a drain connected to the leach field. Environmental investigations are ongoing.

POI-19 is an area where PCBs were released to the ground from two vandalized transformers in July 1997. The PCB-contaminated soil has been removed. The transformer slab will be removed and the debris properly disposed of in 1999.

### 3.17.2.3 Marine Drive Utility

**Storage Tanks and Pipelines.** ASTs were used on site during the 1940s. However, no potential releases were reported. No USTs or pipelines have been located on site, and no evidence of potential release from ASTs, USTs, or pipelines were reported.

**Hazardous Materials/Waste Management Sites.** Buried drums were reportedly found west of the property and Route 34, adjacent to the Harmon Water Pump Station, in 1991. They were removed along with the surrounding soil. The contents of these drums are unknown. Soil samples were collected from the area surrounding the drums and submitted for TCLP analyses for metals and volatile and semi-volatile organics. The available data indicate that the soils were not considered hazardous according to the TCLP standards. No information is available regarding the location of these soil samples. Although documentation confirming the completion of removal activities was not available, it is assumed that the area remediation was completed.

**Radon.** Radon levels as high as 94.56 pCi/l were detected at the GEPA-surveyed Harmon Loop Elementary School located approximately one mile south of the property. Therefore, the potential radon levels within any structure on this property may be greater than the action level of 4 pCi/l for indoor air. In addition, the underlying geologic formation (Mariana Limestone) is known to contribute to elevated radon levels.

**POI Sites.** This property is considered a POI site (POI-11) because of possible contaminant migration from a former Navy power plant, previously located at the current Harmon Substation property.

### 3.17.2.4 Tamuning Telephone Exchange

**Storage Tanks and Pipelines.** Two USTs have been reported at Building 405. One UST, reportedly used to store diesel fuel for the emergency generator, was located on the southern side of the building but removed in 1995. No documentation was found regarding releases associated with this UST or any tank repairs. In addition, no records are available regarding the tank removal or closure.

The second UST was located at the northeast corner of Building 405. No documentation regarding this UST was available, and this tank was not included on the UST inventory maintained by PWC Guam. It was presumed that the tank contained diesel fuel for the emergency generator and installed when Building 405 was constructed in 1949. This UST was removed in 1997 to assess the presence and extent of contamination.

An AST located near the emergency generator room on the south side of Building 405 was shown on drawings dated 1983. These drawings indicate that there were plans to remove the AST in 1983. In addition, a diesel day tank is currently located in the generator room for storage of diesel fuel.

There is no evidence of underground or aboveground pipelines, other than those in the generator room which carry fuel oil and feed directly into the emergency generator.

**Asbestos.** In 1991, an asbestos survey of Building 405 was conducted. Based on this nondestructive survey, no accessible ACM was discovered in Building 405.

**Hazardous Materials/Waste Management Sites.** Hazardous waste data records show that lead acid batteries and battery fluid acid were transported from the Tamuning Telephone Exchange in November 1993. No other information regarding hazardous materials or waste was reported. Materials such as solvents, acids, and paints were reported to have been previously stored on the property.

According to the information available, solvents, including carbon tetrachloride, were used to clean switch relays through 1990. The spent solvent was reportedly disposed of by dumping on the grass behind Building 405 and on a grassy area between Building 405 and the current Taco Bell Restaurant to the east of the Tamuning Telephone Exchange.

Battery acid may have been mixed and excess battery acid temporarily stored at the Tamuning Telephone Exchange, but these actions could not be confirmed.

In 1994, two or three drums were reportedly found on the property after having been dumped. Navy PWC Guam Environmental was contacted and arranged to have the drums removed. Records of this activity were unavailable at PWC Guam.

A metal paint shed, which contained 1-gallon (3.79-liter) paint and oil cans, was previously situated by the fence east of Building 405. The shed has since been removed. Interviews or conversations also indicated that another shed was located in the same general vicinity but photographic evidence was unavailable.

**Lead-based Paint.** Lead-based paint surveys have not been conducted at the Tamuning Telephone Exchange property, but based on the age of the structures, it is likely that lead-based paint was applied to the buildings.

**Polychlorinated Biphenyls (PCBs).** According to the current PCB inventories, there are no active PCB items located on the property containing concentrations greater than 50 ppm. Although pole-mounted transformers were observed, no identifying markings were seen and information regarding their PCB-containing status was unavailable.

**Radon.** No records have been located which indicate that a radon survey was conducted at the Tamuning Telephone Exchange. Some samples were collected during 1993 radon surveys of NAS Agana structures within approximately 2,000 feet (0.6 kilometers) of the property. The radon levels ranged between less than 0.5 and 8.26 pCi/l. Therefore, it is possible that similar radon levels occur on this property and that concentrations may exceed the action level of 4 pCi/l.

**POI Sites.** One POI site (TTE/POI-1) is designated on the Tamuning Telephone Exchange property. This POI site consists of a potential hazardous substances storage and disposal area where hazardous substances, including spent solvents, were disposed of on grassy areas surrounding Building 405, and where sulfuric acid used in batteries may have been stored and

disposed. The septic tank on this property is included in this POI site because it is likely that hazardous substances were discharged to this location.

### **3.17.2.5 NAS Officers Housing**

#### **Storage Tanks and Pipelines**

There are no USTs or ASTs currently on this site. A 6-inch (150-millimeter) aviation gasoline (AVGAS) pipeline passes through the site but there are no records of releases.

In 1994, a 1,000-gallon (3,785-liter) diesel UST and associated pipeline was removed from the Navy Exchange. Contaminated soil was removed and taken to the bioremediation soil farm for disposal. Total petroleum hydrocarbons (TPH) was detected within the excavation, but target compounds benzene, toluene, ethylbenzene, total xylenes (BTEX), and polyaromatic hydrocarbons (PAHs) were not detected or were below regulatory guideline levels. No further action is planned for this site.

#### **Asbestos**

Asbestos surveys were conducted in the residences and Building 1-1019C (pump house) and Building 1-1307 (Navy Exchange). Although asbestos-containing materials (ACMs) were not indicated at the pump house, they were found in the vinyl flooring and mastic in the residences but were in good condition with little potential for human contact or disturbance.

#### **Hazardous Materials/Wastes**

Documentation is not available on the production of hazardous waste or the use of hazardous materials. However, hazardous materials other than those for retail sale and household use are not believed to be present.

#### **Lead-Based Paint (LBP)**

Lead has been detected in paint samples from the Navy Exchange and in a few interior and exterior samples in the residences. The LBP in two areas is reported to be in poor condition. Lead concentrations above the 400 ppm residential action level has also been detected in two areas. As such, soil remediation is planned for areas located at 103 and 402 West Sunset Boulevard.

#### **Pesticides**

Pesticides have been historically used at NAS Agana; however, there is no evidence that pesticides were stored, mixed, or disposed of at the NAS Officers Housing site.

#### **Polychlorinated Biphenyls (PCBs)**

Between December 1997 and March 1998, rapid response cleanup was performed due to damage suffered during Typhoon Paka. Cleanup consisted of the removal of downed electrical poles and transformers and the cleanup of soil impacted by transformer oil spilled from damaged transformers. Contaminated soil in excess of the GEPA cleanup level of 50 milligrams/kilogram of total recoverable petroleum hydrocarbons (TRPH) was removed and stockpiled. As of July 1998, debris and transformer oil-containing soil from the rapid response

cleanup was present on the eastern portion of the NAS Officers Housing parcel at the designated debris lay-down area. All identified PCB-containing materials have been removed from the property.

### **Radon**

A radon survey conducted in 1991 identified 21 structures with levels above the GEPA and US EPA screening levels of 4.0 pCi/l. Four structures were identified with radon levels above the GEPA and US EPA action level of 20 pCi/l. Navy conducted a follow-up radon survey in 1996, but results have not yet been disclosed.

### **3.17.3 Barrigada Region**

The Barrigada property consists of four parcels (N5A, N5B, N5C, and N5D) formerly used for communications operations and later for miscellaneous waste disposal.

#### **Storage Tanks and Pipelines**

**Parcel N5B.** An AST located at the former USCG Communications Building on Parcel N5B was used to store diesel fuel to run two generators located inside the building. The tank is currently empty and the generators are no longer used. No record or visual evidence of a fuel spill was reported. Navy plans to remove the AST in 1999.

#### **Asbestos**

**Parcel N5D.** Non-friable asbestos was removed from the floor inside of Building 31 and from the ground on the exterior of the building. No further action is required.

#### **Hazardous Materials/Waste Management Sites**

Two of the four parcels, N5A and N5B, contain areas that require further study due to hazardous materials and waste management.

**Parcel N5A.** This parcel contains a Pesticide Storage Unit, four closed landfills, and an abandoned dump. The Pesticide Storage Unit is discussed in the Pesticides subsection. The Radio Transmitting Facility (RTF) Barrigada Metal Landfill received municipal trash, freon, asbestos, solvents, waste oil, and small quantities of hazardous wastes from 1940 until 1975. Most of the waste disposed of at this landfill was municipal waste from the housing and galley areas of Barrigada. This area has been designated as a closed IRP site.

The RTF Barrigada Old Housing Rubble Disposal Area received housing rubble, demolition debris, scrap wood, and metal from 1960 to 1981. A majority of the waste came from the demolition of the officer quarters in 1960. Wastes disposed of in this area were reportedly non-hazardous, and this area has been designated as a closed IRP site.

The RTF Barrigada Topsoil Pit Disposal Area received tires, wood boxes, and other inert materials from 1960 to 1979. Although the wastes disposed of in this area were reportedly non-hazardous, this area has been designated as an IRP site.

The Metal Landfill, Old Housing Area Rubble Disposal Area, and Topsoil Pit Disposal Area were investigated and it was determined that no further action was required. GEPA requested

further investigation of the Metal Landfill and after a screening site inspection was conducted, "no further action" was recommended. Operations at these landfills ceased prior to the enactment of sanitary landfill permitting regulations.

A landfill is speculated to underlie an area north of the Barrigada Sports Complex on the western side of Parcel N5A. This landfill was discovered under an area where an unauthorized dump area and unauthorized motocross track were removed. Soil samples were obtained and analyzed for TPH. Soil removal activities, conducted to remediate elevated levels of TPH, uncovered the suspected landfill.

An Abandoned Dump received residential and construction wastes and burned municipal trash from the end of World War II to December 1975. It has been recommended that no further action is required. Operations at this dump ceased prior to the enactment of sanitary landfill permitting regulations.

**Parcel N5B.** This parcel also contains two closed landfills, both of which have been designated as IRP sites. The RTF Barrigada Back Haul Road Disposal received scrap metal and municipal wastes from 1945 to the 1950s. The RTF Barrigada 8th Hole Landfill received galley waste, aluminum scrap, and other inert golf course wastes from 1975 to 1982. Operations at these landfills ceased before the enactment of sanitary landfill permitting regulations. Only inert materials and municipal wastes are known to have been disposed of in these areas. The landfills were investigated and no further action is required.

In addition, the following suspect items were reported near or inside the former USCG Communications Building:

- Rusted 5-gallon (18.9-liter) paint cans were observed stacked near the building on an unpaved area and the ground was stained indicating a release.
- Discolored soil, possibly indicative of a petroleum hydrocarbon release, was found near the Golf Course Equipment Maintenance Shop.

According to the Hazardous Materials Inventory dated October 1, 1996, materials such as paints, oils, grease, hydraulic fluid, and fertilizers are stored at the former USCG Communications Building.

**Parcel N5C.** A portion of this parcel, which is leased to Hawaiian Rock Products (HRP), contains two rock crushers, conveyors, storage piles, and a maintenance shop. The only chemicals used by HRP are lubricants for the rock crushing and conveying system. HRP washes equipment on the property and the wastewater collects in a pond. Visible quantities of grease were observed on the surface of this pond. However, no significant hazardous constituents are known to have contaminated this parcel.

### **Pesticides**

**Parcel N5A.** The Pesticide Storage Unit on Parcel N5A, constructed on a World War II-era concrete slab, stores fertilizer, herbicides, and pesticides for use on the golf course. The concrete slab is cracked, and the facility does not have adequate secondary containment. Pesticides, herbicides, and fertilizers are prepared on an outdoor concrete pad which has a concrete rim to contain spills. A manual valve controls drainage of rainwater when the pad is not in use. Although historic pesticide storage, mixing, and application documentation is

limited, no evidence of unauthorized releases of pesticides was observed. Groundwater sampling results from dry wells and irrigation wells do not indicate pesticide contamination.

Pesticides are also applied to the three agricultural lease areas on Parcel N5A by the leaseholders. Pesticide application is performed in accordance with pesticide control and use restrictions contained in the lease agreements with Navy. No known violations of the pesticide control and use restrictions have occurred.

### Radon

**Parcel N5B.** There are presently no plans to perform a radon survey at the former USCG Communications Building on Parcel N5B. However, radon levels as high as 117.86 pCi/l were detected at the GEPA-surveyed P.C. Lujan Elementary School located approximately 1 mile (0.6 kilometer) west of the property. Therefore, the potential radon levels within any structure on the property or which may be constructed at this property may be greater than the action level of 4 pCi/l for indoor air. The underlying geologic formation (Mariana Limestone) is known to contribute to elevated radon levels.

**IRP Sites.** This property contains five IRP sites, three on Parcel N5A and two on Parcel N5B. Parcel N5A contains IRP-02, IRP-03, and IRP-04. Parcel N5B contains IRP-05 and IRP-06. All IRP sites are inactive landfills.

**Parcel N5A.** IRP-02 on Parcel N5A is known as the RTF Topsoil Pit Disposal Area, while IRP-03 is the RTF Old Housing Rubble Disposal Area. In 1983, the Naval Energy and Environmental Support Activity (NEESA) conducted an Initial Assessment Study (IAS) at both areas and recommended that no further action be required. Navy has proposed no further action for this site. The RTF Topsoil Pit Disposal Area is under further evaluation.

The RTF Metal Landfill is designated as IRP-04. In 1991, a Screening Site Inspection (SSI) was performed and in 1993, an Initial Assessment Study (IAS) was conducted. Both investigations recommended that no further action be required. Navy has proposed no further action for this site.

**Parcel N5B.** IRP-05 on Parcel N5B is known as the 8th Hole Landfill, while IRP-06 is the Back Haul Road Disposal Area. In 1983, the NEESA conducted IASs and recommended that no further action be required in these areas. The BCT has requested that these areas be evaluated further.

### POI Sites

This property contains four POI sites listed in the *BRAC Cleanup Plan* as POI-03, POI-04, POI-20, and POI-21. Two POI sites are located on Parcel N5A (POI-03 and POI-04), one on Parcel N5B (POI-20), and one on Parcel N5D (POI-21).

**Parcel N5A.** POI-03 consists of the unauthorized dumping area and possible landfill north of the Barrigada Sports Complex. There is potential contamination from a suspected landfill that consists of a buried pipe, discolored soil, and metallic debris. Removal activities have addressed surface contamination that resulted from unauthorized dumping operations.

POI-04 consists of the Abandoned Dump with potential contamination from previous dumping activities. The contaminants of concern include burn ash.

**Parcel N5B.** POI-20 consists of the former USCG Communications Building where there is potential unidentified contamination from a release near the golf course maintenance facility.

**Parcel N5D.** POI-21 consists of the area where a non-PCB transformer on Parcel N5D was vandalized and transformer fluid was released to the ground. There is potential contamination from the release, which includes petroleum products.

### 3.17.4 Central Region

#### 3.17.4.1 Nimitz Hill Properties

The Nimitz Hill properties are the Nimitz Hill Enlisted Housing and the Nimitz Hill Vacant Lands. The Nimitz Hill Enlisted Housing includes 78 housing units, undeveloped land, steep slopes, and thick vegetation. The Nimitz Hill Vacant Land remains mostly undeveloped except for the presence of a Navy PWC Guam Sewage Lift Station located in the northern portion of the site.

#### Storage Tanks and Pipelines

**Nimitz Hill Enlisted Housing.** A gas station was previously located here along with a food service facility which may have stored or handled fuel oils. There is no information regarding the size, type, and capacity of the fuel handling and storage equipment used or if such equipment was removed. There is no evidence of releases of hazardous substances at either facility. A UST has been identified on this parcel. Navy plans to remove the UST in 1999.

**Nimitz Hill Vacant Lands.** The former Libugon Radio Station, known to have been located on site, is believed to have stored fuel for a generator. However, review of documents did not identify ASTs, USTs, or pipelines. Documentation indicates that ASTs, USTs, and pipelines are not and have not been located on the remainder of this property.

#### Asbestos

**Nimitz Hill Enlisted Housing.** In 1996, an asbestos survey was conducted. Results are not yet available. Navy personnel have indicated that ACM, such as floor tiles and mastic, are probably present at the site.

**Nimitz Hill Vacant Lands.** Based on the age of the Sewage Lift Station building, it is assumed that ACM is present. The condition of the ACM and whether it has been abated are unknown.

#### Lead-based Paint

**Nimitz Hill Enlisted Housing.** A survey conducted in 1996 identified lead-based paint on this parcel. Twenty soil samples were collected in the vicinity of the housing. The maximum lead concentration obtained was 253 mg/kg; according to HUD criteria, no action is required. The soil in proximity to the housing area will be further evaluated for the presence of elevated lead concentrations and abated as necessary.

**Nimitz Hill Vacant Lands.** Based on the age of the Sewage Lift Station building, lead-based paint may have been used on the interior or exterior of the building.

#### **Radon**

**Nimitz Hill Enlisted Housing.** In 1995-1996, a radon survey was conducted for the housing units. The radon concentration at 39 Turner Road was 19.6 pCi/l. The underlying geologic formation (Mariana Limestone) on both Nimitz Hill parcels is known to contribute to elevated radon levels. Therefore, the potential radon levels within any existing or future structure on the property may be greater than the action level of 4 pCi/l for indoor air.

**Nimitz Hill Vacant Lands.** Radon levels as high as 6.57 pCi/l were detected at the Agana Heights Elementary School located approximately 1.75 mile east of the property. Therefore, the potential radon levels within any existing or future structure on the property may be greater than the action level of 4 pCi/l for indoor air.

#### **POI Sites**

**Nimitz Hill Vacant Lands.** The site of the former Libugon Radio Station is designated as POI-05. The station reportedly maintained fuel storage for an emergency generator. There is no evidence of a UST or AST, and no sign of a possible release was observed by the BCT. Therefore, no investigation or remedial action is required.

### **3.17.4.2 Sasa Valley/Tenjo Vista**

The Sasa Valley/Tenjo property was previously used for fuel storage and military housing. It is now an undeveloped buffer zone for the Fleet and Industrial Supply Center (FISC) Petroleum, Oil, and Lubricants (POL) operations.

#### **Storage Tanks and Pipelines**

Navy is currently investigating abandoned pipelines on this parcel. Preliminary results indicate no significant release and Navy will propose "no further action" on this parcel.

**Sasa Valley.** During the 1940s and 1950s, a portion of the Sasa Valley parcel consisted of at least two large ASTs at a Motor Gasoline Tank Farm. Inactive pipelines may be located on this parcel.

**Tenjo Vista.** This parcel is adjacent to the Sasa Valley Tank Farm and the Tenjo Vista Tank Farm. Pipelines from these facilities and the Shell Oil, Agat Terminal Station underlie and/or extend adjacent to this parcel. There is an abandoned pipeline on the southern tip of the parcel; no investigation has taken place. A Naval Supply Center Diesel Oil Tank Farm and military housing were also present on this parcel during the 1940s and 1950s. In May 1997, a spill from the abandoned pipeline was discovered. This area was designated as a POI site.

#### **Hazardous Materials/Waste Management Sites**

Documentation indicates that hazardous substances and waste management areas are not currently nor have they historically been established on these parcels.

## Ordnance

**Tenjo Vista.** In August 1997, Navy PWC Guam personnel discovered UXO on a steep hillside near an illegal dump site situated on the Tenjo Vista parcel. The site is designated POI-16. Navy removed solid waste at this dump site. Navy found approximately 375 World War II Japanese 81-millimeter mortars and 200 point detonating fuses. UXO rounds were removed and a "sweep" of the area was conducted to determine if additional rounds were present. Navy removed all detected ordnance.

## Radon

Enclosed structures do not exist on the Sasa Valley/Tenjo Vista property. Radon levels at the Sasa Valley POL Administration Building and Pump Station, located between the northern border of the Tenjo Vista parcel and the southern border of the Sasa Valley parcel, range from 0.1 to 0.7 pCi/l. This is below the US EPA recommended action level of 4.0 pCi/l. The underlying geologic formation consists of alluvial deposits, sandstone formations, and limestone bedrock (Mariana Limestone), which is known to contribute to elevated radon levels. Based on the geologic information, there is potential for elevated radon levels to occur within structures which may be constructed on the property.

## IRP Sites

**Tenjo Vista.** The abandoned pipeline buried beneath the southern tip of the Tenjo Vista parcel is designated as IRP-01. Contaminants of concern include TPH and other substances associated with fuels.

## POI Sites

Four POI sites are POI-15, POI-16, POI-17, and POI-18. POI-15, POI-16, and POI-17 are located on the Tenjo Vista parcel and POI-18 is on the Sasa Valley parcel.

**Sasa Valley.** The area where ASTs were previously located is designated as POI-18. Although there is no evidence or report of a release at this site, there is potential for contamination from the former tank farm.

**Tenjo Vista.** POI-15 consists of a disposal area where household waste and abandoned cars were illegally dumped. These unauthorized dumping activities could have contaminated the area. Navy has removed some surface debris.

POI-17 is where an oil spill from the abandoned pipeline occurred parallel to Marine Drive. Surrounding soil was sampled, excavated, and removed in February 1997. The contaminated soil was taken to the PWC Guam bio-berm for remediation. In July 1997, the visible end of the pipeline was capped. The pipe appeared to have been used for drainage. Trace amounts of oil were found in the pipe, but no additional contaminated soil was discovered during the capping activities.

### 3.17.4.3 Polaris Point

**Storage Tanks and Pipelines.** There are currently no ASTs or USTs located on this property. Previously, four ASTs were used for aviation gasoline, automobile gasoline, and diesel fuel

storage and distribution at the old Navy Supply Depot (NSD) Drum Storage Lot. Also located in this area is a valve pit for the abandoned underground fuel lines associated with drum filling activities. Potential concerns include leaks from the subsurface pipes and manifolds and discharge of spilled fuel toward the bermed areas through a 2.5-inch (6.35 millimeter) drain line.

Along the eastern boundary of the property is the active Shell Oil, Agat Terminal pipeline. A 10,000-gallon (37,850-liter) diesel spill from the former GORCO oil pipelines, which are now owned by Shell Oil Company, occurred on June 4, 1980, in the vicinity of the Laguas River outlet to Sasa Bay. The spill was remediated in accordance with RCRA. The northeastern corner of the subject parcel was affected by the spill.

Three semi-active 4-inch (100-millimeter) diameter Navy POL pipelines, periodically used to transport sewage and oily wastewater from aircraft carriers to Polaris Point, run west to east through the property just north of the road to Polaris Point. No records of spills from these pipelines were found.

**Asbestos.** ACM may be found in the building at Polaris Point. No information is available.

**Hazardous Materials/Waste Management Sites.** Although concrete-bermed areas were used for the storage of both full and empty drums at the old NSD Drum Storage Lot, activities occurred over an unbermed area. Therefore, it is possible that wastewater was not properly contained and drummed. The drum rinsate activities produced the greatest amount of waste at the lot, and the rinsate water may have contained hazardous constituents, such as hydrocarbons and cleaning compounds. The potential contaminants of concern at this lot include oils, lubricants, solvents, petroleum products, PCBs, fuel hydrocarbons, and metals, which could migrate through the soil, surface water, or groundwater.

RCRA Facility Investigation (RFI) field activities were conducted at the Old NSD Drum Storage Lot, also known as Solid Waste Management Unit No. 49, between January and March 1996. Field activities included land surveys, drilling and installation of nine monitoring wells, and collection of subsurface oil and groundwater samples. Samples were analyzed for PCBs, volatile organic compounds, polynuclear aromatic hydrocarbons, TPH, and metals. No releases were identified and, therefore, no corrective actions were required.

**Lead-based Paint (LBP).** Based on the age of the building, LBP may have been used on the interior or exterior of facilities on the property. A LBP survey has not been conducted and is not planned because the building is not proposed for use as housing.

**Polychlorinated Biphenyls (PCBs).** PCBs are potential contaminants at the Old NSD Drum Storage Lot because they are a possible constituent of waste oils previously stored at the lot. Documentation and interviews revealed no evidence that transformers once existed on the Polaris Point property.

**IRP Sites.** Two abandoned pipelines cross the property and connect to the Tenjo Vista Tank Farm. These pipelines, which previously carried black oil and diesel fuel, are considered part of IRP-01 on the Sasa Valley/Tenjo Vista property. Potential contaminants include TPH and other substances associated with fuels.

**POI Sites.** The subject parcel is considered a POI site (POI-06) because there is potential contamination from subsurface pipelines and fuel spills. TPH is a contaminant of concern. No further action is planned.

### **3.17.5 Southern Region**

#### **3.17.5.1 Old Apra Heights**

The Apra Heights Substation site was not included as part of the Old Apra Heights parcel in the EBS but was briefly covered as an adjacent property. If subsurface contamination exists on this adjacent property, the Old Apra Heights parcel could be affected.

**Polychlorinated Biphenyls (PCBs).** The Apra Heights Substation adjacent to the southern portion of the property is suspected of potential contamination because oil-filled electrical equipment may potentially contain PCBs. The substation has operated since the mid-1970s; the site was previously undeveloped. Fluids leaking from T70 transformers were observed, but it is unknown whether the fluids are PCB-containing.

Other than the presence of the Apra Heights Substation, documentation, interviews, and the physical reconnaissance indicate that PCBs are not present elsewhere on this property.

#### **3.17.5.2 New Apra Heights/Route 2A**

The area planned for use as the Agat/Santa Rita Wastewater Treatment Plant was not included as part of either the New Apra Heights parcel or the Route 2A parcel in the EBS but was briefly covered as an adjacent property called the Apra Heights site. This area was used as a construction contractor housing area from the 1940s to the 1970s as part of the former Camp Busanda.

#### **Storage Tanks and Pipelines**

**New Apra Heights.** Although a 1953 base topographic map shows the presence of a tank towards the west-central portion of the property, the tank was not observed during the physical reconnaissance and other information regarding the tank was unavailable. No other tanks or pipelines were located on this property.

**Route 2A.** This parcel once accommodated a maintenance and repair unit (MRU) which serviced vehicles and heavy equipment and operated a diesel or gasoline fueling station. The date of operation of the MRU is unknown, but a 1960 drawing of the MRU layout and activities does not indicate fueling activities. The 1977 demolition plan for Building 324 and 325 indicated that two USTs (one diesel and one gasoline) were to be removed, but records of the removal activities were not located. However, based on the results of a geological survey and trenching performed during the Old Western Pacific (WESTPAC) Remedial Investigation, it was determined that the USTs were removed.

#### **Hazardous Materials/Waste Management Sites**

**New Apra Heights.** A portion of the property is presently being used as an industrial vehicle storage area. Maintenance work is not conducted here, nor are any fuel or hazardous substances stored on site. An unmarked 5-gallon (18.9-liter) drum with a viscous, black

material dripping down the sides was discovered on the unpaved ground near the intersection of Route 2A and Route 5. The black material resembled asphaltic oil and its discovery coincided with the road construction observed on Route 2A. There was no indication of stressed vegetation or the potential presence of hazardous substances or petroleum products.

A site investigation (SI) of the former Camp Busanda area identified potential contamination related to former fuel drum storage activities. Background soil sampling was conducted along the border of the former Camp Busanda area and the New Apra Heights property. One sample was obtained with a TPH concentration of 1,200 mg/kg. The sample was also analyzed for polycyclic aromatic hydrocarbons (PAHs), total fuel hydrocarbons, and volatile organics. Results indicated nondetect concentrations for all analytes, except for six unidentified aliphatic compounds with concentrations ranging between 0.18 and 0.37 mg/kg. Sample discoloration was not observed, and no soil discoloration was noted in sampling documentation.

Because no apparent source has been identified and no evidence of a release was observed, the elevated TPH concentration reported appears to be the result of an isolated incident and poses no significant concern.

**Route 2A.** Documentation was not found regarding the on-site packaging, labeling, storage, and record-keeping of hazardous substances or wastes other than for investigation-derived waste (IDW). IDW is potentially hazardous waste or non-hazardous waste that results from field investigation activities on the property or in the immediate vicinity. In accordance with RCRA requirements, a single area serves as the interim storage location for all IDW produced in the vicinity. Besides the IDW, there was no evidence of the presence of hazardous substances on the property during the physical reconnaissance. No evidence of potential release was noted.

As indicated in the 1977 MRU demolition plan, several buildings housed activities associated with POL products. The 1960 MRU area layout and activities map indicate two buildings which may have housed painting activities. Specific types and quantities of potentially hazardous substances used at these facilities are unknown.

The potentially hazardous wastes produced by former activities at the MRU were reportedly disposed on the ground, washed down the storm drain system (which discharges to adjacent wetlands), or disposed in adjacent areas. These wastes included oils, fuel, battery acid, brake and transmission fluid, and sandblast grit. Specific constituents and quantities of potentially hazardous waste disposed of on this property are unknown.

### **Polychlorinated Biphenyls (PCBs)**

**Route 2A.** An Initial Assessment Study (IAS) indicated that two electrical transformers were formerly on the property, so there is a potential for PCBs in the soil. Documentation reveals no oil-containing electrical equipment which may contain PCBs on the property.

### **Radon**

**New Apra Heights.** Although a radon survey has not been conducted at this property, the maximum radon level for a survey at the Harry S Truman Elementary School, located approximately 1 mile (0.6 kilometer) south of the property, was 0.29 pCi/l. Since the maximum radon level detected in these surveys is less than the action level, it appears that the new structures would also be below the action level. However, the limestone bedrock underlying

portions of the property is known to contribute to elevated radon levels. Therefore, on-site structures may experience elevated radon levels.

**Route 2A.** A radon survey has not been conducted at the Route 2A property; however, the property is located atop limestone bedrock, so there is potential for elevated radon levels in new structures.

#### **IRP Sites**

**Route 2A.** This property is designated as an IRP site because former activities included relatively large-scale oil and lubricant handling, painting, and sandblasting. It is referred to in the *BRAC Cleanup Plan* as IRP-07. Potential contaminants identified during a Remedial Investigation (RI) include TPH, PAHs, phenols, organic lead, metals, PCBs, and chlorinated pesticides. This IRP site could potentially impact the adjacent low-lying wetlands.

A groundwater investigation that included the installation of monitoring wells and the collection and analysis of groundwater samples was conducted in July 1992, October 1992, and January 1993 during the Old WESTPAC Site Remedial Investigation (RI). Although sample results indicated the presence of volatile organics, chlorinated pesticides, phenols, and fuels in the groundwater beneath the site, groundwater modeling results indicate that exposure pathways for humans are minimal and there are no downgradient receptors. Confirmation samples to verify the data quality were collected in July 1997.

#### **POI Sites**

**New Apra Heights.** Although the site investigation for the adjacent Southern High School area indicated that no contamination or contaminant migration has occurred from this area which is southeast of the New Apra Heights property, a preliminary geophysical survey conducted in September/October 1997 indicated that a scrap metal pile extends onto this property. Therefore, this property is designated as a POI site (POI-07).

### **3.17.5.3 Rizal/Afleje Beach**

**Lead-based Paint.** Based on the age of the cinder block building, lead-based paint may have been used on the interior or exterior of the structure. A LBP survey has not been conducted and none is planned because the building is not proposed for use as housing.

**POI Sites.** The Rizal/Afleje Beach property is designated as a POI site (POI-08) because it is located to the west of Solid Waste Management Unit No. 11, the PWC Guam Landfill. The Final Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) report for the landfill concluded that there are no contaminant releases from the landfill. Therefore, no further action was recommended by the BCT.

### **3.17.5.4 Navy Ordnance Annex North**

#### **Asbestos**

**East Parcel (N19B).** In 1996, an asbestos survey discovered ACM in the floor tiles throughout the housing units. The condition of the ACM ranged from "good" to "significantly damaged," but asbestos abatement activities have not been planned since the ACM is nonfriable.

### **Lead-based Paint**

**East Parcel (N19).** In October 1994, two paint chip samples were obtained from the housing units and analyzed for lead. The results ranged from nondetect to 270 ppm lead. A comprehensive survey of the housing units and playground equipment was conducted in 1996 using an X-ray fluorescence analyzer. In addition, four soil samples were collected in the play areas. Both interior and exterior paints on the housing units gave positive results for lead. The paints on the playground equipment did not provide any positive results. Concentration of lead in the soil samples ranged from 15 to 57 ppm.

During the 1996 survey, 20 soil samples were also collected in the housing vicinity. The maximum lead concentration for these samples was 393 mg/kg. According to HUD criteria, concentrations of less than 400 mg/kg require no action. Navy plans no further action as the identified reuse is not target housing.

### **Ordnance**

**West Parcel (N19A).** Ordnance was stored in the general vicinity of the parcel in 1944, but no documentation has been located to confirm that ordnance was actually stored on site. Ordnance is not currently generated, stored, or disposed of on this parcel. Buried or scattered remnants of World War II ordnance may be present.

### **POI Sites**

**East Parcel (N19B).** The housing area on this parcel is designated as a POI site (POI-26) because lead-based paint has been identified on the housing and lead has been detected in the soil in the vicinity.

# Chapter 4

---

## ENVIRONMENTAL CONSEQUENCES

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100

## CHAPTER FOUR

### ENVIRONMENTAL CONSEQUENCES

---

#### 4.1 INTRODUCTION

This chapter focuses on conditions and resources that may be significantly affected by the proposed disposal action and reuse alternatives. A "No Action" Alternative has also been considered. Each section includes a discussion of criteria used to determine the significance of impacts, identification and comparison of impacts (direct, indirect, cumulative) of each alternative, and proposed mitigation. Most of the impacts identified in this document are indirect, i.e., the consequence of reuse rather than disposal. Mitigation of these impacts would be the responsibility of the Guam Economic Development Authority (GEDA), a receiving agency, developer, or other acquiring entity.

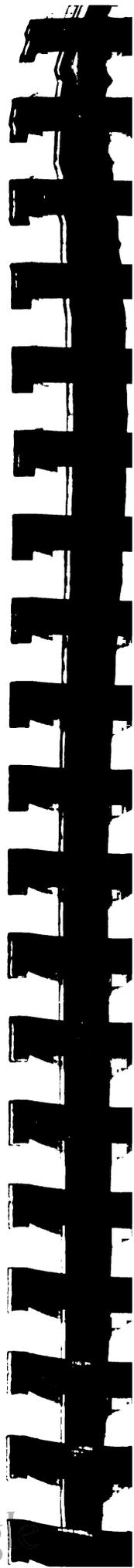
Issues were screened for relevance and potential significance, and those not considered relevant or with little or no potential for significance are not discussed in depth. This approach is consistent with NEPA, which specifies that environmental impact statements should be concise and analytic, and that impacts should be discussed in proportion to their significance. Results of this screening process are presented as Table 4.1-1. To reiterate from Chapter 3, the Region of Influence will vary according to the resource or issue being evaluated. Some impacts may be site-specific, while others may be regional or island-wide.

Cumulative impacts are those resulting from other actions which combined with the proposed action's direct and indirect impacts may be minor but, collectively, could result in significant impacts. The evaluations in this document, as well as the roadway and utility master plans referenced in the EIS analysis, take into account other proposed projects on Guam. Other major projects are discussed in Section 3.15; these include projects under construction in 1998, others known to be in the planning process, and projects that have already received Guam Land Use Commission approval. It is acknowledged that the roadway and utility master plans were prepared when Guam's economy was growing rapidly; hence, estimates of traffic volume and utility demand may be high. The high estimates would be partially but not wholly offset by development on the Tiyan, GLUP, and SRF reuse parcels, which were not accounted for in the master plans.

In the EIS analysis, certain constraints or measures are part of the project alternatives and serve to prevent potential impacts. Most of these measures are required by either the federal or local government. With compliance, potentially significant impacts are lessened. For example, contractors are required by various laws and regulations or as conditions of permit approval to mitigate construction-related impacts such as erosion and runoff, traffic congestion, noise, fugitive dust, emissions from vehicles and equipment, release of hazardous substances and wastes, and impacts relating to solid waste disposal and borrow and fill activities. Hence, temporary impacts during construction are identified but not addressed in detail in this document.

Table 4.1-1: Screening of Issues

Topic	Issues and Determination	Further Analysis Required?
<b>Topography, Geology, and Soils</b>		
Slope	Is proposed development feasible with existing slope?  <b>Determination:</b> Not a significant issue; slope would be a factor in site planning and engineering design.	No
Geologic hazards	Is the region or parcel in a high-risk seismic zone?  <b>Determination:</b> Not a significant issue; structures would be designed and constructed according to the Uniform Building Code and Guam P.L. 23-88 (seismic zone 4).	No
Unique land forms	Would unique landforms be altered by proposed land uses?  <b>Determination:</b> Not a significant issue; no unique landforms are located on any of the parcels.	No
Soil stability	Would structures be adequately supported by existing soils?  <b>Determination:</b> Not a significant issue; soil stability would be a factor in site planning and engineering design.	No
Erosion potential	Would proposed land uses be compatible with erosion potential of the area?  <b>Determination:</b> Not a significant issue; erosion control measures are required by GEPA (e.g., phased grading, seeding of exposed areas, use of hydromulch).	No
Agricultural productivity	Would any of the proposed land uses preclude the use of prime agricultural land with high soil productivity rating?  <b>Determination:</b> Not a significant issue; soil conditions on Guam are generally poor and agriculture is a relatively small industry.	No
<b>Water Quality</b>		
Surface water quality	Would transport mechanisms be present to allow discharge of sediments or contaminants into receiving waters?  <b>Determination:</b> Not a significant issue; runoff would be mitigated by compliance with regulatory requirements (e.g., Best Management Practices [BMPs] and spill prevention plans).	No
Groundwater quality	Would transport mechanisms be present to allow contamination of groundwater? Is there a potential to affect the northern lens?  <b>Determination:</b> Not a significant issue; no parcels are within aquifer recharge areas; impacts can be minimized through compliance with regulatory requirements (e.g., BMPs and spill prevention plans).	No



**Table 4.1-1: Screening of Issues**

Topic	Issues and Determination	Further Analysis Required?
<b>Drainage and Hydrology</b>		
Drainage	<p>Would amount of surface runoff increase due to development of additional impermeable surface areas? Can additional runoff be contained on site?</p> <p><b>Determination:</b> Potentially significant issue; increase in runoff is expected.</p>	<p>Yes (See Section 4.3)</p>
Aquifer recharge potential	<p>Would proposed land uses reduce open land available for aquifer recharge?</p> <p><b>Determination:</b> Not a significant issue; no aquifer is located in the vicinity of reuse parcels.</p>	<p>No</p>
Flood zones and floodplains	<p>Are reuse parcels located within flood zones, floodplains, or tsunami inundation areas?</p> <p><b>Determination:</b> Not a significant issue; must comply with GovGuam floodplain management regulations (Title XVII, Title XIX, Executive Order [EO]78-20), and federal EO 11988 on floodplain management.</p>	<p>No</p>
<b>Air Quality</b>		
Air emissions	<p>Would there be a net increase in air emissions from proposed land uses? Are any parcels in nonattainment areas? Are any stationary sources planned? What is the potential effect on air quality due to increased vehicular traffic? Additional power requirements?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes, Rizal/Afleje Beach (power plant option, Higher Intensity Alternative) (See Section 4.4)</p>
Fugitive dust during construction	<p><b>Determination:</b> Not a significant issue; fugitive dust control measures are required by GEPA (e.g., watering of construction site, seeding of exposed areas, use of hydromulch).</p>	<p>No</p>
<b>Land Use Compatibility</b>		
Land use conflicts and quality of built environment	<p>Would proposed land uses conflict with nearby or adjacent uses in terms of health or safety, land use policies (<i>I Tanò-ta</i>), impairment of existing uses, visual impacts, noise, or traffic?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes (See Section 4.5)</p>
Visual impacts	<p>Would proposed land uses change views from surrounding communities, public highways, or public parks or recreation areas?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes (See Section 4.5)</p>

**Table 4.1-1: Screening of Issues**

Topic	Issues and Determination	Further Analysis Required?
<b>Noise</b>		
Noise during operations	<p>Would noise generated by proposed land uses adversely affect sensitive receptors such as homes, schools, or hospitals (i.e., is noise expected to exceed applicable federal or GovGuam noise standards)? Will aircraft noise levels impact proposed land uses?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes (See Section 4.6)</p>
Noise during construction	<p>Would noise generated during renovation or construction of new development adversely affect sensitive noise receptors?</p> <p><b>Determination:</b> Not a significant issue; noise control measures are required by GEPA (e.g., limiting construction to daylight hours, requiring mufflers on vehicles and equipment).</p>	<p>No</p>
<b>Cultural Resources</b>		
Archaeological sites and historic structures	<p>Are there any cultural resources on the reuse parcels eligible to be listed on the National Register of Historic Places (NRHP)?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes (See Section 4.7)</p>
<b>Terrestrial Biota and Habitats</b>		
Endangered, threatened, or rare or native species; migratory birds and fishes	<p>Are protected plant or animal species present on any reuse parcels?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes (See Section 4.8)</p>
Wetlands, limestone forests, and other sensitive habitat	<p>Are sensitive habitats located on any reuse parcels? Are any of the parcels within federally designated critical habitat or refuge overlays?</p> <p><b>Determination:</b> Potentially significant issue; however, none of the parcels are in critical habitat or refuge overlays.</p>	<p>Yes (See Section 4.8)</p>
Brown tree snake	<p>Does the proposed action increase the risk of introducing the brown tree snake (BTS) into the CNMI or Hawaii?</p> <p><b>Determination:</b> Not a significant issue; reuses are proposed at a conceptual level; movement of materials or equipment between Guam and these locations cannot be speculated at this time.</p>	<p>No</p>
<b>Marine Environment</b>		
Endangered, threatened, or rare species; marine mammals	<p>Are protected plant or animal species present on any reuse parcels?</p> <p><b>Determination:</b> Potentially significant issue.</p>	<p>Yes (See Section 4.9)</p>
Coral reefs; other sensitive marine habitat	<p>Would proposed land uses adversely affect coral reef or other sensitive marine habitat?</p> <p><b>Determination:</b> Potentially significant issue; Rizal/Afleje Beach under Higher Intensity (power plant) Alternative.</p>	<p>Yes (See Section 4.9)</p>

**Table 4.1-1: Screening of Issues**

<b>Topic</b>	<b>Issues and Determination</b>	<b>Further Analysis Required?</b>
<b>Roads and Traffic</b>		
Traffic congestion due to development	Would traffic conditions at existing key intersections be degraded beyond Level of Service (LOS) D?  <b>Determination:</b> Potentially significant issue.	Yes (See Section 4.10)
Traffic congestion during construction	Would construction activities cause traffic congestion?  <b>Determination:</b> Not a significant issue; impacts would be temporary and traffic control measures would be required.	No
<b>Infrastructure</b>		
Potable water supply	Would the potable water supply be sufficient to serve proposed land uses?  <b>Determination:</b> Potentially significant issue; cumulative island-wide impact.	Yes (See Section 4.11)
Wastewater treatment	Would wastewater treatment plant (WWTP) capacity be sufficient to serve land uses?  <b>Determination:</b> Potentially significant issue; cumulative regional impact.	Yes (See Section 4.12)
Solid waste disposal	Would landfill capacity be sufficient to handle construction debris and to serve proposed land uses?  <b>Determination:</b> Potentially significant issue; cumulative island-wide impact.	Yes (See Section 4.13)
Hazardous waste disposal	Would handling and disposal of hazardous wastes generated during construction and operations pose problems?  <b>Determination:</b> Not a significant issue; hazardous wastes would be handled in accordance with local and federal regulations.	No
Electricity	Would electrical generating capacity be sufficient to serve proposed land uses?  <b>Determination:</b> Potentially significant issue; cumulative regional and island-wide impacts.	Yes (See Section 4.14)
Telephone and cable	Would telephone and cable service be available to service proposed land uses?  <b>Determination:</b> Not a significant issue; providers have capability to accommodate new demand.	No

**Table 4.1-1: Screening of Issues**

Topic	Issues and Determination	Further Analysis Required?
<b>Socioeconomics</b>		
Impacts on nearby communities	Would proposed land uses adversely affect existing residential communities in terms of family and neighborhood cohesiveness, crime, and other social indicators? Would proposed land uses adversely affect existing businesses?  <b>Determination:</b> Potentially significant issue.	Yes (See Section 4.15)
Environmental justice	Would disposal and reuse have a disproportionately adverse effect on minority or low-income populations?  <b>Determination:</b> Not a significant issue but needs to be addressed pursuant to Executive Order 12898.	Yes (See Section 4.15.5.1)
Impacts on health and safety of children	Would disposal and reuse have disproportionately adverse effects on the health and safety of children?  <b>Determination:</b> Not a significant issue but needs to be addressed pursuant to Executive Order 13045.	Yes (See Section 4.18)
<b>Public Services</b>		
Schools	Would existing or planned public school capacity be sufficient to serve residents in the reuse areas?  <b>Determination:</b> Potentially significant issue; cumulative regional and island-wide impacts.	Yes (See Section 4.16)
Parks and recreation	Would existing or planned public parks be sufficient to serve residents in the reuse areas?  <b>Determination:</b> Potentially significant issue.	Yes (See Section 4.16)
Health care	Would existing or planned health care facilities be sufficient to serve the reuse areas?  <b>Determination:</b> Potentially significant issue; cumulative regional and island-wide impacts.	Yes (See Section 4.16)
Police and fire protection	Would existing or planned police and fire protection capabilities be sufficient to serve the reuse areas?  <b>Determination:</b> Potentially significant issue; cumulative regional and island-wide impacts.	Yes (See Section 4.16)
Civil defense	Would existing or planned emergency response capabilities be sufficient to serve the reuse areas?  <b>Determination:</b> Potentially significant issue; cumulative regional and island-wide impacts.	Yes (See Section 4.16)
<b>Man-made Hazards and Constraints</b>		
Existing on-site environmental contamination	Would measures be in place to minimize the potential for existing contamination to be a problem during reuse?  <b>Determination:</b> Not a significant issue; potential for construction-related contamination would be minimized by compliance with local and federal regulations. Specific information on hazardous materials use is not available at this time.	No

**Table 4.1-1: Screening of Issues**

Topic	Issues and Determination	Further Analysis Required?
<b>Man-made Hazards and Constraints (continued)</b>		
Release of hazardous materials during construction	<p>Would measures be in place to minimize the potential for contamination from construction activities?</p> <p><b>Determination:</b> Not a significant issue; potential for construction-related contamination would be minimized by compliance with local and federal regulations. Specific information on hazardous materials use is not available at this time.</p>	No
Release of hazardous materials during operations	<p>Would measures be in place to minimize the potential for contamination from reuse activities?</p> <p><b>Determination:</b> Not a significant issue; potential would be minimized by compliance with local and federal regulations. Specific information on hazardous materials use is not available at this time.</p>	No
Impacts due to use of herbicides or pesticides during construction or operations	<p>Would measures be in place to minimize the potential for impacts to non-target species, water quality, visitors to the area, or local residents?</p> <p><b>Determination:</b> Not a significant issue; potential would be minimized by compliance with local and federal regulations; reuses are proposed at a conceptual land use level, and use of herbicides and pesticides cannot be speculated at this time.</p>	No
Explosive safety quantity distance (ESQD) arcs	<p>Are any of the reuse parcels constrained by ESQD arcs that would restrict future development?</p> <p><b>Determination:</b> Not a significant issue; none of the parcels is encumbered by ESQD arcs.</p>	No
Electromagnetic radiation or interference (EMR/EMI)	<p>Are any of the reuse parcels subject to EMR/EMI hazards?</p> <p><b>Determination:</b> Not a significant issue; none of the parcels is subject to EMR/EMI hazards.</p>	No

## 4.2 SOILS, GEOLOGY, AND TOPOGRAPHY

Reuse of the parcels would not pose a significant risk to public health and safety or the environment due to soil, geologic, or topographic characteristics, nor would the proposed reuse significantly impact soils, geology, or topography.

## 4.3 DRAINAGE

Development of the GLUP parcels under all reuse alternatives would alter existing and/or natural drainage patterns and, in most cases, would increase the quantity of storm water runoff. Total runoff quantities would be greater than existing conditions due to an increase in impervious surfaces resulting from new development. Runoff quantities could be

accommodated by various GEPA-approved measures such as the development of drainage infrastructure, infiltration galleries, or ponding basins. Therefore, no substantial increase in runoff would occur. Drainage systems must be approved by GEPA to prevent significant impacts on receiving surface waters. No impact would occur under the "No Action" Alternative.

### 4.3.1 Significance Criteria

Storm water runoff that cannot be accommodated by a GEPA-approved discharge method would be considered significant for the purposes of evaluating impacts on drainage. Risks to public safety and property damage could result if runoff exceeds the capacity of drainage systems. An increase in permeable surfaces results in an increase in the quantity of storm water runoff. For this EIS, an increase of 10 percent in impermeable surface would be considered a substantial increase. This value was chosen because existing drainage systems are typically designed with a minimum of 10 percent reserve capacity due to conservative design assumptions.

### 4.3.2 Methodology

The analysis of storm water runoff generally involves determining the peak rate of runoff, volume, and time distribution of flow resulting from a rainstorm of specific intensity and duration. It is assumed that drainage design plans specific to each site and associated runoff quantities would be determined at the planning and design stages of development for the GLUP parcels.

The runoff quantities for the parcels under the three development alternatives were not assessed since they cannot be determined at this stage. The quantity of runoff from an area of land can be roughly estimated since it is correlated to the percentage of the area that is impermeable. For each parcel under each alternative, the total quantity of impervious surface was estimated based on average "development ratios" (i.e., space allocation) established in *Timesaver Standards for Building Types*. The development ratios represent the total area developed (including parking, circulation, and building footprint) on a unit basis for each of the different land uses. For example, for residential use, the development ratio is 10,000 square feet (929 m<sup>2</sup>) of developed site for each residential unit (i.e., 10,000 sf/d.u. [929 m<sup>2</sup>/d.u.]). The development ratios used in the drainage analysis are provided in Table 4.3-2. The total developed area was then compared to the total parcel land area to estimate the percent of impermeable surface.

**Table 4.3-2: Unit Development Ratios of Land Uses**

Land Use (unit variable)	Unit Development Ratio
Residential Single-Family (dwelling unit)	10,000 sf/d.u. (929 m <sup>2</sup> /d.u.)
Residential Multi-Family (dwelling unit)	5,000 sf/d.u. (464 m <sup>2</sup> /d.u.)
Resort or Hotel or Guest House (room)	1,200 sf/room (111 m <sup>2</sup> /room)
Golf Course Clubhouse (floor space) (sf)	3 sf/sf (3 m <sup>2</sup> / m <sup>2</sup> )
Golf Course (open space)	0 sf/sf * (0 m <sup>2</sup> / m <sup>2</sup> )
Parks and Recreation Facility (floor space) (sf)	3 sf/sf (3 m <sup>2</sup> / m <sup>2</sup> )
Commercial Building (floor space) (sf)	3 sf/sf (3 m <sup>2</sup> / m <sup>2</sup> )
Industrial Building (floor space) (sf)	2 sf/sf (2 m <sup>2</sup> / m <sup>2</sup> )
Aquaculture Facility (floor space) (sf)	3 sf/sf (3 m <sup>2</sup> / m <sup>2</sup> ) (similar to Commercial bldg.)
WWTP	2 sf/sf (2 m <sup>2</sup> / m <sup>2</sup> ) (similar to Industrial bldg.)
Parks and Recreation, Historic, or Conservation (open space)	0 sf/sf * (0 m <sup>2</sup> /m <sup>2</sup> )

\* Note: Golf Course development and Parks and Recreation, Historic, or Conservation are considered open space where there would be no impervious surfaces.

Source: deChara and Callender (1990)

### 4.3.3 Potential Impacts and Proposed Mitigation

The following is an assessment of the significance of the drainage impacts for each development alternative. An increase in impermeable surface of at least 10 percent is considered substantial.

As described above, unit development ratios were applied to the various land uses for each parcel under each alternative to assess the increase in impervious surface. The estimated percent increase in impervious surface for each parcel was analyzed to determine significance of the impact. Table 4.3-3 shows the estimated increase in impermeable surfaces after development.

**Preferred Alternative.** No significant impact would result from the Preferred Alternative with the implementation of measures to accommodate runoff. The analysis shows that less than 10 percent impermeable surface increase would occur on nine of the parcels under this alternative. For the Harmon Annex, Marine Drive Utility, Tamuning Telephone Exchange, NAS Officers Housing, Barrigada Route 15 (N5B), Barrigada Antenna (N5D), and two Nimitz Hill parcels, GEPA-approved infiltration galleries or ponding basins could be sized and developed on site to handle the increase in storm water runoff due to the increase in impermeable surface. In the southern region, development of the Route 2A parcel could increase storm water runoff into the Namo River watershed basin due to the soil's slow permeability (i.e., ponding basins and infiltration galleries would not be adequate). GEPA's current policy is to eliminate storm water discharge into surface waters. Discharge from these systems would require GEPA and Army Corps Of Engineers (ACOE) permits as stated in Section 4.3.5. A storm water collection

Table 4.3-3: Percent Impermeable Surface Increase by Parcel

Parcel	Impermeable Surface Before Development	Impermeable Surface After Development					
		Alternative					
		Preferred	% Increase	Lower	% Increase	Higher	% Increase
<b>Northern Region</b>							
FAA Housing	5.00%	13.63%	8.63%	8.97%	3.97%	17.86%	12.86%
Harmon Annex	10.00%	24.40%	14.40%	12.20%	2.20%	62.91%	52.91%
Marine Drive Utility	10.00%	38.89%	28.89%	23.33%	13.33%	55.56%	45.56%
Tamuning Telephone Exch.	60.00%	96.00%	36.00%	60.00%	0.00%	96.00%	36.00%
NAS Officers Housing	10.00%	25.85%	15.25%	13.87%	3.87%	72.12%	62.12%
<b>Barrigada Region</b>							
N5A	0.00%	1.20%	1.20%	0.60%	0.60%	2.13%	2.13%
N5B	0.00%	48.09%	48.09%	24.05%	24.05%	81.03%	81.03%
N5C	4.00%	9.18%	5.18%	4.59%	0.59%	18.37%	14.37%
N5D	0.00%	45.91%	45.91%	18.36%	18.36%	96.06%	96.06%
<b>Central Region</b>							
Nimitz Hill Enlisted Housing	5.00%	31.95%	26.95%	15.78%	10.78%	60.07%	55.07%
Nimitz Hill Vacant Lands	0.00%	16.58%	16.58%	10.48%	10.48%	25.56%	25.56%
Sasa Valley	0.00%	4.80%	4.80%	0.00%	0.00%	12.00%	12.00%
Tenjo Vista	0.00%	0.37%	0.37%	0.25%	0.25%	0.74%	0.74%
Polaris Point	35.00%	0.84%	-34.16%	0.00%	-35.00%	5.60%	-29.40%
<b>Southern Region</b>							
New Apra Heights	0.00%	0.00%	0.00%	0.00%	0.00%	36.00%	36.00%
Route 2A	25.00%	15.00%	-10.00%	7.50%	-17.50%	60.00%	35.00%
Afilleje Beach	2.00%	5.40%	3.40%	2.58%	0.58%	19.75%	17.75%
Old Apra Heights	0.00%	2.65%	2.65%	1.32%	1.32%	5.30%	5.30%
Navy Ord., Annex North (West)	0.00%	0.17%	0.17%	0.00%	0.00%	11.35%	11.35%
Navy Ord., Annex North (East)	2.00%	3.97%	1.97%	2.48%	0.48%	23.67%	21.67%

and discharge system approved by GEPA would be necessary to reduce impacts to less than significant levels.

**Lower Intensity Alternative.** No significant impact that could not be mitigated would result from this alternative. The analysis indicates that development of only a few parcels would result in an increase in impermeable surfaces and consequently in storm water runoff. For the Marine Drive Utility parcel, Barrigada Route 15 and Antenna (N5B and N5D) parcels, and the two Nimitz Hill parcels, GEPA-approved infiltration galleries or ponding basins could be designed and constructed to accommodate the increase in storm water runoff due to the increase in impermeable surface.

**Higher Intensity Alternative.** The analysis indicates that development of almost all the parcels would result in an increase in impermeable surfaces and consequently in storm water runoff. For all the northern region parcels, the Barrigada, Route 16, Route 15, and Antenna (N5A, N5B, and N5D) parcels, and the two Nimitz Hill parcels, GEPA-approved infiltration galleries or ponding basins could be designed and constructed to accommodate the increase in storm water runoff due to the increase in impermeable surface. This would reduce impact to nonsignificant levels.

In the southern region, development of the Route 2A and two Navy Ordnance Annex North parcels would increase storm runoff into the Namu River watershed basin due to the soil's slow permeability. Development of a GEPA-approved storm water collection and discharge system would be necessary to reduce impacts to less than significant levels. GEPA and ACOE permits may also be required, as stated for the Preferred Alternative

The Afleje Beach parcel is adjacent to the coastline. Development of a GEPA-approved storm water collection and discharge system would be required to mitigate potential impacts. Should the design call for discharging into an ocean outfall or surface waters, GEPA and ACOE permits would be required.

**"No Action" Alternative.** Under this alternative, no development would occur, there would be no change in impermeable surface, and no significant impact would occur.

For each of the proposed developments, drainage planning must take into consideration the transport of runoff from storms with an expected exceedance frequency of 50 percent, 20 percent, or 10 percent (two-year, five-year, or 10-year storms), according to land use. Depending on soil characteristics, foundation drains, proper grading, construction of dikes and channels, and compaction of gravel fill material could mitigate potential soil stability impacts due to increased runoff.

#### 4.3.4 Cumulative Impacts

There would be no significant cumulative impacts due to storm water runoff under any of the alternatives.

### 4.3.5 Compliance/Consistency with Applicable Laws and Regulations

Before issuance of any permit for development within any designated flood hazard area, a tentative plan of the proposed development must be submitted to the Building Permit Division of DPW, including a thorough description of the proposed development and other site-specific data. Planning for any parcel in a designated flood hazard area must comply with the Flood Hazard Area Rules and Regulations.

The rules and regulations pertaining to flood plain management have been written under the authority of Titles XVIII and XIX of the Government of Guam and Executive Order 78-20, which established guidelines and standards for the management of flood hazard areas. These rules and regulations apply to all developments on Government of Guam or private lands. Compliance to the rules and regulations governing developments within designated flood hazards areas is required by the Building Permit Division, Department of Public Works.

Executive Order 11988 (May 24, 1977) provides floodplain management direction to federal agencies for avoiding to the extent possible the long- and short-term adverse impacts of occupying and modifying floodplains, and for avoiding direct and indirect support of floodplain development wherever this is practical. It requires actions to be taken to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Each agency is required to evaluate the potential effects of any actions it may take in a floodplain to ensure that its planning and budget requests reflect consideration of flood hazards and floodplain management, and to prescribe procedures to implement policies and requirements of this Executive Order. In accordance with Executive Order 11988, Navy would place a notice in the conveyance document that describes those uses that are restricted under federal and local floodplain regulations.

Reuse projects would have to comply with *the Revised Guam Water Quality Standards* and the National Pollutant Discharge Elimination System (NPDES) program, both administered by GEPA.

For any work in wetlands or coastal waters, an ACOE permit would be required in accordance with the Clean Water Act (CWA) (see Sections 4.8.4 and 4.9.4).

## 4.4 AIR QUALITY

Potentially significant issues identified in the screening process (refer to Table 4.1-1) include emissions from stationary and vehicular emission sources. No significant impacts on air quality are expected from stationary sources. With the exception of possible infrequent exceedences of the National Ambient Air Quality Standard (NAAQS) for carbon monoxide (CO) along specific heavily traveled intersections during peak-hour traffic, no significant impacts on air quality from mobile (vehicular) emissions are anticipated.

#### 4.4.1 Significance Criteria

**Stationary Sources.** Significance criteria for stationary sources vary depending on whether the impacted area is within an attainment area or not. For attainment areas, an impact (pollutant concentration) is considered significant if any one of the NAAQS are exceeded. For nonattainment areas (NAAs), an impact is considered significant if the criteria established in the *Rules and Regulations for the Guam Environmental Protection Agency Air Pollution Control Standards and Regulations* are not met. These criteria include the following:

- The NAA source will meet an emission limitation which is the lowest achievable emission rate for that source and that NAA pollutant;
- The owner or operator of the NAA source certifies that all existing major sources owned or operated by that person in Guam are in compliance with all terms and conditions contained in air pollution control permits of each of the sources;
- The owner or operator demonstrates that emission reductions for the NAA pollutant from the existing sources in the allowable offset area of the NAA source (whether or not under the same ownership) meet the requirements in §1105.5 (NAA Offset Standards);
- The owner or operator demonstrates that emissions will not cause concentrations of the NAA pollutant to exceed the applicable increase over the baseline concentration as defined and established for any attainment area; and
- There are no federal or GEPA rules that would otherwise prohibit construction of the NAA source in nonattainment area.

**Vehicular Sources.** CO is the primary emission constituent from vehicular sources. It is the cause of short-term, localized, and elevated concentrations known as “hot spots” that can cause acute health effects from short-term exposures. These hot spots, occurring along heavily traveled transportation corridors, are a function of vehicular delays, number of vehicles, and meteorological conditions. CO concentrations from vehicular emissions can be modeled to estimate their concentrations and then compared to NAAQS, which are health-based standards, to determine if the vehicular emissions impact may be significant. For this EIS, because vehicular emissions impact on air quality is a function of vehicular delays, traffic projections have been used to infer potential effects on air quality. If vehicular delays are significantly increased, as identified by a change in Level of Service (LOS) classification (e.g., from LOS D to LOS E) and degraded beyond LOS D, the potential for CO hot spots increases. If total vehicle count at intersection is 5,500 or greater per hour,<sup>1</sup> the impact to air quality could be significant. However, if the LOS is not substantially degraded from year 2010 traffic without reuse or the LOS is not degraded beyond LOS D, no significant impact to air quality is expected.

At a regional level, no criteria have been identified for evaluating the regional effects of vehicular emissions. Because of the predominant trade wind conditions and lack of a regional

---

<sup>1</sup> Based on computer model results wherein total vehicle counts greater than 5,500 per hour entering intersections under LOS F conditions produced “hot spot” concentrations of CO near the 1-hour NAAQS for CO (Department of Navy, September 1998).

air shed (defined by topography and meteorology) emissions from vehicular sources are unlikely to produce regional effects.

#### 4.4.2 Potential Impacts and Proposed Mitigation

Development of the 20 GLUP parcels would need to be conducted in accordance with federal and local rules and regulations for air pollution control. For emissions within the attainment areas, applicable rules and regulations would include federal Prevention of Deterioration (PSD) rules and the *Rules and Regulations for the Guam Environmental Protection Agency Air Pollution Control Standards and Regulations*. With the exception of possible infrequent exceedences of the CO NAAQS associated with peak hour traffic, no significant impacts to air quality are expected from the disposal and reuse of these properties.

The proposed uses for the 20 parcels include resort or hotel, residential, industrial, commercial, agricultural, and parks and recreation. The primary source of emissions associated with these operations is expected to be from vehicles. Other sources of emissions may include generators, back-up generators, industrial activities, and construction-related equipment under all reuse alternatives and a power plant under the Higher Intensity Alternative.

##### Stationary Sources

As discussed in Section 3.4, seven of the 20 parcels evaluated in this EIS are currently located within sulfur dioxide (SO<sub>2</sub>) nonattainment areas: FAA Housing, Harmon Annex, Marine Drive Utility, Nimitz Hill Vacant Lands, Sasa Valley, Tenjo Vista, and Polaris Point. Additional restrictions on air emissions would be required for the Preferred, Lower Intensity, and Higher Intensity alternatives. If GEPA obtains approval from US EPA to redesignate the nonattainment areas on Guam to attainment, these additional restrictions would not apply to the seven sites, and the requirements for attainment areas identified in the preceding paragraph would apply. SO<sub>2</sub> emissions could occur from combustion of fossil fuels that may be used for on-site generators, along with short-term emissions from construction equipment. Development must comply with the requirements for SO<sub>2</sub> emissions identified in Section 4.4.1. Because compliance with these requirements would need to be demonstrated, no significant impacts to air quality are expected under any of the reuse alternatives. Under the "No Action" Alternative, there would be no change in air emissions.

##### Vehicular Emissions

Table 4.4-1 summarizes the traffic conditions at selected intersections by LOS with and without the proposed reuse (year 2010 conditions). These data show that degradation in LOS is anticipated at most of the intersections affected by the proposed reuse. Traffic delays aggravated by the reuse alternatives at one intersection would remain unacceptable, even with mitigation, which could cause significant air quality impacts due to exceedences in the NAAQS for CO. In addition to vehicular delays, the magnitude of the CO concentrations from vehicles is dependent on the number of vehicles per hour. Total vehicle counts greater than 5,500 per hour entering intersections under LOS F conditions have been modeled to produce hot spot concentrations of CO near the 1-hour NAAQS for CO (Navy, September 1998).

**Table 4.4-1: LOS at Selected Intersections With and Without Proposed Reuse (Year 2010)**

Intersection	Without Reuse				With Preferred Alternative				With Mitigation			
	Morning Peak Hour		Afternoon Peak Hour		Morning Peak Hour		Afternoon Peak Hour		Morning Peak Hour		Afternoon Peak Hour	
	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C	LOS
<b>North Study Area</b>												
Routes 3 & 28	0.688	B	0.529	B	*	B	*	B	NA	NA	NA	NA
Route 3 & Parcel N3 Access Road	-	-	-	-	*	F	*	F	*	C <sup>2</sup>	*	F <sup>2</sup>
Routes 1 & 3	0.958	E	0.857	C	1.026	E	0.959	D	0.860	D	0.889	D
Routes 1 & 16	1.091	F	1.111	F	1.133	F	1.188	F	0.991	D	1.087	F
<b>Barrigada Study Area</b>												
Routes 8 & 10	0.953	D	1.075	F	1.118	F	1.290	F	0.948	D	0.908	D
Routes 8 & 16	*	F	*	F	*	F	*	F	***	***	***	*
Route 16 & Post Office Driveway	0.578	A	0.718	B	0.605	A	0.771	B	0.636	B	0.773	B
Routes 10 & 15	0.971	D	0.905	D	1.315	F	1.273	F	0.837	C	0.894	D
Route 15 & Parcel N5B Access Road	NA	NA	NA	NA	*	F	*	F	0.639	C	0.847	C
Central Ave. & Route 8	*	F	*	F	1.103	F	1.057	E	0.909	D	0.952	D
<b>Nimitz Hill Study Area</b>												
Routes 1 & 6 (Adelup)	0.874	C	0.908	C	0.885	C	1.014	D	**	**	0.913	C
Routes 1 & 6 (Piti)	0.863	B	0.875	B	0.919	B	0.965	C	NA	NA	0.866	B
Routes 6 & 7	*	B	*	B	*	B	*	C	NA	NA	NA	NA
Route 6 & Murray Rd. East	*	B	*	B	*	C	*	C	NA	NA	NA	NA
Route 6 & Murray Rd. West	*	B	*	B	*	B	*	B	NA	NA	NA	NA
<b>Central-South Study Area</b>												
Routes 1 & 18	0.908	B	0.910	B	0.937	B	0.944	C	NA	NA	NA	NA
Routes 1 & 2A	0.637	B	1.032	E	0.667	C	1.069	E	**	**	0.921	D
Routes 2A & 5	1.245	F	0.837	C	1.260	F <sup>1</sup>	0.896	C	0.917	C	**	*
Routes 2 & 12	0.831	C	0.861	C	0.851	C	0.902	C	NA	NA	NA	NA
Routes 5 & 17	*	B	*	C	*	B	*	C	NA	NA	NA	NA

- 1 - Effects of reuse are not significant.
- 2 - N3 Access Road
- \* - V/C is not calculated for intersections with STOP sign controls.
- \*\* - Improvement not quantified.
- \*\*\* - Mitigating traffic to acceptable conditions would require upgrading a proposed National Guard roadway and diverting traffic through it, and widening Route 16.
- NA - Not analyzed.

Source: Wilbur Smith Associates (February 1999)

Vehicle counts for intersections degraded beyond LOS D are summarized in Table 4.4-2. Under stagnant meteorological conditions, which are infrequent, significant air quality impacts due to exceedences of the CO NAAQS could occur at the intersection of Routes 1 and 16 with and without the proposed reuse.

**Table 4.4-2: Intersections Degraded Beyond LOS D with Traffic Mitigation and Vehicle Counts Greater Than 5,500 Per Hour**

Location	Year 2010 Morning Peak Hour		Year 2010 Afternoon Peak Hour	
	Without Reuse	With Reuse	Without Reuse	With Reuse
<b>North Study Area</b>				
Routes 1 & 16	Route 1 (EB): 2,240 Route 1 (WB): 3,510 Route 16: 1,530 TOTAL: 7,280	Route 1 (EB): 2,350 Route 1 (WB): 3,742 Route 16: 1,550 TOTAL: 7,642	Route 1 (EB): 3,660 Route 1 (WB): 2,000 Route 16: 1,830 TOTAL: 7,490	Route 1 (EB): 3,914 Route 1 (WB): 2,237 Route 16: 1,898 TOTAL: 8,049

Note: NB = northbound, SB = southbound, EB = eastbound, and WB = westbound.

Source: Wilbur Smith Associates (February 1999)

These findings are based on the Preferred Alternative, which represents the middle range intensity of development. Hence, the likelihood of CO NAAQS exceedences would be greatest with the Higher Intensity Alternative and lesser under the Lower Intensity Alternative. Under the "No Action" Alternative, forecasts indicate that traffic conditions at Routes 1 and 16 would remain unacceptable and significant air quality impacts could occur. Further, these impacts would occur for this intersection even with roadway improvements.

### 4.4.3 Cumulative Impacts

Outside of the possible infrequent exceedences of the CO NAAQS associated with peak-hour traffic, no significant cumulative impacts on air quality are expected from the reuse alternatives. This determination assumes implementation of specific regulatory controls for stationary sources identified in Section 4.4.1 and traffic mitigation measures identified in Section 4.10.

### 4.4.4 Compliance/Consistency with Applicable Laws and Regulations

#### 4.4.4.1 Clean Air Act

Section 176 of the Clean Air Act (CAA), 42 U.S.C. §7401, prohibits any federal agency from engaging in, supporting, providing financial assistance for, licensing, permitting, or approving any activity that does not conform to an applicable federal or state implementation plan (SIP). To implement the intention of Section 176(c), federal conformity rules have been promulgated and are provided in 40 C.F.R. Parts 51 and 93. These rules require that specific actions proposed in nonattainment and maintenance areas conform with applicable federal and state implementation plans and that the federal agency determine that the proposed action conforms to the applicable implementation plan prior to taking action. These rules are not applicable to the proposed action as property conveyance is exempt from the provisions of these rules.

#### 4.4.4.2 Prevention of Significant Deterioration

The federal Prevention of Significant Deterioration (PSD) program was developed to ensure that economic growth would occur while preserving air quality in areas where the NAAQS are being met ("attainment areas"). US EPA Region IX administers the program for Guam.

It is unknown at this time whether PSD permitting will be triggered by the proposed reuse of the GLUP parcels. A PSD permit is, however, expected to be required should the power plant be developed under the Higher Intensity Alternative at Rizal/Afleje Beach. The GEDA or other subsequent landowner or user would be responsible for obtaining this permit. PSD would be applicable to proposed stationary sources located in attainment areas and that meet one of the following conditions:

- The source is a "major" stationary source (one of 28 source categories listed under CAA that have the potential to emit equal to or greater than 100 tons per year [tpy] [90.7 metric tons per year] of a regulated air pollutant, or any stationary source that emits equal to or greater than 250 tpy [226.7 metric tons per year] of a regulated air pollutant).
- The source undergoes a major modification and would result in a significant net emissions increase, as defined by PSD regulations.

PSD applicability requires that certain evaluations be conducted to assess the potential impact on air quality. These evaluations could include, but are not limited to, baseline ambient air pollutant monitoring, air quality impact analysis (involving computer air dispersion modeling assessments), and a best available control technology analysis.

#### 4.4.4.3 Government of Guam Jurisdiction

Currently, all stationary sources are subject to the permitting requirements in Chapter 3 of the *Guam Air Pollution Control Standards and Regulations*, as promulgated on January 1, 1987. However, GEPA has drafted an alternate operating permit program in response to US EPA's CAA Title V Conditional Exemption codified under 40 C.F.R. §69. Once approved by US EPA, this alternate operating permit program will replace the existing *Guam Air Pollution Control Standards and Regulations* and will subject all stationary sources to new permitting requirements. The level of effort associated with the permit process is dependent upon which permit program is in effect, the nature of stationary sources on the GLUP parcels, and the potential emission rates from these stationary sources. Any stationary source determined to be a major source of hazardous air pollutants (HAPs), as defined in CAA Section 112 (42 U.S.C. §7413) or a solid waste incinerator subject to CAA Section 129(e) (42 U.S.C. §7429) would also require a Federal Operating Permit issued by US EPA, Region IX under 40 C.F.R. §71. If the existing *Guam Air Pollution Control Standards and Regulations* are still in effect, then any stationary source determined to be a major stationary source or a major modification would also require a PSD permit. If the new alternate operating program currently being reviewed by US EPA becomes effective, then the new alternate operating permit would address all PSD requirements.

## 4.5 LAND USE COMPATIBILITY

An analysis of land use compatibility includes discussion of potential land use conflicts due to GLUP property redevelopment, including compatibility with existing and future adjacent uses and potential visual impacts. Discussion of potential impacts of the Preferred, Higher, and Lower Intensity Alternatives are described together, as land use at varying intensities would generally be the same for each alternative. If one alternative presents a much different land use characteristic, it is discussed separately.

### 4.5.1 Land Use

No significant land use compatibility issues would occur that could not be mitigated under the Preferred Alternative and Lower Intensity Alternative. The proposed uses are generally compatible with adjacent land uses and with Guam's *I Tanò-ta Zoning and Land Use Plan*. In general, the reuse alternatives reflect land uses that match uses permitted under the zoning code. However, there are discrepancies between the GEDA *Reuse Plan* and *I Tanò-ta* land use designations on several parcels. The Tenjo Vista and two Navy Ornanca Annex North parcels are designated "military." GEDA proposes industrial use on the Polaris Point parcel, which is zoned "Low Intensity." Development of a power plant on the Rizal/Afleje Beach parcel would be inconsistent with its park zoning designation.

Without mitigation or management measures, the following land uses have the potential to significantly impact surrounding land uses.

- Proposed residential development at Barrigada N5B would be incompatible with the existing Hawaiian Rock Products quarry operation under all reuse alternatives.
- Construction of a power plant at the Rizal/Afleje Beach property, as indicated in the Higher Intensity Alternative, would have the potential to significantly impact visual resources of the neighboring park and oceanfront.
- Odor potentially emitted from GovGuam's proposed Agat-Santa Rita WWTP adjacent to the New Apra Heights parcel could impact residential development under the Higher Intensity Alternative at this parcel.

Roadway improvements would not result in significant land use impacts to surrounding properties but would benefit island transportation and improve traffic safety. Widened roadways would be compatible with the surrounding land use, provided that appropriate landscaping, buffers, and building setbacks are provided between the road and new facilities on the GLUP properties.

Under the "No Action" Alternative, there would be no change in land use.

### 4.5.1.1 Significance Criteria

Land use conflicts due to the reuse alternatives would be considered significant if proposed land uses are substantially incompatible with surrounding uses in terms of health or safety, impairment of use, land use policies, negative visual effects, noise, traffic, roadway patterns, and general annoyance factors. The analysis focuses on land adjacent to the subject properties as well as potential conflicts within the municipality or region.

### 4.5.1.2 Potential Impacts and Proposed Mitigation

#### Northern Region

**FAA Housing.** No significant impacts on adjacent lands would be expected under the Preferred, Lower, or Higher Intensity alternatives, or from the "No Action" Alternative. Single-family affordable residences are compatible with adjacent residential communities. Small-scale resorts and a golf course development are compatible with *I Tano'-ta's* low to moderate intensity zoning designations. Sensitive coastline, cliff, and limestone forest habitat would remain in conservation. As a deed restriction, a 100-foot (30.5-meter) buffer (such as landscaping, setbacks, berms) between the South Finegayan Housing and potential redevelopment would be maintained. The parcel lies outside of the NCTAMS Finegayan Radio Frequency Interference arc; therefore, there would be no safety risk to the site's new occupants. Although the residential and guest population along Route 3 would increase, planned highway expansion would mitigate potential traffic problems.

**Harmon Annex.** No significant land use impacts would result from the proposed reuse of Building 50 as a community recreation center or government agency office under any of the reuse alternatives. This type of reuse would not generate a significant amount of traffic. The community center would benefit neighboring communities and would be compatible with *I Tano'-ta's* low intensity zoning designation.

**Marine Drive Utility.** Development of commercial facilities under all reuse alternatives would not result in significant impacts on adjacent land uses or the community. The electrical substation between the parcels would continue current operations. Commercial use would be consistent with surrounding activities and with the property's moderate intensity zoning designation.

**Tamuning Telephone Exchange.** No significant land use impacts would result from any of the commercial reuse alternatives. The surrounding area is a highly urbanized corridor of Tamuning. High intensity development is consistent with the *I Tanò-ta* zoning district.

**NAS Officers Housing.** Residential and limited commercial development under the reuse alternatives would not result in significant land use impacts. Existing residential units on the parcel have been compatible with the surrounding private and military residential, office, and open space uses. The proposed construction of new homes to replace the existing structures would be consistent with the parcel's previous use and with the designated moderate intensity zoning. Limited commercial development of the Navy Exchange would be consistent with prior use and is consistent with the moderate intensity zoning designation. Future development

of the proposed Laderan Tiyan Parkway has the potential for noise, visual, safety, and general annoyance impacts on adjacent residences on site and south of the parcel. Establishing buffers between the parkway and residential developments (open space, setbacks, and noise attenuation) would help to minimize such impacts.

Under the "No Action" Alternative, no land use impacts would be associated with any of the northern parcels.

### **Barrigada Region**

No significant impacts on adjacent land uses would result from the Preferred Alternative or from the Lower or Higher Intensity alternatives that could not be mitigated through site planning. Single-family affordable housing is compatible with adjacent residential communities. Proposed new warehouse storage facilities on the N5A and N5C parcels and small-scale neighborhood commercial developments are compatible with the moderate-intensity zoning. Current uses of the property—the Barrigada Sports Complex and Department of Agriculture operations—would expand.

Currently, Hawaiian Rock Products operates on parcel N5C, which has relatively little other development. With residential development across Route 15 at N5B, there is a potential for the quarry operations to disturb the new residents (noise, heavy-vehicle traffic, and airborne fugitive dust). These annoyances could be mitigated by providing adequate building setbacks, constructing with noise-attenuating materials, providing a buffer between the residential development and Route 15, and/or adding berms and landscaping. Future long-term use of the entire N5C parcel would be more suited to a low to moderate intensity use.

Setbacks for pedestrian safety would also be required between residences and the Navy's Admiral Nimitz Golf Course. In order to prevent conflict with the neighboring military communications stations to the north and south of Barrigada parcels N5A and N5B, height restrictions would apply to all buildings constructed on the parcels as a Navy Condition of Release. Navy studies have concluded that no operational, health, or safety risks for electromagnetic radiation or electromagnetic interference (EMR/EMI) associated with the communications stations would occur (Department of the Navy, 1994).

Under the "No Action" Alternative, no significant land use impacts are expected for any of the Barrigada parcels.

### **Central Region**

**Nimitz Hill Parcels.** No significant land use impacts would result from the Preferred, Higher, or Lower Intensity alternatives, or from "No Action." Existing residential units on parcel N10A are compatible with the surrounding residential and open space uses. The proposed renovation and construction of new housing would be consistent with previous use of Nimitz Hill for military officer housing and with the designated moderate intensity zoning. The proposed conservation or historical use would preserve open space and cultural resources. Cultural and commercial facilities are proposed on parcel N10B along Route 6, including museums, art galleries, and theaters. Although commercial development would result in a change from the current open space, the use would be consistent with the area's moderate-intensity zoning designation and would be set away from neighboring homes.

**Sasa Valley/Tenjo Vista.** The majority of land in these two parcels would be set aside in conservation or open space due to the site's natural constraints. No significant land use impacts would result from any of the alternatives. At Sasa Valley, under the Preferred and Higher Intensity alternatives, expansion of the Guam Veterans Cemetery would not introduce a new land use. Low intensity commercial development along Marine Drive on the Tenjo Vista parcel would be consistent with the moderate intensity zoning designation.

**Polaris Point.** With proper monitoring of pond water quality and handling of effluent, no significant land use impacts would result from the aquaculture operations proposed under the Preferred Alternative. The remainder of the site would remain in open space. Aquaculture would be a low-impact land use. The Lower Intensity Alternative of recreation, conservation, or open space for the entire site would have no impact on surrounding land uses. Full industrial use of the site, the Higher Intensity Alternative assumed for this EIS (the GEDA-recommended alternative), is not consistent with *I Tano'-ta's* low intensity, District 2 zoning designation and would require a zone change or variance from the Guam Land Use Commission.

Under the "No Action" Alternative, there would be no land use impacts for any of the Central parcels.

### **Southern Region**

**New Apra Heights.** Depending on wind conditions, construction of GovGuam's WWTP could introduce unpleasant odors to proposed residential development at New Apra Heights under the Higher Intensity Alternative. No significant impact would occur if odors are controlled through proper treatment plant design and operational management to prevent generation of hydrogen sulfide. Under the Preferred, Lower Intensity, and "No Action" alternatives, no impacts on adjacent land use would occur, as the parcel would be preserved entirely as open space.

**Route 2A.** Commercial or office development under all reuse alternatives at the Route 2A parcel would not result in significant land use impacts. This use would be consistent with the site's designated moderate intensity zoning.

**Rizal/Afleje Beach.** No significant impacts would result from continued use of this beachfront parcel for a public park. Land use activity would not change from current use for the Preferred, Lower Intensity, and "No Action" alternatives. However, under the Higher Intensity Alternative, GPA would construct a baseload generating power plant on the north end of the parcel that could affect recreational activity along this portion of Agat Bay. On-site and off-site land use conflicts on the park (such as noise from power plant equipment) could be minimized if considered during facility design. Depending on how power is generated, an ocean intake and outfall for power plant cooling water could conflict with area fishing and beach activity, or alternately could be designed to enhance and attract fish populations. GPA would be required to complete separate environmental documentation prior to gaining GovGuam approval to build the power plant on this property. The property is currently zoned for park use. Construction of a power plant would require a zoning change or variance approved by the Guam Land Use Commission.

**Old Apra Heights.** The reuse alternatives would not result in significant land use impacts to neighboring residences. Small-scale neighborhood commercial development considered for all

reuse alternatives would be compatible with the surrounding land use and consistent with its lower to moderate intensity zoning designation. Existing roadway easements that allow access to private residences from Route 17 would need to be surveyed and maintained.

**Navy Ordnance Annex North.** No land use impacts would result from the proposed park or conservation, youth camp, or residential developments proposed under all reuse alternatives. These uses would be compatible with surrounding private and military open space and residential areas. The proposed reuse is consistent with the low to moderate intensity zoning designation.

Under the "No Action" Alternative, no land use impacts would occur on any of the Southern parcels.

#### 4.5.1.3 Cumulative Impacts

As the GLUP properties are spread throughout various regions of the island, no significant cumulative land use impacts are expected under any reuse alternative. No cumulative impacts would occur under the "No Action" Alternative. Development of the GLUP properties would occur over an extended period of time, especially considering Guam's current economic climate. Prior to development of the individual properties, GEDA, the landowner, or developer would be required to complete environmental documentation as well as gain public input to further evaluate specific land use impacts related to their projects.

#### 4.5.1.4 Compliance/Consistency with Applicable Laws and Regulations

As noted above, the Preferred, Lower, and Higher Intensity reuse alternatives are generally consistent with *I Tano'-ta's* land use and zoning designations for the reuse parcels, except for the following locations:

- The Tenjo Vista and Navy Ordnance Annex North parcels are designated "military."
- Industrial use (Higher Intensity Alternative) of the Polaris Point property is inconsistent with its District 2, low intensity zoning designation.
- A power plant proposed at Rizal/Aflleje Beach under the Higher Intensity Alternative is inconsistent with the site's District 1, park zoning designation. Power plants are allowed in industrial District 8.

Implementing nonconforming land uses would require a zoning change or variance approved by the Guam Land Use Commission.

## 4.5.2 Visual Resources

No significant impact on visual resources would occur under the Preferred or Lower Intensity alternatives. Construction of a power plant at the Rizal/Afilleje Beach parcel (Higher Intensity Alternative) could substantially affect the beachfront and park views resulting in a significant impact. Under "No Action" Alternative, no significant aesthetic or visual impacts would occur. Public access to the majority of the properties would be restricted. The properties would be maintained in a condition similar to what exists today. Vegetation would remain and landforms would not be altered.

### 4.5.2.1 Significance Criteria

An alternative would result in a significant impact to the area's visual resources if it: (1) substantially degrades the quality of an identified visual resource, including, but not limited to, unique topographic features, undisturbed native vegetation, surface waters and major drainageways, and parks or recreational areas; or (2) substantially obstructs the public view of any scenic vista.

### 4.5.2.2 Potential Impacts and Proposed Mitigation

#### Northern Region

**FAA Housing.** None of the alternatives would significantly impact the parcel's visual resources. Residential and resort construction is limited by zoning to low to moderate intensity, one- to three-story buildings. A golf course integrated into the resort and residences would preserve open space and scenic views. Additionally, the golf course would have a similar natural appearance to existing grassy fields. Limestone forests that are set well within the site and along the cliff line would be preserved in conservation. Opening shoreline and cliff line access to hiking trails and recreational facilities would allow the public more panoramic ocean and forest views, representing a beneficial impact. Views would remain unchanged under the "No Action" Alternative.

**Harmon Annex.** No significant visual impact would result from the reuse and expansion of Building 50 as a community center or office building. The redevelopment would slightly increase the development density of the site. However, the building is set back over 0.5 mile (0.8 kilometers) from the nearest public roadway (Route 3). Existing vegetation on adjacent properties block views to the property. Under the "No Action" Alternative, views would remain unchanged.

**Marine Drive Utility.** Development of new commercial buildings under all reuse alternatives would enhance the parcel's visual quality. Construction of new two- to three-story buildings at the property's east and west ends and renovation of the existing Stars and Stripes building would result in the loss of some existing trees. However, the current landscape is degraded, and landscape treatment along the building and in parking lots would improve the site's appearance. The electrical substation would remain with no change in its industrial

appearance, although new landscaping would buffer it from the proposed commercial development, sidewalks, and roadway. Removal of fences and undergrounding of utilities, or shifting the overhead lines to the rear of the property as suggested in the Higher Intensity Alternative, would greatly improve views from public roadways. "No Action" would result in no change to existing visual characteristics.

**Tamuning Telephone Exchange.** High intensity commercial development proposed under all of the reuse alternatives along the frontage of Marine Drive would not significantly impact the visual character of this highly urbanized area. New commercial, office, or hotel buildings, parking, and signage would not be inconsistent with the nearby fast food, storage, and office buildings. A maximum-allowed five- to six-story structure would not block panoramic views from Tiyan. Demolition of the existing utilitarian buildings and replacement with modern structures would improve the site's visual character. This character would remain unchanged under the "No Action" Alternative.

**NAS Officers Housing.** Construction of residential and limited commercial buildings under the reuse alternatives would not significantly impact the parcel's visual resources. It would not be a dramatic change from its existing condition. Development of the low-rise structures would be limited by zoning to moderate intensity. Views could be enhanced through preservation of view corridors, providing building setbacks, landscaping, and minimizing the visual impact of existing on-site electrical lines. Future construction of the Laderan Tiyan Parkway would have a negative affect on views from the proposed residences to Agana Bay. Mitigation could involve adjustment of roadway elevations in relation to building elevations to preserve views, and use of setbacks and buffers. Views would remain unchanged under the "No Action" Alternative.

### **Barrigada Region**

Low to moderate intensity residential, agricultural, park, and low intensity industrial and warehouse uses proposed under all reuse alternatives would not significantly impact the visual character of the former Barrigada communications station. Although the parcels are relatively undeveloped with scrub vegetation and grasses, development would consist of low-rise structures of little impact. Open space would be incorporated into residential areas. Building height restrictions, as part of Navy's Conditions of Release, would prevent any impact on views from the Barrigada Hill overlook, 1 mile (0.8 kilometer) to the north of the properties. Views would remain unchanged under the "No Action" Alternative.

### **Central Region**

**Nimitz Hill Parcels.** With adherence to *I Tanò-ta* performance guidelines, no significant visual impact would result along scenic highway Route 6 from proposed residential expansion or commercial development at Nimitz Hill. The redevelopment would increase the intensity of the enlisted housing on N10A and replace open space at N10B. New in-fill housing and commercial structures at the top of the hill may block views; however, the buildings could be designed to minimize visual impacts through preservation of view corridors between buildings, setbacks, height restrictions, landscaping, and hillside development protection measures. The proposed reuse under all alternatives would have no impact on the Spruance Drive public overlook, which is located downhill with views focused away from the properties. Views would remain unchanged under the "No Action" Alternative.

**Sasa Valley/Tenjo Vista.** As the majority of land at the N12 parcels would remain as conservation or open space, no significant visual impact would result from development under all reuse alternatives. Expansion of the Guam Veterans Cemetery at the Sasa Valley parcel would be visually consistent with the main cemetery to the north. The addition of small-scale commercial buildings along Marine Drive would be visually consistent with nearby commercial properties. Although views into the valley at Tenjo Vista are not designated as a scenic resource by GovGuam, they have high scenic quality. Site planning and low-impact commercial structures could minimize visual impacts to this currently undeveloped resource. Views would remain unchanged under the "No Action" Alternative.

**Polaris Point.** No significant impact on visual resources would occur from the aquaculture, industrial, or conservation uses proposed under the various reuse alternatives. The portion of the property recommended for reuse was previously developed as an industrial tank farm; asphalt pavement still remains. Aquaculture or industry facilities would not change the site's aesthetic character. Proposed activities would be consistent with port operations at Apra Harbor. Views from the harbor into the parcel are blocked by vegetation. Views would remain unchanged under the "No Action" Alternative.

### **Southern Region**

**Rizal/Afleje Beach.** Under the Higher Intensity Alternative, construction of a GPA power plant could substantially degrade the quality of the adjacent park's visual resources resulting in a significant impact. The industrial character of the beachfront power plant would be visible from the public park, as well as from nearshore waters and Shoreline Drive. Although a landfill and military facilities are located nearby, they are set back from the ocean and parks. GPA would be responsible for submitting environmental documentation to gain GovGuam approval to build the power plant on this property. Visual impacts could be reduced to less than significant if considered during facility design or by screening the power plant with landscaping or natural features. No significant impacts would result under the Preferred or Lower Intensity alternatives. Views would remain unchanged under the "No Action" Alternative.

**Old Apra Heights/New Apra Heights/Route 2A/Navy Ordnance Annex North.** The Preferred, Higher, and Lower Intensity alternatives would not significantly impact the area's visual resources. The commercial, recreational, residential, and park uses would be limited by zoning to low to moderate intensity, one- to three-story buildings. Forested areas and open space would be preserved in conservation. Opening shoreline and hillside access to hiking trails and recreational facilities would allow the public more ocean and forest views, representing a beneficial impact. Views would remain unchanged under the "No Action" Alternative.

### **4.5.2.3 Cumulative Impacts**

As the parcels are spread across the island and potential impacts on the visual environment are site-specific, no significant cumulative impacts on visual resources would occur under any of the reuse alternatives. There are no cumulative impacts under the "No Action" Alternative.

#### 4.5.2.4 Compliance/Consistency with Applicable Laws and Regulations

The GEDA-recommended land uses and intensities for the GLUP parcels are generally consistent with *I Tanò-ta* land use designations. The Zoning Code applies dimensional, density, and performance requirements to each district. It is assumed that new development would be consistent with applicable performance standards designed to mitigate visual impacts, such as requirements for building placement and setbacks, building height restrictions, and standards for signage, vegetation protection, landscape, historic and cultural conservation, hillside development, and open space.

The Higher Intensity Alternative for a GPA power plant at Rizal/Afleje Beach is inconsistent with zoning. If this alternative is selected, GovGuam should consider potential visual impacts on neighboring park use in the permit review process.

### 4.6 NOISE

During the screening process, noise generated by the proposed reuse alternative and effects on adjacent properties were identified as a potentially significant issue (refer to Table 4.1-1). Noise due to construction is not considered a significant impact as noise control measures would be required by GEPA. No significant noise impacts would result from the reuse alternatives that could not be mitigated. Activities on four GLUP parcels have the potential for noise impacts: high-speed vehicular traffic along the proposed Laderan Tiyan Parkway, trucks servicing warehouses at Barrigada parcels N5A and N5C, the Hawaiian Rock Products quarry operations (all reuse alternatives), and power plant mechanical noise and heavy-vehicle traffic at the Rizal/Afleje Beach parcel (Higher Intensity Alternative). The "No Action" Alternative would have no noise impacts.

#### 4.6.1 Significance Criteria

Impacts on noise sensitive land uses adjacent to the GLUP parcels would be considered significant if noise generated from the reuse alternatives exceeds applicable standards. As GovGuam does not have specific noise level regulations, federal standards would apply.

Federal agencies apply noise standards and criteria based on noise levels and proposed land use. These criteria have been developed by various agencies, including US EPA and the federal Department of Housing and Urban Development (HUD), to meet specific objectives. Hence, there is no one set of criteria that applies to all noise evaluations. The most sensitive land use and associated population type is residential. Except for US EPA, federal agencies generally use 65 DNL as a maximum exposure level for residential land use without incorporation of interior sound attenuation.

Specific federal standards are as follows:

- According to Federal Aviation Administration (FAA) guidelines, all land uses are considered compatible with noise levels less than 65 DNL. The FAA generally accepts 60 DNL as the

maximum for "open environment" life styles. At higher noise exposures, certain selected land uses are deemed acceptable.

- The US EPA recommends a DNL below 55 for outdoor noise levels and 45 for indoor noise levels in residential areas.
- For developments supported by HUD funds, noise exposure of 65 DNL or less is acceptable; noise levels between 65 and 75 DNL are acceptable only if appropriate sound attenuation is provided. Noise levels above 75 DNL are unacceptable.

Despite the federal standards and any differences between them, local authorities still have primary responsibility for determining permissible land use. The inclusion of land uses which are not compatible by federal standards will affect the level of federal funding available for housing or other types of improvements. The FAA's 65 DNL criteria will be used as a standard for determining significant impacts to residential land use from aircraft noise. Other types of land uses will be assessed based on EPA guidelines.

#### **4.6.2 Methodology**

Noise sampling and modeling were not conducted for this EIS since no major sources of noise are proposed under the reuse alternatives. Mitigation measures can be applied to reduce noise from sources adjacent to the reuse parcels to less than significant levels. Anticipated ambient noise levels for the proposed land uses (residential, commercial, open space) would not exceed 55 DNL. Proposed light industrial uses may generate slightly higher levels of exterior noise but are generally located in remote areas away from noise sensitive receptors. In evaluating the future noise environment and potential impacts, the planned land uses were considered in relation to noise sensitive receptors or generators in the vicinity of the parcels.

#### **4.6.3 Potential Impacts and Proposed Mitigation**

Except for certain reuse alternatives for the NAS Officers Housing, Barrigada, and Rizal/Afilleje Beach parcels, none of the alternative land uses would result in a significant impact or substantially degrade existing community noise environments above federal agency guidelines. Proposed land uses in the most sensitive rural and low-noise areas are primarily residential, agricultural, and light industrial (warehouse storage). Proposed reuses have the potential to add to residential noise but would be specific to the neighborhood in which the particular project is developed. Traffic noise generated by roadway improvement projects may directly or indirectly impact existing or planned residences and other noise-sensitive receptors located near these major roadways. However, these impacts could be mitigated. Existing quarry support operations on parcel N5C may have significant noise impacts if housing is developed as planned on parcels N5B and N5D.

Future development of the GLUP parcels may require further environmental assessment by GEDA, the landowner, or developer, in accordance with GovGuam environmental regulations, to determine specific environmental impacts such as noise.

There would be no noise impacts under the "No Action" Alternative.

### **Northern Region**

Vehicular noise would increase but would not be significant along primary access roadways on Route 3 and along Marine Drive. Setbacks, buffers, and landscaping would be useful in decreasing potential noise impacts between new residential development at the FAA Housing property and Route 3. Under all reuse alternatives, housing on the NAS Officer Housing parcel will be subject to noise from high-speed vehicular traffic along the proposed Laderan Tiyan Parkway. These impacts could be mitigated by designing the new developments with noise-attenuating materials, lowering vehicle speeds, and by providing setbacks and buffers fronting the roadways.

None of the remaining land uses under the reuse alternatives would generate significant noise in the region; the proposed reuses are residential, small-scale resort, park, or commercial. Residential and commercial development of the NAS Officers Housing parcel would not be significantly impacted by aircraft noise from the expanded A. B. Won Pat Guam International Airport as noise levels reaching the parcel would not exceed 60 DNL (GIAA, *Guam International Airport Master Plan*).

### **Barrigada Region**

Noise from heavy equipment emanating from the existing Hawaiian Rock Products quarry support operations (N5C) would have the potential to significantly impact residential development along Route 15 as proposed under all reuse alternatives. In addition to existing housing, new housing is proposed at the N5B and N5D parcels. The use of quieter equipment and curfew periods for quarry operations would minimize noise impacts. Setbacks and buffers between Hawaiian Rock Products and the new homes would be an effective mitigation measure.

No significant noise impacts would be generated from the remaining land uses proposed for the Barrigada parcels, which include residential, warehouse facilities, neighborhood commercial, and park uses.

### **Central Region**

No significant noise impacts would be generated from the proposed residential, commercial, aquaculture, or park facilities indicated in all of the reuse alternatives. Depending on the type of industrial activity proposed for the Higher Intensity use of the Polaris Point parcel, noise could be generated. However, no noise-sensitive receptors are located nearby.

### **Southern Region**

Under the Higher Intensity Alternative at the Rizal/Afleje Beach parcel, noise generated from the proposed baseload generating power plant could significantly impact neighboring park areas but could be mitigated to a less than significant level through plant design, equipment selection, and buffers. If trucks are used to deliver fuel to the plant, noise generated from heavy vehicles could also impact park users. However, fuel delivery could be through pipelines and truck deliveries could be scheduled during non-peak park user hours.

No significant noise impacts would be generated from the proposed residential, commercial, or park use indicated in the Preferred, Higher Intensity, or Lower Intensity reuse alternatives. The proposed development would increase existing background ambient noise levels due to urbanization of presently vacant lands. However, the noise levels would be low.

The "No Action" Alternative would not involve construction or development of facilities that would generate noise. No significant noise impacts on adjacent properties would result due to this alternative.

For all regions, no change in existing noise conditions would occur under the "No Action" Alternative.

#### **4.6.4 Cumulative Impacts**

No significant cumulative noise impacts would result from any of the alternatives.

#### **4.6.5 Compliance/Consistency with Applicable Laws and Regulations**

Enforcement of land use controls relative to noise is the responsibility of GovGuam. The following noise standards and regulations would be applicable:

- FAA guidelines (FAR Part 150), which establish a voluntary program of airport noise compatibility planning.
- US EPA guidelines on noise impacts, referred to as the "Levels Document" (1974) and entitled Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.
- Department of Housing and Urban Development (HUD) guidelines on residential land use and noise exposure.
- Federal Interagency Committee on Urban Noise (FICUN) Guidelines for Considering Noise in Land Use Planning and Control (1980), which establish a common basis on which standards can be developed.

### **4.7 CULTURAL RESOURCES**

This section describes impacts to cultural resources that could occur under the disposal and reuse alternatives and under the "No Action" Alternative. Impacts to cultural resources are analyzed against baseline conditions as described in Section 3.7.

For purposes of this analysis, the only cultural resources identified in the GLUP parcels are historic properties. Historic properties are those properties listed in or eligible for inclusion in

the National Register of Historic Places (NRHP) or the Guam Register of Historic Places (GRHP).

Section 3.7.3 discusses the archaeological sites and historic buildings currently identified on the reuse parcels, including their NRHP and GRHP status and estimates of possible significance, i.e., eligibility for listing (see Table 3.7-1). Each parcel is assessed in terms of archaeological sensitivity, i.e., the degree of probability of sites being present.

The region of influence for cultural resources is the area defined by the boundaries of a particular parcel on which the resource is located because only cultural resources within the boundaries of a parcel could be affected by reuse activities.

#### **4.7.1 Impact of Disposal**

Disposal of NRHP or GRHP eligible properties without adequate provisions to protect their historic integrity could result in a significant impact by adversely affecting their continued eligibility for listing. Prior to disposal, Navy, Guam Historic Preservation Officer (HPO), and Advisory Council on Historic Preservation (ACHP) will implement a Programmatic Agreement (PA) containing adequate provisions to protect the historic integrity of the properties. Navy will include the applicable provisions of the PA as conditions of the conveyance.

#### **4.7.2 Significance Criteria**

For purposes of this analysis, historic properties are those properties listed or eligible for listing on the NRHP. As defined in implementing regulations for Section 106 of the National Historic Preservation Act (NHPA), effects of an undertaking on such resources would be considered adverse if they "diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" [36 C.F.R. §800.9(b)]. Examples of adverse effects include, but are not limited to, the following:

- Physical destruction, damage, or alteration of all or part of the property;
- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the NRHP;
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;
- Neglect of a property resulting in its deterioration or destruction; and
- Transfer, lease, or sale of the property [36 C.F.R. §800.9(b)].

An adverse effect or a combination of adverse effects as defined by NHPA are not necessarily significant impacts as defined by NEPA.

As explained in Section 3.7, each parcel has been assessed for its archaeological sensitivity, indicating the potential for historic properties being present. The reuse parcels have been subdivided into areas of high, medium, low, and no sensitivity. Historic properties refer to archaeological sites and buildings that are listed on the NRHP, have been determined eligible for listing, or are recommended as eligible based on NRHP criteria.

Impacts on such resources could be considered potentially adverse if reuse alternatives include plans for development in areas of high sensitivity. It is possible that property disposal could have a significant effect on historic properties if their protection cannot be assured without specific agreements.

### 4.7.3 Potential Impacts

Following is a discussion of potential impacts of each alternative. The discussion focuses on parcels with high archaeological sensitivity areas. Seven parcels are fully developed with little or no probability of eligible sites being present, and these are not discussed in this section (see Table 3.7-2).

#### 4.7.3.1 Preferred Alternative

##### Northern Region

**FAA Housing.** Two high sensitivity areas are identified on this parcel: the cliff between the ocean and former housing, planned for parks, recreation, historic, or conservation use; and a portion of the plateau between the housing and Route 3, planned for resort use.

No development would occur in the coastal cliff area, a locale of intensive prehistoric activity where numerous rock shelters and cultural deposits have been recorded and where there is high potential for additional site discovery. There is a potential for adverse effects in the proposed resort area, where historic remains have been found and where there is high potential for prehistoric sites.

**Marine Drive Utility.** The majority of the parcel, planned for commercial use (outside of the electrical substation and telephone exchange sites), is categorized as high sensitivity. This was a possible World War II complex, but the potential for prehistoric remains is very low. Potential impacts could be avoided by proper site planning.

##### Barrigada Region

**Parcel N5A.** A portion of the parcel containing overgrown vegetation is ranked high in archaeological sensitivity due to the presence of World War II era sites. This area is planned for industrial, recreational, and agricultural use. With development, there is a potential for adverse impacts. Farmed and developed areas are considered low sensitivity.

**Parcel N5B.** The central portion of this parcel is classified as high sensitivity. It is a jungle area with potential for World War II remains and is designated in the reuse plan for residential development. There is a potential for adverse impacts if this area is developed.

### Central Region

**Nimitz Hill Enlisted Housing.** A portion of the Fonte Plateau Battlefield, listed on both the Guam and National Registers, is located on this parcel. This is where one of the major inland battles for the recapture of Guam occurred during World War II. Other listed or eligible sites include a Japanese bunker and a Quonset hut. Over half of the parcel is designated as high sensitivity, most of which is planned for parks, recreation, historic, and conservation use. These types of land uses would minimize impacts on cultural resources.

**Nimitz Hill Vacant Lands.** The entire parcel is considered as high sensitivity. Part of the Fonte Plateau Battlefield covers the northern section of the parcel, which is planned for commercial use. This site has the potential to be affected by development. Japanese caves and pre-war sites are situated on the parcel in areas designated for parks, recreation, historic, and conservation use, so impacts could be avoided.

**Sasa Valley/Tenjo Vista.** All of this parcel is in the high sensitivity classification. There are known prehistoric and historic remains, and the potential for prehistoric remains (and for prehistoric burials) is high, particularly in the stream mouth area fronting the Polaris Point parcel. Except for a narrow commercial strip along Marine Drive, the remainder of the parcel is planned for parks, recreation, historic, and conservation use. Potential impacts could be avoided with proper site planning.

**Polaris Point.** About a quarter of the parcel, located north of the access road and fronting Marine Drive in the vicinity of the stream mouth, is a high sensitivity area. It is planned for conservation, so adverse effects are unlikely. Both prehistoric and historic cultural remains exist in this area, and there is a potential for additional prehistoric sites and possible burials.

### Southern Region

**Rizal/Afleje Beach.** The undeveloped inland portion of this parcel, generally between the on-site coastal road and Shoreline Drive, is classified as high sensitivity. There are prehistoric and historic sites (including World War II Japanese defense), and there is potential for extensive subsurface deposits. Under the Preferred Alternative, all of the parcel is designated for parks, recreation, historic, and conservation use, so adverse impacts can be avoided.

**Old Apra Heights.** The northern third of the parcel, vegetated and partially disturbed, is determined to be a high-sensitivity area due to existing and potential World War II sites. This area is planned for commercial use; there is a potential for adverse impacts.

**Navy Ordnance Annex North.** Most the parcel is undeveloped and classified as high sensitivity, except for the portion occupied by former family housing. In parcel N19A, there is a major World War II defensive complex and potential for prehistoric and additional World War II features. Abandoned magazines on parcel N19B are considered eligible for the National and Guam Registers. The entire parcel is planned for parks, recreation, historic, and conservation use, so impacts could be minimized or avoided.

### 4.7.3.2 Lower Intensity Alternative

#### Northern Region

With fewer hotel units and no golf course on the FAA Housing parcel, impacts on possible prehistoric sites on the plateau area would be minimized. Avoiding sites on the Marine Drive Utility parcel would be easier under this alternative.

#### Barrigada Region

Lower intensity development would have less impact than the Preferred Alternative on areas containing World War II remains. Through site planning, these sites could be avoided or appropriately incorporated into the development.

#### Central Region

The high sensitivity areas on the Nimitz Hill, Sasa Valley, and Tenjo Vista parcels are located in undeveloped areas, mainly on sloping terrain, ridges, and gulches. At Polaris Point, the high sensitivity areas consist of limestone coastline and wetlands. Low-impact land uses (for example, parks and conservation) are proposed for these areas under all reuse alternatives. Hence, impacts under the Lower Intensity Alternative would be generally similar to the Preferred Alternative. Potential impacts due to commercial development on the Nimitz Hill Vacant Lands parcel would be less.

#### Southern Region

Potential impacts on the Rizal/Afleje Beach and Navy Ordnance Annex North parcels would be generally similar under all reuse alternatives since they all call for park and conservation use. For the Old Apra Heights parcel, the Lower Intensity Alternative would have less potential for adverse effects given proper site planning.

### 4.7.3.3 Higher Intensity Alternative

#### Northern Region

Impacts on the FAA Housing parcel cultural resources would be greater than the Preferred or Lower Intensity Alternatives given more hotel units and more extensive golf course development. Likewise, it would be more difficult to avoid impacts on the Marine Drive Utility Parcel with higher intensity commercial development.

#### Barrigada Region

Higher intensity development of parcels containing high sensitivity areas could result in greater impacts on cultural resources compared to the other reuse alternatives.

## Central Region

Impacts under the Higher Intensity Alternative would be generally similar to the Preferred and Lower Intensity Alternatives for Nimitz Hill, Sasa Valley, Tenjo Vista, and Polaris Point since the high sensitivity areas are proposed for park and conservation use. Higher intensity commercial development on the Nimitz Hill Vacant Lands parcel could result in greater impacts than the other reuse alternatives.

## Southern Region

Development of a power plant on the Rizal/Afleje Beach parcel under this alternative could result in greater impacts on cultural resources compared to the other reuse alternatives. Impacts on the Navy Ordnance Annex North parcel would be generally similar with park and conservation use. The Higher Intensity Alternative would pose a higher potential for adverse effects on sites located on the Old Apra Heights parcel.

### 4.7.3.4 "No Action" Alternative

Under this alternative, the property would remain in caretaker status under continued federal ownership. Navy would continue to use the appropriate standards published in the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* (U.S. Department of the Interior, 1996b) and *National Park Service Preservation Brief 31, Mothballing Historic Buildings* (National Park Service, 1993) for the layaway and maintenance of historic properties to avoid adverse effects.

### 4.7.4 Proposed Mitigation

Various measures are available to avoid or mitigate potential impacts on cultural resources, including preservation and data recovery. The disposal and reuse alternative selected will be implemented according to the terms of a Programmatic Agreement (PA) to be signed by the Navy, Guam HPO, and ACHP. The PA will deal with short-term impacts to historic properties between the signing of the agreement and conveyance of the GLUP parcels, as well as long-term impacts as the conveyed property is reused. It will stipulate actions to mitigate potentially significant impacts, including site treatment and restrictions on future development and activities as needed. The PA will also address the possibility that potentially significant, unidentified cultural remains may be encountered in the course of development activities following conveyance.

In addition, protective deed covenants will be included in conveyance documents to ensure appropriate treatment of resources potentially affected by reuse. Hence, with promulgation of the PA and the deed covenants, no significant impacts on cultural resources would occur with disposal and reuse.

#### **4.7.5 Cumulative Impacts**

No cumulative impacts have been identified.

#### **4.7.6 Compliance/Consistency with Applicable Laws and Regulations**

The federal and GovGuam laws applicable to historic preservation are as follows:

- Section 106 of the NHPA, 16 U.S.C. 470f, as amended, and its implementing regulations, 36 CFR Part 800, require federal agencies to consider the effects of their actions on properties listed or eligible for listing in the NRHP in consultation with the HPO. It also requires that agencies provide the ACHP an opportunity to comment on actions that will directly or indirectly affect properties included in or eligible for inclusion in the NRHP.
- GovGuam defines “historic property” to mean any building, structure, object, area, or site that is significant in the history, architecture, archaeology, or culture of Guam or the nation (21 G.C.A. §76102, 1998). The government has established a program for historic preservation, restoration, and preservation. A certificate of approval from the Guam HPO must be obtained before any action affecting potential historic sites is undertaken (21 G.C.A. §76511).

Navy has no role in the planning and implementation of the GEDA’s *Reuse Plan*. Only the Navy action to dispose of surplus GLUP parcels is subject to federal historic preservation law and regulations. Implementation of the reuse plan will be subject to Guam historic preservation laws. Therefore, a distinction is made between Navy’s disposal action and the community’s proposed reuse.

### **4.8 TERRESTRIAL BIOTA AND HABITAT**

No protected species were observed on any of the parcels during biological surveys conducted in 1988-89 and 1998. A small wetland area at Tenjo Vista, described as secondary habitat of the endangered Mariana common moorhen (*Gallinula chloropus guami*), can be avoided during development. Wetland and limestone forest areas on other parcels can be avoided through site planning. Hence, no significant impacts are expected.

#### **4.8.1 Significance Criteria**

Impacts would be considered significant if the proposed action:

- Resulted in jeopardizing the continued existence of threatened, endangered, or other species protected by the federal government, in accordance with the federal Endangered Species Act of 1973 (16 U.S.C. §1531 et seq).
- Caused a reduction in habitat that would jeopardize the continued existence of threatened or endangered species. For example, impacts to important habitats would be considered

significant if reuse alternatives included plans for development that led to destruction of such habitats, including wetlands, native limestone forests, and ravine forests.

As described in section 3.8, virtually the entire bird population of Guam has declined precipitously due to brown tree snake (BTS) predation. Populations of most species of native birds have been either extirpated or severely decimated, and many listed species are possibly extinct. Therefore, protection of remaining birds—particularly native species, whether listed or not—is a high priority for the island.

#### 4.8.2 Potential Impacts and Proposed Mitigation

No protected (threatened or endangered) species are known to occur on any of these parcels. Thus, no impacts to threatened or endangered species are anticipated as a result of the proposed action. Portions of three parcels—FAA Housing, Sasa Valley, and Tenjo Vista—are designated as part of the Guam National Wildlife Refuge under a 1994 Cooperative Agreement between GovGuam, Navy, Air Force, and USFWS. However, after conveyance, the new owners of the parcels will not be encumbered by this agreement. Several of the sites (N2, N5 [A, B, and D], N10B, N12, N14, and N15), which includes the three listed above, have areas of native vegetation or wetlands. These habitats could, now or in the future, support endangered, threatened, or candidate animal species.

Prior to development on lands that may contain important habitats, consultation in accordance with GovGuam or federal endangered species laws and regulations (Section 7 of the Endangered Species Act of 1973) will be required. No significant impacts to important habitats would be expected if the required consultation process and resulting appropriate mitigation measures are applied.

While no significant impacts on terrestrial biological resources are expected from the proposed reuse alternatives given the prescribed consultation process, the potential for adverse impacts on these resources is present because of effects (e.g., noise) from adjacent developments. For this reason, the potential for adverse impacts would be greatest in the Higher Intensity Alternative, followed by the Preferred Alternative, Lower Intensity Alternative, and “No Action” Alternative.

**FAA Housing.** Limestone forest occurs on the northwest portion of this site. The limestone forest of highest value is generally found on steep slopes, which are relatively inaccessible and not suitable for development. In addition, the portion of the site on which limestone forest occurs is slated for use as park, recreational, historic preservation, and conservation land. Maintaining the limestone cliffs as conservation lands should be adequate to assure the continued preservation of the higher-value areas of forest on the site. *Heritiera longipetiolata*, if present, would be preserved as part of the overall vegetation assemblage. In addition, for the reasons already explained, such protection may also benefit the Mariana crow (*Corvus kubaryi*), Mariana fruit bat (*Pteropus mariannus mariannus*), and Guam-protected tree snails. Thus, no significant impacts to limestone forest areas or to protected species that may be associated with this habitat are expected to result from any of the alternatives.

**Barrigada.** Wetlands and limestone forest areas are found on parts of these properties. The wetlands have not be delineated. On parcel N5A, a small corner of the southern “panhandle”

contains wetlands. This area is designated for expansion of agricultural activities. Parcel N5B contains wetlands along the southwest part of its border and limestone forest in the northeastern corner. These areas are slated for affordable single-family housing development. Approximately one-third of parcel N5D contains limestone forest, and this area is also designated for residential development.

The proposed uses as presently defined are not fully compatible with preservation of important habitats. To avoid or minimize adverse impacts, development in wetland areas can be avoided by delineating the boundaries of wetlands and limestone forests and siting homes on parcels N5B and N5D to leave the habitat intact.

**Nimitz Hill Vacant Lands.** An area of limestone forest estimated at less than 10 acres (4.05 hectares) occupies the southwest corner of the site. This area is proposed for small-scale residential development (fewer than 100 units). Because the development would not cover the entire parcel, it should be possible to choose sites for the units that are outside of the limestone forest. With careful site planning, no significant impacts to this remaining natural area are anticipated.

**Tenjo Vista.** Most of the property is designated for park, recreational, historic preservation, and conservation use. A narrow strip along the west side (Marine Drive) of the property is proposed for small retail development and possible expansion of Marine Drive. Within this strip is a cluster of small wetlands. In addition, three narrow ravines traversing the site in an east-west direction contain ravine forest habitat. The wetlands have been identified as secondary habitat for the endangered Mariana common moorhen. To avoid impacts to this habitat, the developer would need to delineate the boundaries of the wetland areas to guide the siting of any commercial development and prevent development in wetland areas. A buffer zone could be established between the wetland and adjacent development. Construction and other activities in the vicinity can be controlled to prevent runoff and sedimentation impacts on the wetland.

**Polaris Point.** Most of the site is designated for low intensity industrial development, which could include such activities as agriculture, aquaculture, and marine facilities. The northeastern quarter of the parcel is designated as a conservation area. Within this conservation zone are found mangrove scrub, coastal marsh, and swamp forest wetlands.

The designation of the northeastern portion of the site for conservation is consistent with the objective of protecting wetland values on the site. Proper use of chemicals in the adjacent low intensity industrial area (e.g., fertilizers, pesticides, herbicides, petroleum products) would avoid any deleterious effect on biota in the mangrove area. If aquaculture is practiced on adjacent portions of the site, proper handling of effluent from these facilities would assure that nearby wetland areas are not adversely affected. These measures should be adequate to ensure the maintenance of important habitats on the site. Therefore, no significant impacts are expected from the reuse alternatives.

**New Apra Heights.** A swamp forest wetland is found in a low-lying area along the eastern margin of the site. Conservation use proposed under the Preferred and Lower Intensity alternatives would have no impact on wetlands. Residential development under the Higher Intensity Alternative could avoid the wetland area.

As no development would occur under the "No Action" Alternative, no significant impacts would occur on the GLUP parcels.

### 4.8.3 Cumulative Impacts

Although it is possible that ongoing or proposed projects on Guam may lead to the reduction in total area of important habitats, Guam's principal habitats of importance, wetlands and limestone and ravine forests, are protected. As presented in earlier sections, wetlands are protected under the Clean Water Act and development of wetlands requires permit approval from the U.S. Army Corps of Engineers. Remaining limestone and ravine forests on Guam are *de facto* preserve areas by virtue of their occurrence almost exclusively on steep-slope terrain, which is not readily developable. These factors are expected to minimize cumulative impacts brought about by loss of such habitats that may otherwise occur on the GLUP parcels and elsewhere on the island. Thus, no significant cumulative impacts to terrestrial biological resources are anticipated as a result of the proposed action.

### 4.8.4 Compliance/Consistency with Applicable Laws and Regulations

**Endangered Species Act.** Prior to conveyance of land from the Navy to Guam that may contain federally listed threatened or endangered species, consultation in accordance with federal endangered species laws and regulations will be required. The federal Endangered Species Act of 1973, 16 U.S.C. §§1531-1544, requires that any action authorized by a federal agency be found not likely to jeopardize the continued existence of any endangered or threatened species or to result in destruction or adverse impact of habitat critical to that species. Section 7 of the Act requires the responsible federal agency to consult with the USFWS and National Marine Fisheries Service (NMFS).

**Fish And Wildlife Coordination Act.** Section 2 of the Fish And Wildlife Coordination Act, 16 U.S.C. §662, directs federal agencies to consult with USFWS and local agencies before authorizing alterations to water bodies. No alterations to water bodies are anticipated as part of this action.

**Clean Water Act.** Section 404 CWA, 33 U.S.C. §1344, Discharges in Navigable Waters of the United States, limits the discharge of dredged or fill materials into navigable waters. Developers of parcels that contain wetlands would be required to obtain approvals from the United States Army Corps of Engineers (ACOE) in accordance with the Clean Water Act. The construction of outfalls would also require approval under this program.

**Executive Order 11990—Protection of Wetlands.** In furtherance of NEPA and its amendments, this Executive Order was issued to avoid long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands. Since the marine wetland and seasonal wetlands may be disturbed or eliminated under the reuse plans, the acquiring entity would be required to obtain permits from the U.S. Army Corps of Engineers in accordance with Section 404 of the CWA. The stringent requirements of this law would provide adequate mitigation for the loss of wetlands.

## 4.9 MARINE ENVIRONMENT

No significant impacts on marine resources would be associated with the Preferred, Lower Intensity, or "No Action" alternatives. The development of a power plant at Rizal/Afilleje Beach under the Higher Intensity Alternative has the potential for significant localized impacts on coral reefs and marine life due to the construction of power plant intake and outfall structures and discharge of cooling water effluent. However, proper construction practices and siting would avoid these impacts.

### 4.9.1 Significance Criteria

Impacts would be considered significant if the proposed action:

- Resulted in jeopardizing the continued existence of threatened or endangered marine species protected by the federal government, in accordance with the Endangered Species Act of 1973 (16 U.S.C. §1531 *et seq.*).
- Caused a reduction in the habitat that would jeopardize the continued existence of protected marine species.

### 4.9.2 Potential Impacts and Proposed Mitigation

No significant impacts on marine resources are anticipated at any of the coastal parcels under the Preferred, Lower Intensity, and "No Action" alternatives. For each parcel, except for Rizal/Afilleje Beach under the Higher Intensity Alternative, the alternative actions (including "No Action") would have approximately equal impacts with respect to marine resources. Federally protected sea turtles may frequent the nearshore waters adjacent to three coastal GLUP parcels. These waters may be frequented by turtles, but no turtle nesting areas are known to occur on these parcels.

**FAA Housing.** Proposed plans call for mixed residential, resort, conservation, and recreational use on the site. All construction activities on the site would comply with applicable federal (Clean Water Act) and GovGuam (Water Pollution Control Act, Title 10, Chapter 47, Guam Code Annotated) regulations governing discharges into coastal waters. The proposed development would also incorporate appropriate measures to assure full compliance for any discharges of storm water during operation. No impacts to any threatened or endangered marine species are anticipated. Protected sea turtles may frequent the area, but it is not known as a nesting site.

**Polaris Point.** The area of the parcel containing or directly adjacent to important marine habitats is proposed for conservation. Thus, no direct loss or destruction of such habitats is anticipated. The remainder of the site is designated for industrial use (with aquaculture being one specific activity under consideration for this portion of the parcel). The activities would

comply with applicable federal and GovGuam regulations as stated above governing discharges into nearshore waters. No impacts to any threatened or endangered marine species are anticipated; the area is not known as a turtle nesting site.

**Rizal/Afleje Beach.** The parcel is proposed under the Preferred and Lower Intensity reuse alternatives as park, recreational, and conservation land. Some construction may be required for development of small-scale commercial operations. Construction activities would comply with applicable federal and GovGuam regulations as stated above governing discharges into coastal waters. No impacts are anticipated during the operational phase. No impacts to any threatened or endangered marine species are expected; the area is not known as a turtle nesting site.

Under the Higher Intensity Alternative, development of a baseload-generating power plant could have a significant local impact on the marine environment. Construction of intake and outfall cooling water concrete pipelines and structures across the Agat Bay reef flat could affect the coral reef in the vicinity of the structures. The impact would not be significant to the overall reef condition since effects would be localized. No significant impact on the marine environment would result from the discharge of power plant cooling water. The higher temperature of the effluent crater could be harmful to marine life and the coral reef, but could be mitigated to less than significant by locating the discharge in deep waters with an adequate dispersal zone and discharging away from living coral.

#### 4.9.3 Cumulative Impacts

A regulatory framework is in place to reduce cumulative effects of land-based activities on marine resources to less than significant. Through the National Pollutant Discharge Elimination System (NPDES) program, projects are required to implement Best Management Practices to control erosion and runoff during construction so that the quality of coastal waters is maintained. GovGuam also requires the preparation of Environmental Protection Plans (EPPs) and erosion control plans for development projects

#### 4.9.4 Compliance/Consistency with Applicable Laws and Regulations

As discussed above, the proposed action would have to be carried out in accordance with the Endangered Species Act of 1973, 16 U.S.C. §§1531-1544; the Fish And Wildlife Coordination Act, 16 U.S.C. §662 (refer to Section 4.8.4); the Coastal Zone Management Act of 1972, 16 U.S.C. §1451; and the National Pollutant Discharge Elimination System (NPDES) pursuant to Section 402 of the Clean Water Act, 33 U.S.C. §§1251-1381.

Executive Order 13089 on Coral Reef Protection was signed by the President on June 11, 1998. Under this EO, all federal agencies whose actions may affect U.S. coral reef ecosystems are required to:

- identify their actions that may affect U.S. coral reef ecosystems;

- utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and
- to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the condition of such ecosystems.

Except for the power plant alternative at Rizal/Afleje Beach, none of the uses proposed for any of the GLUP parcels has the potential to result in the direct destruction of, or damage to, coral reefs. Indirect impacts that could affect coral areas and that might occur as a result of land-based development activities, such as increased pollution or siltation, could be controlled through the application of appropriate management practices during construction and operation. Thus, The Preferred, Lower Intensity, and "No Action" alternatives are consistent with the intent of this EO to protect coral reefs. The Higher Intensity (power plant) Alternative at Rizal/Afleje Beach would require GPA to obtain an NPDES Point Source Discharge permit from GEPA, Section 401 Water Quality Certification from GEPA, and a permit for dredge and fill activities from the U.S. Army Corps of Engineers in accordance with Section 404 of the Clean Water Act.

## 4.10 ROADS AND TRAFFIC

The proposed reuse of the largely undeveloped GLUP parcels, assuming buildout density by the traffic planning horizon year of 2010, would generate traffic demand that would otherwise not occur. Redevelopment in each region would create additional vehicle trips per day, which consequently would affect the number of cars on the roadways and lead to delays at intersections. Regional traffic is described in Section 3.10; potential impacts on future traffic are evaluated below. Potential traffic congestion during construction under the reuse alternatives was not considered significant as it would be temporary and traffic control measures would be required. No further analysis was conducted (refer to Table 4.1-1).

Overall, traffic volumes on affected roadway segments from the proposed reuse are anticipated to increase from one or two percent on some roadways, to as much as 30 to 40 percent on heavily affected routes. Without mitigation, key intersections in the northern, Barrigada, and southern regions would be significantly impacted, having unacceptable level of service (LOS E or F). With the exception of one northern region intersection (Route 1 and Route 16), mitigation measures such as widening roads and adding turning lanes are available to improve signalized intersection service to acceptable levels. No traffic impacts would occur under the "No Action" Alternative, although certain intersections would operate at unacceptable levels of service even without reuse.

### 4.10.1 Significance Criteria

Traffic performance expressed in terms of delay experienced by an individual vehicle is expressed as a level of service (LOS). A significant impact would occur if the proposed reuse caused an intersection to function at LOS E or worse, or cause a vehicle to roadway capacity (V/C) ratio of 95 percent to occur. Intersection LOS, measured for both morning and afternoon peak hours, provides a standard of how the roadway is functioning based on the average delay

experienced in passing through the intersection. Levels of service from "A" to "C" are considered acceptable, "D" is marginal (average delay of 25 to 40 seconds), and "E" or below is unacceptable (average delay of 40 to 60 seconds). A V/C ratio of 95 percent would generally be associated with LOS E. However, while LOS as observed at an intersection may be subject to management by improving signal timing, V/C is not subject to management, short of constructed roadway improvements.

The evaluation factors discussed in Section 3.10.1 to describe existing conditions provide the measures of change caused by the project against which the significance of impacts can be evaluated. Potential impacts originate from the number of vehicle trips per day generated by development of each reuse parcels and how they collectively affect roadway traffic flow in the region. These flows are described in terms of (1) number of daily trips generated by the proposed reuse at three intensity alternatives; (2) average daily trips (ADT) volume, including project and non-project trips; (3) V/C; and (4) LOS at key intersections. While there is no standard for significance of increased numbers of daily trips or ADT because significance is related to traffic flow relative to roadway capacity rather than total volume, relative change in trips generated or ADT reflects contribution of the proposed action to the total traffic volume. The ratio of total traffic volume to theoretical design capacity for a roadway or intersection is its vehicle-to-capacity ratio. Delays increase as traffic volume approaches capacity.

#### 4.10.2 Methodology

Existing conditions described in Section 3.10 provide the baseline against which comparisons have been made in a traffic study for the year 2010, with and without the proposed action. A primary traffic evaluation was conducted for the Preferred Alternative. The Higher and Lower Intensity and "No Action" alternatives have been discussed and compared with the Preferred Alternative based on differences in vehicle trips generated by each.

For this study the following assumptions were made:

- Existing conditions are based on traffic data collected in 1998. Data from the 1995 baseline year were not available and traffic conditions in 1998 are similar to those in 1995.
- Buildout of the planned reuse would occur by the planning year 2010 to match 2010 traffic forecasts.
- Traffic generation rates attributable to the planned reuse at buildout density have been developed for each of the compared alternatives.
- Year 2010 projection of growth without the proposed reuse is based on a comparison to base year 1990 travel forecasts made for the *Guam 2010 Highway Master Plan Study*.

#### 4.10.3 Potential Impacts and Proposed Mitigation

Table 4.10-1 summarizes the average daily trips (ADT) that would be generated by each of the parcels under each of the four alternatives. Table 4.10-2 summarizes the ADT volume on selected major roadway segments. In the northern region, a comparison of trip generation for

**Table 4.10-1: Comparison of Trip Generation Among Alternatives**

Region/Parcel	Average Daily Trip Generation			
	Lower Intensity Alternative	Preferred Alternative	Higher Intensity Alternative	"No Action"
<b>Northern</b>				
N2 FAA Housing	5,223	6,032	7,964	0
N3 Harmon Annex	92	183	473	0
N4B Marine Drive Utility	3,630	5,879	7,519	0
N4C Tamuning Telephone Exchange	285	454	1,021	0
<b>Total Northern</b>	<b>9,230</b>	<b>12,548</b>	<b>16,977</b>	<b>0</b>
<b>Barrigada</b>				
N5A	1,254	1,614	4,502	0
N5B	7,163	14,325	25,971	0
N5C	73	146	293	0
N5D	840	2,832	5,914	0
	1,229	1,904	6,879	0
<b>Total Barrigada</b>	<b>10,559</b>	<b>20,823</b>	<b>43,559</b>	<b>0</b>
<b>Nimitz Hill</b>				
N10A Nimitz Hill Enlisted Housing	1,098	1,751	3,505	0
N10B Nimitz Hill Vacant Lands	2,066	3,716	5,539	0
<b>Total Nimitz Hill</b>	<b>3,164</b>	<b>5,467</b>	<b>9,044</b>	<b>0</b>
<b>Central-Southern</b>				
N12A Sasa Valley	32	35	35	0
N12B Tenjo Vista	3,383	3,749	4,608	0
N14 Polaris Point	177	177	766	0
N15 New Apra Heights	571	518	2,393	0
N16 Route 2A	1,019	1,695	4,989	0
N17 Rizal/Afilleje Beach	221	221	401	0
N18 Old Apra Heights	179	335	670	0
N19A Navy Ordn. Annex North (West)	206	206	324	0
N19B Navy Ordn. Annex North (East)	215	215	359	0
<b>Total Central-Southern</b>	<b>6,003</b>	<b>7,151</b>	<b>14,545</b>	<b>0</b>

Source: Wilbur Smith Associates (February 1999)

Table 4.10-2: Average Daily Trips Volume for the Preferred Alternative

TRAFFIC REGION	ROADWAY SEGMENT	1998	2010 WITHOUT PREFERRED ALTERNATIVE	2010 WITH PREFERRED ALTERNATIVE	REUSE PERCENT CHANGE
Northern	Rt. 1 near Parcel 4C	70,000	100,000	101,200	1%
	Rt. 1 West of Rt. 16	63,000	79,000	83,500	6%
	Rt. 1 east of Rt. 3	39,000	47,000	49,000	4%
	Rt. 16 south of Rt. 1	25,000	31,000	32,000	3%
	Rt. 28 east of Rt. 3	6,000	9,200	9,600	4%
Barrigada	Rt. 8 west of Rt. 10	37,000	54,000	59,500	10%
	Rt. 8 near Parcel 5A	3,500	5,800	8,100	40%
	Rt. 10 south of Rt. 8	37,000	54,000	63,000	17%
	Rt. 10 south of Rt. 15	34,500	51,500	57,000	11%
	Rt. 16 east of Rt. 8	41,000	64,000	68,000	6%
	Central Ave. between Route 10A & Route 8	*1,562	*2,187	*2,468	*13%
Nimitz Hill	Rt. 1 west of Adelup	32,000	51,000	51,500	1%
	Rt. 1 south of Piti	28,000	45,000	46,000	2%
	Rt. 6 south of Adelup	10,000	15,800	17,800	13%
	Rt. 6 west of Murray Rd.	2,500	3,600	5,000	39%
	Murray Rd. west of Rt. 6	2,500	3,500	4,600	31%
Central/Southern	Rt. 1 north of Piti	27,500	43,200	45,200	5%
	Rt. 1 north of Rt. 2A	28,500	44,000	45,600	4%
	Rt. 2A east of Rt. 1	23,000	36,400	37,800	4%
	Rt. 5 east of Rt. 2A	11,600	18,000	18,800	4%
	Rt. 17 east of Rt. 5	4,200	6,600	7,000	6%
	Rt. 2 north of Rt. 12	13,200	20,500	21,500	5%

\* Only 1996 peak hour counts are available and are used to calculate relative change. Based on regional projected growth, 40 percent is used to reflect 2010 baseline conditions (*Guam Land Use Plan Traffic Impact Study*, February 1999, pp. 7-2).

the Lower and Higher Intensity alternatives with the Preferred Alternative indicates that about 25 percent less traffic would be generated in the lower intensity scenario, and about 35 percent more traffic would be generated in the higher intensity scenario.

In the Barrigada region, comparison of trip generation for the Lower and Higher Intensity alternatives with the Preferred Alternative indicates that about 50 percent less traffic would be generated in the lower intensity scenario, and about 110 percent more traffic would be generated in the higher intensity scenario. The higher intensity scenario would be expected to significantly aggravate the conditions of problem intersections in the Barrigada region. In the Nimitz Hill area, comparison of trip generation for the Lower and Higher Intensity alternatives with the Preferred Alternative indicates that about 40 percent less traffic would be generated in

the lower intensity scenario, and about 65 percent more traffic would be generated in the higher intensity scenario.

In the Central-Southern region, comparison of trip generation for the Lower and Higher Intensity alternatives with the Preferred Alternative indicates that about 15 percent less traffic would be generated in the lower intensity scenario, but over 100 percent more traffic would be generated in the higher intensity scenario. This increase would be associated primarily with the New Apra Heights and Route 2A parcels, which are located along Route 2A and would be expected to significantly increase impacts at the intersections at Routes 1 and 2A and Routes 2A and 5. The "No Action" Alternative would not generate measurable traffic.

To determine the relevance of these traffic volume figures, key intersections were analyzed; results are summarized in Table 4.10-3.

**Table 4.10-3: Traffic Conditions at Key Regional Intersections**

Study Area & Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	V/C	LOS
<b>Northern</b>					
Route 3 & Route 28	1998	*	F	*	D
	2010 "No Action"	0.668	B	0.529	B
	2010 With Reuse	0.707	B	0.606	B
	With Mitigation	NA	NA	NA	NA
Route 1 (Marine Drive) & Route 3	1998	1.015	E	0.875	C
	2010 "No Action"	0.958	E	0.857	C
	2010 With Reuse	1.026	E	0.959	D
	With Mitigation	0.860	D	0.889	D
Route 1 & Route 16	1998	0.969	D	1.084	F
	2010 "No Action"	1.091	F	1.111	F
	2010 With Reuse	1.133	F	1.188	F
	With Mitigation	0.991	D	1.087	F
Route 3 & Parcel N2 South Access Rd.	1998	*	*	*	*
	2010 "No Action" (with traffic signal)	*	*	*	*
	2010 With Reuse (with traffic signal)	*	F	*	E
	With Mitigation	0.909	B	0.952	D

- V/C = Ratio of the traffic volume to the theoretical capacity of the intersection.
- LOS = Level of service.
- \* = V/C is not calculated for intersections with STOP sign controls.
- NA = Not analyzed.

Source: Wilbur Smith Associates (February 1999)

**Table 4.10-3: Traffic Conditions at Key Regional Intersections (continued)**

Study Area & Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	V/C	LOS
<b>Barrigada</b>					
Route 8 & Route 10	1998	0.865	D	0.838	C
	2010 "No Action"	0.953	D	1.075	F
	2010 With Reuse	1.118	F	1.290	F
	With Mitigation	0.948	D	0.908	D
Route 8 & Route 16	1998	*	F	*	F
	2010 "No Action"	*	F	*	F
	2010 With Reuse	*	F	*	F
	With Mitigation	***	***	***	***
Route 16 & Post Office Driveway	1998	0.502	A	0.555	B
	2010 "No Action"	0.578	A	0.837	B
	2010 With Reuse	0.605	A	0.896	B
	With Mitigation	0.636	B	0.793	B
Route 10 & Route 15	1998	0.730	C	0.676	C
	2010 "No Action"	0.971	D	0.905	D
	2010 With Reuse	1.315	F	1.273	F
	With Mitigation	0.837	C	0.894	D
Route 15 & Parcel N5B Access Rd.	1998	NA	NA	NA	NA
	2010 "No Action"	*	*	*	*
	2010 With Reuse	*	F	*	F
	With Mitigation	0.639	C	0.847	C
Central Avenue & Route 8	1998	*	F	*	F
	2010 "No Action"	1.000	D	0.984	D
	2010 With Reuse	1.103	F	1.057	E
	With Mitigation	0.909	D	0.952	D

- V/C - Ratio of the traffic volume to the theoretical capacity of the intersection.
- LOS - Level of service.
- \*
- \*\*\* - Mitigating traffic to acceptable levels would require upgrading a proposed National Guard roadway and diverting traffic through it, and widening of Route 16.
- NA - Not analyzed.

Source: Wilbur Smith Associates (February 1999)

**Table 4.10-3: Traffic Conditions at Key Regional Intersections (continued)**

Study Area & Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	V/C	LOS
<b>Nimitz Hill</b>					
Route 1 (Marine Dr.) & Route 6 (Adelup)	1998	0.569	B	0.757	C
	2010 "No Action"	0.874	C	0.908	C
	2010 With Reuse	0.885	C	1.014	D
	With Mitigation	NA	NA	0.913	C
Route 1 (Marine Dr.) & Route 6 (Piti)	1998	0.559	A	0.589	A
	2010 "No Action"	0.854	B	0.838	B
	2010 With Reuse	0.919	B	0.965	C
	With Mitigation	NA	NA	0.866	B
Route 6 & Route 7	1998	*	A	*	B
	2010 "No Action"	*	B	*	B
	2010 With Reuse	*	B	*	C
	With Mitigation	NA	NA	NA	NA
Route 6 & Murray Rd. (East Junction)	1998	*	A	*	A
	2010 "No Action"	*	B	*	B
	2010 With Reuse	*	C	*	C
	With Mitigation	NA	NA	NA	NA
Route 6 & Murray Rd. (West Junction)	1998	*	A	*	A
	2010 "No Action"	*	B	*	B
	2010 With Reuse	*	B	*	B
	With Mitigation	NA	NA	NA	NA

- V/C = Ratio of the traffic volume to the theoretical capacity of the intersection.
- LOS = Level of service.
- \* = V/C is not calculated for intersections with STOP sign controls.
- NA = Not analyzed.

Source: Wilbur Smith Associates (February 1999)

**Table 4.10-3: Traffic Conditions at Key Regional Intersections (continued)**

Study Area & Intersection	Scenario	Morning Peak Hour		Afternoon Peak Hour	
		V/C	LOS	V/C	LOS
<b>Central-Southern</b>					
Route 1 (Marine Dr.) & Route 18 (Polaris Point Rd.)	1998	0.649	B	0.668	B
	2010 "No Action"	0.908	B	0.910	B
	2010 With Reuse	0.937	B	0.944	C
	With Mitigation	NA	NA	NA	NA
Route 1 (Marine Dr.) & Route 2A	1998	0.437	B	0.696	B
	2010 "No Action"	0.637	B	1.032	E
	2010 With Reuse	0.667	C	1.069	E
	With Mitigation	**	**	0.921	D
Route 2A & Route 5	1998	0.814	C	0.555	B
	2010 "No Action"	1.245	F	0.837	C
	2010 With Reuse	1.260	F	0.896	C
	With Mitigation	0.917	C	**	**
Route 2 & Route 12	1998	0.669	B	0.569	B
	2010 "No Action"	0.831	C	0.861	C
	2010 With Reuse	0.851	C	0.902	C
	With Mitigation	NA	NA	NA	NA
Route 5 & Route 17	1998	*	B	*	B
	2010 "No Action"	*	B	*	C
	2010 With Reuse	*	B	*	C
	With Mitigation	NA	NA	NA	NA

- V/C - Ratio of the traffic volume to the theoretical capacity of the intersection.
- LOS - Level of service.
- \* - V/C is not calculated for intersections with STOP sign controls.
- \*\* - Improvement not qualified.
- NA - Not analyzed.

Source: Wilbur Smith Associates (February 1999)

Of the intersections analyzed, the following intersections would be significantly impacted by the reuse alternatives:

**Northern Region.** Under the Preferred Alternative, the following traffic conditions would occur. The unsignalized FAA Housing parcel intersections with Route 3 would operate at unacceptable conditions at peak hours. Traffic signal control would provide acceptable conditions. Similar conditions would occur at the Harmon Annex parcel access road with Route 3. Turn lanes, refuge lanes, and acceleration lanes would improve intersection performance to a less than significant impact. Along Route 1 (Marine Drive), the signalized intersections with Route 3 and with Route 16 would cause LOS to be unacceptable, with the Route 3 intersection subject to mitigation to marginal performance with the addition of a southbound lane on the Route 3 approach to the intersection. At the commercial center proposed at the Marine Drive Utility, a traffic signal would be required to allow left turns onto

Route 1 due to its heavy traffic. The Route 16 and Route 1 intersection would be expected to operate above capacity with or without the proposed reuse. Mitigation would compensate for the reuse component of traffic at this intersection, which would still remain above capacity in 2010. Construction of a roadway grade separation (interchange) and condemnation or purchase of private property to widen Route 1 would be required to mitigate traffic conditions to acceptable levels. While technically feasible, these improvements are impractical and would require the taking of unreasonable amounts of land. While the unacceptable traffic conditions would occur regardless of reuse, development under the reuse alternatives would contribute to traffic congestion.

The result of traffic increases under the Lower Intensity Alternative would adversely affect traffic conditions at the Route 1 intersections with Route 3 and with Route 16. The roadway improvements recommended for the Preferred Alternative would be needed to mitigate these impacts. A significant impact due to unacceptable conditions at the intersection of Route 1 and 16 would remain, even with mitigation.

The Higher Intensity Alternative traffic conditions would slightly worsen at each intersection when compared to the Preferred Alternative. Most of the traffic increase would occur in the morning peak hour, as compared to the Preferred Alternative, due to traffic from the FAA Housing parcel. Traffic generated from the Marine Drive Utility commercial complex would also account for the traffic increase. Mitigation proposed under the Preferred Alternative would be sufficient to accommodate the increased traffic, except at Routes 1 and 16.

**Barrigada Region.** The intersection of Route 8 with Route 10 would be at LOS D without the proposed reuse and is expected to be at LOS F with all reuse alternatives, for both morning and afternoon peak periods. Under the Preferred Alternative, the addition of a second right-turn lane on the Route 10 approach would improve morning peak performance to LOS D. For the afternoon peak, to achieve LOS D, an eastbound right-turn lane and a third westbound left-turn lane would be needed on Route 8, as well as a second northbound left-turn lane on Route 10. The intersection of Route 8 with Route 16 would operate at LOS F during the morning and afternoon peak periods regardless of the proposed reuse. Possible mitigation would be to upgrade and divert traffic through a proposed National Guard access roadway, which would connect their facility to Post Office Driveway. The upgrade of this connection could provide a route for future reuse traffic from Route 8. Along with planned widening of Route 16, the Route 8-Route 16 intersection could operate at acceptable levels. This mitigation, although feasible, is not Navy's responsibility. If GovGuam is unable to implement mitigation, a significant traffic impact is expected to occur due to unacceptable conditions with or without the proposed reuse alternatives.

In the Barrigada Region, the intersection of Route 10 with Route 15 would deteriorate from LOS D to LOS F as a consequence of the reuse alternatives, for both morning and afternoon peaks. For the Preferred Alternative, Route 10 would need to be widened to six through lanes with a second southbound left-turn lane, as well as a second westbound right-turn lane on Route 15 to achieve LOS C in the morning peak. These changes would also meet afternoon peak requirements. The intersection of Central Avenue and Route 8 would operate at unacceptable conditions with or without the proposed reuse at peak periods regardless of signalization; this intersection is currently unsignalized. Double turn lanes on Route 8 and on Central Avenue and widening Route 8 westbound for through lanes would improve intersection performance to a less than significant impact. Mitigation would be required regardless of reuse.

Reduced residential development in the Barrigada region under the Lower Intensity Alternative would result in a reduction of vehicle trips generated compared to the Preferred Alternative. Traffic conditions would substantially worsen at the Route 10 intersections with Route 8 and Route 15, exceeding intersection capacity. Major roadway modifications, similar to those discussed for the Preferred Alternative, would be needed to mitigate the impacts of reuse at these two intersections. A traffic signal may not be necessary for the Route 15 intersection with Barrigada parcel N5B access road if several access roads are provided to disperse traffic.

The Higher Intensity Alternative would substantially worsen traffic conditions due to development of large residential subdivisions, light industrial facilities, golf course expansion, and small visitor accommodations. Mitigation proposed under the Preferred Alternative would be needed to mitigate the impacts. Most of the additional vehicle trips would be added to the parcels along Route 15 and would worsen congested conditions at the Route 10 intersections with Routes 8 and 15. Mitigation would require construction of a new roadway connector between Route 15 and Route 16, such as the planned Adacao Connector Road. Two lanes would be required in each direction. Increased trips to and from the NAS Officers Housing parcel would support the need for a traffic signal and additional lanes at the Route 8 and Central Avenue intersections.

**Nimitz Hill.** No significant traffic impacts would occur under the reuse or "No Action" alternatives that could not be mitigated. At the Route 1 and Route 6 (Piti) intersection, turn lanes would improve traffic conditions to less than significant. Under the Lower Intensity Alternative, traffic conditions at the Piti intersections of Routes 1 and 6 would likely remain at acceptable levels and not require mitigation. Traffic increases under the Higher Intensity Alternative during peak hours would amount to less than one percent over the Preferred Alternative. This small increase in peak hour vehicle trips would not greatly worsen the conditions described for the Preferred Alternative, nor require additional mitigation actions.

**Central-Southern Region.** The intersection of Route 1 with Route 2A would not be significantly affected by the Preferred Alternative, with the intersection remaining at LOS E during the afternoon peak, with or without reuse. Given that this is an unsatisfactory condition, it could be improved by adding a second westbound left-turn lane, which would compensate for the effect of the preferred reuse but would still leave the intersection at LOS E. Realignment intersection approaches or widening Route 1 would be needed to make the intersection function within capacity. Likewise, the intersection of Route 2A with Route 5 would operate at LOS F during the morning peak regardless of reuse. Two Route 5 right-hand turn lanes and signalization would improve performance to a less than significant impact. Mitigation would be required with or without reuse.

Under the Lower Intensity Alternative, there would be fewer trips generated for parcels located along Route 1 and Route 2A than the Preferred Alternative. The trips in the central/southern region would be dispersed over a large area, resulting in little difference in peak hour traffic volumes on any particular roadway segment. Traffic impacts and mitigation would be similar to those described for the Preferred Alternative.

The Higher Intensity Alternative traffic impacts would also be similar to the Preferred Alternative at the intersections of Route 1 and 2A and Routes 2A and 5. To mitigate potential traffic impacts resulting from industrial use of the Polaris Point parcel, construction of double turn lanes on the Polaris Point Access Road approach of Marine Drive would be warranted.

Increased commercial use of the Route 2A parcel would require a traffic signal or additional left turn lanes to mitigate adverse traffic conditions.

#### **4.10.4 Cumulative Impacts**

Traffic impacts are inherently cumulative, and the impacts described above consider the cumulative effects of the proposed reuse alternatives in the context of other reuse parcels in the region and of projected regional growth. Certain intersections are projected to function unacceptably even without the proposed action. Locations where the proposed action would contribute to the unacceptable condition have been noted in the EIS.

#### **4.10.5 Compliance/Consistency with Applicable Laws and Regulations**

Design and construction of the proposed roadway improvements would be subject to GovGuam environmental and planning reviews. If federal funds are involved in improvements, Section 4(f) of the Department of Transportation Act, 49 U.S.C. §303 may apply, in compliance with national policy to preserve public parks, recreation areas, wildlife and waterfowl refuges, and historic sites.

### **4.11 POTABLE WATER SUPPLY**

Guam's estimated available water supply for new development in the year 2010 is expected to be sufficient to accommodate projected demand of the reuse alternatives. Hence, there would be no significant impacts on the island-wide potable water supply.

#### **4.11.1 Significance Criteria**

The available island-wide water supply must be adequate to meet the water demand of the proposed reuses. An average day water demand that exceeds the estimated available (average day) water supply of 10 mgd (37,854 cubic meters/day) would be considered significant (see discussion of Estimated Available Water Supply below).

Use of criteria such as existing storage capacities or pressures are not deemed appropriate since most of the parcels are not currently served by any waterlines. Regarding distribution system pressures and fire protection flows, it is anticipated that new lines would be constructed to serve newly developed parcels and their users. The sizing of these new lines would be determined during the utility master planning stage and reconfirmed at the time of site design.

#### **Estimated Available Water Supply**

GWA's *Guam Water Facilities Master Plan Update* (GWFMPU) estimated that the average day water demand created by natural population growth on Guam would increase only slightly over the next decade, and by the year 2010, demand would be approximately 27 million

gallons per day (mgd) (102,206 cubic meters/day). This represents the natural growth of Guam's existing residential or non-tourist-based population. Based on an available water supply of 28 mgd (105,992 cubic meters/day) from GWA's well production, GWA has adequate water capacity to support this population growth. However, in addition to planning for the water needs of Guam's residents, GWA must plan for the water needs of Guam's hotels and hotel-induced residential population. To plan for this tourist-based population, the GWFMPU projected two water source scenarios: Water Supply Level I and Water Supply Level II. These scenarios provide two planning horizons to GWA such that water supply improvements can be designed and constructed in a timely manner to accommodate economic development.

Water Supply Level (WSL) I is the minimum GWA water supply scenario. It corresponds to 37 mgd (140,060 cubic meters/day) and represents the following water resources:

- Groundwater (wellhead) production: 30 mgd (113,562 cubic meters/day)
- Military purchased water: 5 mgd (18,927 cubic meters/day)
- Ugum River intake: 2 mgd (7,571 cubic meters/day).

WSL II, the maximum GWA water supply scenario, corresponds to an additional 30 mgd (11,356 cubic meters/day) yielded from groundwater sources for a total of 67 mgd (227,124 cubic meters/day). WSL II is the supply level required to meet projected hotel-induced water demand. Since the hotel development industry has tapered off substantially in recent years, it cannot be assumed that WSL II would be available in the year 2010.

For this EIS, the more conservative planning projection is assumed. Therefore, WSL I of 37 mgd (140,059 cubic meters/day) is used as the island's maximum available water supply for the year 2010. Reserving 27 mgd (102,206 cubic meters/day) for Guam's population growth demand, the available (average day) water supply would be 10 mgd (37,854 cubic meters/day).

### **Conditions Affecting Available Water Supply**

The GWFMPU was referenced to determine the available water supply. This master plan made several assumptions to determine future population and land use trends to project water demand. Since the GWFMPU was completed prior to adoption of the *I Tanò-ta* Land Use Plan, the projection of future population and land use trends was based on 1992 statistics. The GWFMPU made the following assumptions about future conditions:

- Continued Growth of Tourism: When the GWFMPU was written, Guam's tourism market was strong but inextricably tied to Japan. Consequently, the viability of Guam's tourism industry was highly dependent on the economic well being of Japan.
- Continuation of Current Government Policy: It was assumed that the local official policy of "pro-development" would continue. Federal policies on land ownership were also assumed to continue. The GWFMPU assumed that lands currently occupied by the federal government would not be significantly reduced. It should be noted that the proposed action (disposal of military property) would nullify this assumption.

- **Military Population:** Military population, including dependents of military personnel, was assumed to remain constant. It should be noted that the proposed action (disposal of military property) would nullify this assumption.
- **“Mega-Resort” Development in the South:** At the time the GWFMPU was prepared, Japanese developers were proposing large destination resorts. As no reliable predictions on actual developments could be made, the study projected only those developments that were under construction or had acquired zoning variances.

Since publication of the GWFMPU, economic and government activities have taken place that would seem to alter the demand and distribution scenarios put forth by GWA’s planners. For example, the Japanese and other Asian economies have weakened in recent years with a marked decrease in development prospects. At the same time, the proposed release of military properties to civilian use creates new development opportunities that did not exist in 1992.

For the purpose of this analysis, it is assumed that the Navy Public Works Center (PWC) will provide water service to parcels that are remote from GWA waterlines and have Navy waterlines on site or nearby. The specifics of this water supply arrangement for each parcel will need to be established between GWA and the PWC. The water demands are analyzed with respect to impacts on the island’s overall water supply capacity.

#### 4.11.2 Methodology

To determine estimated water demand for the reuse alternatives, standards or guidelines from local utility agencies were used for planning level analysis, including the GWA GWFMPU design criteria and the Water System Standards manual from the State of Hawaii (1985). Textbook data were also referenced. The planning guidelines in Hawaii’s standards provide detailed consumption demand factors that are not available in Guam’s standards, and the textbook data was used to derive an irrigation demand factor. The demand factors and the corresponding references used in these analyses are provided in Table 4.11-1.

The Hawaii standards have different demand factors for each of the Hawaiian Islands. Demand factors for Oahu were used, except for golf course irrigation and the aquaculture farm facility. Due to the climate of Guam, it is common practice that golf courses are not irrigated on a regular basis. Thus a lower demand factor of 1,000 gpd per acre (9.35 cubic meters/day/hectare), derived from general irrigation data, was used. Parks proposed for the reuse parcels are primarily sports fields and conservation lands. Because neither of these land uses is typically irrigated on Guam, irrigation of parks and conservation land is not included in the water demand calculations. For the aquaculture administrative facility, a demand factor similar to commercial buildings (based on floor area) was used. For the aquaculture farm facility, the Hawaii demand factor for Maui agriculture was used.

Based on GWA’s design criteria, the following equations were used to estimate peak hourly demand and maximum daily demand from average daily flow demands:

- Peak hourly flow = average daily flow x 3
- Maximum daily flow = average daily flow x 1.5

**Table 4.11-1: Potable Water Demand Factors**

Land Use (unit variable)	Demand Factor	Reference
Resort, Hotel, Guest House (room)	450 gallons/day/room (1.70 m <sup>3</sup> /day/room)	GWA GWFMPU
Residential Unit (dwelling unit)	400 gallons/day/du* (1.51 m <sup>3</sup> /day/du)	GWA GWFMPU
Golf Course Clubhouse (floor area, sf/m <sup>2</sup> )	100 gallons/day/1,000 sf (0.407 m <sup>3</sup> /day/100 m <sup>2</sup> )	Hawaii's Water System Standards
Golf Course Irrigation (ac/ha)	1,000 gallons/day/ac (9.35 m <sup>3</sup> /day/ha)	Derived from data in Water Supply and Pollution Control <sup>^</sup>
Parks and Recreation Facilities floor area, except conservation areas (sf/ m <sup>2</sup> )	100 gallons/day/1,000 sf (0.407 m <sup>3</sup> /day/100 m <sup>2</sup> )	Hawaii's Water System Standards
Commercial Building (floor area, sf/ m <sup>2</sup> )	100 gallons/day/1,000 sf (0.407 m <sup>3</sup> /day/100 m <sup>2</sup> )	Hawaii's Water System Standards
Industrial Building (floor area, sf/ m <sup>2</sup> )	100 gallons/day/1,000 sf (0.407 m <sup>3</sup> /day/100 m <sup>2</sup> )	Hawaii's Water System Standards
Aquaculture Facility (floor area, sf/ m <sup>2</sup> )	100 gallons/day/1,000 sf (0.407 m <sup>3</sup> /day/100 m <sup>2</sup> )	Hawaii's Water System Standards
Aquaculture Facility (ac/ha)	5,000 gallons/day/ac (9.35 m <sup>3</sup> /day/ha)	Hawaii's Water System Standards (agricultural)

- <sup>^</sup> Clark, J., W. Viessman and M. Hammer (1977) *Water Supply and Pollution Control*. Third edition. New York: Harper and Row.
  - \* Assumes four capita per dwelling unit
- Notes: du = dwelling unit    sf = square feet    m<sup>2</sup> = square meters    cap = capita

### 4.11.3 Potential Impacts and Proposed Mitigation

Water demands for each land use on each parcel were projected for the Preferred, Lower Intensity, and Higher Intensity alternatives. Since this analysis assumes full development of all parcels under the three reuse scenarios, the projected water demands were aggregated to determine the total water demand of each alternative. Table 4.11-2 presents the projected total water demands associated with each alternative.

Based on the projected water demand for all reuse alternatives, there would be no significant impact on the island's water supply. All of the alternatives would have an average daily demand well below the available 10 mgd (37,854 cubic meters/day). The "No Action" Alternative would involve no additional demand on the potable water supply.

**Table 4.11-2: Water Demands for Proposed Alternatives**

Land Use Alternative	Water Demand mgd (m <sup>3</sup> /d)		
	Average Daily Flow	Maximum Daily Flow	Peak Hourly Flow
Preferred	1.60 (6,075)	2.41 (9,112)	4.81 (18,225)
Low Density	0.60 (2,255)	0.89 (3,383)	1.79 (6,766)
High Density	2.55 (9,645)	3.83 (14,507)	7.67 (29,050)
"No Action"	No additional demand		

Implementing service in the reuse areas would require distribution infrastructure. The greatest impact of providing potable water system services to the reuse parcels would be the construction of new distribution pipelines. Table 4.11-3 estimates the minimum distance for new waterline requirements to serve the various GLUP parcels. The sizes, locations, and ownership entities of the existing waterlines were determined from Navy and GWA water facilities master plans.

**Table 4.11-3: Distance to Nearest Water Source**

No.	Parcel	Nearest Water Source	Distance
N2	FAA Housing	10-in (250-mm) Navy line on Route 3	25 ft (8 m)
N3	Harmon Annex	12-in (300-mm) Navy line on Route 3	25 ft (8 m)
N4B	Marine Drive Utility	12-in (300-mm) Navy line on Route 3	25 ft (8 m)
N4C	Tamuning Telephone Exchange	GWA waterline on Marine Drive	25 ft (8 m)
N5A	Barrigada	12-in (300-mm) Navy line in antenna field	50 ft (15 m)
N5B	Barrigada	12-in (300-mm) Navy line at Golf Course 24-in (600-mm) GWA line along Route 15	50 ft (15 m) 25 ft (8 m)
N5C	Barrigada	24-in (600-mm) GWA line along Route 15	25 ft (8 m)
N5D	Barrigada	24-in (600-mm) GWA line along Route 15	25 ft (8 m)
	NAS Officers Housing	16-in (400-mm) Navy line along Route 8	100 ft (30 m)
N10A	Nimitz Hill Enlisted Housing	Navy-owned lines within parcel	0
N10B	Nimitz Hill Vacant Lands	Navy-owned dist. adjacent housing area	150 ft (46 m)
N12A	Sasa Valley	24-in (600-mm) Navy line along Marine Drive	250 ft (76 m)
N12B	Tenjo Vista	24-in (600-mm) Navy line along Marine Drive	20 ft (6 m)
N14	Polaris Point	12-in (300-mm) Navy line along Polaris Drive	20 ft (6 m)
N15	New Apra Heights	24-in (600-mm) Navy line along Route 2A	20 ft (6 m)
N16	Route 2A	24-in (600-mm) Navy line along Route 2A	20 ft (6 m)
N17	Rizal/Afleje Beach	18-in (450-mm) Navy line along Route 2	20 ft (6 m)
N18	Old Apra Heights	10-in (250-mm) Navy line along Route 5	200 ft (60 m)
N19A	Navy Ordn. Annex North (West)	14-in (350-mm) Navy line along Route 5	200 ft (60 m)
N19B	Navy Ordn. Annex North Housing (East)	Navy-owned lines within parcel	0

There would be an adequate supply of potable water available island wide to support redevelopment under each reuse alternative. No mitigation is required.

Only those parcels with existing on-site buildings currently have waterlines serving them. It is assumed that water service would be included in development of the various parcels.

#### 4.11.4 Cumulative Impacts

It is assumed that development of these GLUP reuse parcels would compete with other developments on Guam for water supply. Several new hotels have been completed recently or are expected to be completed in the next two to three years. In addition, federal property located at Tiyan (Naval Air Station Agaña) is anticipated to be released for development. To determine if the overall developments would significantly stress the island's water supply capacity, cumulative impacts were analyzed.

The largest impact to water supply would come from new hotels and the Tiyan development. For purposes of this analysis, the water demands of the total new or proposed hotel rooms plus the "highest-demand" Tiyan development were added to each of the three reuse alternatives to determine the cumulative impact. The total average water demand from these competing developments is 3.00 mgd (11,346 cubic meters/day). The cumulative impact of each alternative with the "new development" is provided in Table 4.11-4.

**Table 4.11-4: Cumulative Water Demand Impacts**

Reuse Alternative	Water Demand mgd (m <sup>3</sup> /d)			
	Average Daily Flow	New Development Average Daily Flow	Cumulative Average Daily Flow	Cumulative Maximum Daily Flow
Preferred	1.60 (6,057)	3.00 (11,346)	4.60 (17,421)	6.90 (26,131)
Lower Intensity	0.60 (2,255)	3.00 (11,346)	3.60 (13,601)	5.40 (20,401)
Higher Intensity	2.55 (9,645)	3.00 (11,346)	5.55 (20,991)	8.33 (31,487)
"No Action"	No additional demand			

For each alternative, the total of the projected water demand for the reuse parcels plus the new development demand would be less than the available 10 mgd (37,854 cubic meters/day). Therefore, the cumulative impact of providing potable water service to the reuse parcels and to other anticipated new developments would not be significant.

#### 4.11.5 Compliance/Consistency with Applicable Laws and Regulations

For the purpose of this assessment, design, construction, and operation of the water system must conform with federal and GovGuam laws and regulations applicable to such activities.

## 4.12 WASTEWATER COLLECTION AND TREATMENT

Under the Preferred and Lower Intensity alternatives, no significant impacts on Guam's regional wastewater systems are anticipated. Under the Higher Intensity Alternative, there is a potential for significant impact on peak flows at the Agana Wastewater Treatment Plant (WWTP), but flows can be diverted to the Northern District WWTP which has available capacity. With development of the new Agat WWTP, there would be adequate capacity to support development of the parcels in the southern region under all reuse alternatives. No cumulative impacts are expected on the Northern District and new Agat WWTP under any of the reuse alternatives.

### 4.12.1 Significance Criteria

If projected wastewater flows exceed system capacities, facilities would have to be upgraded. Any increase in wastewater flows necessitating an upgrade or new construction of a treatment plant would be considered significant.

Since most of the reuse parcels have no sewers, it is assumed that new sewer lines would have to be installed as part of the development process. It is also assumed that existing wastewater collection system components would need to be upgraded from time to time. Collection system capacity was not considered to be an appropriate significance criterion for the purpose of this analysis for the following reasons:

- Upgrading components of a large collection system is an ongoing process.
- Many factors contribute to the determination of when a specific component needs to be upgraded.
- The location of the reuse parcels is such that they will individually impact different portions of the collection system.

### 4.12.2 Methodology

The *Guam Islandwide Wastewater Facilities Plan* (GIWFP), published in 1994, used a market-driven forecasting methodology to project employment and population for Guam over a 20-year horizon. Similar to the water master plan, this plan distributed the growth spatially based on historic trends, recent developments, proposed projects, and in anticipation of the new Land Use Plan for Guam (*I Tano'-ta*). The GIWFP used two forecasting approaches—forward and backward looking—to predict growth overall. Since many growth pressures are externally controlled, an assessment of these external factors influencing growth on Guam is a better measure than an assessment of past trends. To predict where growth was likely to occur, the GIWFP based projections upon historic trends. At the time the GIWFP was written, planners did not forecast surplus Navy parcels as possible developable sites. As described in the potable water impact section, these new development opportunities may partially offset the recent

decrease in Japanese development prospects such that wastewater projections in the GIWFP remain essentially valid in the long term.

It is also assumed that the new Agat WWTP on the New Apra Heights parcel would be constructed concurrently with other developments assessed in this EIS. This assumption is discussed further in subsequent sections.

### Wastewater Generation Rates

Wastewater flows to be generated under each of the reuse alternatives were calculated for each parcel. For this analysis, the average wastewater generation rates were assumed to be 90 percent of the average water consumption rates. This percentage was considered reasonable because of the relatively small portion of potable water consumption typically used for landscape irrigation on Guam. For land uses that require a significant amount of landscape irrigation, such as the FAA golf course, a zero-capture was assumed, meaning no wastewater was generated based on the amount of water used. The average wastewater generation rates are listed in Table 4.12-1.

Table 4.12-1: Average Wastewater Generation Rates

Land Use Type	Unit	Wastewater Generation Rate	
		gal/day	m <sup>3</sup> /day
Resort, Hotel, Guest House	Room	405	1.53
Residential	Dwelling unit	360	1.36
Commercial Building Industrial Golf Course Clubhouse Parks and Recreation Facilities	1,000 sf	90	0.34
Aquaculture Facility	Acre	4,500	17.03

Source: Based on Table 4.11-2: Water Demands for Proposed Action

Similar to the water demand impact analysis, the wastewater impact considers total development of all parcels for each reuse alternative. Unlike potable water, however, Guam's wastewater is collected and treated in six different wastewater service districts (WWSD). Since the parcels are scattered throughout the island, they are not all within the same WWSD, as designated by GWA. Rather than clustering the parcels by regions designated in this study, the wastewater analysis clustered the parcels according to their geographical WWSD.

There are currently seven operating WWTPs that receive and treat wastewater from the six WWSDs. To determine wastewater impacts, projected flows for each alternative were compared with available capacities of the corresponding WWTP.

The treatment plants affected by the GLUP reuse parcels are the Northern District WWTP, the Agana WWTP, and the Agat WWTP. The wastewater service districts and treatment plant designations for each parcel are listed in table 4.12-2.

At the time the GIWFP was written, the (old) Agat WWTP was over capacity. Subsequent to the plan's publication, GWA completed Phase I of the Agat/Santa Rita wastewater system, which included installation of dual 16-inch (400-millimeter) effluent force mains from the existing Agat WWTP to a new pump station at the N15 site. Phase II calls for construction of the new Agat WWTP.

In the meantime, flows from the new pump station are pumped via dual 16-inch (400-millimeter) force mains to merge with effluent from Navy's Apra Harbor WWTP. The combined flows discharge via a joint outfall at Tupalao on NAVACTS. Only one of the dual 16-inch (400 millimeter) force mains on each leg is activated to accommodate current flows. The redundant 16-inch line will be activated in the future to meet additional demands.

**Table 4.12-2: Wastewater Treatment Plants Affected by GLUP Parcels**

Parcel	Parcel Name	WWSD	Wastewater Treatment Plant
N2	FAA Housing	V (B)	Northern District WWTP
N3	Harmon Annex		
N4B	Marine Drive Utility		
N5A	Barrigada		
N5B	Barrigada		
N5C	Barrigada		
N5D	Barrigada		
N4C	Tamuning Telephone Exchange	V(A)	Agana WWTP
	NAS Officers Housing		
N10A	Nimitz Hill Enlisted Housing		
N10B	Nimitz Hill Vacant Land	IV	Agat WWTP
N12A	Sasa Valley		
N12B	Tenjo Vista		
N14	Polaris Point		
N15	New Apra Heights		
N16	Route 2A		
N17	Rizal/Afilleje Beach		
N18	Old Apra Heights		
N19A	Navy Ordnance Annex North (West)		
N19B	Navy Ordnance Annex North (East)		

The GLUP reuse plan recommended that the New Apra Heights parcel be reserved for the new Agat WWTP. Since GWA has already constructed Phase I of the Agat-Santa Rita wastewater system, it is assumed Phase II will be implemented in the near future. Therefore, for purposes of this study, the available capacity of the new Agat WWTP is the significance criteria for parcels in this WWSD.

To determine available daily flows at the treatment plants, a comparison was made between each plant's design flow and the estimated 1998 flow to the plant. The difference between the two flows is considered the "available flow." The design and estimated 1998 flows of the affected WWTPs were taken from the GIWFP and are tabulated in Table 4.12-3.

**Table 4.12-3: WWTP Design Capacities and Estimated 1998 Flows**

Treatment Plant	Designed Average Daily Flow	Estimated 1998 Average Daily Flow	Designed Peak Flow	Estimated 1998 Peak Flow
Northern District	12.0 mgd (45,400 m <sup>3</sup> /d)	7.19 mgd (27,200 m <sup>3</sup> /d)	27.0 mgd (102,200 m <sup>3</sup> /d)	17.23 mgd (65,200 m <sup>3</sup> /d)
Agana	12.0 mgd (45,400 m <sup>3</sup> /d)	8.77 mgd (33,200 m <sup>3</sup> /d)	21.0 mgd (79,500 m <sup>3</sup> /d)	19.72 mgd (74,650 m <sup>3</sup> /d)
New Agat	4.2 mgd (16,000 m <sup>3</sup> /d)	1.44 mgd (5,450 m <sup>3</sup> /d)	11.67mgd (44,200 m <sup>3</sup> /d)	3.23 mgd (12,200 m <sup>3</sup> /d)

The difference between the designed average/peak flows and the estimated 1998 average/peak flows yields the available capacities at the treatment plants. These calculated capacities are tabulated in Table 4.12-4.

**Table 4.12-4: Available Capacities of WWTPs**

Treatment Plant	Available Average Daily Flow	Available Peak Flow
Northern District	4.81 mgd (18,200 m <sup>3</sup> /d)	9.77 mgd (37,000 m <sup>3</sup> /d)
Agana	3.23 mgd (12,200 m <sup>3</sup> /d)	1.28 mgd (4,850 m <sup>3</sup> /d)
New Agat	2.76 mgd (10,500 m <sup>3</sup> /d)	8.44 mgd (31,950 m <sup>3</sup> /d)

### 4.12.3 Potential Impacts and Proposed Mitigation

The wastewater loads generated under each of the reuse alternatives were grouped according to their respective WWTPs. Total average and peak wastewater loads projected for the three WWTPs for each alternative are tabulated in Tables 4.12-5 and 4.12-6, respectively.

**Table 4.12-5: Average Wastewater Flows to WWTPs by Alternative**

Land Use Alternative	Wastewater Generated mgd (m <sup>3</sup> /d)		
	Northern District WWTP (4.81 mgd/ 18,200 m <sup>3</sup> /d avail.)	Agana WWTP (3.23 mgd/12,200 m <sup>3</sup> /d avail.)	New Agat WWTP (2.76 mgd /10,500 m <sup>3</sup> /d avail.)
Preferred	1.22 (4,622)	0.29 (1,084)	0.15 (557)
Lower Intensity	0.69 (2,604)	0.13 (486)	0.01 (36)
Higher Intensity	2.04 (7,732)	0.62 (2,336)	0.25 (894)
"No Action"	Negligible	Negligible	Negligible

**Table 4.12-6: Peak Wastewater Flows to WWTPs by Alternative**

Land Use Alternative	Wastewater Generated mgd (m <sup>3</sup> /d)		
	Northern District WWTP (9.77 mgd 37,000 m <sup>3</sup> /d avail.)	Agana WWTP (1.28 mgd/4,850 m <sup>3</sup> /d avail.)	New Agat WWTP (8.44 mgd /31,950 m <sup>3</sup> /d avail.)
Preferred	3.26 (12,326)	0.78 (2,952)	0.40 (1,518)
Lower Intensity	1.81 (6,844)	0.35 (1,325)	0.03 (98)
Higher Intensity	5.47 (20,720)	1.68 (6,362)	0.63 (2,375)
"No Action"	Negligible	Negligible	Negligible

Comparing computed flows to the available capacities of the three WWTPs, the Preferred and Lower Intensity alternatives would not have a significant impact on average or peak flows at the three WWTPs. The Higher Intensity Alternative under peak demand would have a significant effect on the Agana WWTP. The computed flow is 1.68 mgd and the available peak flow at Agana WWTP is 1.28 mgd. Wastewater generated under the "No Action" Alternative would be negligible.

Implementing service in the reuse areas would require sewage collection and transmission infrastructure, including the construction of new pipelines and manholes. Table 4.12-7 describes the minimum sewer line requirements to serve the various GLUP parcels.

**Table 4.12-7: Minimum Sewer Line Requirements**

No.	Parcel	Minimum Sewer Line Requirements
N2	FAA Housing	Connect to existing Rt. 3 sewer line, 1,500 lf (457 m)
N3	Harmon Annex	Connect to existing sewer line on Rt. 3,500 lf (1,067 m)
N4B	Marine Drive Utility	Connect to existing sewer line behind parcel, 500 lf (152 m)
N5A	Barrigada	Connect to existing Rt. 16 sewer line, 50 lf (15 m)
N5B	Barrigada	Gravity sewer to Latte Hts. P.S., 3,200 lf (976 m)
N5C	Barrigada	Gravity sewer to Latte Hts. P.S., 3,200 lf (976 m)
N5D	Barrigada	Gravity sewer to Latte Hts. P.S., 1,000 lf (305 m)
N4C	Tamuning Telephone Exchange	Connect to existing Rt. 1 sewer line, 40 lf (12 m)
	NAS Officers Housing	Connect to existing sewer line on Rt. 8, 200 lf (61 m)
N10A	Nimitz Hill Enlisted Housing	Connect to existing Rt. 6 sewer line, 50 lf (15 m)
N10B	Nimitz Hill Vacant Lands	Upgrade lift station on parcel, fm to Rt. 6, 250 lf (76 m)
N12A	Sasa Valley	Sewer line to New Agat WWTP, 3 miles (4.8 km)
N12B	Tenjo Vista	Sewer line to New Agat WWTP, 3 miles (4.8 km)
N14	Polaris Point	Sewer line to New Agat WWTP, 3 miles (4.8 km)
N15	New Apra Heights	(New treatment plant), no sewer line required
N16	Route 2A	Connect to New Agat WWTP, 100 lf (30 m)
N17	Rizal/Afleje Beach	Connect to Route 2 sewer line, 200 lf (61 m)
N18	Old Apra Heights	Connect to New Agat WWTP, 1.5 miles (2.4 km)
N19A	Navy Ordnance Annex North West	Connect to New Agat WWTP, 2.5 miles (4.0 km)
N19B	Navy Ordnance Annex North East	Connect to New Agat WWTP, 2.5 miles (4.0 km)

Given available capacities of the three affected WWTPs, there appears to be adequate capacity to support the total development of all parcels under the Preferred and Lower Intensity reuse alternatives. For the Higher Intensity Alternative, the development-induced peak flow to the Agana WWTP would have a significant impact on the available peak flow capacity at the treatment plant. To mitigate this impact, GWA is currently considering options that include redirecting flow from the Mamajanao and Ypao sewer pump stations to the Northern District WWTP. The projected 1998 flow to each of these SPSs is 0.7 mgd (2,840 m<sup>3</sup>/d), for a total of 1.5 mgd (5,680 m<sup>3</sup>/d). As stated in Table 4.12-4, the projected excess capacity of the Northern District WWTP for 1998 is approximately 4.81 mgd. Redirecting the discharges from the Mamajanao and Ypao SPSs to the Northern District WWTP would provide capacity at the Agana WWTP that would exceed the projected flow increase resulting from implementation of the Higher Intensity Alternative.

The GWFMPU recommended upgrading both the Agana and Northern District WWTPs to secondary treatment, but it did not recommend capacity expansions at either of these plants. For long-term planning, it appears that expansion of the Northern District WWTP may be more practical than expansion at the Agana WWTP due to site limitations of the latter.

#### 4.12.4 Cumulative Impacts

Similar to the potable water demand impacts, it is assumed that development of the GLUP reuse parcels would compete with other new developments for WWTP capacity. There are several new or proposed hotels plus the proposed Tiyan development that would require wastewater treatment capacity at the corresponding WWTPs. To determine if the overall developments would exceed the available capacities of the treatment plants, cumulative impacts were analyzed.

For purposes of this analysis, the new developments were added to the three GLUP alternatives to determine the cumulative impact. For Tiyan, the alternative with the highest wastewater flow was used in this analysis. There are no new developments in the new Agat WWTP district, so there are no cumulative impacts associated with this WWTP. The cumulative impacts of each GLUP alternative together with new developments are tabulated in Table 4.12-8.

**Table 4.12-8: Cumulative Impacts on Wastewater Treatment Facilities**

Land Use Alternative	Wastewater Generated mgd (m <sup>3</sup> /d)					
	Northern District (WWTP) (4.81 mgd/18,200 m <sup>3</sup> /d avail.)			Agana WWTP (3.23 mgd/12,200 m <sup>3</sup> /d avail.)		
	GLUP	New Dev.	Total	GLUP	New Dev.	Total
Preferred	0.84 (3,188)	1.35 (5,094)	2.61 (8,282)	0.29 (1,084)	1.62 (6,150)	1.91 (7,234)
Lower Intensity	0.47 (1,796)	1.35 (5,094)	1.82 (6,890)	0.13 (486)	1.62 (6,150)	1.75 (6,636)
Higher Intensity	1.41 (5,233)	1.35 (5,094)	2.76 (10,327)	0.62 (2,336)	1.62 (6,150)	2.24 (8,479)
"No Action"	No cumulative impacts					

Based on the available capacities of the Northern District and Agana WWTPs, the cumulative impact of any of the GLUP reuse alternatives with other new/proposed developments in the respective service districts would not be significant.

#### **4.12.5 Compliance/Consistency with Applicable Laws and Regulations**

For the purpose of this assessment, design, construction, and operation of the wastewater system must conform with all federal and local laws and regulations applicable to such activities that are in effect at the time of the activity.

### **4.13 SOLID WASTE DISPOSAL**

Under the Preferred, Lower, and Higher Intensity alternatives, municipal solid waste generated by GLUP developments would have no significant impact on projected landfill capacity. The Higher Intensity Alternative, combined with other planned developments on the island, has the potential to result in a significant cumulative impact on projected landfill capacity and a decrease in the life span of the proposed new landfill.

#### **4.13.1 Significance Criteria**

The proposed reuse alternatives would result in a significant impact on the solid waste infrastructure if they:

- Substantially decrease the lifespan of the existing or planned landfill;
- Reach or exceed the current capacity of the existing or planned landfill; or
- Require development of new facilities beyond those existing or currently planned.

As described in Section 3.13, the Integrated Solid Waste Management Plan (ISWMP) forecasts total municipal solid waste (MSW) for the target years 1998, 2003, and 2008. Since these target years fall within the planning horizons of this EIS, the forecast generation rates are used to determine impacts to solid waste disposal by the GLUP parcel developments. The total MSW generation forecasts are summarized in Table 4.13-1.

It is assumed that the new landfill would be designed to handle the MSW as forecast in the ISWMP. Since it is mandated by law, it is also assumed that the new landfill would be in place around the time the GLUP parcels are conveyed to GovGuam. The forecast totals are based on population growth as well as "MSW generation acceleration rates" (annual percentage increases in generation rates defined by the US EPA in a 1995 Update of "Characterization of Municipal Solid Waste in the United States"). The update projects the "generation acceleration rates" for the years 1990–2000 at 1.2 percent and for the years 2001–2010 at 1.6 percent.

Although each alternative for development of the GLUP parcels would increase the number of houses and commercial establishments on Guam, it is anticipated that the Preferred and Lower Intensity alternatives would not generate an increase in population beyond what is already forecast. Rather, under the Preferred and Lower Intensity alternatives a minor redistribution of population combined with the existing growth forecast is anticipated. There would be no major influx of population based on the increased commercial and industrial sector employment. Up to 2,000 newly created jobs under these alternatives are expected to be absorbed by the projected population growth.

**Table 4.13-1: Total MSW Generation Forecasts for 1998, 2003, and 2008**

	1998	2003	2008
Total Population of Guam	159,721	180,575	199,442
MSW Generation Rate – Low	4.94 pcd (2.24 kgcd)	5.30 pcd (2.4 kgcd)	5.74 pcd (2.61 kgcd)
MSW Generation Rate – High	5.08 pcd (2.31 kgcd)	5.54 pcd (2.51 kgcd)	6.02 pcd (2.73 kgcd)
Total MSW Generation – Low	394 t/d (357 mt/d)	479 t/d (435 mt/d)	572 t/d (519 mt/d)
Total MSW Generation – High	406 t/d (368 mt/d)	500 t/d (454 mt/d)	601 t/d (545 mt/d)

pcd = pounds per capita per day  
kgcd = kilograms per capita per day

For the Higher Intensity Alternative, there would be an influx of workers, assuming that 1.2 million square feet (111,484 square meters) of commercial and industrial space would be constructed. Under this alternative, it is assumed that new commercial and industrial entities would be created, rather than just the relocation and expansion of existing businesses.

For this analysis, the predicted solid waste generation for all parcels, assuming full development, is calculated for each alternative. Since it is assumed that the Preferred and Lower Intensity alternatives would not induce population growth, there would be no significant increase in solid waste generation over the existing projections.

As stated above, it is assumed the Higher Intensity Alternative would induce population growth. This population growth corresponds to an increase in solid waste generation. For purposes of this analysis, the predicted solid waste generated under the Higher Intensity Alternative will be compared to the 2008 Total MSW Generation (Low). A substantial increase in solid waste generation may result in increased collection and disposal costs, as well as a reduction in the design life of the new landfill. The uncertainties inherent in projecting waste tonnages and the effects of variables such as composition of the additional MSW counter an increase of less than three percent. There is a necessary relationship between generation and capacity.

To determine the significance of cumulative impacts, the total solid waste generated by other proposed developments is added to each of the GLUP alternatives. If the total predicted solid waste generated is substantial, it would be considered a significant impact on Guam's solid waste infrastructure.

### 4.13.2 Potential Impacts and Proposed Mitigation

For each parcel, the generated solid waste was calculated based on proposed land use(s) and daily rate factors. The daily rate factors used in this analysis are summarized in Table 4.13-2.

**Table 4.13-2: Solid Waste Generation - Daily Rate Factors**

Land Use (unit variable)	Daily Rate	Reference
Resort, Hotel, Guest House (rooms)	4.61 lbs/room/d (2.09 kg/room/d)	Handbook of Environmental Engineering
Residential (dwelling unit)	10.8 lbs/du/d (4.90 kg/du/d)	Handbook of Environmental Engineering
Golf Course Clubhouse (floor area) (sf /m <sup>2</sup> )	0.005 lb/sf/d (0.025 kg/m <sup>2</sup> /d)	Solid Waste Disposal, NAVFACENGCOM DM 5.10
Commercial Building (floor area) (sf /m <sup>2</sup> )	0.005 lb/sf/d (0.025 kg/m <sup>2</sup> /d)	Solid Waste Disposal, NAVFACENGCOM DM 5.10
Industrial Building (floor area) (sf /m <sup>2</sup> )	0.001 lb/sf/d (0.005 kg/m <sup>2</sup> /d)	Solid Waste Disposal, NAVFACENGCOM DM 5.10
Park/Recreation Facilities (floor area) (sf /m <sup>2</sup> )	0.003 lb/sf/d (0.015 kg/m <sup>2</sup> /d)	Solid Waste Disposal, NAVFACENGCOM DM 5.10
Aquaculture Facility (floor area) (sf /m <sup>2</sup> )	0.005 lb/sf/d (0.025 kg/m <sup>2</sup> /d)	Solid Waste Disposal, NAVFACENGCOM DM 5.10

Similar to the water and wastewater analyses, the impact to be measured is the cumulative impact of all the parcels being developed. Table 4.13-3 summarizes the predicted total solid waste generated for each alternative.

**Table 4.13-3: Predicted Solid Waste Generation by Alternative**

Alternative	Solid Waste Generated	
	Tons/day	Metric tons/day
Preferred	15.45	14.02
Lower Intensity	8.06	7.31
Higher Intensity	29.76	27.00
"No Action"	Negligible	Negligible

The predicted solid waste generated by the Preferred Alternative would not be a significant impact on Guam's future landfill capacity as the proposed reuse would generate less than 3 percent of the total MSW generation in 2008. The Lower Intensity Alternative would generate less solid waste and would not cause a significant impact. The predicted solid waste generated by the Higher Intensity Alternative represents less than 5 percent of the 2008 Total MSW Generation and would not cause the landfill to reach its planned capacity or require development of another landfill. Therefore, there is no significant impact on Guam's solid waste infrastructure due to development under any of the reuse alternatives.

Under the "No Action" Alternative, small amounts of solid waste would be generated by maintenance activities but the effect would be negligible.

The solid waste disposal challenge on Guam resulting from the impending closure of Ordot Sanitary Landfill must be addressed whether the GLUP parcels are developed or not. The ISWMP must be implemented so that new solid waste facilities, whether they consist of a sanitary landfill, a waste-to-energy plant, a centralized recycling facility, or some combination of these, provide sufficient reserve capacity for future population and economic growth on the island.

### 4.13.3 Cumulative Impacts

All solid waste impacts are cumulative because solid waste must be disposed of within the capacity of existing or planned facilities serving the island. It is assumed that development of the GLUP parcels would be competing with other new developments for landfill capacity. To determine if the overall developments would significantly impact the landfill's capacity, a cumulative impacts analysis was conducted.

For purposes of this analysis, the new developments, as listed in Section 4.15.4, were added to the three GLUP alternatives to determine a cumulative impact. For Tiyan, the alternative with the highest solid waste generated was used in this analysis. The cumulative impacts of each GLUP alternative together with new developments are tabulated in Table 4.13-4.

**Table 4.13-4: Cumulative Solid Waste Impacts**

Land Use Alternative	Solid Waste Generated - Tons/day (metric tons/day)		
	GLUP development	New developments	Cumulative Impact
Preferred	15.45 (14.02)	10.31 (9.36)	25.76 (23.38)
Lower Intensity	8.06 (7.31)	10.31 (9.36)	18.37 (16.67)
Higher Intensity	29.76 (27.00)	10.31 (9.36)	40.07 (36.36)
"No Action"	No cumulative impacts		

The cumulative solid waste impacts of the Higher Intensity Alternative could decrease the life-span of the new landfill. Cumulative solid waste generation under this alternative would represent over 5 percent of the 2008 Total Forecast MSW Generation. Mitigation measures would reduce this impact to less than significant. Implementation of ISWMP objectives to promote the reuse, recovery, and recycling of solid wastes would enhance future disposal capacity. The long-range plan to build a waste-to-energy conversion facility by January 1, 2009, would provide additional capacity. The Preferred, Lower Intensity, and "No Action" alternatives would not substantially contribute to cumulative waste generation.

### 4.13.4 Compliance/Consistency with Applicable Laws and Regulations

All applicable laws and regulations regarding collection (Guam P.L. 23-64) and disposal (Guam P.L. 14-22 and 23-64; U.S. P.L. 91-512, Federal Solid Waste Disposal Act) of solid wastes must be complied with during the development and operational phases of the GLUP reuse.

## 4.14 ELECTRICAL SUPPLY AND ENERGY USE

Development of the GLUP parcels would not have a significant impact on the island's electrical generating capacity under any of the alternatives if necessary generation and transmission facilities are phased in with reuse. However, in combination with other planned developments, there would be a significant cumulative impacts under all reuse alternatives.

### 4.14.1 Significance Criteria

Should any of the alternatives exceed Guam Power Authority's (GPA's) generating capacity (requiring construction or expansion of power plants), the impact would be considered significant.

### 4.14.2 Methodology

Electrical demand estimates were prepared for each region under each alternative. Demand factors were extracted from NAVFAC P-80 (*Facility Planning Criteria for Navy and Marine Corps Shore Installations*, Navy Facility Engineering Command, October 1992). These demand factors are identified in NAVFAC P-80 as representing "maximum demand" for broad planning purposes.

The demand factors were applied to each land use for each parcel to produce maximum estimates of total electrical demand for the alternatives. The projected annual energy consumption for each parcel was developed by applying estimated daily durations to the power demand estimates.

Currently, GPA is revising its forecasting model used to determine electrical supply needs based on electrical demands. The model is based on visitor arrivals to forecast demands to the year 2015. Since the forecast model and GPA's resource plans are not finalized, GPA's engineers were consulted to determine the impact of the reuse alternatives on GPA's future supply plans. The electrical demands and energy consumption of the proposed action and alternatives were provided to GPA engineers to incorporate into their future demand and supply models.

GPA compared the energy requirements of the GLUP reuse alternatives with the GPA five-year energy sales growth projection for fiscal year 2002 through 2006. If the GLUP energy requirements do not exceed GPA's five-year energy sales projections, there would be no impact on GPA's infrastructure development plans. If GLUP requirements do exceed the sales projection, then GPA would model the net additional capacity requirements to determine an optimal generating capacity expansion plan. GPA used the electrical demand of the Higher Intensity Alternative in its analyses and modeled it as a general large-demand class sales addition spread over five years from fiscal year 2002 to 2006.

### 4.14.3 Potential Impacts and Proposed Mitigation

Since 100 percent of the island's electrical power is provided by GPA, the impacts on electrical demand are considered island-wide, as opposed to regional or site-specific. The estimated maximum electrical demand and energy consumption for each alternative are presented in Table 4.14-1.

**Table 4.14-1: Electrical Demand and Annual Consumption Estimates for Each Alternative**

Land Use Alternative	Demand (MW)	Annual Consumption (MWh/yr)
Preferred	21.74	95,207
Lower Intensity	12.07	52,878
Higher Intensity	40.56	177,640
"No Action"	negligible	negligible

According to GPA's analysis, the demand of each reuse alternative does not exceed the GPA five-year energy sales projections. Therefore, there would be no significant impact on GPA's electrical generating capacity due to the proposed action or alternatives. The "No Action" Alternative would have no effect on GPA's electrical supply.

Accommodating the projected increase in electrical power consumption would require development of necessary generation and transmission facilities in phase with the reuse plans. Implementation of an energy conservation program for the GLUP parcels is another viable measure. A detailed analysis of secondary infrastructure impacts and proposal of mitigation measures, such as the increased importation of fuel oil to Guam or development of alternative power generation facilities, is beyond the scope of the EIS.

Construction of major electrical infrastructure would be required for all of the alternatives. Substations may be required for the larger developments, such as the FAA Housing and Barrigada parcels. Site specific demands, to be determined in the design phase, would determine locations and sizes. A substation would require approximately 1 acre (0.4 hectare) of land. GPA would determine the preferred locations.

Specific development plans must address the requirements for electrical transmission easements and the need for either overhead or underground facilities. Underground transmission facilities, while much more costly, are less intrusive and considerably more resistant to typhoons and earthquakes, both of which are natural hazards on Guam.

Increased generation and transmission capacity would continue to be the responsibility of GPA. The provision of adequate land parcels and easements for substations and transmission lines would be the responsibility of the appropriate GovGuam agencies. The development and implementation of a comprehensive energy conservation program for the GLUP reuse would require cooperation between GPA and other GovGuam agencies.

#### **4.14.4 Cumulative Impacts**

Due to the nature of electrical power generation, all increases in demand for peak generating capacity and in total electrical energy consumption are considered cumulative. If total peak demand resulting from the proposed action combined with existing or planned developments exceeds generating capacity, the impact would be significant. Generating capacity would need to be increased or peak demands would not be met.

It is assumed that development of the GLUP parcels would compete with other developments on Guam for electrical supply. Several new hotels have been completed recently or are expected to be completed before 2005. In addition, federal property located at Tiyan (NAS Agana) is proposed for disposal and reuse. To determine if these other developments combined with the proposed action or alternatives would significantly impact the island's electrical supply, an analysis of cumulative impacts was conducted by GPA.

The largest impact to the electrical supply would come from new hotels and the Tiyan redevelopment. For purposes of this analysis, electrical demand of the total new or proposed hotels plus the "highest demand" estimates for Tiyan were added to each of the three reuse alternatives to determine the cumulative impact.

According to GPA's analysis, the combined total of the reuse alternatives and new developments would significantly impact GPA's current generating capacity and expansion plans. Without GLUP reuse and the new developments, GPA plans to construct a new modular medium speed diesel generating plant in the year 2008. With the reuse alternatives and new developments, the need for additional generating capacity is moved up from 2006 to 2004 or from 2008 to 2005, depending upon the retirement schedule for existing generating equipment. In order to mitigate impacts, the cumulative requirements indicate that GPA would need to add another 60 to 68 MW of capacity through fiscal year 2015 to the GPA baseline capacity.

Total electrical energy consumption translates directly to fuel consumption. Power plants on Guam are typically configured to burn fuel oil. An increase in electrical consumption would also require an increase in fuel oil acquisition, transportation, and handling to supply the generating facilities.

#### **4.14.5 Compliance/Consistency with Applicable Laws and Regulations**

Compliance with all laws and regulations applicable to the production, distribution, and consumption of electrical energy is required for development of the GLUP parcels.

### **4.15 SOCIOECONOMICS**

No significant impacts on Guam's socioeconomic environment would occur under the reuse alternatives. With all reuse alternatives, there would be a substantial increase in Barrigada's population associated with the proposed housing development which may affect public services. There would be an adverse impact on Guam's overbuilt commercial and industrial real estate markets due to new development.

For purposes of the socioeconomic analysis, it is assumed that disposal and reuse would occur within 10 years from the baseline year of 1995. The economic analysis considers both direct and indirect impacts of disposal and the planned development activities on the local economy. Economic growth is highly contingent on the recovery of the Japanese economy and increased federal spending.

The analysis uses current estimated costs and does not consider the effect of inflation on future development costs. Ultimate costs would depend upon when construction takes place, as yet unknown, and inflation rates at that time. Inflation rates have varied markedly on Guam, so considering inflation as a factor—especially over the long term—would tend to distort construction cost projections.

It is also assumed that economic, social, and cultural impacts, both positive and negative, would generally be felt island wide, given Guam's small geographic size and single local government.

#### **4.15.1 Significance Criteria**

Socioeconomic impacts would be significant under the following circumstances:

- Change in the number of on-site jobs or in the share of jobs island wide that would either (a) cause a substantial rise in regional or island-wide unemployment, or (b) create direct or indirect jobs that could not be filled by the current population and hence result in a major in-migration of new residents to fill those jobs.
- Changes in the demand for housing or commercial or industrial space causing substantial dislocation in the real estate market, reflected by accelerated price increases or decreases and vacancy rates below or above historic levels.
- Interference with neighboring businesses or the regional economy, such that expenditures by government agencies could not eventually be balanced by tax revenue collections.
- Substantial adverse social or cultural impacts; for example, adverse impacts on cultural practices or increases in inter-ethnic conflicts.
- Disproportionately high and adverse environmental effects on minority and/or low income populations.

#### **4.15.2 Potential Impacts and Proposed Mitigation**

##### **4.15.2.1 Population, Employment, and Social Impacts**

Changes in population and the generation of jobs and income would result from the proposed disposal and subsequent reuse of the GLUP parcels. These changes are discussed in more detail in the following sections since they would be associated with resort, residential,

commercial, and industrial development. Although no significant impacts would result from the proposed action or alternatives, there is a potential for the following adverse impacts:

- Substantial population increases beyond those attributed to natural growth are anticipated for the Barrigada region under all reuse alternatives. Addressing the problems associated with a large increase in regional population would require long-range planning by GovGuam to assure adequate schools, police and fire protection, roads, and other infrastructure to serve the new communities.
- It is anticipated that jobs generated by commercial and industrial activities under the Preferred and Lower Intensity alternatives could be filled by Guam residents, assuming normal population growth, and particularly since these new jobs would be spread out over time. The Higher Intensity Alternative, however, could require an influx of workers from off-island if the estimated 1.5 million square feet (139,355 square meters) of commercial or industrial space are added during the next 10 years and leased by new businesses. There would be no need for in-migrants to fill jobs in cases where existing businesses relocate to new buildings, which is what is happening now.
- Development of the Higher Intensity Alternative is unlikely to reach full build-out in 10 years, further minimizing the employment of in-migrants. Off-island workers would primarily come from the U.S. mainland, Hawaii, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, and certain other Pacific Islands. This is due to the lack of any visa or immigration requirements for individuals from these locations.
- Potential social impacts associated with new arrivals to Guam may stem from the stress of adjusting to a new environment, aggravated by difficulties in finding adequate and affordable housing and the high cost of living. Family problems may arise, requiring responses from social service agencies, schools, health care providers, and the law enforcement and justice systems.

Assuming that new employment would occur over an extended period, there is sufficient time for long-range planning to assure that an adequate work force is available when needed. Training programs for local residents to fill the new position could help minimize the need for off-island workers, and employee support services could help smooth the transition for workers relocating to Guam. The latter may include assistance with finding housing, employment for spouses, and child care, as well as informing new arrivals of resources available in the community. Therefore, social impacts would not be significant.

Under the "No Action" Alternative, there would be no impacts relative to population, employment, or the social environment.

#### 4.15.2.2 Economic Impact of Development

##### Resort Development

The following table summarizes and compares tax revenue, employment, and income to be generated during construction and operations by the various alternatives for resort development. Under the Preferred Alternative, a 128-room hotel and 18-hole golf course

would be developed on the FAA Housing parcel. A lower intensity development would reduce the number of rooms to 64 and eliminate the golf course, while a higher intensity resort development would be comprised of a 192-room hotel and 27-hole golf course. Bed and breakfast or motel type accommodations are included in all of the reuse alternatives, to be located in other regions.

**Table 4.15-1: Estimated Tax Revenue, Employment, and Income from Resort Development**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	"No Action"
Number of resort hotel rooms	128	64	192	0
Number of bed & breakfast (B&B) and motel rooms	32	32	160	0
Number of golf holes	18	0	27	0
Total construction costs	\$24,760,000	\$3,030,000	\$41,000,000	\$0
Gross receipt taxes from all hotel and golf course construction revenue	\$990,400	\$121,200	\$1,640,000	\$0
Total construction payroll (30% of total cost)	\$7,428,000	\$909,000	\$12,300,000	\$0
Total construction payroll withholding taxes (15% rate)	\$1,114,200	\$136,350	\$1,845,000	\$0
Annual gross receipts taxes from all hotel operations	\$170,000	\$100,000	\$300,000	\$0
Annual occupancy taxes from all hotel operations	\$411,000	\$275,000	\$660,000	\$0
Golf course annual gross receipts taxes	\$150,000	No golf course	\$200,000	\$0
Hotel or B&B: number of employees	162	48	276	0
Golf course: number of employees	60-100	No golf course	80-120	0
Total annual payroll for all hotel and golf course operations	\$3,000,000	\$600,000	\$5,000,000	\$0
Total payroll withholding taxes from all hotel and golf course operations	\$450,000	\$90,000	\$750,000	\$0

Source: Ernst & Young (December 1998)

The data presented in Table 4.15-1 are based on the following assumptions:

- The estimated construction costs assume an average construction cost of \$45,000 per room for the resort hotel, \$30,000 per room for the bed and breakfast or motel, and approximately \$1 million per golf hole.
- Construction payroll is estimated at 30 percent of total cost, and a 15 percent effective income tax rate is assumed in estimating payroll withholding taxes.
- To estimate annual room, food, and beverage revenues for the resort hotel, an 80 percent occupancy at an average rate of \$100 per night was assumed. A lower room rate was assumed for the bed and breakfast or motel.
- To estimate number of hotel employees, the current employee to room ratio of 1.19 was used, as reported by the Guam Hotel and Restaurant Association in May 1998.
- Payroll during operations is estimated based on the average weekly earnings of \$252.86 for hospitality service employees in March 1998.
- Golf course revenue was calculated by assuming an average of \$75 per round and an annual average of 50,000 rounds.

**Preferred Alternative.** With implementation of the Preferred Alternative, adding 160 hotel rooms to the island's existing inventory of approximately 7,000 rooms would not have a significant impact on the market. Within a 10-year time frame, a new resort project may be feasible upon recovery of the Asian economies.

**Lower Intensity Alternative.** Under the Lower Intensity Alternative, a total of 96 rooms would be added to the island's hotel room inventory. This is not expected to significantly impact existing businesses. It is noted that small hotels located outside of the Tumon-Tamuning area have been only mildly successful, relying heavily on military personnel who use their temporary living allowances upon moving to Guam.

**Higher Intensity Alternative.** Existing businesses would not be significantly impacted by development of 192 rooms on the FAA Housing parcel under the Higher Intensity Alternative. However, the smaller accommodations proposed for Barrigada and the central region are not expected to perform well given Guam's current economic conditions.

**"No Action" Alternative.** With no proposed development, there would be no impact.

### **Residential Development**

It is assumed that proposed housing under all three reuse alternatives would be a mix of small (1,200 sf [111.5 square meters]), affordable, single-family units with an average selling price of approximately \$130,000, and large, single- and multi-family units with an average price of \$300,000 up to \$500,000 at the NAS Officers Housing parcel. Table 4.15-2 summarizes and compares estimated new home sale revenues, gross receipt taxes on that revenue, housing construction costs (assuming a 25 percent profit margin), number of jobs generated during construction, and payroll taxes to be collected by the local government for each alternative.

**Preferred Alternative.** Given existing housing stock, present demand, planned projects, and projected population growth, demand for the number of units under the Preferred Alternative is not expected to materialize until 10 years after 1995. Even if current demand were to triple to approximately 150 units per year, it would take 17 years after 1995 before all of the proposed units could be developed and sold. Building additional phases in less time under the Preferred Alternative may cause dislocation in the housing market in this region.

Most residential development—1,770 units—would occur in the Barrigada region. Barrigada's 1995 population is an estimated 10,800, based on the 1990 census and a 2.5 percent growth rate. Using the average of approximately four persons per household (the 1990 census average for Guam), the population of Barrigada would increase by 6,000 at buildout (2005), or more than 50 percent. This would be a significant increase. Using a 3 percent growth rate, the Barrigada population would not be expected to reach 16,000 until 2012, without the development. For the other regions, the number of residential units is considered reasonable if development occurs over a 10-year time frame, and associated increases in population would not cause a significant impact.

**Table 4.15-2: Estimated Tax Revenue, Employment, and Income from Residential Development**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	"No Action"
Number of housing units	2,565	1,298	4,782	0
New home sales revenue	\$367,000,000	\$188,000,000	\$6,334,000,000	\$0
Gross receipt taxes on home sales	\$14,400,000	\$7,540,000	\$25,500,000	\$0
Total construction cost	\$276,000,000	\$141,500,000	\$474,800,000	\$0
Gross receipt taxes from construction revenue	\$11,040,000	\$5,680,000	\$19,000,000	\$0
Total construction payroll (30% of total cost)	\$82,800,000	\$42,450,000	\$142,400,000	\$0
Total construction payroll withholding taxes (15% rate)	\$12,420,000	\$6,367,500	\$21,360,000	\$0

Source: Ernst & Young (December 1998)

**Lower Intensity Alternative.** Using the average of four persons per household, 838 single-family dwelling units would translate into an additional 3,352 people in Barrigada, which would be a significant increase of 32 percent over the 1995 population of the village. With a 3 percent historical growth rate, this growth would not be expected to occur until 2012.

Population growth in the other northern and central regions due to housing development on the reuse parcels is not expected to cause a significant impact.

**Higher Intensity Alternative.** The total number of housing units at buildout would accommodate 19,128 individuals based on an average of four persons per household. Buildout would occur over a much longer time frame, for example, over a 20- to 30-year period. As in the other alternatives, the increase in population would be substantial in Barrigada: 11,760 additional residents, which is more than double the 1995 estimated population. GovGuam could minimize impacts in Barrigada through long-range planning to assure adequate public services.

**"No Action" Alternative.** There would be no tax revenue associated with "No Action" Alternative and no impact on the housing market.

### **Commercial and Industrial Development**

Table 4.15-3 summarizes and compares revenue, taxes, employment, and income from construction and operation of commercial and industrial facilities under the various alternatives.

These figures assume the following:

- Average construction cost of \$80 per square foot for commercial buildings and an additional \$25 per square foot for commercial leasehold improvements.
- Average construction cost of \$40 per square foot for industrial buildings.
- Average base rental rates of \$2.00 per square foot for commercial property and \$0.50 per square foot for industrial property.
- Annual sales in the range of \$100 to \$300 per square foot.
- Average of three employees per 1,000 square feet (93 square meters) of commercial and industrial space.
- Average monthly earnings of \$374.15 for retail and wholesale trade employees (March 1998 figures).
- Effective income tax rate of 15 percent.

For all reuse alternatives, no significant impacts would occur. Impacts on the commercial and industrial real estate market due to surplus inventory can be avoided by phasing development over a longer period in response to market demand.

**Preferred Alternative.** Commercial and industrial facilities in Guam are currently over-built, so demand for new buildings would not be expected prior to 2005. Without new demand, the commercial and industrial real estate markets would be adversely affected.

**Table 4.15-3: Estimated Tax Revenue, Employment, and Income from Commercial and Industrial Development**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	"No Action"
Square feet (square meters) of commercial and industrial development	496,000 sf (46,079 m <sup>2</sup> )	272,500 sf (25,316 m <sup>2</sup> )	1,360,600 sf (126,404 m <sup>2</sup> )	0
Total construction cost	\$42,300,000	\$23,900,000	\$85,900,000	\$0
Gross receipt taxes from construction revenue	\$1,692,000	\$956,000	\$3,436,000	\$0
Total construction payroll (30% of total cost)	\$12,900,000	\$7,170,000	\$25,770,000	\$0
Total construction payroll withholding taxes (15% rate)	\$1,903,500	\$1,075,500	\$3,685,500	\$0
Annual business receipts	\$49 - 149 million	\$27 - 82 million	\$136 - 408 million	\$0
Annual gross receipts taxes from business receipts	\$2 - 6 million	\$1 - 3 million	\$5 - 17 million	\$0
Annual rental revenue	\$9,568,000	\$5,678,000	\$22,326,000	\$0
Annual gross receipts taxes from rental revenue	\$398,000	\$236,500	\$893,000	\$0
Number of employees for operations	1,488	818	4,081	0
Total annual payroll for operations	\$28,700,000	\$15,700,000	\$73,000,000	\$0
Total payroll withholding taxes (15% rate)	\$4,305,000	\$2,300,000	\$10,950,000	\$0

Source: Ernst &amp; Young (December 1998)

**Lower Intensity Alternative.** Commercial and industrial facilities in the Lower Intensity Alternative would be less than half the space developed under the Preferred Alternative. Even at this level, there would be little demand for new buildings over the next five years. A five- to 10-year buildout period may be realistic.

**Higher Intensity Alternative.** More than 1.2 million square feet would be developed under the Higher Intensity Alternative, more than double the Preferred Alternative. Without new demand, the existing real estate market would be severely affected and buildout would not occur in the short or medium term. A 10- to 20-year development period, at a minimum, would be more feasible.

**"No Action" Alternative.** There would be no impacts.

### Summary

A comparison of the potential economic impacts of resort, residential, commercial, and industrial development under the various alternatives is presented in Table 4.15-4.

**Table 4.15-4 Comparison of Economic Impacts**

	Preferred Alternative	Lower Intensity Alternative	Higher Intensity Alternative	"No Action"
Total construction costs	\$343,060,000	\$168,000,000	\$601,000,000	\$0
Annual business revenues	\$57 - 157 million	\$30 - 85 million	\$144 - 420 million	\$0
Annual rental receipts	\$9,500,000	\$5,300,000	\$22,300,000	\$0
Gross receipt taxes from:				
Construction revenue	\$13,000,000	\$6,800,000	\$24,000,000	\$0
Annual business receipts	\$2 - 6 million	\$1 - 3 million	\$5 - 17 million	\$0
Annual rental receipts	\$372,000	\$212,000	\$890,000	\$0
Payroll from:				
Construction	\$103,128,000	\$50,525,000	\$180,70,000	\$0
Annual business activities	\$31,700,000	\$16,700,000	\$78,000,000	\$0
Payroll income taxes from:				
Construction	\$15,400,000	\$7,580,000	\$27,000,000	\$0
Annual business activities	\$5,300,000	\$1,300,000	\$3,250,000	\$0

Source: Ernst & Young (December 1998)

### 4.15.3 Cumulative Impacts

Socioeconomic impacts of reuse of the GLUP parcels would be cumulative since development projects would be competing with similar existing and future projects in a limited market. There is the cumulative impact of all anticipated GLUP projects, which may be individually minor but collectively have more impact, as well as other projects on the island. Some of the larger known projects are listed below:

- Redevelopment of NAS Agana, to include primarily commercial and industrial facilities and expansion of the airport.
- Redevelopment of the Naval Ship Repair Facility, now known as the Guam Shipyard, for industrial activities. The Preferred Alternative is continuation of existing Guam Shipyard operations with no new development in the near term.
- Hotels under construction in 1998: Outrigger Resort (600 rooms); Royal Riviera Hotel (300 rooms); Pacific Island Club (292-room expansion); Santa Fe Inn on the Bay in Tamuning (120 rooms); Accion Hotel Guam in Yona (150 rooms, Phase 1).
- Announced hotel projects: Tomen Development business hotel (120 rooms); Pacific Hacienda (77 rooms); Sky City Marianas (160 rooms).
- Planned golf courses approved by the Guam Land Use Commission: Leo Palace Resort in Yona (additional 18 holes); Maruhan Corp. in Yona (18 holes); Marbo Cave Resort in Mangilao (18-hole course with condominiums and shopping center); Agat Lake & Country Club (18 holes); Dan Dan Estate & Country Club in Inarajan (27-hole course with hotel and residential units); Johyo Sangyo Resort in Tamuning (9-hole course with 719 condominiums and 157-room hotel); Yona Country Club (18 holes); Togcha Beach Country Club in Yona (18 holes); Talofoto Garden Golf Course (18 holes); Kurson Guahan Golf Course in Talofoto (18-hole course with hotel and condominiums); Lonfit New Town in Asan (18-hole course with single-family units, condominiums, and shopping center).
- Affordable housing under construction in 1998: Lada Estates in Dededo (400 units); Laquina Estates in Talofoto (78 single-family units); Goring Villa Estates in Yigo (56 units).
- Commercial retail projects under construction in 1998: Micronesia Mall (213,000-sf [19,788-square meter] expansion); Town Center in Dededo (25 retail shops, restaurant, and department store); Agat Point Commercial and Retail Center (18,000 sf [1,672 square meters] [first two phases]).

There would be cumulative adverse effects on the commercial and industrial real estate markets under all reuse alternatives due to a surplus of inventory. These effects could be alleviated by extending the development period over a longer time period and proceeding with development in phases according to market demand. Social impacts—particularly combined with the Higher Intensity Alternative resulting from the need to fill new commercial and industrial jobs with large numbers of off-island workers—would be more severe on a cumulative basis. These impacts would not be significant and could be minimized through appropriate planning.

## **4.15.4 Compliance/Consistency with Applicable Laws and Regulations**

### **4.15.4.1 Environmental Justice**

Under Executive Order 12898, dated February 11, 1994, federal agencies are required to address the potential for disproportionately high and adverse environmental effects of their actions on minority and low-income populations. Agencies are required to ensure that their programs and activities that affect human health or the environment do not directly or indirectly use criteria, methods, or practices that discriminate on the basis of race, color, or national origin. NEPA documents are specifically required to analyze effects of federal actions on minority and low-income populations and, whenever feasible, to develop mitigation measures to address significant and adverse effects on such communities. In addition, the Executive Order requires provisions of opportunities for community input in the NEPA process and adequate access to public information relating to human health or environmental planning, regulation, and enforcement.

In response to the Executive Order, this document provides a demographic frame of reference for the setting in which the GLUP reuse parcels are located. Census data on income and race or ethnicity in the regions of influence were analyzed (Section 3.15).

The process used by Navy in its environmental documentation is being conducted in a manner that does not discriminate against low-income or minority populations on Guam. Specifically, none of the criteria used to evaluate the various alternatives or the significance of impacts discriminates on the basis of race, color, national origin, or income.

This document assesses human health, socioeconomic, and environmental effects of the various alternatives. The analysis reveals that the disposal and subsequent reuse of the subject parcels may have significant impacts on the island's public services and infrastructure—specifically school enrollment and roadway capacities. These are conditions felt island wide, and traffic congestion is more pronounced in heavily populated and developed areas. Without infrastructure improvements, any new major development would add to the demand and burden already inadequate systems, such as power plants and landfills. However, none of these impacts would fall disproportionately on one particular group.

Executive Order 12898 requires federal agencies to assure opportunities for community input into the NEPA process and to provide adequate access to public information. A public workshop was held during scoping, and a public hearing will be conducted during the DEIS comment period. Opportunities for written comments are also provided by the NEPA process.

## **4.16 PUBLIC SERVICES**

This section analyzes impacts on public services including schools, parks, health care, police and fire protection, and civil defense. Most public schools on Guam are currently operating at or over capacity. With the development of new housing under all of the reuse alternatives, there will be a substantial increase in or significant impact on school enrollment in three districts, which could be mitigated through long-term planning to fund new schools. No significant impacts are expected in the other public services under any of the alternatives,

although cumulative impacts on health care, police, fire protection, and civil defense could be significant. Long-range planning would help to mitigate these impacts.

#### 4.16.1 Significance Criteria

The proposed action and alternatives would have a significant impact on public services if they:

- result in current public service capacity to be exceeded such that accepted levels of service could not be maintained; or
- require additional public facilities to be developed and staffing levels increased beyond those existing or currently planned.

#### 4.16.2 Potential Impacts and Proposed Mitigation

##### 4.16.2.1 Schools

The GLUP reuse alternatives would contribute to a significant regional impact on the northern, Barrigada, and Nimitz Hill school districts, which could be mitigated by new school construction. Public schools throughout Guam are currently overcrowded.

Under all reuse alternatives, the regional student population would substantially increase, particularly in the Kattan (Barrigada) school district. Over 1,900 new students would be added to the Barrigada region under the Preferred Alternative. Increases in the Lagu (northern region) and Luchan (Nimitz Hill) school districts would also be significant, increasing by 437 students and 289 students, respectively, due to the construction of affordable housing in these regions. The majority of new students would come from other areas of Guam.

Since most schools are at or over capacity, the reuse alternatives could result in further overcrowding. The GEDA *Reuse Plan* does not propose the development of new schools on GLUP properties. Guam DOE is preparing a master plan to evaluate current capacity, identify the need for new schools, and recommend school locations. As the proposed housing projects would be constructed over a long period of time and constructed in phases to meet demand, DOE would have time to consider population characteristics and growth in planning new schools. Pending availability of funds, the overcrowding could be mitigated by construction of new schools.

The Lower Intensity Alternative would increase student population by approximately 1,420 students, or 4 percent of the current DOE enrollment. The Higher Intensity Alternative would increase student population by approximately 4,223 students, or 13 percent of the current DOE enrollment. (These figures are based on the 1990 Census in which approximately 28 percent of the population was of school age.) The "No Action" Alternative would not involve re-occupation or construction of housing units and would not generate population growth. The school districts would not be affected.

### **4.16.2.2 Parks and Recreation**

The reuse alternatives would not cause significant impacts on parks and recreation. The effect would be beneficial under all reuse alternatives with parks made available for public use. Up to 119,631 square feet (11,114 square meters) of new recreational facilities would potentially be open to the public and over 900 acres (364.2 hectares) of conservation or recreation or open space would be preserved under the Preferred Alternative. Community open space would also be set aside in residential developments according to *I Tano'ta* performance guidelines.

Creation of diverse park facilities such as expansion of the Barrigada Sports Complex, Rizal/Afleje Beach Park, and a youth camp at the Navy Ordnance Annex property, along with development of hiking trails, would help to meet the demands of the local population. In addition, a golf course at the FAA Housing property could potentially be available for public play under the Preferred and Higher Intensity alternatives.

Under the Lower Intensity Alternative, approximately 75,000 sf (6,968 square meters) of recreational facilities and 1,541 acres (624 hectares) of open space are indicated. Under the Higher Intensity Alternative, recreational facilities increase to approximately 290,500 sf (26,988 square meters). However, under the Higher Intensity Alternative the Rizal/Afleje Beach Park would be reduced to allow for siting of a GPA power plant.

No new recreational facilities would be developed under the "No Action" Alternative. This represents no change compared to baseline conditions. The existing leases of Navy property to GovGuam for recreational uses are expected to continue.

### **4.16.2.3 Health Care**

None of the alternatives being evaluated would significantly impact Guam's existing and planned health care facilities. Private health care providers are currently responding to growing demand with expanded services. The redevelopment of GLUP properties involves incremental increases and would occur over an extended period and would not, by itself, place a burden on the health care system.

With the expansion of health care services, the commercial facilities proposed for the Northern and Barrigada regions could possibly house additional clinics and private health care providers. Presently, many of the clinics are located in retail centers in the villages of Tamuning and Harmon.

No impact on the Guam's health care services would occur under the "No Action" Alternative. As no development would occur on the GLUP properties, there would be no population growth or corresponding increase in demand for health care services.

### **4.16.2.4 Public Safety: Police, Fire Protection, and Civil Defense**

Under the reuse alternatives, no significant impacts to police, fire protection, or civil defense services would result, assuming that GovGuam is able to incrementally respond to increased

demands for these services. As the population of the redeveloped GLUP properties gradually increases, the requirements for emergency service would increase. Additional staff and facilities would be required before the existing systems reach a point where response time is inadequate. However, redevelopment of the properties would occur gradually over a long time period and would not be concentrated in a single municipality.

Establishment of new residential, commercial and industrial associated with all reuse alternatives are likely to add security and fire protection demands on the police and fire departments. Additional demands are expected near the FAA Housing and Barrigada parcels. A 10 to 20 percent increase in the size of police and fire department forces would be a reasonable estimate to cover additional staffing, equipment, and facilities.

Under the "No Action" Alternative, there would be no additional demand on Guam's police, fire, or civil defense services.

#### 4.16.3 Cumulative Impacts

**Schools.** There would be a significant cumulative impact in the northern, Barrigada, and Nimitz Hill school districts. Schools in those regions are currently overcrowded; the reuse alternatives along with other planned development and forecasted island population growth of approximately 3 percent per year would contribute to further overcrowding. This impact would occur due to an increase in students residing in new residential developments in those regions. Construction of new schools would be required to mitigate these impacts.

Military families have the option of sending their children to public, private, or DoDEA schools. Approximately 2,600 military children attend DoDEA schools. DoD is planning construction of a new combined elementary and middle school at Anderson AFB in place of an existing interim school. This school would potentially attract new students, slightly reducing the impact on elementary and middle school in the Northern and Barrigada regions.

**Parks and Recreation.** There would be no cumulative adverse effect on parks and recreation facilities due to the reuse alternatives. Additional park and open space provided by release of the GLUP properties would benefit the entire island community. Specific properties designated for park and recreation, historical and conservation use would enhance both national and territorial parks nearby, such as the War in the Pacific National Historical Park and Guam Veterans Cemetery.

**Health Care.** Given the high demand for health care services, there is a potential for redevelopment of GLUP properties to contribute to significant cumulative impacts on Guam's health care system, particularly if the island's economy and resident and visitor populations continue to grow. The private sector is responding with current expansion programs. To reduce potential impacts to nonsignificant levels, long-range planning is needed to facilitate future expansion.

**Police, Fire Protection, and Civil Defense.** The present level of service provided by the police and fire departments appears to be insufficient to meet growing demand. Cumulative impacts on public services could be significant with or without reuse. The GLUP property redevelopment is just one of many projects being considered. To prevent significant impacts,

long-range planning by GovGuam needs to take into account the cumulative effects of all development occurring on the island.

No significant impacts on public services would occur under the "No Action" Alternative.

#### **4.16.4 Compliance/Consistency with Applicable Laws and Regulations**

The Department of Parks and Recreation and Department of Agriculture drafted a *Master Plan for Recommended Parks* (February 20, 1996), which outlines important park resources on Guam. The proposed reuse of the FAA Housing parcel is consistent with applicable GovGuam Plans.

GovGuam Department of Parks and Recreation has identified the Dededo coastal areas from Hilaan to Harmon Communication Annex (Guam P.L. 103-339 properties) as having "high aesthetic value and containing important cultural and natural resources." It is proposed that this region be designated as a Territorial Park. The FAA Housing area is just north of this potential park site. Under the proposed alternatives, the FAA property's cliffs and natural and cultural resources would be preserved in conservation, complementing and extending resource protection along the coastline. Therefore, the proposed land use is compatible with the master plan recommendation.

### **4.17 ENVIRONMENTAL CONTAMINATION**

This section evaluates the conditions created by existing on-site environmental contamination described in Section 3.17. Environmental contamination creates the potential for adverse effects requiring mitigation or remediation prior to land use. Potential environmental concerns evaluated include storage tanks, hazardous materials or hazardous waste management, solid waste management, PCBs, asbestos, lead-based paint, radon, RCRA facilities, wastewater and storm water discharges and NPDES permits, pesticide management, oil-and-water separators, radioactive material, and mixed waste. Only the environmental issues determined to potentially impact human health or the environment or to impact site reuse are discussed below.

During the screening process, the following issues were deemed not significant and were not further analyzed (refer to Table 4.1-1):

- Potential environmental impacts due to the handling of hazardous materials and wastes (including herbicides or pesticides) during construction or due to operations on the GLUP parcels under the reuse alternatives are addressed through compliance with applicable federal and GovGuam laws and regulations (see Section 4.17.4.2).
- None of the parcels is encumbered by explosive safety quantity distance (ESQD) arcs.
- None of the parcels is subject to EMR or EMI hazards.

### 4.17.1 Significance Criteria

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process requires that remedial actions at the GLUP parcels must be protective of human health and the environment, must consider subsequent reuse of the property, and must include appropriate restrictions where necessary. Complying with CERCLA assures that the property is conveyed with adequate protections related to human health and the environment in conjunction with the planned land uses.

### 4.17.2 Potential Impacts and Proposed Mitigation

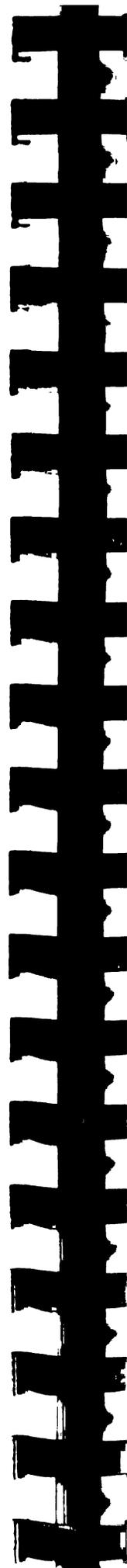
No significant impacts from existing contaminated areas would occur because existing areas of contamination and POIs must be identified and remediated to levels protective of human health and the environment (or have proven, effective remediation underway). Many of the existing areas of contamination and POIs have been successfully cleaned up or sampling data have indicated that they may be suitable for the proposed land uses. If cleanup is not completed prior to property conveyance, an amendment to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Section 334 of the Fiscal Year 1997 Defense Authorization Act) allows for conveyance of contaminated or potentially contaminated properties with the Governor's approval. In this case, the following conditions must be accomplished:

- agreement by the US EPA and GovGuam that the property is suitable for the intended use and that the intended use will protect human health and the environment;
- public notice and comment;
- property use restrictions, if necessary, to ensure that human health and the environment are protected and that the necessary remedial actions can take place;
- assurances from the federal government that transfer of the property will not substantially delay response actions at the property and that the federal government will continue any necessary response actions after transfer; and
- a federal budget request for adequate funding to complete the remedial actions on schedule.

Deed restrictions could ensure that future development of these areas such as reuse of landfill areas at the Barrigada parcels remain protective of human health and the environment. Navy will ensure that remediation is completed.

### 4.17.3 Cumulative Impacts

No significant cumulative impacts are expected to occur.



## **4.17.4 Compliance/Consistency with Applicable Laws and Regulations**

### **4.17.4.1 CERFA/CERCLA Environmental Compliance**

The Community Environmental Response Facilitation Act of 1992 (CERFA) P.L. 102-426, applies to real property controlled by DoD that is scheduled for property transfer. CERFA amends CERCLA for the purpose of identifying uncontaminated property that can be made available for reuse or reallocation in a cost-effective and timely manner. CERCLA gave the US EPA the responsibility for regulating the uncontrolled release of hazardous substances nationwide. The Superfund Amendments and Reauthorization Act of 1986 amended CERCLA so that it applies to all federal facilities.

In compliance with applicable federal laws and DoD policies, various EBSs have been completed for the sites discussed in this document. Based upon information presented in these EBSs, a BRAC Cleanup Plan (BCP) was prepared. The BCP provides the status of cleanup activities.

### **4.17.4.2 Resource Conservation and Recovery Act**

The 1976 Resource Conservation and Recovery Act (RCRA) was established to protect human health and the environment from hazards associated with solid and hazardous waste generation, transportation, treatment, storage and disposal. Subtitle C imposes specific requirements for developing spill contingency plans. RCRA also provides for the tracking of hazardous waste through a record-keeping system that requires the manifesting of hazardous waste shipments from the point of generation to ultimate disposal. Hazardous waste management will be performed in accordance with applicable regulations. Present and all future tenants will be responsible for their own hazardous substances or hazardous waste management programs including spill contingency planning.

### **4.17.4.3 Toxic Substance Control Act**

The Toxic Substances Control Act (TSCA) 15 U.S.C. §2601 *et. seq.*, and its associated regulations (found at 40 C.F.R. §702 to 799) subdivide the regulation of toxics into two components: "chemical control" and "hazard evaluation." Chemical control covers enforcement aspects related to specific chemicals under Section 6 of TSCA, including asbestos, PCBs, and chlorofluorocarbons (CFCs). Hazard evaluation refers to the various record keeping, reporting, and marketing submittal requirements specified in Sections 5, 8, 12, and 13 of TSCA.

### **4.17.4.4 Clean Air Act**

Section 176 of the Clean Air Act (CAA), 42 U.S.C §7401, prohibits any federal agency from engaging in, supporting, providing financial assistance for, licensing, permitting, or approving

any activity that does not conform to an applicable federal or state implementation plan. To implement the intent of Section 176 (c), federal conformity rules have been published and are provided in 40 C.F.R. §51 and 93. These rules are not applicable to the proposed action because (1) the transfer of property is exempt from the provisions of the rules; and (2) the conformity rules are only applicable in nonattainment and maintenance areas. The island of Guam is in attainment of the National Ambient Air Quality Standards (NAAQS), with the exception of small areas surrounding two electrical power plants outside of the project sites.

#### 4.17.4.5 Clean Water Act

The Clean Water Act (CWA), 33 U.S.C §1251, contains many regulatory programs to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Section 404 CWA, 33 U.S.C §1344, Discharges in Navigable Waters, limits the discharges of dredged or fill materials into navigable waters (and wetlands). After land transfer, the alternatives to develop a portion or the site as a marine or fishery terminal or other related industrial activities would require construction of additional outlets to Apra Harbor. Approval would be required from the U.S. Army Corps of Engineers and either US EPA or GEPA. Discharges of pollutants into surface waters of the U.S. (including storm water to oceans via outfalls) are controlled under the NPDES program, pursuant to Section 402 CWA. Future construction activities on the project sites involving 5 acres (2 hectares) or more would require NPDES General Permit coverage for discharges associated with construction activity dewatering and for hydrotesting.

### 4.18 PROTECTION OF CHILDREN FROM HEALTH AND SAFETY RISKS

Executive Order 13045 (April 21, 1997) requires that federal agencies make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. It also requires that agencies ensure that their policies, programs, activities, and standards address such risks.

The following issues require discussion of the potential for disproportionate effects on children:

- **Existing Environmental Contamination.** As explained in Sections 3.17 and 4.17 in this document, Navy will identify and remediate (or be in the process of remediating) existing areas of contamination to protect human health and the environment prior to property conveyance. A higher level of cleanup is required in areas slated for residential, recreational, and other more sensitive land uses. Hence, no disproportionate effects on children would be associated with the proposed action.
- **Radon.** As discussed in Section 3.1.7, the potential for elevated radon (concentrations in excess of the 4pCi/l screening level) exists due to the underlying geologic formation (Mariana Limestone). In accordance with DoD policy, the Navy has disclosed the locations of known elevated radon concentrations. DoD policy states that disclosure prior to conveyance meets the disclosure/action requirements of TSCA Subtitle III U.S.C. §2661-2671. Since disclosure has been made and the future users of the affected properties can

provide for adequate ventilation to mitigate radon concentrations, no disproportionate effects on children would be associated with the proposed action.

- **Lead Based Paint.** As discussed in Section 3.17, LBP surveys have been completed for structures anticipated for use as housing. Soil in the vicinity of proposed housing where LBP was identified was also sampled. No LBP was identified for the parcels anticipated for housing. A LBP survey was not completed for the cinder block building at the Rizal/Afleje Beach property. Since the building is not proposed for use as housing, no LBP survey is planned. Since LBP was not identified on buildings or in soil to which children will routinely be exposed, no disproportionate effects on children would be associated with the proposed action.

#### **4.19 RELATIONSHIP OF SHORT-TERM USES AND LONG-TERM PRODUCTIVITY**

Pending disposal of the subject GLUP parcels by Navy, some of the land is in use for various purposes, but most of the properties are vacant and unused. Short-term or interim uses include the following:

- N5 Barrigada outleases to: Barrigada municipality for use as a recreational area; GovGuam Department of Agriculture; Guam Army National Guard for training and maintenance facilities; and Hawaiian Rock Products for quarry support operations.
- Lease of the Rizal/Afleje Beach parcel to GovGuam for use as a park.
- Lease to GPA for electrical substations on portions of the Marine Drive Utility and Old Apra Heights parcels.
- Lease to GovGuam on Route 2A parcel for school bus parking.

The Preferred Alternative would continue use of all of the above activities, excluding the Route 2A parcel, which is proposed for commercial and office development and transfer of federal property to the National Guard Bureau in Barrigada.

Many of the GLUP reuse parcels would partially benefit Guam's economy in the long term. Conservation areas are considered valuable for their recreation potential and for the protection of natural and cultural resources.

The "No Action" Alternative would leave the property in caretaker status.

#### **4.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES**

The three reuse alternatives represent an irretrievable commitment of financial resources and development of land that would essentially be unavailable for other uses. Water and energy are two irretrievable resources that would have to be committed to the new developments. In

addition, clearing sites for construction would involve loss of existing vegetation, to be partially replaced by landscaping. No known or threatened plant species would be lost. Under the "No Action" Alternative, resources would be committed only to the maintenance of properties in caretaker status.

#### **4.21 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL**

Energy consumption would be required for the demolition and construction associated with the reuse alternatives. Such energy requirements would be short term. With buildout, electricity demand would increase. Annual electrical consumption of the reuse alternative would range from an estimated 52,878 MWh (Lower Intensity Alternative) to 172,908 MWh (Higher Intensity Alternative). Demolition of non-reusable buildings and renovation of older buildings scheduled for reuse may result in greater energy efficiency. Additionally, new and retrofitted buildings could be constructed with energy efficient systems, such as improved air conditioning systems, and could be more efficient in the long run.

To promote conservation efforts, construction and demolition debris could be recycled and reused to the maximum extent practicable. Clearing and grubbing waste could be reused as topsoil for landscaping and parks. Concrete and asphalt debris generated in demolition could be reclaimed for use in new construction on site or elsewhere.

#### **4.22 UNRESOLVED ISSUES**

There are no unresolved issues.

#### **4.23 SIGNIFICANT UNMITIGABLE IMPACTS**

A significant unmitigable traffic impact would occur due to unacceptable levels of service (LOS) at the northern region intersection of Route 1 (Marine Drive) and Route 16. This intersection would operate at unacceptable LOS with or without the proposed action. The unacceptable traffic condition at this intersection may result in exceedences of NAAQS for CO.

# Chapter 5

---

LIST OF PREPARERS

THE UNIVERSITY OF CHICAGO PRESS

## **CHAPTER FIVE**

### **LIST OF PREPARERS**

---

Listed below are employees of the Navy who are responsible for the preparation of this EIS. Responsibility for these documents is with Navy staff of the Pacific Division, Naval Facilities Engineering Command in Pearl Harbor, Hawaii. Included below are the identities and backgrounds of the principal preparers.

As in any other significant redevelopment project, substantial assistance and data analysis were provided by Navy and its consultants. The prime consultant was Belt Collins Hawaii. In accordance with CEQ 1506.5c, a written statement was submitted by the contractor, disclosing that it has no financial or other interests in the execution, outcome, or mitigation measures of the proposed disposal and reuse of surplus Navy properties on Guam.

In accordance with Section 1502.6 of CEQ regulations, the efforts of an interdisciplinary team consisting of technicians and experts in various fields were required to accomplish this study. Specialists involved in the EIS included those in such fields as land use planning, civil engineering, environmental services, noise assessment and abatement, air pollution, biology, cultural resources, and other disciplines. It should be noted that while an interdisciplinary approach has been used, all decisions made with regard to the content and scope of this EIS are those of Navy.

#### **Navy**

Gerald Gibbons, Planner in Charge; M.S. degree in industrial engineering, and B.S. degree in civil engineering; Navy point of contact responsible for the EIS project.

#### **Belt Collins Hawaii**

Susan Sakai, Planner; M.A. degree in political science; principal in charge and project manager; contributed to the organization and content of all sections; wrote executive summary and sections on purpose and need, overview, regions of influence, and cultural resources; reviewed document for accuracy, completeness, and consistency.

Lisa Reinke, Planner; B.A. degree in architecture and B.S. degree in mechanical engineering; contributed to the organization and content of all sections; wrote sections on proposed action and alternatives, public services, and land use compatibility.

Betty Gayle, Civil Engineer; B.S. degree in civil engineering; prepared soils/water quality, drainage, potable water, wastewater, solid waste, and electrical supply/energy use sections.

Walter Billingsley, Civil Engineer; M.S. and B.S. degrees in civil engineering and B.S. degree in geography and environmental studies; collaborated on all infrastructure sections.

John Goody, Planner; M.S. degree in urban and regional planning and M.S. degree in general management; responsible for the traffic summary.

James Berdach, Environmental Scientist; B.S. and M.S. degrees in botany; responsible for sections on terrestrial biota and habitats and marine environment.

Lesley Matsumoto, Environmental Scientist; B.S. degree in atmospheric science; responsible for air quality analysis and for document review.

Rhonda Goyke, Environmental Scientist; B.S. degree in dietetics; collaborated on environmental contamination section.

Christine Hayes, Environmental Scientist; B.S. degree in combined sciences (geology, biology); collaborated on environmental contamination section.

Vanessa Kawamura, Environmental Engineer; B.S. degree in chemical engineering; collaborated on environmental contamination section.

Karon Aoki, Graphic Designer; B.A. degree in fine arts; responsible for maps and graphics.

#### **Other Contributors**

Richard Boice, C.P.A., Ernst and Young LLP; B.A. degree in accounting and English; conducted socioeconomic analysis and assessment of public services.

Scott Moylan, Ernst and Young LLP; B.S. degree in finance; collaborated on socioeconomic analysis and public services assessment.

Terry Brothers, Traffic Engineer, Wilbur Smith and Associates; M.S. degree in transportation engineering, B.S. in civil engineering; conducted traffic analysis.

Art Whistler, Isle Botanica; Ph.D. and M.S. degrees in botany; conducted botanical survey.

Phil Bruner, Wildlife Biologist; M.S. degree in zoology; conducted fauna survey.

David Tuggle, International Archaeological Research Institute, Inc.; Ph.D. in archaeology; conducted archaeological assessment.

# Chapter 6

---

REFERENCES

THE HISTORY OF THE  
CITY OF BOSTON  
FROM 1630 TO 1880  
BY  
JOHN B. HENNINGSON  
AND  
JOHN W. COOPER  
EDITED BY  
JOHN W. COOPER  
BOSTON  
PUBLISHED BY  
LITTLE, BROWN AND COMPANY  
1880

## CHAPTER SIX REFERENCES

---

- Barrett Consulting Group (February 1992). *Guam Water Facilities Master Plan Update*. Prepared for the Public Utility Agency of Guam, Government of Guam.
- Belt Collins Hawaii (December 7, 1998). *Drainage and Infrastructure Supporting Documentation: Drainage Systems, Water, Wastewater, Solid Waste, and Electrical*. Prepared for the EIS for the Disposal and Reuse of Surplus Property Identified in the Guam Land Use Plan.
- BioSystems Analysis, Inc. (1989). *Natural Resources Survey for the U.S. Naval Communication Area Master Station Guam (NAVCOMS)*.
- \_\_\_\_\_ (1989). *Natural Resources Survey for the U.S. Naval Supply Depot, Guam, (NSD)*.
- \_\_\_\_\_ (1989). *Natural Resources Survey for the U.S. Naval Public Works Center, Guam (PWC)*.
- \_\_\_\_\_ (1988). *Natural Resources Survey for the U.S. Naval Station, Guam (NAVSTA)*.
- Bruner, Phil (September 8, 1998). *Avifaunal and Feral Mammal Survey for Six U.S. Navy Guam Land Use Plan (GLUP) Parcels, Territory of Guam*.
- Bureau of Planning, Government of Guam (August 1982). *Guam's Natural and Manmade Constraints*.
- Clark, Viessman, Hammer (1977). *Water Supply and Pollution Control*, Harper & Row Publishers.
- Corbitt, Robert (1990). *Standard Handbook of Environmental Engineering*, McGraw-Hill Publishing.
- deChiara and Callender (1990). *Timesaver Standards for Building Types*. McGraw-Hill Publishing.
- Department of the Navy (December 1995). *Final Environmental Impact Statement for Land Use and Development Plan, Bellows Air Force Station, Waimanalo, Hawaii*.
- Department of Defense (July 1995). Memorandum F-50 distributing "DoD Guidance on the Environmental Review Process to Reach a Finding Of Suitability to Transfer (FOST) for Property Where Release or Disposal Has Occurred."
- \_\_\_\_\_ (April 1995). *GLUP '94 - Guam Land Use Plan Update, A Plan for Department of Defense Real Estate on Guam*.
-

- \_\_\_\_\_ (April 1994). *GLUP '94 - Guam Land Use Plan Update Briefing Booklet, A Plan for Department of Defense Real Estate on Guam.*
- \_\_\_\_\_ (March 1985). *Navy Activities Guam Regional Profile - Mariana Islands (Final).*
- Dueñas & Associates, Inc. with CH2M Hill (December 1994). *Guam Islandwide Wastewater Facilities Plan. Volume I.* Prepared for the Public Utility Agency of Guam, Government of Guam.
- \_\_\_\_\_ Application for Public Benefit Conveyance of Proposed Laderan Tiyan Parkway (July 10, 1998). Prepared for GEDA GovGuam and BRAC GovGuam Steering Committee.
- \_\_\_\_\_ with Black & Veatch (August 1998). *Phase I Report Islandwide Solid Waste Management Plan for the Island of Guam.* Prepared for the Guam Environmental Protection Agency.
- Ernst & Young (September 25, 1998). *Socioeconomic Report for EA for the Reuse of NAS Agana Officer Housing Area, Guam.*
- \_\_\_\_\_ (December 21, 1998). *Socioeconomic Report for EIS for the Disposal and Reuse of Surplus Navy Property Identified in the Guam Land Use Plan (GLUP '94).*
- Flores, W.B. and Strategic Planning Group (April 1998). *I Tano'-ta, The Land Use Plan for Guam (Zoning Code).* Prepared for the Guam Territorial Planning Council.
- \_\_\_\_\_ (April 1998). *I Tano'-ta, The Land Use Plan for Guam (Final Land Use Plan).* Prepared for the Guam Territorial Planning Council.
- Government of Guam, Bureau of Planning (August 1982). *Procedures Guide for Achieving Federal Consistency with the Guam Coastal Management Program.*
- \_\_\_\_\_, Komitea Para Tiyan (December 1995, reprinted April 1998). *NAS Agana Base Reuse Master Plan.*
- \_\_\_\_\_, (1998). *I Tano'-ta Zoning Code of the Territory of Guam (Exhibit 2)*
- Guam Environmental Protection Agency (December 29, 1998). *Rules and Regulations of the Guam Environmental Protection Agency Air Pollution Control Standards and Regulations.*
- \_\_\_\_\_ (January 1992). *Revised Guam Water Quality Standards.*
- Harris Miller Miller Hanson, Inc., (March 1993). *Aircraft Noise Survey for Naval Air Station Agana, Guam.*
- International Archaeological Research Institute, Inc. (August 1998). *Prefinal Navy Guam Land Use Plan Releasable Parcels: Archaeological Assessment Study.*

JFP International, Inc. (April 12, 1995). *GIAA Master Plan, Working Papers, Volume I and II*. Prepared for Guam International Airport Authority.

Memorandum for the Record, (August 1998). Information from GEPA.

Memorandum for the Record (July 23, 1998). Guam Environmental Protection Agency and Belt Collins Hawaii.

Metcalf & Eddy (1969). *Standards of Sewer System*. Prepared for the Public Utility Agency of Guam.

National Flood Insurance Program (November 1985). Flood Insurance Rate Map (FIRM), Territory of Guam.

Ogden Environmental and Energy Services Co., Inc. (October 1998). *Environmental Baseline Survey, Public Works Center, Various Sites Guam, Mariana Islands*.

\_\_\_\_\_ (January 1998). *Draft BRAC Cleanup Plan Update #1 for FISC, NAVACTS, PWC Guam Sites*.

\_\_\_\_\_ (January 1998). *Ecological Risk Assessment for Former Fourth Auto Hobby Shop, NAS Agana, Guam (Draft)*.

\_\_\_\_\_ (April 1998). *Joint BRAC III/IV Cleanup Plan for Former NAS Agana*.

\_\_\_\_\_ (October 1997). *Environmental Baseline Survey (EBS) Addendum Report for Public Works Center, Various Sites, Guam, Mariana Islands (Draft)*.

\_\_\_\_\_ (October 1997). *Environmental Baseline Survey Addendum Report for Naval Activities, Various Sites, Volume I, Guam, Mariana Islands (Draft)*.

\_\_\_\_\_ (October 1997). *Environmental Baseline Survey Addendum Report for Fleet Industrial Supply Center, Sasa Valley/Tenjo Vista, Guam, Mariana Islands (Draft)*.

\_\_\_\_\_ (May 1997). *Environmental Baseline Survey (EBS) Final (Supplemental) for NAS Agana Officer Family Housing Area and Tamuning Telephone Exchange, Guam*.

\_\_\_\_\_ (November 1996). *Environmental Baseline Survey Final For Naval Activities, Various Sites, Volume I, Guam, Mariana Islands*.

\_\_\_\_\_ (October 1996). *Environmental Baseline Survey - Fleet and Industrial Supply Center, Sasa Valley/Tenjo Vista, Guam, Mariana Islands*.

\_\_\_\_\_ (October 1996). *Environmental Baseline Survey, Public Works Center, Various Sites, Guam, Mariana Islands*.

\_\_\_\_\_ (August 1996). *Environmental Baseline Survey Final for NAS Agana Officer Family Housing Area and Tamuning Telephone Exchange, Guam*.

Record of Conversation, (January 25, 1999). Information from Mr. David Welhouse, U.S. Department of the Interior, Federal Aviation Administration.

Record of Conversation, (May 3, 1999). Information on Guam's landfills from Mr. Betwin Alokoa, Director of Solid Waste Management, GEPA.

Record of Conversation, (May 6, 1999). Information on Guam's landfills from Danny Iizama, Director, Guam DPW.

State of Hawaii (1985). *Water System Standards*.

Tchobanoglous, George, Hilary Theisen, and Rolf Eilassen (1977). *Solid Wastes: Engineering Principles and Management Issues*.

U.S. Army Corps of Engineers Honolulu District (September 1980). *Flooding and Drainage on Guam: A Handbook of Basic Information*. (A Technical Report from the Comprehensive Study of Guam's Water and Related Land Resources).

\_\_\_\_\_ (September 1980). *Guam Storm Drainage Manual: A Technical Report from the Comprehensive Study of Guam's Water and Related Resources*.

U.S. Department of Agriculture, Soil Conservation Service (May 1988). *Soil Survey of Territory of Guam*.

U.S. Department of Fish And Wildlife (September 1992). *Moorhen Recovery Plan*.

U.S. Navy (January 1994). Cooperative Agreement Between the U.S. Navy and the U.S. Fish And Wildlife Service for the Establishment and Management of the Guam National Wildlife Refuge, Guam.

\_\_\_\_\_ (December 1993). Memorandum of Understanding Among GovGuam and the U.S. Air Force and the U.S. Navy and the U.S. Fish And Wildlife Service for the Establishment and Management of the Guam National Wildlife Refuge, Guam.

U.S. Navy, Pacific Division, Naval Facilities Engineering Command (February 1999). *Draft Environmental Impact Statement, Disposal and Reuse of the Former Naval Air Station Agana, Guam*.

\_\_\_\_\_ (October 1992). *Facility Planning Criteria for Navy and Marine Corps Shore Installations*.

\_\_\_\_\_ (July 1993). *Final Environmental Impact Statement for Proposed Facilities Development and Relocation of Navy Activities to the Territory of Guam from the Republic of the Philippines*.

\_\_\_\_\_ (September 1986). *Solid Waste Disposal, Civil Engineering Design Manual*  
5.10.

\_\_\_\_\_ (January 1997). *Draft Environmental Impact Statement for Military Training in the Mariana Islands.*

\_\_\_\_\_, Navy Public Works Center (December 1994). *Utility Technical Study for Potable Water and Sanitary Sewer System; Apra Harbor Naval Base and Naval Magazine.*

Whistler, Dr. W. Arthur (July 1998). *Draft Botanical Survey of Selected U.S. Navy Guam Land Use Plan (GLUP) Parcels, Territory of Guam.*

Wilbur Smith Associates with Dueñas & Associates (July 1992). *Guam 2010 Highway Master Plan - Draft.*

Wilbur Smith Associates (February 1999). *Guam Land Use Plan Traffic Impact Study.*



# Chapter 7

---

DISTRIBUTION OF DEIS



## CHAPTER SEVEN

### DISTRIBUTION OF DEIS

TITLE	FIRST NAME	LAST NAME	ORGANIZATION	CITY	STATE/ TERRITORY
<b>FEDERAL AGENCIES</b>					
COMMANDING OFFICER			U S NAVAL COMPUTER AND TELECOMMUNICATIONS STATION GUAM	FPO AP	GU
COMMANDER	LT CRAIG S	PRATHER	U S NAVAL FORCES MARIANAS	FPO AP	GU
OFFICER IN CHARGE			PACNAVFACENGCOM CARETAKER SITE OFFICE	BARRIGADA	GU
EXECUTIVE DIRECTOR			ADVISORY COUNCIL ON HISTORIC PRESERVATION	WASHINGTON	DC
DIRECTOR			ADVISORY COUNCIL ON HISTORIC PRESERVATION WESTERN OFFICE PROJECT REVIEW	GOLDEN	CO
SUPERINTENDENT	KAREN	DUSTIN	NATIONAL PARKS SERVICE WAR IN THE PACIFIC NATIONAL HISTORICAL PARK	AGANA	GU
CHIEF	FRANK	DAYTON	U S ARMY CORPS OF ENGINEERS GUAM PROJECT OFFICE	AGANA	GU
DISTRICT SUPERVISOR	MIKE	PITZLER	U S DEPARTMENT OF AGRICULTURE WILDLIFE SERVICES	BARRIGADA HEIGHTS	GU
PROTECTED SPECIES PROGRAM COORDINATOR	EUGENE	NITTA	U S DEPARTMENT OF COMMERCE NATIONAL MARINE FISHERIES SERVICE	HONOLULU	HI
DIRECTOR	DR WILLIE	TAYLOR	U S DEPARTMENT OF INTERIOR OFFICE OF ENVIRONMENTAL POLICY AND COMPLIANCE	WASHINGTON	DC
REFUGE MANAGER	ROGER	DIROSA	U S DEPARTMENT OF INTERIOR FISH AND WILDLIFE SERVICE	DEDEDO	GU
CHIEF	DAVID	FARREL	U S ENVIRONMENTAL PROTECTION AGENCY REGION IX	SAN FRANCISCO	CA
	FIONA	QUALLS	U S GEOLOGICAL SERVICES BIOLOGICAL RESOURCES DIVISION	DEDEDO	GU
CONGRESSMAN	ROBERT A	UNDERWOOD	U S HOUSE OF REPRESENTATIVES CANNON HOB	WASHINGTON	DC
DISTRICT DIRECTOR	VINCE	LEON GUERRERO	U S HOUSE OF REPRESENTATIVES	AGANA	GU

TITLE	FIRST NAME	LAST NAME	ORGANIZATION	CITY	STATE/ TERRITORY
<b>GUAM GOVERNMENT AGENCIES</b>					
ACTING DIRECTOR	JUANITA	MAFNAS	AGENCY FOR HUMAN RESOURCE DEVELOPMENT	AGANA	GU
ADMINISTRATOR	JOE T	SAN AUGUSTIN	BRAC 95 GOVGUAM STEERING COMMITTEE	AGANA	GU
ACTING DIRECTOR	JOSEPH E	RIVERA	BUREAU OF BUDGET AND MANAGEMENT RESEARCH	AGANA	GU
CHIEF PLANNER	CRAIG-LEON	GUERRERO	BUREAU OF PLANNING	AGANA	GU
DIRECTOR	CLIFFORD	GUZMAN	BUREAU OF PLANNING	AGANA	GU
ADMINISTRATOR	MICHAEL L	HAM	BUREAU OF PLANNING GUAM COASTAL MANAGEMENT PROGRAM	AGANA	GU
ADMINISTRATIVE DIRECTOR	JOSEPH M	BORJA	CHAMORRO LAND TRUST COMMISSION	AGANA	GU
EXECUTIVE DIRECTOR	LELAND	BETTIS	COMMISSION ON SELF-DETERMINATION	AGANA	GU
CHIEF	ROBERT	ANDERSEN	DEPARTMENT OF AGRICULTURE DIVISION OF AQUATIC AND WILDLIFE SERVICES	MANGILAO	GU
DIRECTOR	JOSEPH	CRUZ	DEPARTMENT OF COMMERCE	TIYAN	GU
DIRECTOR	RONALD L G	TAIMANGLO	DEPARTMENT OF EDUCATION	AGANA	GU
DIRECTOR	JUAN M	TAJJITO	DEPARTMENT OF LABOR	TAMUNING	GU
DIRECTOR	CARL	AGUON	DEPARTMENT OF LAND MANAGEMENT	AGANA	GU
HISTORIC PRESERVATION OFFICER	RICHARD	DAVIS	DEPARTMENT OF PARKS AND RECREATION HISTORIC RESOURCES DIVISION	AGANA	GU
DIRECTOR	AUSTIN A J	SHELTON	DEPARTMENT OF PARKS AND RECREATION	TIYAN	GU
DIRECTOR	DENNIS G	RODRIGUEZ	DEPARTMENT OF PUBLIC HEALTH AND SOCIAL SERVICES	AGANA	GU
DIRECTOR	GIL	SHINOHARA	DEPARTMENT OF PUBLIC WORKS	TAMUNING	GU
DIRECTOR	JOSEPH	DUENAS	DEPARTMENT OF REVENUE AND TAXATION	GMF	GU
GENERAL MANAGER	BENNY	PAULINO	GUAM CIVIL DEFENSE EMERGENCY SERVICES OFFICE	AGANA	GU

TITLE	FIRST NAME	LAST NAME	ORGANIZATION	CITY	STATE/ TERRITORY
<b>GUAM GOVERNMENT AGENCIES (CONTINUED)</b>					
ADMINISTRATOR	BENEDICK J G	REYES	GUAM CIVIL DEFENSE EMERGENCY SERVICES OFFICE	AGANA	GU
DIRECTOR	JOSEPH P	SABLAN	GUAM DEPARTMENT OF AGRICULTURE	MANGIALO	GU
ADMINISTRATOR	EDWARD	UNTALAN	GUAM ECONOMIC DEVELOPMENT AUTHORITY	TAMUNING	GU
DIRECTOR	FRED P	CAMACHO	GUAM ENERGY OFFICE	TIYAN	GU
ADMINISTRATOR	JESUS T	SALAS	GUAM ENVIRONMENTAL PROTECTION AGENCY	BARRIGADA	GU
FIRE CHIEF	GIL P	REYES	GUAM FIRE DEPARTMENT	AGANA	GU
PRESIDENT	JAMES G	SABLAN	GUAM HOUSING CORPORATION	AGANA	GU
EXECUTIVE DIRECTOR	TALING	TAITANO	GUAM HOUSING AND URBAN RENEWAL AUTHORITY	SINAJANA	GU
EXECUTIVE MANAGER	GERALD	YINGLING	GUAM INTERNATIONAL AIRPORT AUTHORITY	TAMUNING	GU
GENERAL MANAGER	JAMES H	UNDERWOOD	GUAM MASS TRANSIT AUTHORITY	AGANA	GU
ADJUTANT GENERAL	BENNY	PAULINO	GUAM NATIONAL GUARD	TAMUNING	GU
EXECUTIVE ASST	GALEN	LUJAN	GUAM PLANNING COUNCIL	TIYAN	GU
CHIEF OF POLICE	JAMES M	MARQUES	GUAM POLICE DEPARTMENT	TIYAN	GU
GENERAL MANAGER	RICHARD	UNPINGCO	GUAM POWER AUTHORITY	AGANA	GU
CHIEF EXECUTIVE OFFICER	DAVID	SHIMIZU	GUAM PRESERVATION TRUST	AGANA	GU
DIRECTOR	CHRISTINE	SCOTT SMITH	GUAM PUBLIC LIBRARY	AGANA	GU
DIRECTOR	CHRISTINE	SCOTT SMITH	GUAM PUBLIC LIBRARY	BARRIGADA	GU
DIRECTOR	CHRISTINE	SCOTT SMITH	GUAM PUBLIC LIBRARY	DEDEDO	GU
DIRECTOR	CHRISTINE	SCOTT SMITH	GUAM PUBLIC LIBRARY	MERIZO	GU
DIRECTOR	CHRISTINE	SCOTT SMITH	GUAM PUBLIC LIBRARY	YONA	GU
GENERAL MANAGER	VINCENT	ARRIOLA	GUAM TELEPHONE AUTHORITY	TAMUNING	GU
GENERAL MANAGER	JAMES	NELSON III	GUAM VISITORS BUREAU	AGANA	GU
ACTING CHIEF PLANNER	HELEN	ADA	GUAM WATERWORKS AUTHORITY	AGANA	GU

TITLE	FIRST NAME	LAST NAME	ORGANIZATION	CITY	STATE/ TERRITORY
<b>GUAM GOVERNMENT AGENCIES (CONTINUED)</b>					
GENERAL MANAGER	RICHARD	QUINTANILLA	GUAM WATERWORKS AUTHORITY	AGANA	GU
GENERAL MANAGER	EULOGIO	BERMUDES	PORT AUTHORITY OF GUAM	PITI	GU
	CEL	BABAUTA	TERRITORIAL BOARD OF EDUCATION	AGANA	GU
EXECUTIVE ASSISTANT	FRANK	CAMACHO	TERRITORIAL PLANNING COUNCIL	TIYAN	GU
PRESIDENT	JOSE T	NEDEDOG	UNIVERSITY OF GUAM	MANGILAO	GU
GOVERNOR	CARL T C	GUTIERREZ	OFFICE OF THE GOVERNOR EXECUTIVE CHAMBERS ADELUP	AGANA	GU
LT GOVERNOR	MADELEINE	BORDALLO	OFFICE OF THE GOVERNOR EXECUTIVE CHAMBERS ADELUP	AGANA	GU
SENATOR	FRANK B	AGUON JR	GUAM LEGISLATURE	AGANA	GU
SENATOR	ANTHONY C	BLAZ	GUAM LEGISLATURE	AGANA	GU
SENATOR	JOANNE M S	BROWN	GUAM LEGISLATURE	AGANA	GU
SENATOR	EDUARDO B	CALVO	GUAM LEGISLATURE CHAIR POWER PUBLIC WORKS TAX REFORM MUNICIPAL AND COMMUNITY AFFAIRS COMMITTEE	AGANA	GU
SENATOR	MARCEL	CAMACHO	GUAM LEGISLATURE CHAIR LAND AGRICULTURE MILITARY AND THE ARTS COMMITTEE	AGANA	GU
SENATOR	MARK	FORBES	GUAM LEGISLATURE	AGANA	GU
SENATOR	CHARLOTTE LEON	GUERRERO	GUAM LEGISLATURE	AGANA	GU
SENATOR	ALBERTO A	LAMORENA	GUAM LEGISLATURE	AGANA	GU
SENATOR	VICENTE C	PANGELINAN	GUAM LEGISLATURE	AGANA	GU
SENATOR	JOHN C	SALAS	GUAM LEGISLATURE	AGANA	GU
SPEAKER	ANTONIO R	UPINGCO	GUAM LEGISLATURE	AGANA	GU
MAYOR	FELIX F	UNGACTA	AGANA	AGANA	GU
MAYOR	PAUL	MCDONALD	AGANA HEIGHTS	AGANA	GU
MAYOR	RAYMOND	LAGUANA	BARRIGADA	AGANA	GU
MAYOR	JOSE A	RIVERA	DEDEDO	AGANA	GU
MAYOR	ANDREW C	VILLAGOMEZ	MONGMONG TOTO MAITE	AGANA	GU

TITLE	FIRST NAME	LAST NAME	ORGANIZATION	CITY	STATE/ TERRITORY
<b>GUAM GOVERNMENT AGENCIES (CONTINUED)</b>					
MAYOR	ISABEL S	HAGGARD	PITI	AGANA	GU
MAYOR	JOSEPH C	WESLEY	SANTA RITA	AGANA	GU
MAYOR	DANIEL E	SABLAN	SINAJANA	AGANA	GU
MAYOR	LUIS	HERRERO	TAMUNING TUMON	AGANA	GU
MAYOR	ROBERT	LIZAMA	YIGO	AGANA	GU
EXECUTIVE DIRECTOR	FRANK J C	CAMACHO	MAYORS COUNCIL OF GUAM	AGANA	GU
TITLE	FIRST NAME	LAST NAME	ORGANIZATION	CITY	STATE/ TERRITORY
<b>COMMUNITY/OTHER</b>					
PROFESSOR	H PAUL	FRIESEMA	NORTHWESTERN UNIVERSITY	EVANSTON	IL

THE UNIVERSITY OF CHICAGO PRESS

# Appendix A

---

SCOPING DOCUMENTATION  
PUBLIC INVOLVEMENT PROCESS

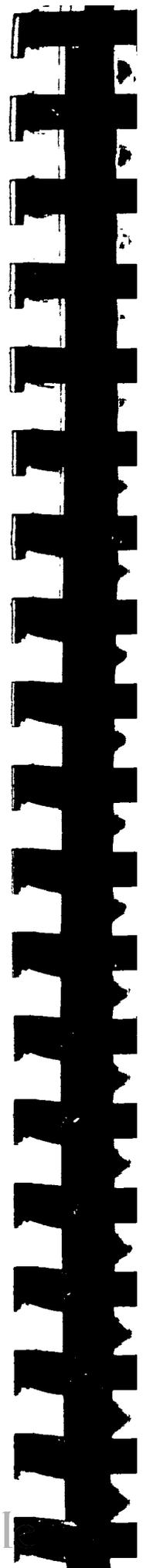
THE HISTORY OF THE  
CITY OF BOSTON  
FROM 1630 TO 1880  
BY  
JOHN H. COOPER  
VOL. I  
1888

**APPENDIX A**

**PUBLIC INVOLVEMENT PROCESS**

**A-1: Notice of Intent**

**A-2: Agency Comment Letters and Responses**



**APPENDIX A-1**

**NOTICE OF INTENT**



## DEPARTMENT OF DEFENSE Department of the Navy

Notice Of Intent To Prepare An Environmental Impact Statement  
For The Disposal And Reuse Of Surplus U.S. Navy Property  
Located In The Territory Of Guam.

AGENCY: Department of the Navy:DoD.

### ACTION: Notice

**SUMMARY:** The Department of the Navy announces the intent to prepare an Environmental Impact Statement (EIS) for the disposal and subsequent reuse of surplus U.S. Navy property in the Territory of Guam. A public scoping workshop will be held to receive oral and written comments to identify potentially significant issues for study in the EIS and to notify parties interested in and affected by the property disposal and reuse. Federal, state and local agencies, and interested individuals are invited to be present or represented at the workshop.

**DATE:** Public workshop date is Thursday, May 7, 1998, 7:00 to 9:00 p.m.

**ADDRESS:** Public scoping workshop location is Chamorro Village Main Pavilion, Paseo Complex, Agana, Guam.

**SUPPLEMENTAL INFORMATION:** The proposed action of the EIS is disposal by the Navy and subsequent reuse of 19 parcels of land, totaling approximately 2800 acres, at 14 sites on the island. The properties consist of developed and undeveloped land, buildings and infrastructure. The properties will be disposed of in accordance with the provisions of the Defense Base Closure and Realignment Act (Public Law 101-510) of 1990 as amended, and applicable federal property disposal regulations.

The properties are among those identified in a plan for Department of Defense real estate on Guam. The Guam Land Use Plan Update 1994 (GLUP 94), the GLUP reviewed all military land requirements on Guam and made recommendations for land retention and disposal based on foreseeable mission tasking and force levels.

The properties to be disposed of are identified as: the former Federal Aviation Administration (FAA) Housing Area in Dededo; the Navy Print Shop (Harmon Annex) and Marine Dyke (Weitengel Junction) parcels in Dededo; Tamuning Telephone Exchange; four parcels adjacent to Naval Computer and Telecommunications Activity Master Station, Barrigada; Nimitz Hill Enlisted Housing and nearby vacant land; parcels at Sasa Valley and Tenjo Vista in Piti; a parcel at Polaris Point; a parcel near the New Apra Heights family housing area; a parcel on Route 2A in Santa Rita; Rialta or Alifje Beach in Santa Rita; a parcel near Old Apra Heights and; two parcels at the naval ordnance area in Santa Rita.

Potential reuse alternatives for the parcels are defined in a Government of Guam (GovGuam) re-use plan prepared for the GLUP 94 Reuse Planning Committee and the Guam Economic Development Authority. Excluded from consideration in the EIS are GLUP 94 Air Force properties. Also excluded are GLUP 94 Navy power plant properties and areas at the former Naval Air Station, Agana, which are being addressed as separate actions.

The EIS will analyze the proposed action, reasonable alternatives to the proposed action, and individual and cumulative environmental impacts. Alternatives considered in the EIS will be influenced by the identification of feasible future uses of the land areas. The GovGuam reuse plan features various land uses, including resort, industrial, commercial, residential, agricultural, parks, recreation, historic and conservation use.

Environmental issues to be considered will include, but are not limited to, effects on cultural resources, terrestrial and aquatic habitats, threatened or endangered species, air and water quality, infrastructure, traffic, noise, flood plain management, installation restoration and environmental clean-up, and the socio-economic environment. Direct, indirect and cumulative impacts will be analyzed, and mitigation measures will be developed if appropriate.

The scoping workshop will provide opportunities for clarification of the U.S. Navy's action in response to Base Realignment and Closure (BRAC) decisions and subsequent identification of surplus properties, and to solicit input from representatives of government agencies and interested individuals regarding the scope of the EIS. The U.S. Navy will set up information stations at the meeting. Each information station will be attended by a knowledgeable person who will be available to answer questions from attendees. Comments will be entered into the official record via written comment sheets available at the meeting and via summary of oral comments to be submitted in writing. All comments oral and written, will become part of the public record and will receive attention and consideration during EIS preparation.

**FOR FURTHER INFORMATION CONTACT:** Written comments may be mailed to Mr. John Bigay (Code 231), Pacific Division, Naval Facilities Engineering Command, Pearl Harbor, HI 96860, 7300; or contact Mr. Bigay by telephone (808) 471-9338 or facsimile (808) 474-5909. Written comments are requested not later than May 26, 1998.

Additional information concerning this notice may be obtained by contacting Mr. Leland Munson (Department of Defense Base

Pacific Daily News, Saturday, April 18, 1998

PACIFIC SUNDAY NEWS, April 19, 1998

Pacific Daily News, Monday, April 20, 1998



**APPENDIX A-2**

**AGENCY COMMENT LETTERS AND RESPONSES**





DEPARTMENT OF THE NAVY  
PACIFIC DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
(MAKALAPA, HI)  
PEARL HARBOR, HAWAII 96860-7300

5090P.1G031  
Ser PLN231/ **971**

**19 MAR 1999**

Mr. Robert Smith  
U.S. Fish and Wildlife Service  
Pacific Islands Ecoregion  
300 Ala Moana Boulevard, Room 3-122  
Box 50088  
Honolulu, HI 96813

Dear Mr. Smith:

Subj: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE  
DISPOSAL AND REUSE OF SURPLUS U.S. NAVY PROPERTY  
IDENTIFIED IN THE TERRITORY OF GUAM

Thank you for your letter of May 29, 1998, providing comments on the Notice of Intent for the proposed action referenced above. In preparing the EIS, we will consider all of the issues raised, with particular attention given to addressing impacts to endangered and threatened species, migratory birds and fishes, and rare native species.

We appreciate your participation in the scoping process for the disposal and reuse action and look forward to further input when the Draft EIS is distributed. Should you have any questions, point of contact is Mr. Gerald Gibbons (PLN231GG) at 471-9338 or by facsimile transmission at 474-5909.

Sincerely,

*Stanley Y. Uehara*  
STANLEY Y. UEHARA  
Director  
Environmental Planning Division  
Acting



DEPARTMENT OF THE NAVY  
PACIFIC DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
(MAKALAPA, HI)  
PEARL HARBOR, HAWAII 96860-7300

5090P.1G031  
Ser PLN231/ 970

19 MAR 1999

Mr. David J. Farrel, Chief  
Federal Activities Office  
U.S. Environmental Protection Agency  
Region IX  
75 Hawthorne Street  
San Francisco, CA 94105

Dear Mr. Farrel:

Subj: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR THE  
DISPOSAL AND REUSE OF SURPLUS U.S. NAVY PROPERTY  
IDENTIFIED IN THE TERRITORY OF GUAM

Thank you for your undated letter providing comments on the Notice of Intent of April 1998 for the proposed action referenced above. In preparing the EIS, we will consider all of the issues raised, including impacts to water quality, air quality, environmental justice, hazardous waste cleanups, hazardous waste management, and the protection of natural resources and wetlands.

We appreciate your participation in the scoping process for the disposal and reuse action and look forward to further input when the Draft EIS is distributed. Should you have any questions, point of contact is Mr. Gerald Gibbons (PLN231GG) at (808) 471-9338 or by facsimile transmission at (808) 474-5909.

Sincerely,

STANLEY Y. UEHARA  
Director  
Environmental Planning Division  
Acting

J4-16st  
SAC S

# OFFICE OF THE MAYOR

*Municipality of Tamuning-Tumon-Harmon*

c/o Mayor's Council of Guam

P.O. Box 786, Agaña-Guam 96932

Telephone #: (671) 646-5211/646-9646/649-2409; FAX#: (671) 646-5210

Luis S.N. HERRERO  
Mayor

Osvaldo B. DOMESTICO  
First Deputy Mayor

May 18, 1998

RECEIVED  
MAY 22 10 56  
MAY 22 1998

Code 231

Pacific Division

Naval Facilities Engineering Command

Pearl Harbor, HI 96860-7300

Attn: Mr. John Biggy

Re: Federal Alternative Lease Plan

Dear Mr. Biggy:

I attended the workshop at Chamorro Village on May 07, 1998 on Guam. The workshop provided some clear picture and information regarding the alternative reuse plan of the Navy Telephone Exchange property in Tamuning. I am interested in the alternative use of the property for the following reasons.

1. Tamuning Mayor's Office is in close proximity to the Navy Telephone Exchange, and closer to the denser population area of Tamuning.
2. Tamuning is the second most populated and diversified community on Guam, resting on a small land size of six (6) square miles with about 52,000 people (so dense).
3. Tamuning is also second on crime rate (GPD Crime Statistics). As population grows, crime and youth violence equates.
4. To provide accommodation for the youths organize wholesome and productive programs as a deterrent to crime, youth violence and graffiti, etc..
5. The need for youth to have a place to spend time constructively after school and at night instead of getting into trouble on the streets.

6. A place to implement the crime deterrent programs under adult supervision where youths may receive guidance and assistance in their school work, learning to get along and to enjoy each others company.
7. A place for youth center or club where youths meet for sharing or interacting socially and educationally with each other, thus help them transform or grow into a wholesome, fruitful and acceptable being in society.
8. Most of the Mayor's youth programs are on hold due to the damages done to the facilities by Typhoon Paka. Recovery work has not begun.
9. To expand facilities for youth programs. Before "Paka" damaged the sports facilities the office experienced tight scheduling on sports events, social and educational projects due to the limited accommodations for programs and activities.
10. Tamuning needs additional buildings to accommodate just the on-going programs: Arts & Crafts, Sewing, assisted school programs, tutoring, etc., Dancing, Story telling, Summer-Camp, Swimming, Sports, Tennis and Basketball classes, Baseball, Soccer, Wrestling, Fine Arts, Taekwondo, Karate, Aerobic, Education against Drugs, etc...

The Tamuning Telephone Exchange building will provide the people of Tamuning particularly the youth a place to meet, to share, to enjoy and to exchange cultural ideas or a fun place where they come together and rekindle old friendship, meet new friends and enjoy their company and perhaps help to reduce some of our youth crime and violence, particularly drugs.

With the acquisition of the Tamuning Telephone Exchange Property, educational classes against crime and violence will be instituted immediately. I would like the crime and violence deterrent programs to begin as soon as possible to eliminate or lower crime activities through education.

We need to make the village clean, safe and beautiful for ourselves and for our visitors. With our financial constraints, Guam needs to help compete worldwide for tourist final destination. Guam needs the help of our tourists industry in order to help in the growth and development of our sinking economy.

I humbly request your assistance. Thank you in advance for your special consideration.

Sincerely,

  
LUIS S.N. HERRERO, Mayor  
Tamuning

COMMENT SHEET

for Disposal and Reuse of Specific Ocean Land Use Plan (GLUP 94) Parcels

Tamuning Mayor's Office  
RE-USE PLAN

Department of the Navy, DoD  
Environmental Impact Statement (EIS)

(Your Name) Luis Henares  
(Street Address) Mayor Tamuning  
(City and ZIP Code) \_\_\_\_\_  
(Telephone) \_\_\_\_\_

Code 231  
Pacific Division  
Naval Facilities Engineering Command  
Pearl Harbor, HI 96860-7300  
ATTN: Mr. John Biggry



For Pags on 4C + 3 }  
Mayor }

Thank you for attending the workshop at Chamorro Village on May 7, 1998. Please use this sheet to write down issues that you think should be studied in the EIS.

Should use for youth recreation  
and education (Youth Center)  
Reserve it as a youth center  
& grounds.

Education at O.I., after school  
activities to provide constructive activities  
as an alternative.

Tamuning is the largest city, it  
is youth population, high youth crime  
also.

(Include additional sheets if necessary)

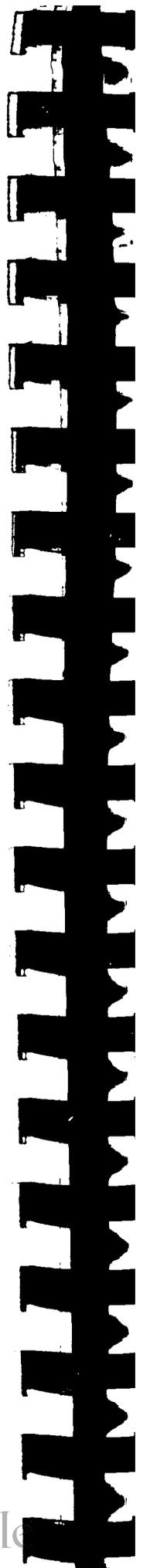
Please turn this in at Table 6. Mailed comments letters should be postmarked no later than  
May 26, 1998.

\_\_\_\_\_  
(Signed)

\_\_\_\_\_  
(Date)

Please fold bottom up to center dot (•), fold top down and seal with tape.

- I. 2<sup>nd</sup> Largest Village
  - a. Population (38,000 plus)
  - b. Land area of 6 square miles
- II. 2<sup>nd</sup> Highest in Crime Rate
  - a. Graffiti
  - b. Vandalism
  - c. Youth Violence
- III. Youth
  - a. Population of about 30,000
  - b. Programs (on hold due to Super typhoon Pats)
    - 1. Education
    - 2. Recreation
    - 3. Social Activities
  - c. Teen Club Center





NOI to Prepare EIS for  
Disposal & Reuse of Supplies Navy  
Property on Guam

attention be given in the Draft EIS to addressing impacts to endangered and threatened species, migratory fishes and birds, and rare native species.

Migratory seabirds that should be addressed include the brown noddie (*Anous stolidus*), and white tern (*Gygis alba*). Migratory fishes and rare, native tree snails should also be addressed in the Draft EIS. The fishes include several gobies (*Awaous guamensis*, *Senogobius marianensis*, *Stiphodon elegans*, *S. Carenia*, and *Sicyopterus* sp.) which migrate between stream and ocean habitats during the course of their life cycles. The tree snails include the Mariana Islands tree snail (*Partula gibba*) and Pacific tree snail (*P. radiolata*), both candidates for Federal listing, along with the Guam tree snail (*P. saltiana*), a species of concern.

Rare plant species that should be addressed in the Draft EIS include *Coccoloba guamensis*, *Lycopodium phlegmaria* var. *longifolium*, *Nerzola jacksonii*, *Tabernaemontana rotensis*, *Thelypteris warburgii*, and *Tricoperna kamospela*. All are species of concern, except for *Tabernaemontana rotensis* which is a candidate for Federal listing.

Federally listed species that may occur in the project area(s) include the Mariana fruit bat (*Pteropus marianus marianus*), the Guam swiftlet (*Collocalia barratti*), the Mariana crow (*Corvus kubaryi*), the Mariana moorhen (*Gallinula chloropus guami*), the green sea turtle (*Chelonia mydas*), the hawksbill sea turtle (*Eretmochelys imbricata*), and the plant species (*Sertanthes melzovi*). All are listed as endangered except for the green sea turtle, which is listed as threatened.

With regard to federally listed endangered and threatened species, a biological assessment (BA) that (1) evaluates the impacts of the proposed action(s) on listed species and (2) determines whether any such species are likely to be adversely affected by the action(s) may be prepared in accordance with the interagency consultation regulations found at 50 CFR Part 402. The information provided in the BA should be comprehensive enough to support any determination the Navy makes regarding the effects of the disposal and reuse activities on threatened or endangered species.

The Service is concerned with the possible introduction of the brown tree snake (*Bufo irregularis*) into the Commonwealth of the Northern Mariana Islands (CNMI) as well as the state of Hawaii. Introduction of the brown tree snake represents a major threat to the preservation of native forest birds and other wildlife resources. If materials and/or equipment may be moved between Guam and the CNMI or Hawaii as part of the proposed property disposal and reuse, potential impacts of brown tree snake introduction into the CNMI or Hawaii should be addressed in the Draft EIS. In addition, measures to prevent the introduction of the brown tree snake to the other islands should be incorporated into the project and identified in the Draft EIS. The Service

2

RECEIVED TIME JUN 9 11:12AM

PRINT TIME JUN. 3. 11:14AM

RECEIVED TIME JUN. 3. 11:12AM

PRINT TIME JUN. 3. 11:14AM

NOI to Prepare EIS for  
Disposal & Reuse of Supplies Navy  
Property on Guam

recommends that U.S. Department of Agriculture (USDA) - Animal Plant Health Inspection Service (APHIS) - Wildlife Services be contacted regarding development of brown tree snake control procedures for the disposal and reuse activities.

The Service appreciates the opportunity to provide comments on the proposed project. If you have questions regarding these comments, please contact Fish and Wildlife Biologist Karen "Kini" Jensen at (808) 541-3441.

Sincerely,



Brooks Harper  
Field Supervisor  
Biological Services

cc: USDA - Wildlife Services, Guam  
NMFS - PAO, Honolulu  
USEPA - Region IX, San Francisco  
DAWR, Guam  
CZMP, Guam  
GEPA, Guam

3



EPA REGIONAL COMMENTS, Planned and Items of Concern U.S. West District, Guam, April 1988

**COMMENTS**

**Water Quality**

1. Under Section 1404 (c) of the Safe Drinking Water Act, USEPA has determined that the northern portion of Guam has an aquifer which is the sole drinking water source for the island and which, if contaminated, would create a significant hazard to public health. If proposed sites for this disposal action are located such that runoff from the sites could affect the aquifer the following applies.

"No commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator (of USEPA) determines may constitute such aquifer through a discharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into plan or design the project to assure that it will not so contaminate the aquifer."

USEPA has defined a "significant hazard to public health" to mean any contamination which may cause a designated sole source aquifer to exceed the maximum contaminant levels (MCL) contained in the National Primary Drinking Water Standards. Exceedance of the MCLs would expose the community which relies on the aquifer to an unhealthy drinking water supply.

In 1978, USEPA and the Guam Environmental Protection Agency entered into a Memorandum of Understanding (MOU) to implement Section 1424 (c). Under the MOU, GEPA is the designated lead agency in reviewing whether Federally-assisted or Federally-funded projects may adversely affect the aquifer. Furthermore, GEPA must work with local and Federal agencies to insure that the planning, design, construction, and operation of any project in the designated area incorporates all reasonable measures to mitigate or prevent any potential adverse effects on the quality of groundwater. In accordance with the MOU, your office should contact GEPA to determine whether the project alternatives could adversely affect the sole source aquifer and to identify appropriate measures to mitigate or prevent potential adverse impacts to groundwater.

For each of the project alternatives, the EIS should describe and discuss any impacts which could adversely affect the Wellhead Protection Program which was developed by GEPA to protect public water supply wells on Guam. Likewise, the EIS should discuss any restrictions which the Wellhead Protection Program would place on the project alternatives.

The DEIS should evaluate the potential of the proposed project to cause adverse aquatic impacts (e.g., increased salinity and turbidity in surface waters, changes in dissolved oxygen, and temperature changes), destruction of aquatic habitat, and water quantity changes.

RECEIVED TIME MAY.21. 10:14AM

PRINT TIME MAY.21. 10:17PM

2. The DEIS should discuss potential impacts to existing beneficial uses.

**Section 404 Comments**

The DEIS should identify potential impacts to wetlands and other aquatic resources protected under the CWA Section 404, including requirements and any associated proposals to ensure compliance. The DEIS should clearly describe impacts and mitigations for wetlands south of the Fiti Power Plant, specifically those in the area of Polaris Point and the Santa Trujito parcel.

EPA will review the proposed action for compliance with the Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230 [Subpart]). promulgated pursuant to Section 404(b)(3) of the CWA. To comply with this Guideline, the proposed action must meet all of the following criteria:

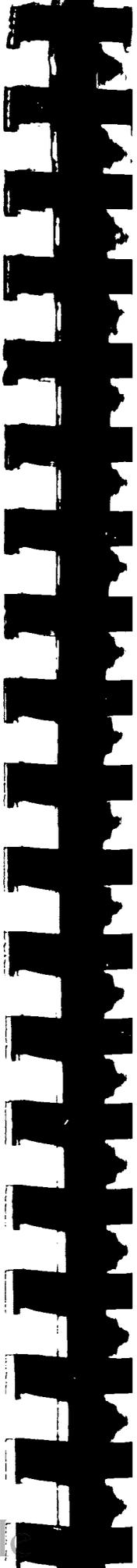
- There is no practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem (40 CFR 230.104(b)).
- The proposed action does not violate State water quality standards, water effluent standards, or jeopardize the continued existence of federally listed species or their critical habitat (40 CFR 230.104(b)).
- The proposed action will not cause or contribute to significant degradation of waters of the United States, including wetlands (40 CFR 230.104(d)). Significant degradation includes loss of fish and wildlife habitat, including cumulative losses.
- All appropriate and practicable steps are taken to minimize adverse impacts on the aquatic ecosystem (i.e., mitigation) (40 CFR 230.104(f)). This includes incorporation of all appropriate and practicable compensation measures for unavoidable losses to waters of the United States, including wetlands. The DEIS should fully address the feasibility of "in-kind" habitat mitigation measures.

**Pesticides, Herbicides, and Herbicides Materials**

1. EPA is involved with remedial investigations on Guam. The DEIS should discuss known or suspected hazardous materials contamination that have been identified through these and other investigations (e.g., Fiti Power Plant, Timpetson Power Plant, and Agaña Dated Power Plant) as among those sites whose contents have been identified, and whether the proposed projects would effect planned or ongoing efforts that may be underway to remediate hazardous substances contamination of soil and/or groundwater.
2. For both the construction and maintenance phases of the project, discuss whether herbicides or pesticides would be used for vegetation clearance, management, or other activities.

RECEIVED TIME MAY.21. 10:44AM

PRINT TIME MAY.21. 10:17PM



EPA REGIONAL COMMISSIONER, MEMPHIS and DEPT. OF JUSTICE, WASHINGTON, D.C., MAY 21, 1998

If use of herbicides or pesticides are proposed, discuss potential impacts to non-target species, water quality, visitors to the area, or local residents. Appropriate mitigation measures should also be discussed.

#### Air Quality

The DEIS should provide a discussion of air quality standards, ambient air quality conditions, and potential air quality impacts of the proposed project, including cumulative and indirect impacts. Federal agencies are required by the CAA to ensure that actions conform to an approved air quality implementation plan. General Conformity Regulations can be found in 40 CFR Parts 51 and 93 (58 Federal Register, page 63214, November 30, 1993). These regulations should be examined for applicability to the proposed action.

#### NEPA

1. EPA recommends that a clear description be provided of project alternatives, potential impacts to the environment, and mitigation for those impacts. The analysis should comparatively evaluate environmental impacts of the alternatives, defining the issues and providing a clear basis for choice among options for the decisionmaker and the public (40 CFR 1502.14).
2. NEPA requires evaluation of reasonable alternatives not within the jurisdiction of the lead agency (40 CFR Section 1502.14(c)). Furthermore, these should be a clear discussion of the reasons for the elimination of alternatives which were not evaluated in detail.
3. The DEIS should analyze potential cumulative effects in the Region of Influence (ROI). According to 40 CFR 1508.7, "(c)umulative impacts can result from individually minor but collectively significant actions taking place over a period of time." A description of all planned, pending and approved projects in the ROI, especially those that have or have pending Clean Water Act (CWA) section 404 permits, should be presented along with a map illustrating the locations of those projects. The effects of the proposed action should be analyzed in relation to the expected development effects in the ROI to determine the total cumulative impacts. Be aware that the Council on Environmental Quality has recently finalized guidance on assessing cumulative impacts under NEPA.

4. Nearby residential areas should be documented and described in the DEIS. The potential for impacts to local residential communities (including temporary construction impacts) should be discussed in keeping with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations. See Environmental Justice.

#### Environmental Justice

In keeping with Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (EO 12898), the DEIS should describe the measures taken to fully analyze the environmental effects of the proposed Federal action on minority communities, e.g. Indian Tribes, and low-income populations, and to present opportunities for affected communities to provide input into the NEPA process. The intent and requirements of EO 12898 are clearly illustrated in the President's February 11, 1994 Memorandum for the Heads of all Departments and Agencies. Be aware that the Council on Environmental Quality is finalizing its guidance memorandum to Federal agencies on incorporating Environmental Justice analyses into NEPA documents.

EPA recommends that the DEIS address attention to low-income populations in the area of the action and that the DEIS address attention to low-income populations in the area of the action.



# Appendix B

---

## LAND USE ASSUMPTIONS



**APPENDIX B**

**LAND USE ASSUMPTIONS**



## APPENDIX B

### LAND USE ASSUMPTIONS

Reuse alternatives (Preferred, Lower Intensity, and Higher Intensity) outlined in Chapter Two are detailed in the text and tables below. Taking into account Guam's zoning requirements, site constraints, and projected market conditions, the following assumptions were made for each land use alternative:

#### **Resort**

The majority of resort development on Guam has been confined in the Tamuning-Tumon area. New tourism-related projects have been approved to meet the anticipated strong demand and historically high occupancy rates. Various projects are proposed in villages which have not experienced major hotel/resort development, especially golf course-related resorts which require more extensive land area than available in Tumon Bay. Notwithstanding the tremendous amount of permitting and application activity in the 1990s, the Japanese and Asian economic recessions have forced a slowdown in project implementation.

Resort development is proposed on the FAA Housing and Nimitz Hill Vacant Land parcels. Smaller guest houses or bed-and-breakfast establishments are offered as alternatives in Barrigada. Overall, it appears that the total number of hotel rooms assumed on GLUP properties (ranging from 100 to 350 units) is reasonable for Guam over the next five to 10 years. Large resorts are not allowed in these designated low and moderate intensity districts. Smaller-scale, "three star" hotels are assumed, limited by zoning to 64 guest rooms each on a maximum 2-acre lot. Hotels at the FAA Housing property would be related to a golf or recreation component. Golf course development may be doubtful until Asian economies recover or unless development costs are kept to a minimum. Recently developed courses on Guam have not been performing well due to high project costs, lack of infrastructure in outlying areas, and the inability to market memberships in Japan. A neighborhood hotel at the Nimitz Hill parcel, affiliated with the commercial and cultural activities, is proposed. Guest houses at Barrigada would be limited to 10 units per development.

#### **Industrial and Warehouse Development**

Guam's industrial development has been limited primarily to warehouse storage; there is very little light industry and no heavy industry on the island. Facilities range from smaller buildings (2,000 to 5,000 square feet [186 to 65 square meters]) to larger warehouses (20,000 square feet [1,858 square meters] or more). The current real estate market is depressed for warehouse space. A proposed industrial park near the commercial port did not materialize due to a downturn in the real estate/construction industry. Projections suggest that a maximum of 100,000 to 200,000 square feet (99,290 to 18,580 square meters) of industrial use space would be needed on Guam over the next five to 10 years.

Wholesale trade or warehousing areas are recommended for the Barrigada properties N5A and N5C, and for Polaris Point N16. Development standards for Districts 3 and 4 will control the design of all new industrial, warehousing, and distribution facilities. At

Barrigada, warehouses are recommended adjacent to the Guam Army National Guard and Hawaiian Rock Products sites. In the southern region, industrial use at the Polaris Point parcel is a viable higher intensity alternative given its proximity to the Port Authority of Guam and readily accessible utilities.

These industrial warehouse facilities would be located off of the main highways, Routes 15 and 16 and Marine Drive. Zoning controls in District 3, 4, or 8 would apply, with allowable densities and building heights greater in District 4 than District 3. Zoning requirements would limit structures to 60-foot (18-meter) building heights in District 4, with a maximum lot coverage ranging from 25 to 50 percent. It is anticipated that industrial facilities would consist of expansive, low structures on large lots (minimum lot size of 1 acre [0.4 hectare]) surrounded by parking and landscaped buffer zones.

### **Commercial/Retail**

Commercial areas include office and retail development. The majority of commercial centers and warehouse stores on Guam are small, ranging from 20,000 to 30,000 square feet (1,858 to 2,787 square meters). These have retail tenants, video rentals, convenience stores, and fast food restaurants. Micronesia Mall, one of the larger retail developments at 288,000 square feet (26,755 square meters) of retail space, is planning an expansion. In general, Guam's retail industry is currently suffering from low occupancy rates.

Retail and related commercial development would be spread throughout all regions, with larger developments planned at the Marine Drive Utility parcel, across from Micronesia Mall, and at the Nimitz Hill Vacant Land parcel. Commercial development at the Nimitz Hill parcel, consisting of theaters, museums, art galleries, a modest hotel, and community shopping center, would depend upon the area's residential population growth and planned competitive developments nearby.

Along Marine Drive, smaller commercial centers would occur at the Tamuning Telephone Exchange parcel and in the southern region at Tenjo Vista, Route 2A, and Old Apra Heights parcels. Included in the higher density alternative, neighborhood commercial centers would be consistent with Barrigada residential development, depending on the future commercial reuse of NAS Agana, now known as Tiyan.

Individual retail lots would be sited on a minimum of 8,000 square feet (743 square meters), with floor area ratios ranging from 25 to 60 percent (up to 80 percent for hotels in District 4). Due to parking requirements, it is likely that an individual retail complex would be a two-story building, with the remainder used for parking and landscaped setbacks. A shopping center would likely be two to three stories in height, with large parking areas.

Office development for private sector, government, or public agency, use is also possible at the Harmon Annex, Tamuning Telephone Exchange, Marine Drive Utility, Route 2A, and Old Apra Heights parcels. Office buildings would range from two to five stories in height.

## Residential

Current housing demand is centered around affordable housing, and it is expected that any new housing projects on Guam would be marketed to local residents. The estimated Guam population of 153,700 is growing at an average annual rate of 3 percent. Assuming four persons per household, 6,000 new housing units would accommodate population growth for the next five years. Over the next 10 years, 12,000 housing units would accommodate the projected population growth.

Approximately 2,565 affordable single-family residences or townhomes are assumed to be constructed on GLUP properties under the Preferred Alternative; alternatives include half that number for the Lower Intensity Alternative and over 4,000 units for the Higher Intensity Alternative. An additional 200 “high-end” single- or multi-family townhouses would be constructed on the NAS Officers Housing parcel under the Preferred Alternative. No high-rise condominiums are anticipated due to zoning constraints on the majority of parcels outside of the urban core and the current real estate slump in the condominium market.

Large affordable single family housing developments of 100 to 200 units per phase are indicated for the FAA Housing area, two Barrigada parcels, and Nimitz Hill parcels. Homeless providers and social services expressed interest in reusing existing housing units at the FAA and Nimitz properties. As stated earlier, the FAA Housing are undergoing demolition. The preferred alternative is for housing at the Nimitz Hill parcel to remain and be expanded for multi-family and/or homeless residential use.

Single-family residential units would range from two-bedroom/one-car to four-bedroom/two-car houses on half-acre lots. Affordable single- and multi-family development densities are considered at four to 14 dwelling units per acre, with one- to three-story structures at 900 square feet (8 square meters) per townhouse to 1,600 square feet (149 square meters) per single-family residence. Allowable single- and multi-family development densities are higher, eight to 20 dwelling units per acre. Single-family housing is compatible with the scale of adjacent residential communities, but multi-family developments would potentially bring a much higher density to the Dededo, Barrigada, Tiyan, and Nimitz Hill areas.

## Agricultural

Agriculture use, primarily crop, plant, vine, and tree production, is recommended for the Barrigada property. Currently, the Guam Department of Agriculture leases land and administers the Navy lease for various small farmers. The farmers have expressed interest in expanding operations at Barrigada. Low-rise storage/equipment structures may be required with expansion, along with adequate water supply and road access.

Aquaculture operations are assumed for the Preferred Alternative at the Polaris Point parcel. A reasonable commercial fishpond operation would occupy at least 10 acres, including ponds and a small warehouse for feed storage and maintenance equipment.

### **Parks, Recreation, Historic, and Conservation**

Parks, conservation lands, and recreational facilities are proposed on over 1,000 acres (405 hectares) or 35 percent of the GLUP properties to protect environmentally sensitive zones as well as to provide public park facilities. Conservation use is recommended for environmentally sensitive areas at the FAA Housing property, Sasa Valley, Tenjo Vista, Polaris Point, Nimitz Hill, and Navy Ordnance Annex North parcels. Conservation districts are characterized by archaeological, cultural, historical, and natural resources, wetlands, scenic areas, pristine ecological communities, beaches, limestone forests, aquifer recharge and reservoir watershed areas, and hazard prone zones (flood plains, tsunami inundation or seismic zones, and steep slopes).

Active recreational facilities at territorial parks, beach parks, natural preserves, conservation areas (for hiking), and community parks are proposed at the FAA Housing property, Harmon Annex, Rizal/Afleje Beach, and Navy Ordnance Annex North parcels. Existing athletic facilities will be reused or expanded at Barrigada and Nimitz Hill Enlisted Housing parcels. Additional open space in the form of small neighborhood parks will be required as part of new residential subdivisions, following *I Tanò-ta* guidelines and Department of Parks and Recreation standards.

The Department of Parks and Recreation, Department of Agriculture, and Guam Land Use Commission (former Territorial Planning Council) have prepared a *Draft Parks and Recreation Master Plan* which designates future Guam parks. Planning, facility design, and density requirements for GovGuam park lands will be determined on a case-by-case basis by the Department of Parks and Recreation. For this EIS analysis, new recreational facilities are based on a typical Floor Area Ratio (FAR) of 2 to 5 percent.



**LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS**

PROPERTY	Development Acreage (less roads, circulation)	Resort / Hotel / Guesthouse Rooms	Residential Units	Industrial Building Sq. Ft.	Commercial Building Sq. Ft.	Agricultural Structures Sq. Ft.	Park & Rec Facilities Sq. Ft.	Golf Course Clubhouse Sq. Ft.
<b>UNIT TOTALS</b>	<b>2,165</b>	<b>176</b>	<b>2,565</b>	<b>133,455</b>	<b>358,018</b>	<b>10,000</b>	<b>166,256</b>	<b>30,000</b>
N2	496	128	390	0	0	0	43,560	30,000
N3	4	0	0	0	0	0	24,800	0
N4B	22	0	0	0	152,460	0	0	0
N4C	2	0	0	0	27,878	0	0	0
N8	69	0	200	0	12,000	0	0	0
N5A	264	0	0	103,455	0	0	27,878	0
N5B	286	0	1,500	0	0	0	0	0
N5C	12	0	0	30,000	0	0	0	0
N5D	44	0	220	0	0	0	0	0
N10A	96	0	158	0	0	0	20,000	0
N10B	163	48	97	0	98,010	0	0	0
N12A	7	0	0	0	0	0	6,273	0
N12B	499	0	0	0	30,000	0	0	0
N14	69	0	0	0	0	10,000	0	0
N15	10	0	0	WWTP	0	0	0	0
N16	12	0	0	0	32,670	0	0	0
N17	14	0	0	0	0	0	12,545	0
N18	5	0	0	0	5,000	0	0	0
N19A	45	0	0	0	0	0	1,200	0
N109B	47	0	0	0	0	0	30,000	0



## LAND USE ASSUMPTIONS GLUP REUSE PARCELS

- Cells F4**  
Notes: Maximum lot size for hotel in District 3 = 2 acres. Large resorts are not allowed in this district.
- Cells H4**  
Notes: Maximum Building height: 24 feet above grade for cliffline properties and lots within 1000 feet of cliffline.
- Cells J4**  
Notes: Recreation Facilities: FAR estimated to range from 2% to 5%. Actual FAR and lot coverage to be determined by the Department of Parks and Recreation.
- Cells D5**  
Notes: Development Site = Total land area after subtracting 20% for roads/circulation. For Resort use, subtract 337 acres for future 27 hole golf course.
- Cells L5**  
Notes: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).
- Cells N8**  
Notes: Parking Area based on 350 sf land area required per car (includes circulation).
- Cells I11**  
Notes: Parking requirement for Hotel.
- Cells L11**  
Notes: Assume 30 acres for hotel development. Remainder of resort area for golf course, recreation facilities, and resort residential. Assume three star hotel, total hotel area based on 750 gross SF hotel per room.
- Cells N11**  
Notes: Assume 200 employees at resort hotel/golf course.
- Cells Q11**  
Notes: Resort Hotel-assume one small resort/bungalow hotel, no golf, remainder is open space.
- Cells R11**  
Notes: Assume 100 employees.
- Cells T11**  
Notes: Resort- assume three resort hotel parcels at 64 units each plus 27 hole golf course.
- Cells U11**  
Notes: Resort/golf course-assume 300 employees.
- Cells L12**  
Notes: Resort bungalow, assume 1,200 SF per bungalow.
- Cells M12**  
Notes: Assume 10 DU/acre for resort bungalows on 23 available acres and 30 acres for hotel.
- Cells A13**  
Notes: Golf course- assume 18 holes developed in 10 year time frame with expansion for future 9 holes.
- Cells N13**  
Notes: Golf clubhouse, assume 15,000 SF public area.
- Cells M17**  
Notes: Dwelling Units- assume average DU/acre of 7.5 (5 + 10)/2. Open space requirement, approx. 4 acres, leaving 52 acres for housing.
- Cells Q17**  
Notes: Housing area open space requirement is approx. 3 acres.
- Cells T17**  
Notes: Assume 10 DU/acre for affordable single family housing. Open space requirement is approx. 5.5 acres
- Cells D19**  
Notes: Buildable area for recreation facilities limited to approx. 50 acres due to steep cliffline and coastal setbacks.
- Cells L19**  
Notes: Recreation facilities, assume low FAR of 2%.
- Cells S19**  
Notes: Recreational facilities, assume average FAR of 3.5%.



**LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS**

**Cell: F4**  
Note: Maximum Lot Coverage based on I Tarr-1a District 3.

**Cell: M**  
Note: Actual FAR and lot coverage to be determined by the Department of Parks and Recreation.

**Cell: L4**  
Note: Assume baseline year is 1995.

**Cell: L5**  
Note: Recommended Use based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).

**Cell: B5**  
Note: Development density based on I Tarr-1a.

**Cell: T5**  
Note: Development density based on I Tarr-1a.

**Cell: D15**  
Note: Development Site = Total land area after subtracting approximately 3.3 acres for leach field and access road from Route 3.

**Cell: I15**  
Note: Parking requirement based on average 1 space per 200 SF, or 1 space per 250 SF GFA for government office.

**Cell: L15**  
Note: Community Center assume expansion (doubling area ) of existing building.

**Cell: N15**  
Note: Parking Area based on 150 SF land area required per car (includes circulation).

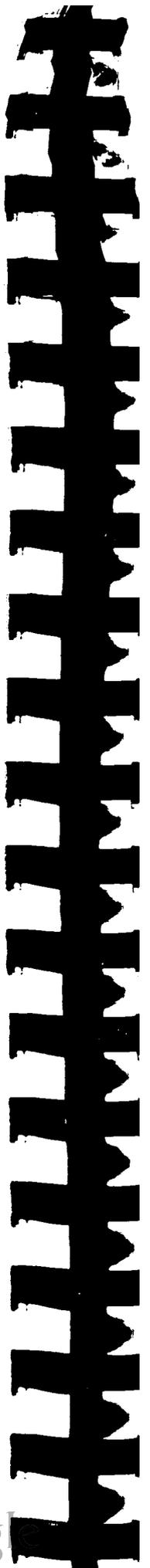
**Cell: P15**  
Note: Community Center or government office-assume lower intensity reuse of existing building with no expansion.

**Cell: S15**  
Note: Community Center max FAR = 40%

LAND USE ASSUMPTIONS  
CLUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY NAC																						
2	TAMUNING TELEPHONE EXCHANGE																						
3																							
4	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE		I Tano-ta Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	PREFERRED ALTERNATIVE Commercial	No Action	Lower Intensity Commercial	Higher Intensity Commercial	TEN YEAR DEVELOPMENT POTENTIAL (Building area & for # of dwelling units)		Lower Intensity Commercial		Higher Intensity Commercial	FUTURE DEVELOPMENT POTENTIAL (20 years +, based on Reuse Plan & Maximum 1 Tano-ta (Conting))			
5		Acres	Percentage of total acreage	Development Site							SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg	SF	DU		
6				Acres																			
7																							
8																							
9																							
10																							
11																							
12	INDUSTRIAL	2	100%	1.60	4	15-60%	3500 SF	20-60	1 per 200 SF GFA	25%	27,878	139	0	17,424	87	55,757	279	55,757					
13	CONCRETE																						
14	RESIDENTIAL																						
15	AGRICULTURAL																						
16	PARKS/RECREATION/																						
17	HISTORIC/CONSERVATION																						
18	SUBTOTAL	2	100%	1.60																			
19	OTHER PROPOSED USE																						
20	HIGHWAY IMPROVEMENTS																						
21	EASIMENTS																						
22	Navy to retain telephone cable	x																					
23	High intensity commercial development.																						
24	ALTERNATIVE USES																						
25	No Action - Navy retains land in caretaker status; no development.																						
26	Lower intensity commercial or office development based on 1 Tano-ta lower intensity FAR, district 4.																						
27	Higher intensity commercial, office, hotel/inns development based on 1 Tano-ta maximum FAR, district 4 (excluding residential and parking structure use)																						
28	FAR = Floor Area Ratio																						
29	DU = Dwelling Unit																						
30	SF = square foot																						
31	GFA = Gross Floor Area																						
32	NA = Not Applicable																						
33																							
34																							
35																							
36																							
37																							
38																							

- TYPICAL LAND USE CATEGORIES
- a: Agriculture
  - b: Residences
  - c: Hotels / Guest Houses
  - d: Schools
  - e: Retail
  - f: Personal Services
  - g: Private Facilities
  - h: Business/Professional Services
  - i: Governmental Services, Limited Public Utility, Quasi-Public
  - j: Recreation/Open Space
  - k: Manufacturing
  - l: Wholesale/Storage/Distribution
  - m: Industrial Services
  - n: Public Utilities



## LAND USE ASSUMPTIONS GLUP REUSE PARCELS

- Call: L4  
Note: Assume baseline year is 1995.
- Call: L5  
Note: Recommended Use and Alternatives based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).
- Call: R5  
Note: Development density based on 1 Tanu-1a.
- Call: T5  
Note: Development density based on 1 Tanu-1a.
- Call: D13  
Note: Development site = Total land area after subtracting 20% for roads and circulation.
- Call: C13  
Note: Minimum lot size in District 4 = 8000 SF for commercial facilities.
- Call: I13  
Note: Average parking requirement for retail commercial establishments.
- Call: R13  
Note: Max. FAR excludes residential and parking structure use.
- Call: L13  
Note: Preferred alternative assumes average commercial/retail FAR of 40%.
- Call: S13  
Note: Higher FAR's in District 4 which were not evaluated include:  
1.) FAR = 300% (Parking structure) = 209,088 SF allowed.  
2.) FAR = 100% (4F dwelling) = 87,120 SF, limited to 64 dwellings total.



**LAND USE ASSUMPTIONS**  
**GLUP REUSE PARCELS**

**Cell: H4**  
**Note:** Condition of Release: Restricted height of development due to airport operations.

**Cell: L4**  
**Note:** Assume baseline year is 1995.

**Cell: D5**  
**Note:** Development Site = Total land area after subtracting 20% for roads/circulation and less 5 acres (undevelopable steep slopes).

**Cell: L5**  
**Note:** Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 94).

**Cell: R5**  
**Note:** Development density based on I Tan-4a.

**Cell: T5**  
**Note:** Development density based on I Tan-4a.

**Cell: M15**  
**Note:** Assume "high-end" multi-family residential development at 4 DU/acre. Open space requirement for residential, assume 7 acres.

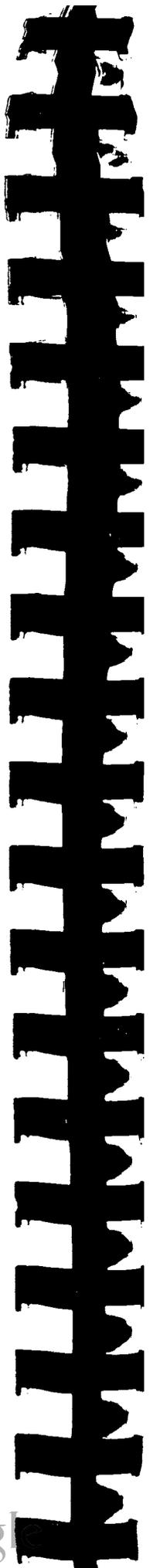
**Cell: Q15**  
**Note:** Assume "high-end" single-family residential development at one DU/acre. Open space requirement for residential, assume 5 acres.

**Cell: T15**  
**Note:** Assume multi-family residential at max. 12 DU/acre. Open space requirement for residential, assume 9 acres.

**Cell: W15**  
**Note:** Multifamily residential development assuming average DU density of 20 per acre. Assumes 9 acres for recreational open space provision.

LAND USE ASSUMPTIONS  
CULUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY NSA																						
2	BARRIGADA																						
3	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE	Development Site	1 Total Land Use/Zoning District #	Max. Lot Coverage (Acres)	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	Low Max	High Max	FAR/DUs per acre	TEN YEAR DEVELOPMENT POTENTIAL (Building area & # of dwelling units)	Lower Intensity	No Action	Higher Intensity	FUTURE DEVELOPMENT POTENTIAL (20 years + based on Reuse Plan & Maximum 1 Tano-la Zoning)						
4		Acres (estimated)	Percentage of total acreage										(Building area & # of dwelling units)										
5		Acres																					
6																							
7																							
8																							
9																							
10																							
11	RESORT INDUSTRIAL	60	17%	4	15-60%	3,500 SF	20-60	1 per 2,000 SF GFA	25%	60%													
12	COMMERCIAL	245	71%	3	20-60%	5,000 SF	25-60	Ag-1 per acre	25%	50%													
13	RESIDENTIAL																						
14	AGRICULTURAL	40	12%	1				1/5,000 SF land + 1 ha/2 acres active rec.	2%	5%													
15	(Ag residential)																						
16	PARKS/RECREATION/HISTORIC/CONSERVATION (Barrigada Sports Complex)	345	100%																				
17	SUBTOTAL																						
18																							
19	OTHER PROPOSED USE																						
20	HIGHWAY IMPROVEMENTS	Route 16 - widening to 57 lanes																					
21		Future Route 8 expansion to 56 lanes																					
22	EASMENTS (retained by Sate)																						
23	Utilities	x																					
24	PREFERRED ALTERNATIVE																						
25	Industrial use																						
26	North of Route 8:																						
27	Recreation use on 42 acres (22 existing and 20 expansion) for Gov/Guam Barrigada Sports Complex.																						
28	South of Route 8:																						
29	Agriculture, including Dept of Ag activities.																						
30	ALTERNATIVE USES																						
31	No Action - Navy retains land in caretaker status; no development.																						
32	Lower intensity industrial and agriculture use based on 1 Tano-la district intensities.																						
33	Higher intensity development of industrial, residential, neighborhood oriented retail, expansion and joint military/public use of Navy golf course.																						
34																							
35																							
36	FAR = Floor Area Ratio																						
37	DU = Dwelling Unit																						
38	SF = square foot																						



## LAND USE ASSUMPTIONS CLUP REUSE PARCELS

- Cell: F4**  
Note: Assume no parking structures (85% max. lot coverage allowed).
- Cell: H4**  
Note: Building height: Conditions for release include restricted building heights to eliminate potential impact on NEXRAD weather radar facility operations.
- Cell: J4**  
Note: Recreation Facilities: FAR estimated to range from 2% to 5%. Actual FAR and lot coverage to be determined by the Department of Parks and Recreation.
- Cell: L4**  
Note: Assume baseline year is 1995.
- Cell: D5**  
Note: Development site = total land area after subtracting 20% for roads and circulation.
- Cell: L5**  
Note: Preferred alternative based on Reuse Plan for CLUP '94 Navy Properties (OX 94).
- Cell: R5**  
Note: Development density based on ITam-1a.
- Cell: I12**  
Note: Parking based on warehousing/storage/wholesale facility.
- Cell: K12**  
Note: FAR max- assume no Hotel development (FAR max= 80%).
- Cell: L12**  
Note: Industrial development would be limited in the next 5-10 years. Assume warehouse storage, smaller light industrial facilities in the 2,000 to 20,000 SF range. Assume 1/4 of 25% FAR would occur in next 10 years.
- Cell: P12**  
Note: Lower intensity industrial development assumes half of recommended development density.
- Cell: S12**  
Note: Higher intensity industrial development assumes 25% FAR density would occur within 10 years.
- Cell: V12**  
Note: Long-term industrial development assumes average density of 42.5% FAR.
- Cell: D15**  
Note: Development area = 163 acres (less approximately 15 acres for (2) existing landfills, less 20% for roads and circulation).
- Cell: S15**  
Note: Higher intensity development area breakdown: Assume 80 acres Dept of Ag operations and expansion, 112 acres golf course expansion, 15 acres existing landfills, 10 acres residential, and 2 acres neighborhood commercial.
- Cell: F17**  
Note: Land Use/Zoning: All area and density requirements will be determined on a case-by case basis by GovGuam Dept. of Parks and Rec.
- Cell: L17**  
Note: Department of Parks and Recreation Sports Complex: Current facilities include ballfields, viewing stand, restaurant, and gravel parking for 50 cars. Assume expansion of sports fields and support facilities.

LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY NSB																						
2	BARRIGADA																						
3	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE			I Tan-ota Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre												
4		Acres (estimated)	Percentage of total acreage	Development Site						Low Max	High Max												
5		ACRES																					
6		MODERATE INTENSITY																					
7																							
8																							
9																							
10	RESORT																						
11	INDUSTRIAL																						
12	COMMERCIAL (guesthouses)																						
13	(Neighborhood commercial)																						
14	RESIDENTIAL	358	100%	286	3	20-60%	4,000 SF	25-60	1 per 150 SF GFA	25%	25%												
15										25%	50%												
16	AGRICULTURAL									8	20												
17	PARKS/RECREATION/																						
18	HISTORIC/CONSERVATION																						
19	SUBTOTAL	358	100%	286																			
20	OTHER PROPOSED USE																						
21	HIGHWAY IMPROVEMENTS	Route 8 - expansion to 5/6 lanes			Wicken Route 15 to 2/3 lane																		
22	EASEMENTS (acquired by)																						
23	Parcel																						
24	Existing Landfills	(2)																					
25	Utilities	7																					
26	Access	7																					
27	PREFERRED ALTERNATIVE																						
28	Large single and multi-family developments.																						
29																							
30	ALTERNATIVE USES																						
31	* No Action - Navy retains land in caretaker status; no development.																						
32	* Lower intensity development of single and multi-family residential based on I Tan-ota minimum, district 3.																						
33	* Higher intensity development of single and multi-family residential, neighborhood-oriented commercial, including small scale-wed/guesthouse/restaurant based on I Tan-ota maximum, district 3.																						
34																							
35																							
36	FAR = Floor Area Ratio																						
37	DU = Dwelling Unit																						
38	SF = square foot																						
39																							
40																							



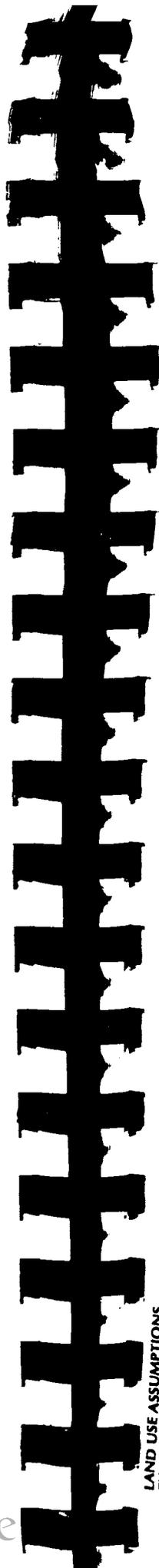
## LAND USE ASSUMPTIONS CLUP REUSE PARCELS

- Cell: H4**  
Note: Condition of Release: Restricted height of development to prevent impact on NEXRAD operations.  
**Cell: L4**  
Note: Assume baseline year is 1995.  
**Cell: D5**  
Note: Development Site = Total land area after subtracting 20% for roads/circulation.  
**Cell: L5**  
Note: Preferred alternative based on Reuse Plan for CLUP '94 Navy Properties (Oct 96).  
**Cell: R5**  
Note: Development density based on I Tanu-4.  
**Cell: T5**  
Note: Development density based on I Tanu-4. Assume higher intensity development based on: 20 acres hotel/guesthouses, 10 acres existing landfill, remainder for residential/neighborhood commercial. Less 20% for roads and circulation.  
**Cell: S13**  
Note: Neighborhood commercial-assume 5% of land area.  
**Cell: T13**  
Note: Assume 20 acres for hotel/guesthouses and remainder for residential.  
**Cell: V13**  
Note: Neighborhood commercial-assume 5% of land area.  
**Cell: T14**  
Note: Assume neighborhood commercial on 2 acres.  
**Cell: V14**  
Note: Assume neighborhood commercial on 2 acres.  
**Cell: M16**  
Note: Average DU/acre = 14e. 88-2092. Development area reduced by 10 acres for existing landfills. Residential density based on meeting projected population growth.  
**Cell: Q16**  
Note: Lower density development area; Assume less 10 acres for existing landfills.

LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY NSC																						
2	BARRIGADA																						
3	PROPOSED LAND USE																						
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11	RESORT INDUSTRIAL	15	100%	12	3	25-60%	4,000	25-40	varies, 1/4000-2,000 SF GFA	25%	50%	30,000	75	0	15,000	38	60,000	150	60,000				
12	COMMERCIAL																						
13	RESIDENTIAL																						
14	AGRICULTURAL																						
15	PARKS/RECREATION/HISTORIC/CONSERVATION																						
16	SUBTOTAL	15	100%	12	3	25-60%	4,000	25-40	varies, 1/4000-2,000 SF GFA	25%	50%	30,000	75	0	15,000	38	60,000	150	60,000				
17																							
18																							
19	OTHER PROPOSED USE																						
20	HIGHWAY IMPROVEMENTS																						
21																							
22	EASEMENTS (vestained by Navy)																						
23																							
24																							
25																							
26	PREFERRED ALTERNATIVE																						
27																							
28																							
29																							
30																							
31	ALTERNATIVE USES																						
32																							
33																							
34																							
35																							
36																							
37																							
38																							

TYPICAL LAND USE CATEGORIES  
a: Agriculture  
b: Residences  
c: Schools  
d: Retail  
e: Private Facilities  
f: Business/Professional Services  
g: Governmental Services, Limited Public Utility, Open-Public  
h: Recreation/Open Space  
i: Manufacturing  
j: Wholesale/Storage/Distribution  
k: Industrial Services  
l: Public Utilities  
m: Industrial Services



**LAND USE ASSUMPTIONS**  
**GLUP REUSE PARCELS**

Cell: H4  
Note: Building height: Conditions for release include restricted building heights to eliminate potential impact on NEXRAD weather radar facility operations.

Cell: L4  
Note: Assume baseline year is 1995.

Cell: D5  
Note: Development site = total land area after subtracting 20% for roads and circulation.

Cell: L5  
Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).

Cell: R5  
Note: Development density based on I Tani-a and market demand.

Cell: T5  
Note: Development density based on I Tani-a and market demand.

Cell: U12  
Note: Assume Hawaiian Rock Products continues quarry support on 6.5 acres, new industrial/warehouse development on remaining 5.5 acres.

Cell: P12  
Note: Assume Hawaiian Rock Products continues operations, see note above.

Cell: S12  
Note: Assume Hawaiian Rock Products continues operations, see note above.

Cell: V12  
Note: Assume Hawaiian Rock Products continues operations, see note above.



**LAND USE ASSUMPTIONS**  
**GLUP REUSE PARCELS**

**Cell: H4**  
Notes: Condition of Release: Restricted height of development to prevent impact on NEXRAD operations.

**Cell: L4**  
Notes: Assume baseline year is 1995.

**Cell: D5**  
Notes: Development Site = Total land area after subtracting 20% for roads/circulation.

**Cell: L5**  
Notes: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).

**Cell: R5**  
Notes: Development density based on 1 Tanna-ia.

**Cell: T5**  
Notes: Development density based on 1 Tanna-ia.

**Cell: S14**  
Notes: Guesthouse-assume 2 guesthouses, each with 16 rooms on 0.5 acre. CFA = 750 SF per room.

**Cell: U14**  
Notes: Guesthouse - Assume 40 employees/two guesthouses.

**Cell: W14**  
Notes: Guesthouse-assume 2 guesthouses, each with 16 rooms on 0.5 acre. CFA = 750 SF per room.

**Cell: M16**  
Notes: Assume affordable SF residential development. Considering a 3% projected annual population growth rate, the Barrigada/Mangilao community will increase by 6,978 persons in 10 years, equaling 17,201 new 4-person households. Assume that the NSD property (44 acres out of NS's designated 318 residential development acres) would accommodate 14% of the homes. DU average = 5 acre.

**Cell: Q16**  
Notes: Lower density SF affordable housing on 1/2 acre lots (for cluster housing; smaller lots with more neighborhood open space.)

**Cell: T16**  
Notes: Residential density assumes SF affordable housing at Max FAR of 100%. Open space provisions considered. Assumes 3% population growth rate in region.

**Cell: W16**  
Notes: Single and Multifamily Residential development assuming average DU density of 14 per acre. Assumes 2 acres for recreational open space provision.

LAND USE ASSUMPTIONS  
CLUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY N10A																						
2	NIMITZ HILL ENLISTED HOUSING																						
3	GEDA-RECOMMENDED REUSE																						
4	PROPOSED LAND USE	Acres (estimated)	Percentage of total acreage	Development Site Acres	Tan'ola Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	High Max	Low Max	PREFERRED ALTERNATIVE	No Action	Lower Intensity	Higher Intensity	FUTURE DEVELOPMENT POTENTIAL (20 years +, based on Reuse Plan & Maximum 1 Tan'ola Zoning)					
5																							
6																							
7																							
8																							
9																							
10																							
11	RESORT																						
12	INDUSTRIAL																						
13	COMMERCIAL																						
14	(Community facilities)																						
15	RESIDENTIAL	50	42%	40	3	20-60%	4,000 SF	25-60		25%	B	20	50%	158	0	78	302					35,000	78
16	(new and existing housing)																						
17	AGRICULTURAL	70	58%	56	3					2%		5%		20,000		15,000	30,000					30,000	30000+
18	PARKS/RECREATION/																						
19	HISTORIC/CONSERVATION	120	100%	96																			
20	SUBTOTAL																						
21	OTHER PROPOSED USE																						
22	HIGHWAY IMPROVEMENTS																						
23	EASEMENTS (retained by Navy)																						
24	Access																						
25	Utilities																						
26	to private residences north of site																						
27	DDI easements																						
28	PREFERRED ALTERNATIVE																						
29	Retain existing (78) housing units for affordable housing and construct additional single/multi-family units																						
30	Retain existing pool and sports fields for public recreation.																						
31	Remaining land use for historic/preservation due to steep slopes and historical remains.																						
32	ALTERNATIVE USES																						
33	No Action - Navy retains land in caretaker status; no development.																						
34	Lower intensity development - retain existing housing and recreation facilities. No new construction.																						
35	Higher intensity development of multi-family (apt. condos, townhouse) residential, neighborhood commercial, office complex, and community facilities.																						
36	based on 1 Tan'ola maximum, district 3.																						
37	GEA = Gross Floor Area																						
38	FAR = Floor Area Ratio																						
39	NA = Not Applicable																						
40	DU = Dwelling Unit																						
41	SF = square feet																						
42																							

TYPICAL LAND USE CATEGORIES  
 b: Residences  
 c: Hotels / Guest Houses  
 d: Schools  
 e: Retail  
 f: Personal Services  
 g: Private Facilities  
 h: Business/Professional Services  
 i: Governmental Services, Limited Public Utility, Quasi-Public  
 j: Recreation/Open Space  
 k: Manufacturing  
 l: Wholesale/Storage/Distribution  
 m: Industrial Services  
 n: Public Utilities



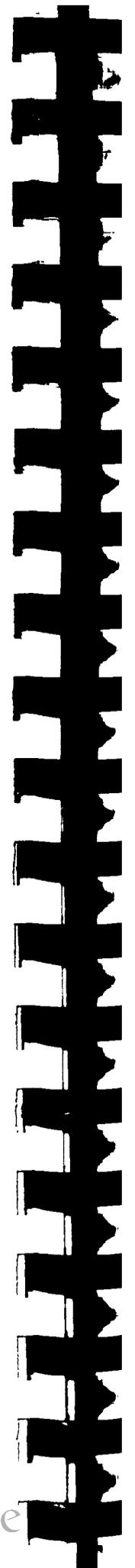
**LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS**

- Cell: M**  
Note: Recreation Facilities: FAR estimated in range from 2% to 5%. Actual FAR and lot coverage to be determined by the Department of Parks and Recreation.
- Cell: L4**  
Note: Assume baseline year is 1995.
- Cell: D5**  
Note: Development Site = Total land area after subtracting 20% for roads/circulation.
- Cell: L5**  
Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 94).
- Cell: R5**  
Note: Development density based on I Tamu-1a.
- Cell: T5**  
Note: Development density based on I Tamu-1a.
- Cell: S14**  
Note: Community facilities such as library, nr., center and pavilion, police station, snack shop, bank: Assume 35,000 SF on 5 acres.
- Cell: V14**  
Note: Community facilities such as library, nr., center and pavilion, police station, snack shop, bank: Assume 35,000 SF on 5 acres.
- Cell: M16**  
Note: Retain 78 existing housing units. In addition, assume development of SF and MF units, limited to 20 acres due to existing housing and steep slopes. Less 20% for roads and circulation = 16 acres. Assume low density at average 5 DUs per acre.
- Cell: T16**  
Note: Retain existing 78 housing units. In addition, assume additional residential development on 16 acres at average 14 DU/acre for intensity district 3.
- Cell: W16**  
Note: Retain existing 78 housing units. In addition, assume additional residential development on 16 acres at max. 20 DU/acre for intensity district 3.
- Cell: L18**  
Note: Coniger Field-assume small expansion of existing recreation facilities to 20,000 SF total on 3 acres.
- Cell: P18**  
Note: Coniger Field-assume existing facilities (park, field) are 15,000 SF on 3 acres.

LAND USE ASSUMPTIONS  
CLUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W					
1	PROPERTY N10B																											
2	NIMITZ HILL VACANT LAND																											
3																												
4	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE		I Tan'ola Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	TEN YEAR DEVELOPMENT POTENTIAL (building area & # of dwelling units)	PREFERRED ALTERNATIVE	Lower Intensity	Higher Intensity	FUTURE DEVELOPMENT POTENTIAL (20 years +, based on Reuse Plan & Maximum I Tan'ola Zoning)													
5		Acres (estimated)	Percentage of total ACREAGE	Development Site					Low Max	High Max		No Action			Future Build-out													
6												Relevant Land Use categories																
7		Acres		Acres								I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W		
8												SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg		
9		<b>PARK &amp; MODERATE INTENSITY</b>																										
10	RESORT																											
11	INDUSTRIAL																											
12	COMMERCIAL	30	16%	20	25-35%	8000 SF	35	1 per 200 SF GFA	25%	35%	0	98,010	0	49,005	147,015												196,020	
13	Residential (single/multi)																											64
14	RESIDENTIAL	20	11%	10	35%	1	35		35%	32	0	48	0	32	64													
15	AGRICULTURAL (low/houses)								20-60%	4,000 SF	25-60																	152
16	AGRICULTURAL																											
17	PARKS/RECREATION/HISTORIC/CONSERVATION	133	73%	133	25%	0	35		2%	5%	0																	
18	HISTORIC/CONSERVATION																											
19	SUBTOTAL	183	100%	163																								
20	OTHER PROPOSED USE	Widen portions of Mt. Auburn Rd.																										
21	HIGHWAY IMPROVEMENTS	Hoboy Rd. expansion to 5-lane.																										
22	EASEMENTS (retained by Navy)	Access Road to Nimitz Hill reservoir.																										
23	Access Road	to Nimitz Hill reservoir.																										
24	Utilities	PCL lines																										
25	PREFERRED ALTERNATIVE																											
26	Community and cultural commercial development along Route 6.																											
27	Recreational hiking trails and conservation land use in middle 1/3 of property. No facility construction.																											
28	Multi-family residential on each side of Mount Auburn Road-south end of property.																											
29																												
30																												
31																												
32	ALTERNATIVE USES																											
33	* No Action - Navy retains land in caretaker status; no development.																											
34	* Lower intensity commercial, residential, park/conservation development based on I Tan'ola minimum density, district 3.																											
35	* Higher intensity development commercial, residential, park/conservation development based on I Tan'ola maximum density, district 3.																											
36																												
37	FAR = Floor Area Ratio	GFA = Gross Floor Area																										
38	DU = Dwelling Unit	NA = Not Applicable																										
39	SF = square foot																											
40																												

**TYPICAL LAND USE CATEGORIES**  
a: Agriculture  
b: Residences | n: Public Utilities  
c: Hotels / Guest Houses  
d: Schools  
e: Retail  
f: Personal Services  
g: Private Facilities  
h: Business/Professional Services  
i: Governmental Services, Limited Public Utility, Quasi-Public  
j: Restaurant/ Open Space  
k: Manufacturing  
l: Wholesale/Storage/Distribution  
m: Industrial Services



- Call: L4  
Note: Assume baseline year is 1995.
- Call: D5  
Note: Development Site: Total land area after subtracting 20% for roads/circulation.
- Call: L5  
Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (D-1 96).
- Call: R5  
Note: Development density based on 1 Tam-4a.
- Call: T5  
Note: Development density based on 1 Tam-4a.
- Call: D13  
Note: Commercial development site reduced due to steep slopes to approx. 20 acres.
- Call: I13  
Note: Average parking requirement for retail commercial establishments.
- Call: I13  
Note: Commercial development - assume 22 out of 74 acres available. Remaining 2 acres for hotel development. Assume commercial density to be approx. 1/3 of 25% FAR in 10 year time frame.
- Call: M14  
Note: Hotel development: 1 Tam-4a zoning allows 2 acres max. for hotel. Assume moderate 24 rooms per acre.
- Call: D15  
Note: Residential sites reduced (less 8 acres) due to steep slopes, greater than 20%. Total development site = 20-8)=12% roads and circulation.
- Call: M16  
Note: Multi-family residential: Assume moderate (brownhouse) intensity at 12 DU/acre. Open space requirement is approx. 1.5 acres.
- Call: T16  
Note: Residential open space requirement is approx. 2 acres.



**LAND USE ASSUMPTIONS**  
**GLUP REUSE PARCELS**

Cell: L4

Note: Assume baseline year is 1995.

Cell: D5

Note: Development Site = total land area after subtracting 20% for roads and circulation.

Cell: L5

Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).

Cell: R5

Note: Development density based on I Tam-1a.

Cell: T5

Note: Development density based on I Tam-1a.

Cell: F17

Note: Assume maximum lot coverage excludes marina, zoo, and sewage lift stations (other permitted uses in Intensity District 2).

Cell: I17

Note: FAR is not defined for all permitted uses in Intensity District 2 (community, recreational facilities, agricultural activities).

Assume low intensity consistency or recreational development at average 2.5% FAR.

Cell: P17

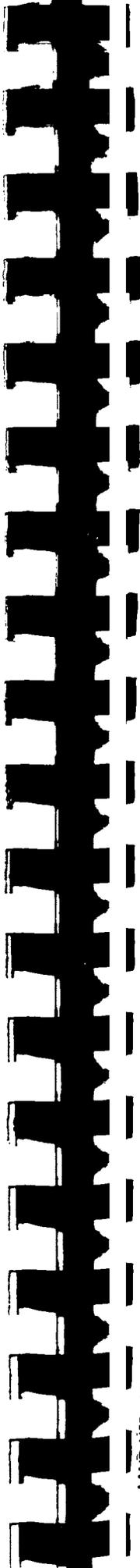
Note: Assume conservation/recreation use (such as open space or hiking trails) with no constructed facilities except for parking lot.

Cell: R17

Note: For recreation parking requirement, assume 4.5 acres of recreation land (such as hiking trails), remainder as conservation due to limited access and steep slopes.

LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY N12B																					
2	TENJO VISTA																					
3	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE	1 Tan'ota Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	FAR/DUs per acre	Preferred Alternative	No Action	Lower Intensity	Higher Intensity	TEN YEAR DEVELOPMENT POTENTIAL (Building area &/or # of dwelling units)	FUTURE DEVELOPMENT POTENTIAL (20 years +, based on Reuse Plan & Maximum 1 Tan'ota Zoning)						
4		Acres (estimated)	Development Site					Low Max	High Max		SF	DU	SF	DU								
5		Percentage of total acreage									h/g/e/f/g/h	h/g/e/f/g/h	h/g/e/f/g/h	h/g/e/f/g/h								
6		Acres									SF	DU	SF	DU								
7											Plg	Plg	Plg	Plg								
8																						
9		CONSERVATION & MODERATE INTENSITY																				
10	RESORT																					
11	INDUSTRIAL																					
12	COMMERCIAL	70	13%	19	8 (3)	8000 SF	25-35%	35	1 per 200 SF GFA	25%	25%	0	20,000	100	60,000	300	209,088					
13	RESIDENTIAL																					
14	AGRICULTURAL																					
15	PARKS/RECREATION/	480	87%	480	8 (1)						0	0	0	0	0							
16	HISTORIC/CONSERVATION																					
17	SUBTOTAL	550	100%	499																		
18	OTHER PROPOSED USE																					
19	HIGHWAY IMPROVEMENTS	Marine Drive- expand to 5-lane (Polaris Pt. Access Rd. to Rte. 2A).																				
20	EASEMENTS (retained by Navy)																					
21	Access																					
22	Utilities																					
23	x & POL lines																					
24	access and utility to private properties at top of hill.																					
25	EASEMENTS (Private)																					
26	PREFERRED ALTERNATIVE																					
27	Commercial (small retail center) fronting Marine Drive.																					
28	Conservation use of majority of site due to wetlands, steep slopes, wildlife habitats, and historic sites.																					
29																						
30	ALTERNATIVE USES																					
31	No Action - Navy retains land in caretaker status; no development.																					
32	Lower intensity commercial use (small retail center). Remainder as Conservation Use.																					
33	Higher intensity commercial use (two small retail centers). Remainder as Conservation Use.																					
34																						
35																						
36																						
37	FAR = Floor Area Ratio																					
38	DU = Dwelling Unit																					
39	SF = square foot																					
40																						
41																						
42																						
43																						
44																						
45																						
46																						
47																						
48																						
49																						
50																						
51																						
52																						
53																						
54																						
55																						
56																						
57																						
58																						
59																						
60																						
61																						
62																						
63																						
64																						
65																						
66																						
67																						
68																						
69																						
70																						
71																						
72																						
73																						
74																						
75																						
76																						
77																						
78																						
79																						
80																						
81																						
82																						
83																						
84																						
85																						
86																						
87																						
88																						
89																						
90																						
91																						
92																						
93																						
94																						
95																						
96																						
97																						
98																						
99																						
100																						



**LAND USE ASSUMPTIONS**  
**GLUP REUSE PARCELS**

**Cell E4**  
Note: Tenjo Vista Property is not zoned in I Tani-ia, but is designated "Military." Adjacent properties are zoned districts 1, 2, 3 (Parks, low and moderate intensity). Assume District 1, Parks and District 3, Moderate Intensity zoning requirements for this site.

**Cell L4**  
Note: Assume baseline year is 1995.

**Cell D5**  
Note: Development Site- Total land area after subtracting 20% for roads/circulation. Additional land subtracted for steep slopes, wetlands, habitats.

**Cell L5**  
Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).

**Cell R5**  
Note: Development density based on I Tani-ia.

**Cell T5**  
Note: Development density based on I Tani-ia.

**Cell D13**  
Note: Environmental constraints include wetlands, floodplains, rivers, steep slopes, and historic sites. Assume suitable commercial development area is approximately 24 acres, less 20% for roads and circulation.

**Cell I13**  
Note: Average parking requirement for retail commercial establishments.

**Cell L13**  
Note: Commercial development alternative: Assume small retail center, typically 20,000 to 30,000 SF, based on Guam's current retail facilities.

LAND USE ASSUMPTIONS  
CLUP: REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W		
1	PROPERTY N14																								
2	POLARIS POINT																								
3																									
4	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE		I Tan'ia Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	High Max	TEN YEAR DEVELOPMENT POTENTIAL (Building area &/or # of dwelling units)										FUTURE DEVELOPMENT POTENTIAL (20 years +, based on Reuse Plan & Maximum 1 Tan'ia Zoning)			
5		Acres	Percentage of total acreage	Development Site					Low Max	High Max		Preferred Alternative (Aquaculture)	No Action	Lower Intensity (Recreation)	Higher Intensity (Industrial)	Referent Land Use categories						Future Build-out			
6												SF	DU	Plg	m	SF	DU	Plg	m	SF	DU	Plg	SF	DU	
7																									
8		CONSERVATION & LOW INTENSITY																							
9																									
10																									
11	INDUSTRIAL				8	25-60%	4,000	25-60	varies, 1/400-2,000 SF GFA	25%	50%	0	0	0		100,000							83	583,704	
12	COMMERCIAL																								
13	RESIDENTIAL																								
14	AGRICULTURAL	67	82%	54	2	20-40%	4,200 SF to 5 acres	35-45	1 per acre land	15%	25%	10,000	20	0	0										
15																									
16	PARKS/RECREATION	15	18%	15	2					2%	5%	0	0	0	6,000	100	0							0	
17	HISTORIC/CONSERVATION	82	100%	69																					
18																									
19																									
20	OTHER PROPOSED USE																								
21	HIGHWAY IMPROVEMENTS	Marine Drive- expand to 5-lane (Polaris Pt. Access Rd. to Rte. 2A).																							
22	EASEMENTS retained by																								
23	Navy)																								
24	Utilities	Fuel pipeline (Shell Oil) along Marine Dr. to Polaris Point Naval Station																							
25	Access																								
26	PREFERRED ALTERNATIVE																								
27	Low intensity use such as agriculture/aquaculture/marine facilities (in keeping with I Tan'ia Zoning District 2: Low intensity).																								
28	Assume 20 acre commercial aquaculture farm.																								
29	Park/recreation/conservation use of eastern half of property, north of Polaris Point Road due to presence of wetlands.																								
30	ALTERNATIVE USES																								
31	• No Action - Navy retains land in caretaker status; no development.																								
32	• Lower intensity use, such as recreational facilities based on I Tan'ia density, district 2.																								
33	• Higher intensity industrial (marine or warehousing) park as recommended in GEDA Reuse Plan, based on I Tan'ia allowable density, Industrial District.																								
34	GFA = Gross Floor Area																								
35	DU = Dwelling Unit																								
36	NA = Not Applicable																								
37	SF = square foot																								
38																									

TYPICAL LAND USE CATEGORIES  
a: Agriculture  
b: Residences  
c: Schools  
d: Retail  
e: Private Facilities  
f: Business/Professional Services  
g: Governmental Services, Limited Public Utility, quasi-Public  
h: Recreation/Open Space  
i: Manufacturing  
j: Wholesale/Storage/Distribution  
k: Industrial Services  
l: Public Utilities  
m: n: Public Utilities

**LAND USE ASSUMPTIONS**  
**GLUP REUSE PARCELS**

- Cell: L4**  
Note: Assume baseline year is 1995.
- Cell: D5**  
Note: Development site = total land area after subtracting 20% for roads and circulation.
- Cell: L5**  
Note: Preferred alternative based on Reuse Plan for GLUP 94 Navy Properties (Oct 96).
- Cell: R5**  
Note: Development density based on I Tan-a.
- Cell: T5**  
Note: Development density based on I Tan-a.
- Cell: S12**  
Note: Assume higher intensity industrial activity on the site, as recommended in CEDA's Reuse Plan given the site's proximity to the Port Authority of Guam.  
(Note: I Tan-a zoning includes residential, agriculture, aquaculture, public services...)  
Assume development of previously leased, asphalt 20 acres to south of Polaris Point Road at 10-12% FAR over next 10 years.
- Cell: U12**  
Note: Industrial parking requirement ranges from 1 space per 400 SF (manufacturing) to 1 per 2,000 SF (warehousing.) Assume average 1 space per 1,200 SF.
- Cell: V12**  
Note: Industrial park based on industrial zoning density of 25% FAR on 54 acres.
- Cell: A15**  
Note: Reuse alternatives considered: agriculture, aquaculture, public service, recreational facilities, marinas, Houses of Worship, conveniences, retail, and personal service establishments. (Not including residential or ecological parks.)
- Cell: L15**  
Note: Preferred alternative: Assume aquaculture operation (raising freshwater prawns, tilapia, or catfish) on 10-20 acres.  
Optimal site conditions: flat site, availability of water, and plentiful sunshine. Warehouse for feed storage & maintenance equipment.
- Cell: P17**  
Note: Lower intensity alternative: In non-conservation area, assume recreational use (on 54 acres), consisting of a small pavilion, picnic areas, shoreline trails, and restrooms.
- Cell: R17**  
Note: Recreational parking : Assume low-intensity use, approximately 100 parking spaces, maximum.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	
1	PROPERTY N15																							
2	NEW APRA HEIGHTS																							
3																								
4	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE		I Tan'ota and Use/Zoning District #		Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	TEN YEAR DEVELOPMENT POTENTIAL (Building area &/or # of dwelling units)		Lower Intensity		Higher Intensity		FUTURE DEVELOPMENT POTENTIAL (20 years +, based on Reuse Plan & Maximum I Tan'ota Zoning)						
5		Acres	Percentage of total acreage	Development Site						Low Max	High Max	Preferred Alternative	No Action	Relevant Land Use categories		m		n		Future Build-out				
6														SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg	DU	
7		Acres																						
8		INDUSTRIAL & CONSERVATION																						
9																								
10																								
11		RESORT																						
12		INDUSTRIAL	102	100%	10	3 (8)	25-60%	4,000	25-60	25%	50%													
13		COMMERCIAL																						
14		RESIDENTIAL				3	20-60%	4,000 SF	25-60	25%	50%													
15		AGRICULTURAL								8	20													
16																								
17		PARKS/RECREATION/ HISTORIC CONSERVATION																						
18		SUBTOTAL	102	100%	10																			
19																								
20		OTHER PROPOSED USE																						
21		HIGHWAY IMPROVEMENTS																						
22		EASEMENTS (retained by N15)																						
23		Utilities																						
24		Access																						
25																								
26																								
27		PREFERRED ALTERNATIVE																						
28		Scrub forest to remain open space/conservation due to potential for wetlands and area of steep slope.																						
29																								
30																								
31		ALTERNATIVE USES																						
32		No Action - Navy retains land in caretaker status; no development.																						
33		Lower intensity : Entire site for conservation.																						
34		Higher intensity : Construction of moderate intensity residences in selected areas, based on I Tan'ota District 3.																						
35																								
36		FAR = Floor Area Ratio																						
37		DU = Dwelling Unit																						
38		SF = square foot																						

- a: Agriculture/Aquaculture
- b: Residences
- c: Schools
- d: Retail
- e: Private Facilities
- f: Business/Professional Services
- g: Governmental Services, Limited Public Utility, Quasi-Public
- h: Recreation/Open Space
- i: Manufacturing
- j: Wholesale/Storage/Distribution
- k: Industrial Services
- m: Public Utilities

**LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS**

Cell: L4

Note: Assume baseline year is 1995.

Cell: D5

Note: Development site = total land area after subtracting 20% for roads and circulation.

Cell: L5

Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (DRI 96).

Cell: B5

Note: Development density based on 1TAm-1a.

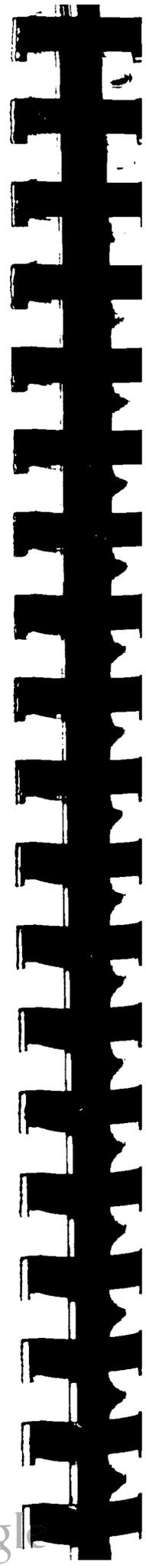
Cell: T5

Note: Development density based on 1TAm-1a.

Cell: T15

Note: Residential: Assume 40 acres are available for residential development (areas not on steep slopes or potential wetland areas), less 20% for roads and circulation. Assume moderate residential density for single family and townhouse development (DU=10/acre.)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	PROPERTY N15																						
2	NEW APRA HEIGHTS																						
3																							
4	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE	Percentage of total acreage	Development Site	I Tan'ota Land Use/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre												
5																							
6																							
7																							
8																							
9																							
10																							
11	RESORT																						
12	INDUSTRIAL	102	100%	10	3 (B)	25-60%	4,000	25-60		25%	50%												
13	COMMERCIAL																						
14	RESIDENTIAL				3	20-60%	4,000 SF	25-60		25%	50%												
15										B	20												
16	AGRICULTURAL																						
17	PARKS/RECREATION/HISTORIC/CONSERVATION																						
18	SUBTOTAL	102	100%	10																			
19																							
20	OTHER PROPOSED USE																						
21	HIGHWAY IMPROVEMENTS																						
22																							
23	EASEMENTS (retained by N15)																						
24	Utilities																						
25	Access																						
26																							
27	PREFERRED ALTERNATIVE																						
28																							
29																							
30	ALTERNATIVE USES																						
31																							
32																							
33																							
34																							
35																							
36																							
37																							
38																							



**LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS**

Cell: 14

Note: Assume baseline year is 1995.

Cell: D5

Note: Development site = total land area after subtracting 20% for roads and circulation.

Cell: L5

Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (DXT 96).

Cell: R5

Note: Development density based on 1 Tano-Ha.

Cell: T5

Note: Development density based on 1 Tano-Ha.

Cell: T15

Note: Residential: Assume 40 acres are available for residential development (areas not on steep slopes or potential wetland areas), less 20% for roads and circulation. Assume moderate residential density for single family and townhouse development (DU=10/acre.)

LAND USE ASSUMPTIONS  
CLUP REUSE PARCELS

1	2	3	A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	
			PROPERTY N16 ROUTE 2A	PROPOSED LAND USE																							
4																											
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											
13																											
14																											
15																											
16																											
17																											
18																											
19																											
20																											
21																											
22																											
23																											
24																											
25																											
26																											
27																											
28																											
29																											
30																											
31																											
32																											
33																											
34																											
35																											
36																											
37																											
38																											

TYPICAL LAND USE CATEGORIES  
a: Agr/aquaculture  
b: Residences  
c: Hotels / Guest Houses  
d: Schools  
e: Retail  
f: Personal Services  
g: Private Facilities  
h: Business/Professional Services  
i: Governmental Services, Limited Public Utility, Quasi-Public  
j: Manufacturing  
k: Wholesale/Storage/Distribution  
m: Industrial Services  
n: Public Utilities

## LAND USE ASSUMPTIONS GLUP REUSE PARCELS

Cells L4

Note: Assume baseline year is 1995.

Cells L5

Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).

Cells R5

Note: Development density based on I Tam-2a.

Cells T5

Note: Development density based on I Tam-2a.

Cells D13

Note: Development site = Total land area after subtracting 20% for roads and circulation.

Cells I13

Note: Average parking requirement for retail commercial establishments.

Cells L13

Note: Commercial development area- assume approx. 30,000 SF of office/commercial based on market conditions (approximately one-quarter of maximum FAR, District 3.)

Cells P13

Note: Lower intensity commercial development, assume half of recommended density.





**LAND USE ASSUMPTIONS**  
**CLUP REUSE PARCELS**

Cell: L4  
Note: Assume baseline year is 1995.

Cell: D5  
Note: Development Site = total land area after subtracting 10% for park roads and circulation.

Cell: L5  
Note: Preferred alternative based on Reuse Plan for CLUP '94 Navy Properties (Oxt 94).

Cell: B5  
Note: Development density based on 1 Tan-1a.

Cell: T5  
Note: Development density based on 1 Tan-1a.

Cell: S12  
Note: Higher intensity use: assume that CPA can successfully demonstrate that a portion of N17 is the only remaining area available for a husband generating facility, obtain environmental permits, and determine consistency with adjacent War in the Pacific National Historical Park.

Cell: V12  
Note: Higher intensity use: assume that CPA can successfully demonstrate that a portion of N17 is the only remaining area available for a husband generating facility, obtain environmental permits, and determine consistency with adjacent War in the Pacific National Historical Park.

Cell: L17  
Note: Recreational Park facility design will be determined by the Department of Parks and Recreation on a case-by-case basis. Assume use of existing pavilions and development of additional pavilions, BBQ area, restroom, outside showers. Commercial facilities such as water-recreation, and arts and crafts would be temporary, portable, and not require supporting structures.

Cell: B17  
Note: For recreation parking requirement, assume 5 acres of existing developed recreation area (existing pavilion, BBQ areas), remainder as conservation.

Cell: S17  
Note: Power plant : assume approximately 5 acres. Existing park facilities remain at south end of site.





**LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS**

- Cell: L4  
Note: Assume baseline year is 1995.
- Cell: L5  
Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).
- Cell: B5  
Note: Development density based on I Tami-4a.
- Cell: T5  
Note: Development density based on I Tami-4a.
- Cell: D13  
Note: Development site = Total land area after subtracting 20% for roads and circulation.
- Cell: I13  
Note: Average parking requirement for retail commercial establishments.
- Cell: P13  
Note: Lowest intensity commercial development and park/playground.
- Cell: D14  
Note: Development site reduced to approximately 6 acres at north and south ends, due to center roadway easements to neighboring residences. (Verify if these are official easements.)
- Cell: P16  
Note: Assume neighborhood park and playground on approximately 2.5 acres at north end of property.

LAND USE ASSUMPTIONS  
GLUIP REUSE PARCELS

1	2	3	A B C D E F G H I J K L M N O P Q R S T U V W																																			
			PROPERTY N19A NAVY ORDNANCE ANNEX NORTH (WEST PARCEL)																																			
4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	TEN YEAR DEVELOPMENT POTENTIAL (Building area for # of dwelling units)		FUTURE DEVELOPMENT POTENTIAL (20 years + based on Reuse Plan & Maximum 1 Tano-la Zoning)	
																																			Preferred Alternative	No Action	Lower Intensity	Higher Intensity
PROPOSED LAND USE		CEDA-RECOMMENDED REUSE		1 Tano-la Land Use/Zoning District #		Max Lot Coverage		Min Lot Size (Acres)		Max Bldg. Height (feet)		Parking Requirement		FAR/DUs per acre		FAR/DUs per acre		SF		DU		Pkg		SF		DU		Pkg		SF		DU						
GEDA-RECOMMENDED REUSE		Percentage of total acreage		Development Site		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres		Acres						
LOW TO MODERATE INTENSITY		50		100%		45		50		100%		45		50		100%		45		50		100%		45		50		100%		45		50						
OTHER PROPOSED USE		Route 5 reconstruct to modern design standards																																				
HIGHWAY IMPROVEMENTS		Route 5 reconstruct to modern design standards																																				
EASEMENTS retained by		Navy																																				
Access Utilities		X																																				
Fence/		around installation about perimeter, family housing																																				
PREFERRED ALTERNATIVE		Park and recreation use for youth camp.																																				
ALTERNATIVE USES		No Action - Navy retains land in caretaker status; no development.																																				
		Lower intensity conservation use for entire property.																																				
		Higher intensity development of a residences at north end, camping, recreation to south.																																				
FAR = Floor Area Ratio		GFA = Gross Floor Area																																				
DU = Dwelling Unit		NA = Not Applicable																																				
SF = square foot																																						

TYPICAL LAND USE CATEGORIES  
a: Agriculture  
b: Residences  
c: Hotels / Guest Houses  
d: Schools  
e: Retail  
f: Personal Services  
g: Private Facilities  
h: Business/Professional Services  
i: Governmental Services, Limited Public Utility, Quasi-Public  
j: Recreation/Open Space  
k: Manufacturing  
l: Wholesale/Storage/Distribution  
m: Industrial Services  
n: Public Utilities

**LAND USE ASSUMPTIONS  
CLUP REUSE PARCELS**

Cell: L4  
Note: Assume baseline year is 1995.

Cell: D5  
Note: Development Site = total land area after subtracting 20% for roads and circulation.

Cell: L5  
Note: Preferred alternative based on Reuse Plan for CLUP '94 Navy Properties (Oct 96).

Cell: R5  
Note: Development density based on I Tamu-1a.

Cell: T5  
Note: Development density based on I Tamu-1a.

Cell: K14  
Note: Residential density ranges from 5-7 dwelling units per acre (excluding mobile homes.)

Cell: T14  
Note: Residential - assume duplex or townhouse development at 6 DUs per acre. Development site limited due to steep slopes. Approximately 5 acres available along the north end of Route 5, less 20 % for roads and circulation.

Cell: L16  
Note: Recreational-youth camp; assume restroom facilities only for camping area.

Cell: N16  
Note: Parking; assume 25 spaces for camping area.

Cell: S16  
Note: Recreation facilities; Assume restrooms and pavilion for youth camp and camp site at south end of property.

LAND USE ASSUMPTIONS  
GLUP REUSE PARCELS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	
1	PROPERTY N19B																							
2	NAVY ORDNANCE ANNEX NORTH HOUSING (EAST PARCEL)																							
3	PROPOSED LAND USE	GEDA-RECOMMENDED REUSE		I Tan'ota Land User/Zoning District #	Max. Lot Coverage	Min. Lot Size (Acres)	Max. Bldg. Height (feet)	Parking Requirement	FAR/DUs per acre	FAR/DUs per acre	FAR/DUs per acre	TEN YEAR DEVELOPMENT POTENTIAL (Building area &/or # of dwelling units)		Preferred Alternative		No Action	Lower Intensity	Higher Intensity	FUTURE DEVELOPMENT POTENTIAL (20 years + based on Reuse Plan & Maximum I Tan'ota Zoning)					
4		Acres (estimated)	Percentage of total acreage	Development Site											SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg	
5		Acres													SF	DU	Pkg	SF	DU	Pkg	SF	DU	Pkg	
6		LOW TO MODERATE INTENSITY																						
7																								
8																								
9																								
10																								
11	RESORT																							
12	INDUSTRIAL																							
13	COMMERCIAL																							
14	RESIDENTIAL																							
15	(youth camp guesthouse)																							
16	AGRICULTURAL																							
17	PARK/RECREATION/	52	100%	47																				
18	HISTORIC/CONSERVATION																							
19	SUBTOTAL	52	100%	47																				
20	OTHER PROPOSED USE	Route 5-reconstruct to modern design standards																						
21	HIGHWAY IMPROVEMENTS																							
22	EASEMENTS (retained by Navy)																							
23	Access																							
24	Utilities	X																						
25	Fencing																							
26	PREFERRED ALTERNATIVE																							
27	Park and recreation use for community recreation, youth camp, camping, hiking trails.																							
28	Reuse of existing housing for youth camp and construction of new community recreation facilities																							
29																								
30																								
31	ALTERNATIVE USES																							
32	* No Action - Navy retains land in caretaker status; no development.																							
33	* Lower intensity conservation and youth camp use for entire property.																							
34	* Higher intensity development of youth camp, community recreation, and residences.																							
35																								
36																								
37	FAR = Floor Area Ratio	GFA = Gross Floor Area																						
38	DU = Dwelling Unit	NA = Not Applicable																						
39	SF = square feet	GPA = Guam Power Authority																						
40																								
		<p>Relevant Land Use categories</p> <p>a: Agriculture</p> <p>b: Residences</p> <p>c: Hotels / Guest Houses</p> <p>d: Schools</p> <p>e: Retail</p> <p>f: Personal Services</p> <p>g: Private Facilities</p> <p>h: Business/Professional Services</p> <p>i: Governmental Services, Limited Public Utility, Quasi-Public</p> <p>j: Recreation/Open Space</p> <p>k: Manufacturing</p> <p>l: Wholesale/Storage/Distribution</p> <p>m: Industrial Services</p> <p>ni: Public Utilities</p>																						
		<p>Typical Land Use Categories</p> <p>a: Agriculture</p> <p>b: Residences</p> <p>c: Hotels / Guest Houses</p> <p>d: Schools</p> <p>e: Retail</p> <p>f: Personal Services</p> <p>g: Private Facilities</p> <p>h: Business/Professional Services</p> <p>i: Governmental Services, Limited Public Utility, Quasi-Public</p> <p>j: Recreation/Open Space</p> <p>k: Manufacturing</p> <p>l: Wholesale/Storage/Distribution</p> <p>m: Industrial Services</p> <p>ni: Public Utilities</p>																						





## LAND USE ASSUMPTIONS GLUP REUSE PARCELS

- Cell: L4**  
Note: Assume baseline year is 1995.
- Cell: D5**  
Note: Development Site = total land area after subtracting 20% for park roads and circulation.
- Cell: L5**  
Note: Preferred alternative based on Reuse Plan for GLUP '94 Navy Properties (Oct 96).
- Cell: R5**  
Note: Development density based on 1 Taro-4a.
- Cell: T5**  
Note: Development density based on 1 Taro-4a.
- Cell: K14**  
Note: Residential density ranges from 5-7 dwelling units per acre (including mobile homes.)
- Cell: T14**  
Note: Residential on northern end of property; assume 6 DU's per acre duplex or townhouse. Development site limited to eight acres due to steep slopes, open space requirement, road, and circulation.
- Cell: L15**  
Note: Youth camp; assume reuse of existing buildings for overnight accommodation and support facilities. (9) buildings of 17 units totaling 18,747 SF.
- Cell: P15**  
Note: Youth camp; see note above.
- Cell: L17**  
Note: Community recreation facilities; assume construction of approximately 10,000-15,000 SF (swimming pool, sport courts, restrooms, and pavilions.)
- Cell: N17**  
Note: Assume 25 spaces for youth camp plus 25 to 50 for community recreation. Parking to include bus parking.
- Cell: Q17**  
Note: Parking to include bus parking.
- Cell: S17**  
Note: Community recreation facility; Assume reuse of existing housing at south end of property for youth camp and additional community recreation facilities.

THE UNIVERSITY OF CHICAGO PRESS

# Appendix C

---

TERRESTRIAL BIOTA AND SENSITIVE HABITATS



**APPENDIX C**

**TERRESTRIAL BIOTA AND SENSITIVE HABITATS**



## VEGETATION COMMUNITY TYPES

Based on the *Natural Resources Surveys* prepared for the Navy (Biosystems Analysis, Inc., 1988-1989), a total of nine different types of vegetation communities were characterized for the GLUP parcels. *The Botanical Survey of Selected U.S. Navy Guam Land Use Plan Parcels* (Whistler, 1998) classified the observed vegetation on the GLUP parcels into 13 different categories. Several of these categories are apparently equivalent to those defined in the BioSystems reports. These different vegetation types are briefly described below.

Several of the sites are fully developed and have no vegetation or suitable habitat for wildlife. Therefore, no survey of these sites were conducted and discussions on biological resources of these parcels are subsequently omitted.

### BIOSYSTEMS CATEGORIES

**Cultivars.** In certain areas, cultivars introduced to Guam may have become naturalized to form an artificial "forest." The most common plants found in such areas are South African tulip tree (*Spathodea campanulata*) orchid tree (*Bauhinia monandra*), flame tree (*Delonix regia*), and Hibiscus (*Hibiscus* sp.)

**Weeds with Scattered Shrubs.** These are areas where native vegetation is generally lacking, and opportunistic weed species and occasional shrubs are the dominant plants.

**Cleared Fields.** Though not specifically defined in the BioSystems survey reports, in general terms, cleared fields refers to areas that may be devoid of vegetation or have small numbers of emergent weeds.

**Tangantangan Scrub Forest.** This vegetation type is found on much of the undeveloped lands on Guam, and is dominated by the introduced small tree, tangantangan (*Leucaena leucocephala*). Dense stands may be almost pure tangantangan, with almost no understory vegetation, or may intergrade with mixed grassland or *Casuarina* woodland.

**Wetlands.** Several of the sites have areas of wetlands present. Along the coastline, these are mostly mangrove or swamp forest wetlands. Inland, these are primarily palustrine wetlands (freshwater, non-tidally influenced, and dominated by emergent vegetation, trees or shrubs).

**Limestone Forest.** Limestone forest is probably the original vegetation that covered most of Guam prior to the arrival of the first settlers thousands of years ago. It is a broad-leaved evergreen forest dominated by native species that are adapted to the limestone soils of the island. Typically limestone forests have a well-developed understory and abundant epiphytes, including ferns and orchids.

## Degraded Limestone Forest, Introduced Mixed Limestone Forest

Areas of limestone forest that have been subjected to disturbance or degradation occur on a number of the GLUP parcels. Disturbances may include clearing for roads or dumps, burning, or erosion on hill slopes. Such disturbances have resulted in a more open understory due to loss of seedlings, which in turn has allowed weed species to enter these areas.

In some cases, introduced species have intergraded with the original limestone forest species. The principal introductions include tangantangan (*Leucaena leucocephala*), breadfruit (*Artocarpus altilis*), South African tulip tree (*Spathodea campanulata*), golden shower tree (*Cassia fistula*), white ixora (*Ixora finlaysoniana*), kamachile (*Pithecellobium dulce*) and love vine (*Antigonon leptopus*).

**Savanna.** Guam savanna is grassland on clayey soil. Four communities are generally recognized in this ecosystem: (1) *Miscanthus*, (2) *Dimeria*, (3) *Phragmites*, and (4) an erosion-scar community (Fosberg 1960). The *Miscanthus* community (swordgrass) is made of dense clumps of grass that exclude other species. The *Dimeria* community is an open mixed community. The *Phragmites* (Chamorro=karisso) community tends to occur in wetlands; on the savanna, ephemeral wetlands occur on depressions in impermeable clays. Erosion scar communities are typically colonized first by vine-ferns, and later by less hardy species which utilize the shade formed by the earlier colonizers.

**Ravine (Riparian) Forest.** Ravine forest communities on Guam occur on the steeply-sloped stream banks which form on volcanic substrata. Ravine forests share about 60 percent of the same species with limestone forests, yet are distinct enough from them to be classed separately. The ravine forests of the Fonte Plateau area (including properties at Nimitz Hill) are distinctive, being dominated by an introduced palm, palma brava (*Heterospathe elata*).

## WHISTLER CATEGORIES

**Managed Vegetation.** This vegetation is found on areas of land currently being managed, mostly through mowing of lawns, but also through bulldozing or burning. These management activities alter the physical character or species composition of the vegetation community. The man-made disturbances encourage the growth of weed (ruderal) species. For example, in mowed lawns, low-growing species that can avoid frequent cutting survive and proliferate. In areas that are burned, those plants having underground rhizomes can survive and rapidly send up new shoots once the fires are finished.

**Abandoned Fields.** The vegetation on abandoned field sites apparently arises following discontinuance of previous management activities. On the GLUP parcels, this type is found only at the Former FAA Housing parcel. Abandoned fields are dominated by herbaceous species, especially sword fern (*Nephrolepis hirsutula*).

**Mixed Grassland.** This is a previously-managed or disturbed type of plant community that is dominated by herbaceous species, especially grasses. It intergrades into *Leucaena* scrub (tangantangan). Dominant species include wild sugarcane (*Saccharum spontaneum*), *Imperata conferta*, and mission grass (*Pennisetum polystachyon*).

**Phragmites/Saccharum Grassland.** Similar to mixed grassland, this community is dominated by phragmites grass (*Phragmites karka*) and wild sugarcane (*Saccharum spontaneum*), which because of their height and density exclude all other species.

**Leucaena Scrub.** Equivalent to tangantangan scrub forest as described by BioSystems (see above).

**Hibiscus Thicket.** This type is dominated by beach hibiscus (*Hibiscus tiliaceus*), a spreading tree which forms dense thickets. On Guam, it is usually found in wet areas, and often intergrades with swamp forest. On drier soils it may intergrade with *Leucaena* scrub.

**Casuarina Woodland.** This is an open forest type of vegetation dominated by ironwood (*Casuarina equisetifolia*). When dense, ground cover in this type of woodland is scarce, partly because of the accumulation of "needles" which litter the forest floor and inhibit understory growth. Less dense ironwood stands may intergrade into tangantangan or mixed grassland.

**Disturbed Forest.** This forest type is dominated by native and introduced tree species that are able to colonize disturbed areas. The most common trees here are *Vitex parviflora*, *ahgao* (*Premna serratifolia*), ironwood, and tangantangan.

**Limestone Forest.** Identical to limestone forest as described by BioSystems (see above).

**Littoral Strand.** This category of vegetation occurs on the immediate shoreline and is dominated by species that are dispersed by ocean currents or sea birds and are adapted to areas exposed to constant salt spray. Three subtypes can be recognized, based on structure—herbaceous strand, littoral shrubland, and littoral forest.

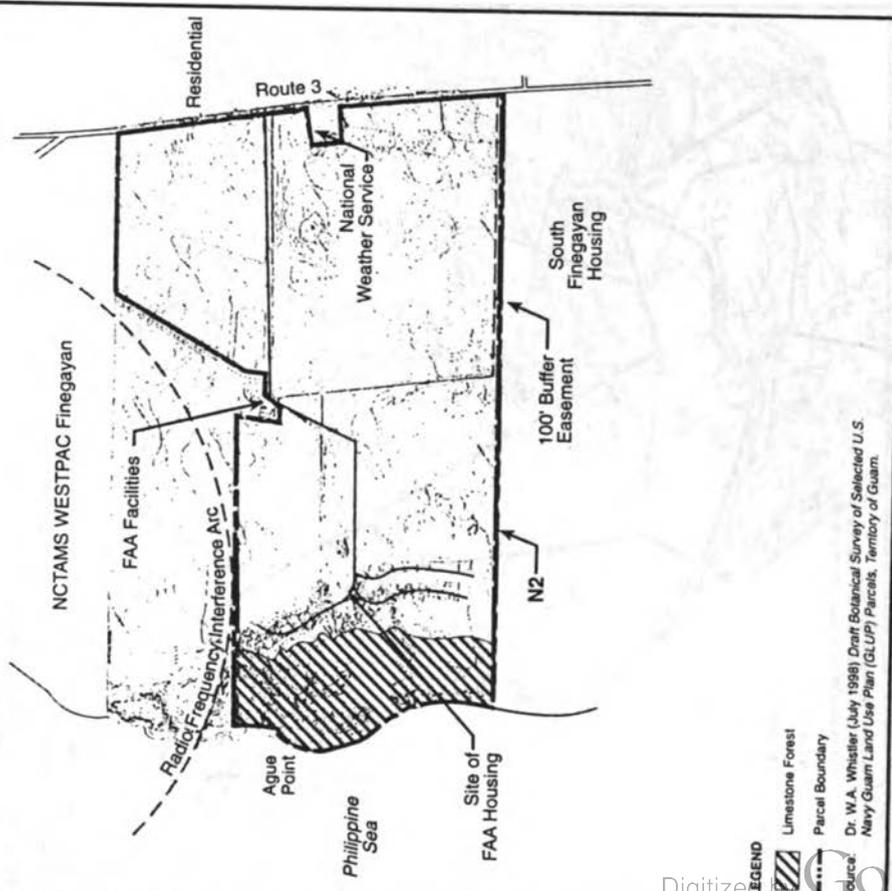
**Coastal Marsh.** Coastal marshes are wetlands that contain primarily herbaceous species. They are often dominated by a single species, usually grasses, sedges, or ferns that are adapted to wet soil and brackish water conditions.

**Mangrove Scrub.** Mangrove scrub is a type of wetland comprising trees that are adapted to wet, saline soil, occurring particularly in estuaries or on coastal mud flats. Mangroves, in turn, are a heterogeneous grouping of plants in various families that are adapted to living in such conditions. The most common family of mangrove plants, the Rhizophoraceae, is well-represented in the mangrove areas on Guam.

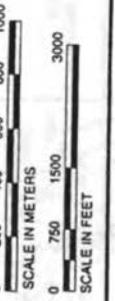
Mangrove scrub may intergrade into swamp forest, a similar type of vegetation community.

**Swamp Forest.** Like mangrove scrub, plants of the swamp forest are adapted to growing in wet conditions, but in areas with fresh, rather than saline ground water. Near the shore, swamp forest intergrades with mangrove scrub.

443 0107008-3 1427176



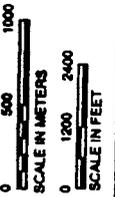
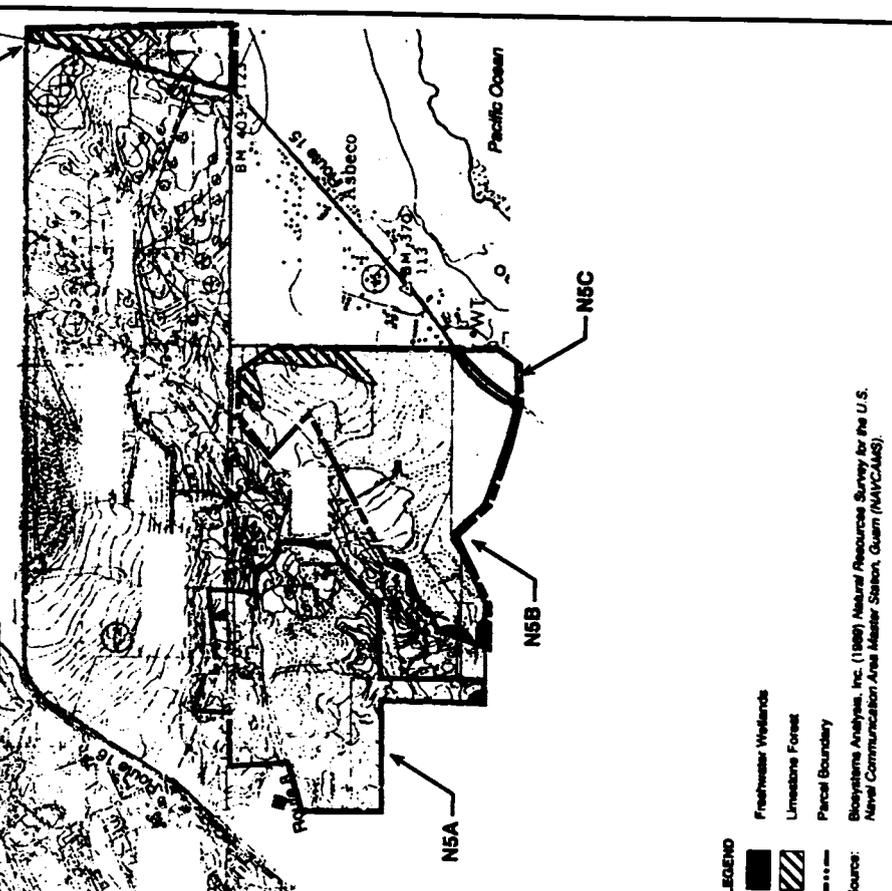
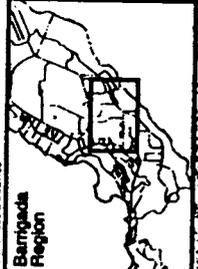
**SENSITIVE VEGETATION:**  
**FAA HOUSING PARCEL N2**  
 EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property on Guam



- LEGEND**
- Limestone Forest
  - Parcel Boundary

Source: Dr. W.A. Whistler (July 1998) Draft Botanical Survey of Selected U.S. Navy Guam Land Use Plan (GLUP) Parcels, Territory of Guam.

443 0107008-3 1427176

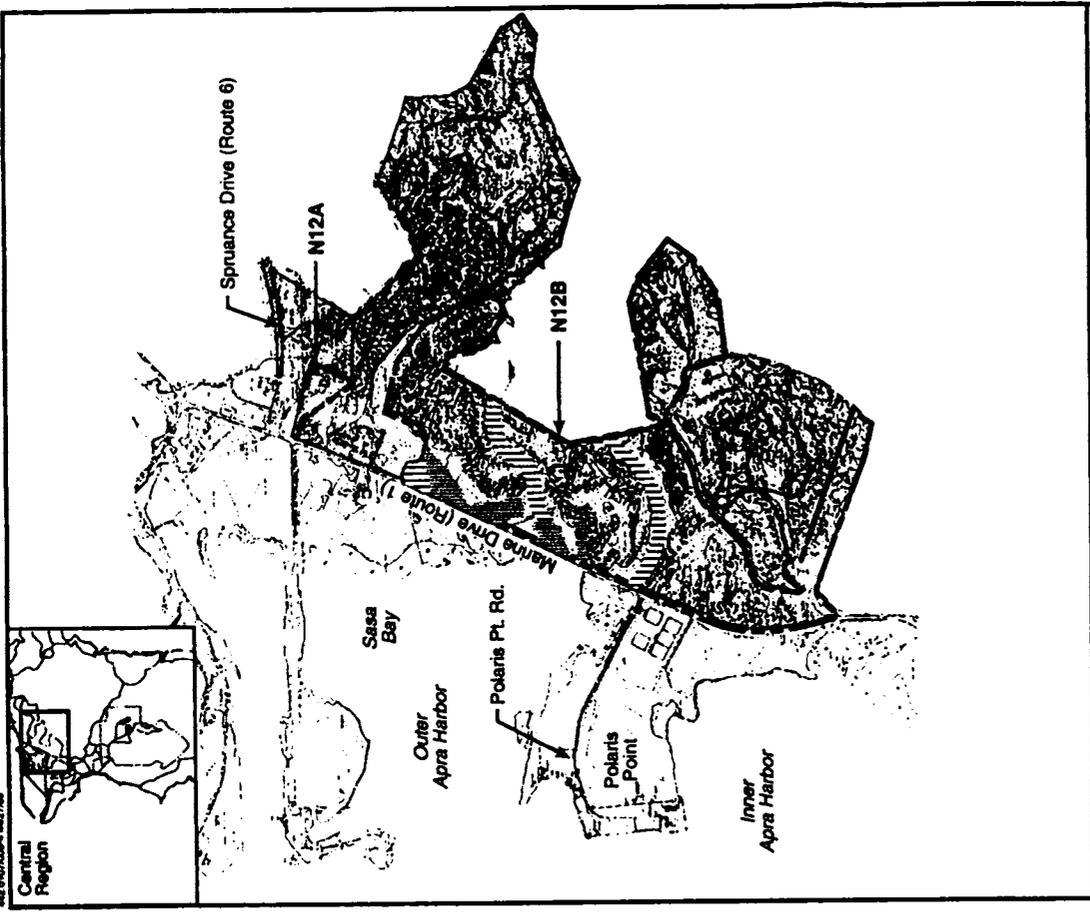
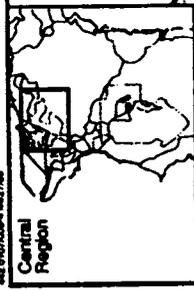


- LEGEND**
- Freshwater Wetlands
  - Limestone Forest
  - Parcel Boundary

Source: Biosystems Analysis, Inc. (1989) Natural Resource Survey for the U.S. Naval Communication Area Master Station, Guam (NAVCAMS).

**NATIVE VEGETATION:**  
**NCTAMS BARRIGADA PARCEL N5**  
 EIS for Disposal & Reuse of GLUP '94  
 U.S. Navy Property on Guam

48-519720B-1-NET/708



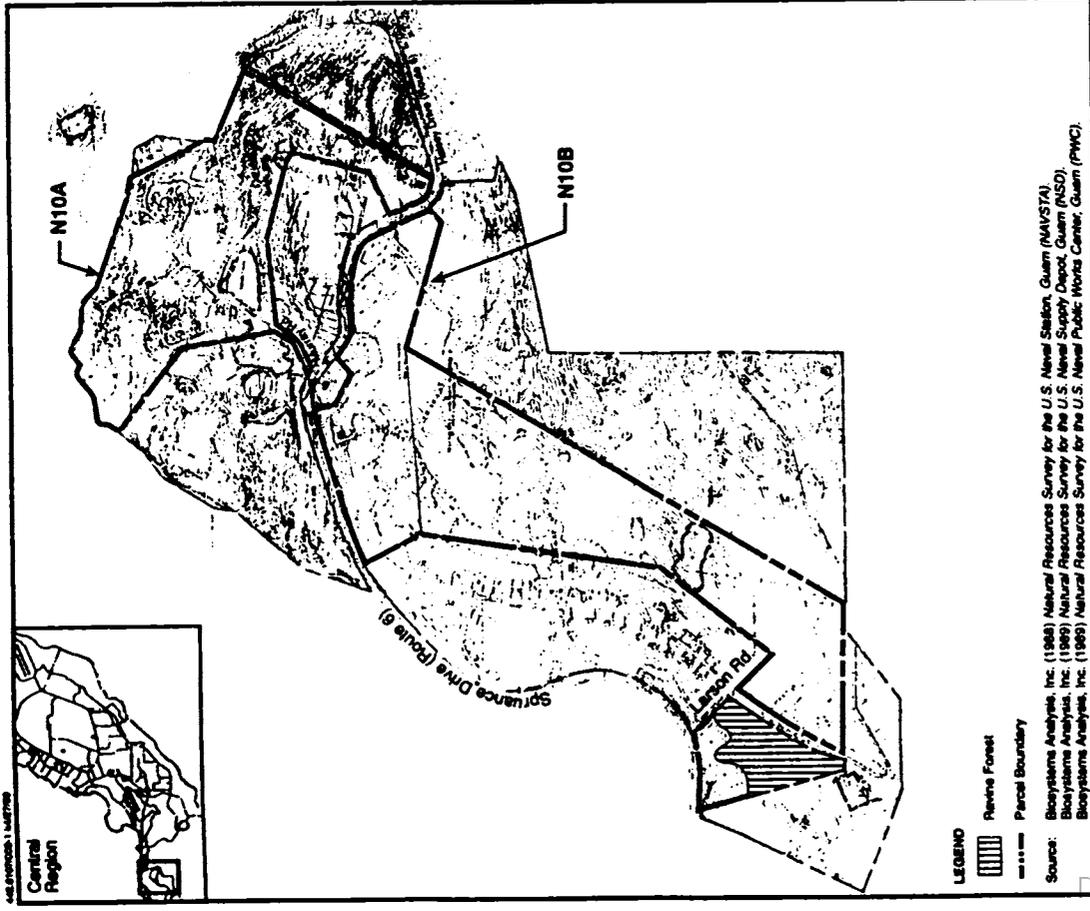
**NATIVE VEGETATION:**  
**SASA VALLEY/TENJO VISTA PARCEL N12**  
 EIS for Disposal & Reuse of GLIP '94  
 U.S. Navy Property on Guam

0 300 600 1200  
 SCALE IN METERS

0 1200 2400 4800  
 SCALE IN FEET

NORTH

48-519720B-1-NET/708



**NATIVE VEGETATION: NIMITZ HILL ENLISTED HOUSING (N10A)  
 AND NIMITZ HILL VACANT LANDS (N10B)**  
 EIS for Disposal & Reuse of GLIP '94  
 U.S. Navy Property on Guam

0 100 200 300 600  
 SCALE IN METERS

0 300 600 1200  
 SCALE IN FEET

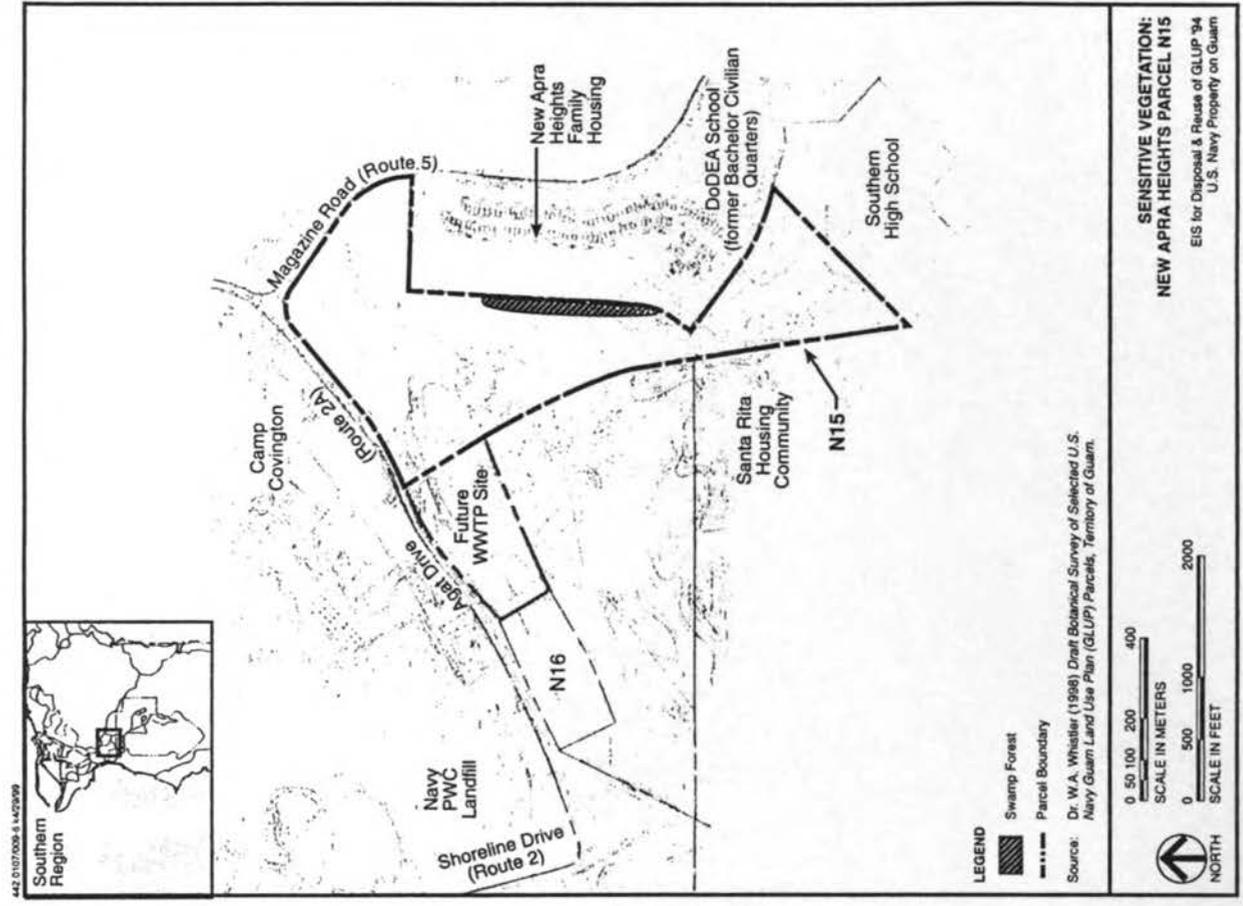
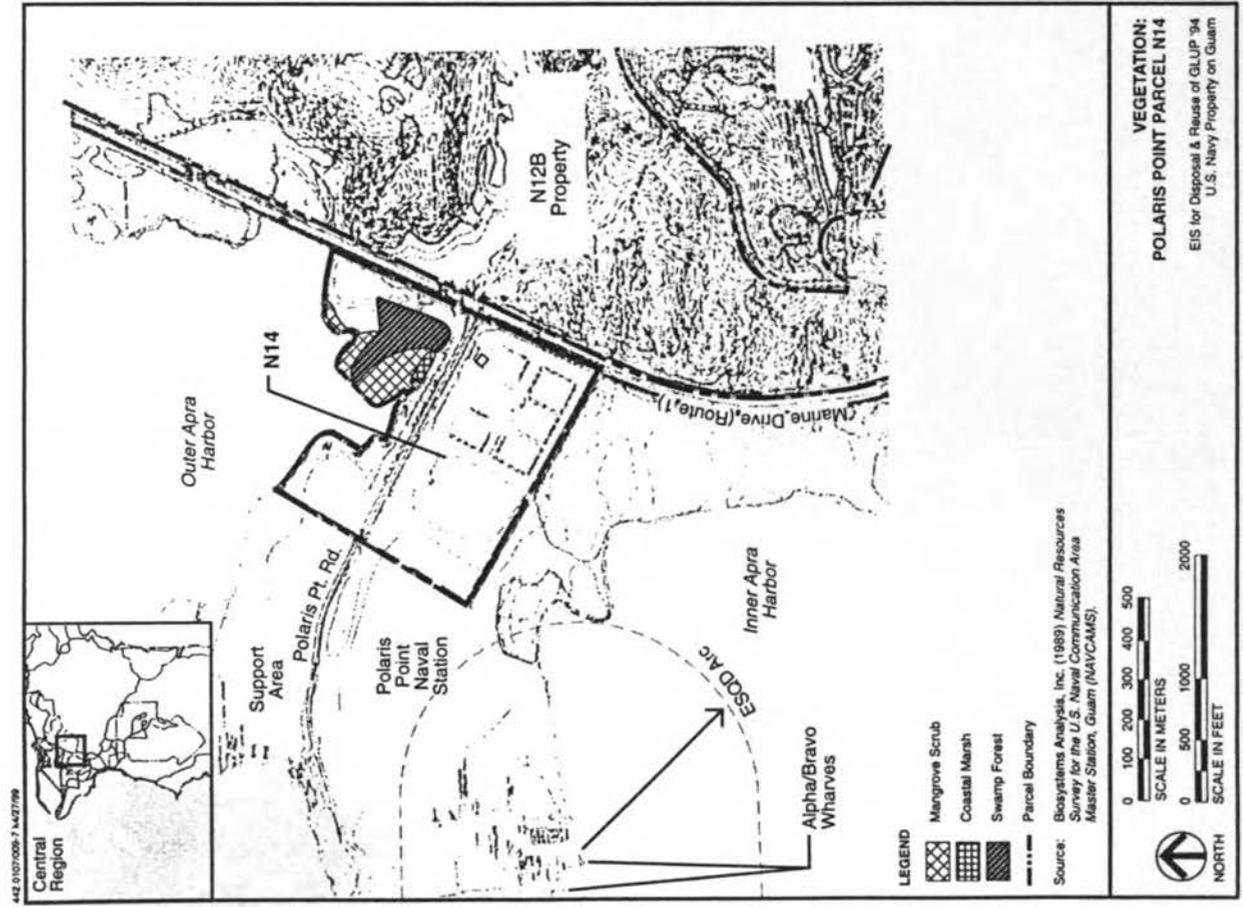
NORTH

**LEGEND**

- Reveget Forest
- Parcel Boundary

Source:  
 Biosystems Analysis, Inc. (1988) Natural Resources Survey for the U.S. Naval Station, Guam (NAVSTA).  
 Biosystems Analysis, Inc. (1989) Natural Resources Survey for the U.S. Naval Supply Depot, Guam (NSD).  
 Biosystems Analysis, Inc. (1989) Natural Resources Survey for the U.S. Naval Public Works Center, Guam (PWC).







1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100

