

Guam and CNMI Military Relocation EIS

Volume 6: Related Actions – Utilities and Roadway Projects (Guam)

Table of Contents

CHAPTER 1. PURPOSE OF AND NEED FOR ACTIONS	1-1
1.1 PURPOSE OF AND NEED FOR ROADWAY IMPROVEMENTS	1-4
1.1.1 Introduction	1-4
1.1.2 Project Purpose.....	1-4
1.1.3 Project Need	1-5
1.1.4 Project Location, Funding, and Setting	1-5
1.1.5 Governing Laws, Regulations, and Standards.....	1-7
1.1.5.1 Least Environmentally Damaging Practicable Alternative.....	1-8
1.2 DIRECT AND INDIRECT IMPACTS	1-9
1.2.1 Direct Impacts for Utilities and Roadways	1-9
1.2.2 Indirect Impacts for Utilities and Roadways	1-9
1.2.2.1 Construction Workforce	1-9
1.2.2.2 Induced Civilian Population	1-10
1.2.2.3 Ability of Guam Utilities to Manage Indirect Impacts	1-11
1.3 NON-DECISION POINT ACTIONS	1-12
1.3.1 Port of Guam	1-13
1.3.2 A.B. Won Pat International Airport	1-14
CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES	2-1
2.1 POWER	2-6
2.1.1 Overview	2-6
2.1.2 Screening Process.....	2-10
2.1.3 Alternatives Dismissed.....	2-10
2.1.3.1 Construct a New SPE-Owned/Operated Base Load Power Plant on DoD-Provided Land with the Ability to Sell Excess Power to GPA.....	2-14
2.1.3.2 Construct a New SPE-Owned/Operated Base Load Power Plant for Load on North Finegayan with No Connection to the GPA	2-14
2.1.3.3 Construct a New Power Plant at Cabras/Piti—Combination of Reconditioning Existing Generation Units (20-40 MW) and New Power Plant and Distribution System, with Base Load Generation Fueled by Coal and Peaking Generation Fueled by Diesel No. 2	2-15
2.1.3.4 Wind Power	2-15
2.1.3.5 Photovoltaic Energy (Solar)	2-16
2.1.3.6 Biofuel (Biodiesel) Power	2-16
2.1.3.7 Fuel Cell Power	2-17
2.1.3.8 Wave-Energy Generation	2-17
2.1.3.9 Waste-to-Energy Conversion.....	2-17
2.1.3.10 Long-Term Renewable-Energy Concepts	2-17

2.1.4	Power Basic Alternative 1 (Preferred)	2-18
2.1.5	Energy Efficiency and Renewable Energy Initiatives.....	2-22
2.2	POTABLE WATER.....	2-26
2.2.1	Overview	2-26
2.2.2	Anticipated Demand.....	2-26
2.2.2.1	On-Base Water Demand	2-28
2.2.2.2	Off-Base Water Demand (Including Indirect Off-Base Induced Population and Construction Workforce)	2-34
2.2.3	Water Supply Sources	2-38
2.2.3.1	DoD Water Supply Sources.....	2-38
2.2.3.2	Non-DoD Water Supply Sources.....	2-39
2.2.3.3	Development of Alternatives to Increase DoD Water Supply Sources	2-40
2.2.3.4	Water Supply Options Considered to Build Alternatives	2-41
2.2.3.5	Options Eliminated from Further Analysis.....	2-44
2.2.4	Alternatives Developed Forward for Potable Water	2-46
2.2.4.1	Basic Alternative 1 (Preferred).....	2-48
2.2.4.2	Basic Alternative 2	2-65
2.2.4.3	Long-Term Alternatives	2-69
2.2.5	Supplemental Water Source Supply Studies	2-72
2.2.5.1	Guam Water Utility Study (NAVFAC Pacific 2010h).....	2-73
2.2.5.2	Barrigada Utility Study to Support USMC Off-Base Housing Facilities Requirements (NAVFAC Pacific 2010a).....	2-73
2.2.5.3	University of Guam—Water and Environmental Research Institute of the Western Pacific Review of Northern Guam Lens Aquifer Sustainable Yield—Guam Water Utility Study for Proposed USMC Relocation (NAVFAC Pacific 2009b).....	2-74
2.2.5.4	Guam Water Well Testing Study (NAVFAC Pacific 2010i)	2-74
2.2.5.5	Northern Guam Lens Aquifer (NGLA) GWUDI Evaluation	2-76
2.2.5.6	Ground-Water Availability in Guam	2-77
2.2.5.7	Guam LID Study	2-77
2.2.5.8	Sustainability Study Program Summary Report.....	2-79
2.3	WASTEWATER	2-80
2.3.1	Overview	2-80
2.3.2	Available Wastewater Facilities.....	2-83
2.3.2.1	DoD Wastewater Facilities	2-83
2.3.2.2	GWA Wastewater Facilities	2-84
2.3.3	Projected Wastewater Flows	2-85
2.3.3.1	Wastewater Flows Associated with Proposed Main Cantonment Alternatives 1 and 2	2-86
2.3.3.2	Wastewater Flows Associated with Proposed Main Cantonment Alternatives 3 and 8	2-88
2.3.3.3	Projected Long-Range Wastewater Flows on Guam.....	2-89
2.3.4	Screening Process.....	2-89
2.3.5	Alternatives Dismissed.....	2-94

- 2.3.5.1 Build a New DoD Tertiary-Treatment Plant near the Selected Main Cantonment on DoD Land and Send Effluent to a New or Existing Water Treatment Plant 2-94
- 2.3.5.2 Build a New DoD Secondary-Treatment Plant and Construct a New Ocean Outfall on the Eastern Coastline 2-96
- 2.3.5.3 Build a New DoD Tertiary-Treatment Plant near the Selected Main Cantonment and Reuse the Effluent; Send the Residual to the GovGuam NDWWTP Outfall..... 2-97
- 2.3.5.4 Build a New DoD Tertiary-Treatment Plant near the Selected Main Cantonment on DoD Land and Install Injection Wells 2-97
- 2.3.5.5 Build a New Separate Secondary Treatment Plant at the GWA NDWWTP Site to Treat DoD Load Only 2-98
- 2.3.5.6 Recondition and Upgrade the Existing Primary Treatment System at the GWA Hagatna WWTP to Accept the Additional Flow and Load from Central Guam 2-98
- 2.3.5.7 Expand and Upgrade the GWA Hagatna WWTP to Secondary Treatment 2-98
- 2.3.5.8 Build a New Separate Secondary Treatment Plant at the GWA Hagatna WWTP Site to Treat DoD Load Only..... 2-99
- 2.3.6 Alternatives Developed Forward for Wastewater 2-99
- 2.3.7 Long-Term Alternatives 2-105
- 2.4 SOLID WASTE 2-108
 - 2.4.1 Anticipated Demand..... 2-108
 - 2.4.2 Available Solid Waste Facilities 2-108
 - 2.4.3 Screening Process..... 2-112
 - 2.4.4 Alternatives Dismissed..... 2-113
 - 2.4.4.1 Install Liner and Other Improvements at Existing Navy Sanitary Landfill at Apra Harbor..... 2-113
 - 2.4.4.2 Construct New DoD Landfill in Central Guam 2-115
 - 2.4.4.3 Construct a Waste-to-Energy Facility..... 2-116
 - 2.4.4.4 Barge Waste Off Guam to a Permitted Facility 2-116
 - 2.4.4.5 Construct New DoD Landfill in Northern Guam 2-117
 - 2.4.4.6 Use Existing Landfill at Andersen AFB 2-117
 - 2.4.4.7 Expand Existing Landfill at Andersen AFB 2-117
 - 2.4.4.8 Use Potential New Private WTE Facility with Landfill at Atantano..... 2-117
 - 2.4.5 Alternative Retained..... 2-118
 - 2.4.5.1 Preferred Alternative 2-118
 - 2.4.5.2 Construction and Demolition Debris 2-122
 - 2.4.5.3 Integrated Solid Waste Management Plan..... 2-124
- 2.5 OFF BASE ROADWAYS..... 2-127
 - 2.5.1 Introduction 2-127
 - 2.5.1.1 Project Background 2-127
 - 2.5.1.2 Roadway and Bridge Strength 2-127
 - 2.5.1.3 Roadway Capacity 2-131
 - 2.5.1.4 Roadway Access..... 2-131
 - 2.5.1.5 Mass Transit 2-133

2.5.1.6	Safety	2-133
2.5.1.7	Proposed Action	2-137
2.5.1.8	Typical Construction Activities	2-147
2.5.2	Alternatives Development Process	2-148
2.5.3	Alternatives	2-149
2.5.3.1	Alternative 1	2-149
2.5.3.2	Alternative 2	2-151
2.5.3.3	Alternative 3	2-151
2.5.3.4	Alternative 8	2-152
2.5.3.5	Firing Range Options	2-152
2.5.3.6	No-Action Alternative	2-156
2.5.3.7	Summary of Guam Road Network Projects Required for Each Alternative	2-156
2.5.4	Preferred Alternative	2-158
2.5.5	Permits and Regulatory Requirements	2-159
CHAPTER 3. UTILITIES		3-1
3.1	AFFECTED ENVIRONMENT	3-1
3.1.1	Power	3-1
3.1.1.1	North	3-5
3.1.1.2	Central	3-6
3.1.1.3	South	3-7
3.1.2	Potable Water	3-7
3.1.2.1	GWA Data and Information Used to Assess Impacts	3-7
3.1.2.2	Water Systems	3-10
3.1.2.3	DoD Water Storage Facilities	3-15
3.1.3	Wastewater	3-17
3.1.3.1	GWA Data and Information Used to Assess Impacts	3-19
3.1.3.2	GWA Compliance Background	3-19
3.1.3.3	Northern District Wastewater Treatment Plant	3-25
3.1.3.4	Hagatna Wastewater Treatment Plant	3-26
3.1.3.5	Apra Harbor WWTP	3-26
3.1.3.6	Agat-Santa Rita Wastewater Treatment Plant	3-28
3.1.3.7	Baza Gardens Wastewater Treatment Plant	3-29
3.1.3.8	Umatac-Merizo Wastewater Treatment Plant	3-29
3.1.3.9	Inarajan Wastewater Treatment Plant	3-29
3.1.3.10	GWA Wastewater Collection System	3-30
3.1.4	Solid Waste	3-31
3.1.4.1	Navy Sanitary Landfill	3-32
3.1.4.2	Air Force Solid Waste Facilities	3-35
3.1.4.3	GovGuam Solid Waste Facilities	3-36
3.1.5	Roadway Projects	3-38
3.1.5.1	North	3-38
3.1.5.2	Central	3-41
3.1.5.3	Apra Harbor	3-43
3.1.5.4	South	3-44

3.2	ENVIRONMENTAL CONSEQUENCES	3-45
3.2.1	Approach to Analysis	3-45
3.2.1.1	Methodology.....	3-45
3.2.1.2	Determination of Significance.....	3-46
3.2.1.3	Issues Identified during Public Scoping Process	3-47
3.2.2	Power.....	3-47
3.2.2.1	Basic Alternative 1 (Preferred Alternative).....	3-49
3.2.2.2	Summary of Impacts.....	3-50
3.2.3	Potable Water	3-51
3.2.3.1	Basic Alternative 1 (Preferred Alternative).....	3-51
3.2.3.2	Basic Alternative 2	3-65
3.2.3.3	Long-Term Alternative 1	3-66
3.2.3.4	Long-Term Alternative 2	3-66
3.2.3.5	Long-Term Alternative 3	3-66
3.2.3.6	Summary of Impacts.....	3-67
3.2.4	Wastewater	3-69
3.2.4.1	Wastewater Direct Impacts.....	3-69
3.2.4.2	Wastewater Indirect Impacts	3-74
3.2.4.3	Proposed Mitigation Measures	3-78
3.2.4.4	Summary of Impacts.....	3-79
3.2.5	Solid Waste	3-81
3.2.5.1	Basic Alternative 1 (Preferred Alternative).....	3-81
3.2.5.2	Summary of Impacts.....	3-83
3.2.6	Roadway Projects	3-84
3.2.6.1	Alternative 1	3-84
3.2.6.2	Alternative 2 (Preferred Alternative).....	3-86
3.2.6.3	Alternative 3	3-86
3.2.6.4	Alternative 8	3-87
3.2.6.5	Summary of Impacts.....	3-87
3.2.6.6	Summary of Proposed Mitigation Measures	3-87
CHAPTER 4. ROADWAYS.....		4-1
4.1	INTRODUCTION	4-1
4.1.1	Definition of Resource	4-1
4.1.1.1	On Base Roadways	4-1
4.1.1.2	Off Base Roadways	4-1
4.1.2	North.....	4-5
4.1.2.1	On Base Roadways	4-5
4.1.2.2	Finegayan.....	4-5
4.1.2.3	Off Base Roadways	4-5
4.1.3	Central	4-12
4.1.3.1	On Base Roadways	4-12
4.1.3.2	Off Base Roadways	4-14
4.1.4	Apra Harbor.....	4-26
4.1.4.1	On Base Roadways	4-26
4.1.4.2	Off Base Roadways	4-26

4.1.5	South.....	4-31
4.1.5.1	On Base Roadways.....	4-31
4.1.5.2	Off Base Roadways.....	4-33
4.2	ENVIRONMENTAL CONSEQUENCES.....	4-39
4.2.1	Approach to Analysis.....	4-39
4.2.1.1	Methodology.....	4-40
4.2.1.2	Determination of Significance.....	4-44
4.2.1.3	Issues Identified during Public Scoping Process.....	4-57
4.2.2	Roadway Alternatives Analysis.....	4-57
4.2.2.1	Alternative 1.....	4-57
4.2.2.2	Alternative 2 (Preferred Alternative).....	4-88
4.2.2.3	Alternative 3.....	4-90
4.2.2.4	Alternative 8.....	4-116
4.2.2.5	No-Action Alternative (Off Base Roadways).....	4-143
4.2.2.6	On Base Roadways Summary of Impacts.....	4-166
4.2.2.7	Off Base Roadways Summary of Impacts.....	4-166
4.2.2.8	Off Base Roadways Summary of Proposed Mitigation Measures.....	4-169
4.2.3	Additional Limited Traffic Analysis.....	4-172
4.2.4	Qualitative Comparison of Alternatives – Limited Roadway Improvements.....	4-200
CHAPTER 5. GEOLOGICAL AND SOIL RESOURCES.....		5-1
5.1	INTRODUCTION.....	5-1
5.2	ENVIRONMENTAL CONSEQUENCES.....	5-1
5.2.1	Approach to Analysis.....	5-1
5.2.1.1	Methodology.....	5-1
5.2.1.2	Determination of Significance.....	5-7
5.2.1.3	Issues Identified during Public Scoping Process.....	5-7
5.2.2	Power.....	5-7
5.2.2.1	Basic Alternative 1: Recondition up to 5 Existing Guam Power Authority Permitted Facilities to Provide Peaking Power/Reserve Capacity.....	5-7
5.2.2.2	Summary of Impacts.....	5-9
5.2.3	Potable Water.....	5-10
5.2.3.1	Basic Alternative 1 (Preferred Alternative).....	5-10
5.2.3.2	Basic Alternative 2.....	5-12
5.2.3.3	Summary of Impacts.....	5-13
5.2.4	Wastewater.....	5-14
5.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	5-14
5.2.4.2	Summary of Impacts.....	5-15
5.2.5	Solid Waste.....	5-16
5.2.5.1	Basic Alternative 1 (Preferred Alternative).....	5-16
5.2.5.2	Summary of Impacts.....	5-16
5.2.6	Off Base Roadways.....	5-17
5.2.6.1	Alternative 1.....	5-17
5.2.6.2	Alternative 2.....	5-19
5.2.6.3	Alternative 3.....	5-20

5.2.6.4	Alternative 8	5-21
5.2.6.5	No-Action Alternative	5-21
5.2.6.6	Summary of Impacts.....	5-22
5.2.6.7	Summary of Proposed Mitigation Measures	5-22
CHAPTER 6. WATER RESOURCES		6-1
6.1	INTRODUCTION	6-1
6.2	ENVIRONMENTAL CONSEQUENCES	6-1
6.2.1	Approach to Analysis	6-1
6.2.1.1	Methodology.....	6-1
6.2.1.2	Determination of Significance.....	6-5
6.2.1.3	Issues Identified During Public Scoping Process	6-5
6.2.2	Power.....	6-6
6.2.2.1	Basic Alternative 1 (Preferred Alternative).....	6-6
6.2.2.2	Summary of Impacts.....	6-7
6.2.3	Potable Water	6-8
6.2.3.1	Basic Alternative 1 (Preferred Alternative).....	6-8
6.2.3.2	Basic Alternative 2	6-13
6.2.3.3	Summary of Impacts.....	6-14
6.2.4	Wastewater	6-15
6.2.4.1	Basic Alternative 1a (Preferred Alternative)	6-16
6.2.4.2	Basic Alternative 1b	6-21
6.2.4.3	Summary of Impacts.....	6-23
6.2.5	Solid Waste	6-24
6.2.5.1	Basic Alternative 1 (Preferred Alternative).....	6-24
6.2.5.2	Summary of Impacts.....	6-25
6.2.6	Off Base Roadways	6-25
6.2.6.1	Alternative 1	6-26
6.2.6.2	Alternative 2 (Preferred Alternative).....	6-34
6.2.6.3	Alternative 3	6-34
6.2.6.4	Alternative 8	6-34
6.2.6.5	No-Action Alternative	6-35
6.2.6.6	Summary of Impacts.....	6-36
6.2.6.7	Summary of Proposed Mitigation Measures	6-37
6.3	LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE	6-38
CHAPTER 7. AIR QUALITY		7-1
7.1	INTRODUCTION	7-1
7.2	ENVIRONMENTAL CONSEQUENCES	7-1
7.2.1	Approach to Analysis	7-8
7.2.1.1	Methodology.....	7-8
7.2.1.2	Determination of Significance.....	7-13
7.2.1.3	Issues Identified During Public Scoping Process	7-15
7.2.2	Power.....	7-16
7.2.2.1	Historical Monitoring Observations and Existing Background Conditions	7-16

7.2.2.2	Basic Alternative	7-16
7.2.2.3	Summary of Impacts.....	7-20
7.2.3	Potable Water	7-20
7.2.3.1	Basic Alternative 1 (Preferred Alternative).....	7-20
7.2.3.2	Basic Alternative 2	7-21
7.2.3.3	Summary of Impacts.....	7-21
7.2.4	Wastewater	7-22
7.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	7-22
7.2.4.2	Long-Term Alternative 1	7-23
7.2.4.3	Summary of Impacts.....	7-23
7.2.5	Solid Waste	7-23
7.2.5.1	Basic Alternative 1 (Preferred Alternative).....	7-23
7.2.5.2	Summary of Impacts.....	7-24
7.2.6	Off Base Roadways	7-26
7.2.6.1	Alternative 1	7-26
7.2.6.2	Alternative 2 (Preferred Alternative).....	7-37
7.2.6.3	Alternative 2 Constrained	7-46
7.2.6.4	Alternative 3	7-54
7.2.6.5	Alternative 8	7-63
7.2.6.6	Summary of Impacts.....	7-72
7.2.6.7	Summary of Proposed Mitigation Measures	7-73
CHAPTER 8. NOISE.....		8-1
8.1	INTRODUCTION.....	8-1
8.2	ENVIRONMENTAL CONSEQUENCES	8-1
8.2.1	Approach to Analysis	8-1
8.2.1.1	Methodology.....	8-1
8.2.1.2	Determination of Significance.....	8-5
8.2.1.3	Issues Identified During Public Scoping	8-7
8.2.2	Power.....	8-7
8.2.2.1	Basic Power Alternative 1 (Preferred Alternative).....	8-7
8.2.3	Potable Water	8-8
8.2.3.1	Basic Alternative 1 (Preferred Alternative).....	8-8
8.2.3.2	Basic Alternative 2	8-9
8.2.3.3	Summary of Impacts.....	8-9
8.2.4	Wastewater	8-10
8.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	8-10
8.2.4.2	Summary of Impacts.....	8-10
8.2.5	Solid Waste	8-11
8.2.5.1	Basic Alternative 1 (Preferred Alternative).....	8-11
8.2.5.2	Summary of Impacts.....	8-11
8.2.6	Off Base Roadways	8-11
8.2.6.1	Alternative 1	8-12
8.2.6.2	Alternative 2 (Preferred Alternative).....	8-40
8.2.6.3	Alternative 3	8-40
8.2.6.4	Alternative 8	8-42

8.2.6.5	No-Action Alternative	8-42
8.2.6.6	Summary of Impacts.....	8-47
8.2.6.7	Summary of Proposed Mitigation Measures	8-50
8.3	NO-ACTION ALTERNATIVE	8-53
8.4	SUMMARY OF IMPACTS	8-53
8.5	SUMMARY OF PROPOSED MITIGATION MEASURES	8-54
CHAPTER 9. AIRSPACE		9-1
9.1	INTRODUCTION	9-1
9.2	ENVIRONMENTAL CONSEQUENCES	9-1
CHAPTER 10. LAND AND SUBMERGED LAND USE.....		10-1
10.1	INTRODUCTION	10-1
10.2	ENVIRONMENTAL CONSEQUENCES	10-1
10.2.1	Approach to Analysis	10-1
10.2.1.1	Land Ownership/Management.....	10-2
10.2.1.2	Land Use.....	10-3
10.2.1.3	Issues Identified During Public Scoping Process	10-4
10.2.2	Power.....	10-5
10.2.2.1	Basic Alternative 1: Recondition up to Five Existing Guam Power Authority–Permitted Facilities to Provide Peaking Power/Reserve Capacity	10-5
10.2.2.2	Summary of Impacts.....	10-6
10.2.3	Potable Water	10-6
10.2.3.1	Basic Alternative 1 (Preferred Alternative).....	10-6
10.2.3.2	Basic Alternative 2	10-7
10.2.3.3	Summary of Impacts.....	10-8
10.2.4	Wastewater	10-8
10.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	10-8
10.2.4.2	Summary of Impacts.....	10-9
10.2.5	Solid Waste	10-9
10.2.5.1	Basic Alternative 1 (Preferred Alternative).....	10-9
10.2.5.2	Summary of Impacts.....	10-10
10.2.6	Off Base Roadways	10-10
10.2.6.1	Alternative 1	10-11
10.2.6.2	Alternative 2 (Preferred Alternative).....	10-14
10.2.6.3	Alternative 3	10-15
10.2.6.4	Alternative 8	10-15
10.2.6.5	No-Action Alternative	10-16
10.2.6.6	Summary of Impacts.....	10-17
10.2.6.7	Summary of Potential Mitigation Measures	10-18
CHAPTER 11. RECREATIONAL RESOURCES		11-1
11.1	INTRODUCTION	11-1
11.2	ENVIRONMENTAL CONSEQUENCES	11-1
11.2.1	Approach to Analysis	11-1
11.2.1.1	Methodology.....	11-1

11.2.1.2	Determination of Significance.....	11-2
11.2.1.3	Issues Identified During Public Scoping Process	11-2
11.2.2	Power.....	11-2
11.2.2.1	Basic Alternative 1: Recondition up to Five Existing Guam Power Authority–Permitted Facilities to Provide Peaking Power/Reserve Capacity	11-2
11.2.2.2	Summary of Impacts.....	11-3
11.2.3	Potable Water	11-3
11.2.3.1	Basic Alternative 1 (Preferred Alternative).....	11-3
11.2.3.2	Basic Alternative 2	11-4
11.2.3.3	Summary of Impacts.....	11-4
11.2.4	Wastewater	11-5
11.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	11-5
11.2.4.2	Basic Alternative 1b	11-5
11.2.4.3	Summary of Impacts.....	11-6
11.2.5	Solid Waste	11-6
11.2.5.1	Basic Alternative 1 (Preferred Alternative).....	11-6
11.2.5.2	Summary of Impacts.....	11-7
11.2.6	Off Base Roadways	11-7
11.2.6.1	Alternative 1	11-8
11.2.6.2	Alternative 2 (Preferred Alternative).....	11-15
11.2.6.3	Alternative 3	11-15
11.2.6.4	Alternative 8	11-15
11.2.6.5	No-Action Alternative	11-16
11.2.6.6	Summary of Impacts.....	11-16
11.2.6.7	Summary of Proposed Mitigation Measures	11-17
CHAPTER 12. TERRESTRIAL BIOLOGICAL RESOURCES		12-1
12.1	INTRODUCTION	12-1
12.2	ENVIRONMENTAL CONSEQUENCES	12-1
12.2.1	Approach to Analysis	12-1
12.2.1.1	Methodology.....	12-1
12.2.1.2	Determination of Significance.....	12-2
12.2.1.3	Issues Identified during Public Scoping Process	12-4
12.2.2	Power.....	12-5
12.2.2.1	Basic Alternative 1 (Preferred Alternative).....	12-5
12.2.2.2	Summary of Impacts.....	12-5
12.2.3	Potable Water	12-5
12.2.3.1	Basic Alternative 1 (Preferred Alternative).....	12-5
12.2.3.2	Basic Alternative 2	12-12
12.2.3.3	Summary of Impacts.....	12-14
12.2.3.4	Summary of Proposed Mitigation Measures	12-15
12.2.4	Wastewater	12-15
12.2.4.1	Basic Alternative 1a (Preferred Alternative)	12-15
12.2.4.2	Basic Alternative 1b	12-17
12.2.4.3	Summary of Impacts.....	12-19

12.2.5	Solid Waste	12-19
12.2.5.1	Basic Alternative 1 (Preferred Alternative).....	12-19
12.2.5.2	Summary of Impacts.....	12-19
12.2.6	Off Base Roadways	12-20
12.2.6.1	Alternative 1	12-36
12.2.6.2	Alternative 2 (Preferred Alternative).....	12-42
12.2.6.3	Alternative 3	12-42
12.2.6.4	Alternative 8	12-43
12.2.6.5	Firing Range Option	12-43
12.2.6.6	Summary of Impacts.....	12-43
12.2.6.7	Summary of Mitigation Measures	12-44
CHAPTER 13. MARINE BIOLOGICAL RESOURCES		13-1
13.1	INTRODUCTION	13-1
13.2	ENVIRONMENTAL CONSEQUENCES	13-1
13.2.1	Approach to Analysis	13-1
13.2.1.1	Methodology.....	13-1
13.2.1.2	Determination of Significance.....	13-3
13.2.1.3	Issues Identified During Public Scoping Process	13-5
13.2.2	Power.....	13-5
13.2.2.1	Basic Alternative 1 (Preferred Alternative).....	13-5
	Construction.....	13-6
	Marine Flora, Invertebrates and Associated EFH	13-6
	Essential Fish Habitat.....	13-6
	Special-Status Species.....	13-8
	Non-native Species.....	13-8
	Operation.....	13-8
	Marine Flora, Invertebrates, and Associated EFH	13-8
	Essential Fish Habitat.....	13-8
	Special-Status Species.....	13-9
	Non-native Species.....	13-9
13.2.2.2	Summary of Impacts.....	13-9
13.2.3	Potable Water	13-10
13.2.3.1	Basic Alternative 1 (Preferred Alternative).....	13-10
	Construction.....	13-10
	Marine Flora, Invertebrates and Associated EFH	13-10
	Essential Fish Habitat.....	13-10
	Special-Status Species.....	13-11
	Non-native Species.....	13-11
	Operation.....	13-11
	Marine Flora, Invertebrates and Associated EFH	13-11
	Essential Fish Habitat.....	13-12
	Special-Status Species.....	13-12
	Non-native Species.....	13-12
13.2.3.2	Basic Alternative 2	13-12
	Construction.....	13-13
	Marine Flora, Invertebrates and Associated EFH	13-13
	Essential Fish Habitat.....	13-13

	Special-Status Species.....	13-13
	Non-native Species.....	13-14
	Operation.....	13-14
	Marine Flora, Invertebrates and Associated EFH	13-14
	Essential Fish Habitat.....	13-14
	Special-Status Species.....	13-14
	Non-native Species.....	13-15
13.2.3.3	Summary of Impacts.....	13-15
13.2.4	Wastewater	13-15
13.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	13-15
	Construction.....	13-16
	Operation.....	13-16
	Marine Flora, Invertebrates, and Associated EFH	13-23
	Essential Fish Habitat.....	13-29
	Special-Status Species.....	13-31
	Non-native Species.....	13-32
13.2.4.2	Summary of Impacts.....	13-33
13.2.5	Solid Waste	13-35
13.2.5.1	Basic Alternative 1 (Preferred Alternative).....	13-35
	Construction.....	13-35
	Operation.....	13-35
	Marine Flora, Invertebrates and Associated EFH	13-35
	Fish and Associated EFH.....	13-36
	Special-Status Species.....	13-36
	Non-native Species.....	13-36
13.2.5.2	Summary of Impacts.....	13-37
13.2.6	Off Base Roadways	13-37
13.2.6.1	Alternative 1	13-43
13.2.6.2	Alternative 2 (Preferred Alternative).....	13-45
13.2.6.3	Alternative 3	13-45
13.2.6.4	Alternative 8	13-45
13.2.6.5	Firing Range Options.....	13-46
13.2.6.6	Summary of Impacts.....	13-46
13.2.6.7	Summary of Proposed Mitigation Measures	13-46
CHAPTER 14. CULTURAL RESOURCES.....		14-1
14.1	INTRODUCTION.....	14-1
14.2	ENVIRONMENTAL CONSEQUENCES	14-1
14.2.1	Approach to Analysis	14-1
14.2.1.1	Methodology.....	14-1
14.2.1.2	Determination of Significance under NEPA	14-2
14.2.1.3	Issues Identified during the Public Scoping Process	14-4
14.2.2	Power.....	14-4
14.2.2.1	Basic Alternative 1: Recondition up to Five Existing Guam Power Authority–Permitted Facilities to Provide Peaking Power/Reserve Capacity	14-4
14.2.3	Potable Water.....	14-11
14.2.3.1	Basic Alternative 1 (Preferred Alternative).....	14-11

14.2.3.2	Basic Alternative 2	14-12
14.2.3.3	Summary of Impacts.....	14-13
14.2.4	Wastewater	14-14
14.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	14-14
14.2.4.2	Basic Alternative 1b	14-14
14.2.4.3	Summary of Impacts.....	14-15
14.2.5	Solid Waste	14-16
14.2.5.1	Basic Alternative 1 (Preferred Alternative).....	14-16
14.2.6	Off Base Roadways	14-16
14.2.6.1	Alternative 1	14-17
14.2.6.2	Alternative 2 (Preferred Alternative).....	14-22
14.2.6.3	Alternative 3	14-22
14.2.6.4	Alternative 8	14-22
14.2.6.5	Summary of Impacts.....	14-22
14.2.6.6	Summary of Proposed Mitigation Measures	14-23
CHAPTER 15. VISUAL RESOURCES		15-1
15.1	INTRODUCTION	15-1
15.2	ENVIRONMENTAL CONSEQUENCES	15-1
15.2.1	Approach to Analysis	15-1
15.2.1.1	Methodology.....	15-1
15.2.1.2	Determination of Significance.....	15-2
15.2.1.3	Issues Identified during Public Scoping Process	15-3
15.2.2	Power.....	15-3
15.2.2.1	Basic Alternative 1: Recondition up to Five Existing Guam Power Authority–Permitted Facilities to Provide Peaking Power/Reserve Capacity	15-3
15.2.2.2	Summary of Impacts.....	15-3
15.2.3	Potable Water	15-3
15.2.3.1	Basic Alternative 1 (Preferred Alternative).....	15-3
15.2.3.2	Basic Alternative 2	15-4
15.2.3.3	Summary of Impacts.....	15-5
15.2.4	Wastewater	15-5
15.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	15-5
15.2.4.2	Alternative 1b	15-5
15.2.4.3	Summary of Impacts.....	15-6
15.2.5	Solid Waste	15-6
15.2.5.1	Basic Alternative 1 (Preferred Alternative).....	15-6
15.2.6	Off Base Roadways	15-6
15.2.6.1	Alternative 1	15-8
15.2.6.2	Alternative 2 (Preferred Alternative).....	15-26
15.2.6.3	Alternative 3	15-27
15.2.6.4	Alternative 8	15-27
15.2.6.5	Summary of Impacts.....	15-28
15.2.6.6	Summary of Proposed Mitigation Measures	15-28
CHAPTER 16. MARINE TRANSPORTATION		16-1

16.1	INTRODUCTION	16-1
16.2	ENVIRONMENTAL CONSEQUENCES	16-1
16.2.1	Approach to Analysis	16-1
16.2.1.1	Methodology.....	16-1
16.2.1.2	Determination of Significance.....	16-1
16.2.1.3	Issues Identified During Public Scoping Process	16-1
16.2.2	Power.....	16-1
16.2.2.1	Summary of Impacts.....	16-2
16.2.3	Potable Water	16-2
16.2.3.1	Summary of Impacts.....	16-2
16.2.4	Wastewater	16-2
16.2.4.1	Summary of Impacts.....	16-3
16.2.5	Solid Waste	16-3
16.2.6	Summary of Impacts	16-3
CHAPTER 17. SOCIOECONOMICS AND GENERAL SERVICES		17-1
17.1	INTRODUCTION	17-1
17.2	ENVIRONMENTAL CONSEQUENCES	17-1
17.2.1	Methodology	17-1
17.2.1.1	Determination of Significance.....	17-1
17.2.1.2	Issues Identified During Scoping.....	17-1
17.2.1.3	Guam Road Network Projects	17-2
17.2.2	Utilities.....	17-2
17.2.2.1	Population Impacts	17-2
17.2.2.2	Economic Impacts	17-3
17.2.2.3	Public Service Impacts	17-10
17.2.2.4	Sociocultural Impacts	17-13
17.2.2.5	Summary of Utilities Impacts.....	17-13
17.2.2.6	No-Action Alternative	17-13
17.2.2.7	Utilities Proposed Mitigation Measures	17-15
17.2.3	Roadway Projects.....	17-17
17.2.3.1	Alternative 1	17-17
17.2.3.2	Alternative 2	17-20
17.2.3.3	Alternative 3	17-21
17.2.3.4	Alternative 8	17-23
17.2.3.5	No-Action Alternative	17-25
17.2.3.6	Creation of Jobs and Economic Activity	17-26
17.2.3.7	Summary of Impacts.....	17-27
17.2.3.8	Summary of Proposed Mitigation Measures	17-28
CHAPTER 18. HAZARDOUS MATERIALS AND WASTE.....		18-1
18.1	INTRODUCTION	18-1
18.2	ENVIRONMENTAL CONSEQUENCES	18-1
18.2.1	Approach to Analysis	18-1
18.2.1.1	Methodology.....	18-1
18.2.1.2	Determination of Significance.....	18-7

18.2.1.3	Issues Identified during Public Scoping Process	18-8
18.2.2	Power.....	18-8
18.2.2.1	Basic Alternative 1 (Preferred Alternative).....	18-9
18.2.2.2	Summary of Impacts.....	18-12
18.2.3	Potable Water.....	18-13
18.2.3.1	Basic Alternative 1 (Preferred Alternative).....	18-13
18.2.3.2	Basic Alternative 2	18-16
18.2.3.3	Summary of Impacts.....	18-16
18.2.4	Wastewater	18-17
18.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	18-18
18.2.4.2	Summary of Impacts.....	18-20
18.2.5	Solid Waste	18-21
18.2.5.1	Basic Alternative 1 (Preferred Alternative).....	18-21
18.2.5.2	Summary of Impacts.....	18-23
18.2.6	Off Base Roadways	18-24
18.2.6.1	Alternative 1	18-29
18.2.6.2	Alternative 2 (Preferred Alternative).....	18-31
18.2.6.3	Alternative 3	18-32
18.2.6.4	Alternative 8	18-32
18.2.6.5	Summary of Impacts.....	18-33
18.2.6.6	Summary of Proposed Mitigation Measures	18-33
CHAPTER 19. PUBLIC HEALTH AND SAFETY		19-1
19.1	INTRODUCTION.....	19-1
19.2	ENVIRONMENTAL CONSEQUENCES	19-1
19.2.1	Approach to Analysis	19-1
19.2.1.1	Methodology.....	19-1
19.2.1.2	Determination of Significance.....	19-3
19.2.1.3	Issues Identified during Public Scoping Process	19-3
19.2.2	Power.....	19-3
19.2.3	Potable Water	19-5
19.2.3.1	Potable Water Health Problems.....	19-5
19.2.4	Wastewater	19-8
19.2.5	Solid Waste	19-12
19.2.6	All Alternatives	19-12
19.2.6.1	Construction Phase	19-12
19.2.6.2	Notifiable Diseases	19-12
19.2.6.3	Mental Illness	19-12
19.2.6.4	Traffic Incidents.....	19-13
19.2.6.5	UXO.....	19-13
19.2.7	Proposed Mitigation Measures.....	19-13
19.2.8	Summary of Impacts	19-14
19.2.9	Roadways	19-15
19.2.9.1	Alternative 1	19-17
19.2.9.2	Alternative 2 (Preferred Alternative).....	19-18
19.2.9.3	Alternative 3	19-19

19.2.9.4	Alternative 8	19-19
19.2.9.5	Summary of Impacts.....	19-20
19.2.9.6	Summary of Proposed Mitigation Measures	19-20
CHAPTER 20. ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN 20-1		
20.1	INTRODUCTION.....	20-1
20.2	ENVIRONMENTAL CONSEQUENCES	20-1
20.2.1	Approach to Analysis	20-1
20.2.1.1	Methodology.....	20-1
20.2.1.2	Determination of Significance.....	20-2
20.2.1.3	Issues Identified during Public Scoping Process	20-3
20.2.2	Power.....	20-3
20.2.2.1	Basic Alternative 1 (Preferred Alternative).....	20-4
20.2.3	Potable Water	20-5
20.2.3.1	Basic Alternative 1 (Preferred Alternative).....	20-5
20.2.3.2	Basic Alternative 2	20-7
20.2.4	Wastewater	20-9
20.2.4.1	Basic Alternative 1a (Preferred Alternative) and 1b.....	20-9
20.2.4.2	Basic Alternative 1b	20-11
20.2.5	Solid Waste	20-11
20.2.5.1	Basic Alternative 1 (Preferred Alternative).....	20-11
20.2.6	Off Base Roadways.....	20-12
20.2.6.1	Alternative 1	20-12
20.2.6.2	Alternative 2 (Preferred Alternative).....	20-14
20.2.6.3	Alternative 3	20-14
20.2.6.4	Alternative 8	20-15
20.2.6.5	Alternative 2 Constrained	20-16
20.2.7	No-Action Alternative.....	20-18
20.2.8	Summary of Impacts	20-18
20.2.9	Summary of Proposed Mitigation Measures	20-20
CHAPTER 21. SECTION 4(F) AND SECTION 6(F) EVALUATION..... 21-1		
21.1	PROPOSED PROJECT.....	21-1
21.1.1	Purpose and Need.....	21-3
21.1.2	Project Alternatives	21-3
21.1.2.1	Alternative 1	21-3
21.1.2.2	Alternative 2 (Preferred Alternative).....	21-4
21.1.2.3	Alternative 3	21-4
21.1.2.4	Alternative 8	21-4
21.1.3	Other Alternatives Considered but Eliminated.....	21-4
21.2	SECTION 4(F) EVALUATION	21-5
21.2.1	Purpose.....	21-5
21.2.2	Section 4(f) Properties.....	21-6
21.2.2.1	Public Parks	21-6
21.2.2.2	Wildlife Refuges.....	21-6
21.2.3	Impacts on Section 4(f) Properties	21-9

21.2.3.1	Public Parks	21-9
21.2.4	Measures to Minimize Harm to Section 4(f) Properties.....	21-14
21.2.4.1	Public Parks	21-14
21.2.4.2	Historic Sites.....	21-15
21.2.5	Section 4(f) Coordination.....	21-15
21.2.6	Section 4(f) Determination.....	21-16
21.2.6.1	Public Parks	21-16
21.2.6.2	Historic Sites.....	21-16
21.3	SECTION 6(F) EVALUATION	21-17
21.3.1	Purpose.....	21-17
21.3.2	Section 6(f) Properties.....	21-17
21.3.3	Impacts on Section 6(f) Properties	21-18
21.3.4	Measures to Minimize Harm to Section 6(f) Properties.....	21-18
21.3.5	Section 6(f) Coordination.....	21-18
CHAPTER 22. REFERENCES.....		22-1
22.1	PURPOSE OF AND NEED FOR ACTIONS.....	22-1
22.2	PROPOSED ACTION AND ALTERNATIVES	22-1
22.3	UTILITIES	22-4
22.4	ROADWAYS.....	22-5
22.5	GEOLOGICAL AND SOIL RESOURCES	22-5
22.6	WATER RESOURCES	22-6
22.7	AIR QUALITY	22-6
22.8	NOISE.....	22-7
22.9	AIRSPACE.....	22-8
22.10	LAND AND SUBMERGED LAND USE	22-8
22.11	RECREATIONAL RESOURCES	22-8
22.12	TERRESTRIAL BIOLOGICAL RESOURCES	22-8
22.13	MARINE BIOLOGICAL RESOURCES	22-9
22.14	CULTURAL RESOURCES.....	22-10
22.15	VISUAL RESOURCES	22-10
22.16	MARINE TRANSPORTATION	22-10
22.17	SOCIOECONOMICS AND GENERAL SERVICES	22-10
22.18	HAZARDOUS MATERIALS AND WASTE.....	22-11
22.19	PUBLIC HEALTH AND SAFETY	22-12
22.20	ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN	22-12
22.21	SECTION 4(F) AND SECTION 6(F) EVALUATION.....	22-12

List of Figures

<u>Figure</u>	<u>Page</u>
1.1-1. Connectivity of the Guam Road Network	1-4
1.1-2. Roadways Connecting Military Lands on Guam.....	1-6
2.0-1. Summary of Proposed Action and Alternatives Carried Forward for Utilities, Guam.....	2-2
2.1-1. Projected CT Operating Hours 2010-2019	2-19
2.1-2. Proposed Power Alternative Locations	2-20
2.1-3. Proposed Upgrades to Existing GPA T&D System.....	2-23
2.2-1. Basic Alternative 1—Proposed Water System Components	2-49
2.2-2. Constraints on Well Placement.....	2-54
2.2-3. Sinkholes and Caves in Northern Guam.....	2-55
2.2-4. IRP Sites in the Vicinity of the Parabasal Zone.....	2-59
2.2-5. Basic Alternative 2—Proposed Water System Components	2-66
2.2-6. Long-Term Alternative 2 Desalination.....	2-71
2.3-1. Wastewater Treatment Plant Locations and Service Areas, Guam.....	2-82
2.3-2. Basic Alternative 1a Proposed Sewer Layout.....	2-102
2.3-3. Basic Alternative 1b Proposed Sewer Layout	2-104
2.3-4. Long-Term Alternative 1 Proposed Sewer Layout for DoD Secondary Treatment	2-107
2.4-1. Solid Waste Facility Locations, Guam	2-111
2.4-2. Navy Sanitary Landfill with Maximum Elevation = 54 feet MSL, Guam	2-119
2.4-3. Layon Landfill Location, Guam	2-120
2.5-1. Bridges on Guam	2-130
2.5-2. Preferred Routes for Hauling Cargo from Port of Guam.....	2-132
2.5-3. Existing Mass Transit Network and Demand Service Areas on Guam	2-134
2.5-4. Proposed Mass Transit Network on Guam	2-135
2.5-5. Mass Transit Network on Guam.....	2-136
2.5-6. Overview of Guam Roads Network	2-139
2.5-7. Geographic Regions of Guam	2-145
2.5-8. Guam Road Network Project Locations	2-146
2.5-9. Alternative 1 Housing and Cantonment	2-150
2.5-10. Alternative 2 Housing and Cantonment	2-153
2.5-11. Alternative 3 Housing and Cantonment	2-154
2.5-12. Alternative 8 Housing and Cantonment	2-155
2.5-13. Government of Guam Organic Growth Project Locations	2-157
3.1-1. Power Facility Locations, Guam	3-3
3.1-2. Potable Water Systems—North and Central Guam.....	3-8
3.1-3. Potable Water Systems—Central and South Guam.....	3-9
3.1-4. Wastewater Treatment Plant Locations and Service Areas	3-18
3.1-5. Existing Navy Sanitary Landfill, Guam	3-33
3.2-1. GWA Supply and Demand	3-56

3.2-2. Well Withdrawal to Meet DoD Average Daily Demand and GWA Average Daily Demand in 2014..... 3-60

3.2-3. Well Withdrawal to Meet DoD Average Daily Demand and GWA Average Daily Demand By Subbasin in 2015..... 3-61

4.1-1. North Region – 2008 a.m. Peak Congestion Levels 4-7

4.1-2. North Region – 2008 p.m. Peak Congestion Levels..... 4-8

4.1-3. North Region – Existing Transit Service..... 4-11

4.1-4. North Region – Existing Pedestrian and Bicycle Facilities 4-13

4.1-5. Central Region – 2008 a.m. Peak Congestion Levels..... 4-18

4.1-6. Central Region – 2008 p.m. Peak Congestion Levels 4-19

4.1-7. Central Region – Existing Transit Service 4-22

4.1-8. Central Region – Existing Bicycle and Pedestrian Facilities..... 4-25

4.1-9. Apra Harbor Region – 2008 a.m. Peak Congestion Levels 4-28

4.1-10. Apra Harbor Region – 2008 p.m. Peak Congestion Levels..... 4-29

4.1-11. Apra Harbor Region – Existing Transit Service..... 4-30

4.1-12. Apra Harbor Region – Existing Pedestrian and Bicycle Facilities 4-32

4.1-13. South Region – 2008 a.m. Peak Congestion Levels 4-35

4.1-14. South Region – 2008 p.m. Peak Congestion Levels..... 4-36

4.1-15. South Region – Existing Transit Service..... 4-37

4.2-1. Island Population Growth..... 4-41

4.2-2. Military Base Population Growth..... 4-42

4.2-3. Comparison of Alternative 1 and 2 in 2014 a.m. Peak Hour..... 4-45

4.2-4. Comparison of Alternative 1 and 2 in 2014 p.m. Peak Hour..... 4-46

4.2-5. Comparison of Alternative 1 and 2 in 2030 a.m. Peak Hour..... 4-47

4.2-6. Comparison of Alternative 1 and 2 in 2030 p.m. Peak Hour..... 4-48

4.2-7. Comparison of Alternative 3 in 2014 a.m. Peak Hour..... 4-49

4.2-8. Comparison of Alternative 3 in 2014 p.m. Peak Hour 4-50

4.2-9. Comparison of Alternative 3 in 2030 a.m. Peak Hour..... 4-51

4.2-10. Comparison of Alternative 3 in 2030 p.m. Peak Hour 4-52

4.2-11. Comparison of Alternative 8 in 2014 a.m. Peak Hour..... 4-53

4.2-12. Comparison of Alternative 8 in 2014 p.m. Peak Hour 4-54

4.2-13. Comparison of Alternative 8 in 2030 a.m. Peak Hour..... 4-55

4.2-14. Comparison of Alternative 8 in 2030 p.m. Peak Hour 4-56

4.2-15. North Region– 2014 a.m. Peak Congestion Levels – Alternatives 1 and 2..... 4-61

4.2-16. North Region – 2014 p.m. Peak Congestion Levels – Alternatives 1 and 2..... 4-62

4.2-17. North Region – 2030 a.m. Peak Congestion Levels – Alternatives 1 and 2..... 4-63

4.2-18. North Region – 2030 p.m. Peak Congestion Levels – Alternatives 1 and 2..... 4-64

4.2-19. Central Region – 2014 a.m. Peak Congestion Levels – Alternatives 1 and 2 4-70

4.2-20. Central Region – 2014 p.m. Peak Congestion Levels – Alternatives 1 and 2 4-71

4.2-21. Central Region – 2030 a.m. Peak Congestion Levels – Alternatives 1 and 2 4-72

4.2-22. Central Region – 2030 p.m. Peak Congestion Levels – Alternatives 1 and 2 4-73

4.2-23. Apra Harbor Region – 2014 a.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-77
4.2-24. Apra Harbor Region – 2014 p.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-78
4.2-25. Apra Harbor Region – 2030 a.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-79
4.2-26. Apra Harbor Region – 2030 p.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-80
4.2-27. South Region – 2014 a.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-84
4.2-28. South Region – 2014 p.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-85
4.2-29. South Region – 2030 a.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-86
4.2-30. South Region – 2030 p.m. Peak Congestion Levels – Alternatives 1 and 2.....	4-87
4.2-31. North Region – 2014 a.m. Peak Congestion Levels – Alternative 3.....	4-92
4.2-32. North Region – 2014 p.m. Peak Congestion Levels – Alternative 3.....	4-93
4.2-33. North Region – 2030 a.m. Peak Congestion Levels – Alternative 3.....	4-94
4.2-34. North Region – 2030 p.m. Peak Congestion Levels – Alternative 3.....	4-95
4.2-35. Central Region – 2014 a.m. Peak Congestion Levels – Alternative 3.....	4-101
4.2-36. Central Region – 2014 p.m. Peak Congestion Levels – Alternative 3.....	4-102
4.2-37. Central Region – 2030 a.m. Peak Congestion Levels – Alternative 3.....	4-103
4.2-38. Central Region – 2030 p.m. Peak Congestion Levels – Alternative 3.....	4-104
4.2-39. Apra Harbor Region – 2014 a.m. Peak Congestion Levels – Alternative 3.....	4-107
4.2-40. Apra Harbor Region – 2014 p.m. Peak Congestion Levels – Alternative 3.....	4-108
4.2-41. Apra Harbor Region – 2030 a.m. Peak Congestion Levels – Alternative 3.....	4-109
4.2-42. Apra Harbor Region – 2030 p.m. Peak Congestion Levels – Alternative 3.....	4-110
4.2-43. South Region – 2014 a.m. Peak Congestion Levels – Alternative 3.....	4-112
4.2-44. South Region – 2014 p.m. Peak Congestion Levels – Alternative 3.....	4-113
4.2-45. South Region – 2030 a.m. Peak Congestion Levels – Alternative 3.....	4-114
4.2-46. South Region – 2030 p.m. Peak Congestion Levels – Alternative 3.....	4-115
4.2-47. North Region – 2014 a.m. Peak Congestion Levels – Alternative 8.....	4-118
4.2-48. North Region – 2014 p.m. Peak Congestion Levels – Alternative 8.....	4-119
4.2-49. North Region – 2030 a.m. and p.m. Peak Congestion Levels – Alternative 8.....	4-120
4.2-50. North Region – 2030 a.m. and p.m. Peak Congestion Levels – Alternative 8.....	4-121
4.2-51. Central Region – 2014 a.m. Peak Congestion Levels – Alternative 8.....	4-127
4.2-52. Central Region – 2014 p.m. Peak Congestion Levels – Alternative 8.....	4-128
4.2-53. Central Region – 2030 a.m. Peak Congestion Levels – Alternative 8.....	4-129
4.2-54. Central Region – 2030 p.m. Peak Congestion Levels – Alternative 8.....	4-130
4.2-55. Apra Harbor Region – 2014 a.m. Peak Congestion Levels – Alternative 8.....	4-133
4.2-56. Apra Harbor Region – 2014 p.m. Peak Congestion Levels – Alternative 8.....	4-134
4.2-57. Apra Harbor Region – 2030 a.m. Peak Congestion Levels – Alternative 8.....	4-135
4.2-58. Apra Harbor Region – 2030 p.m. Peak Congestion Levels – Alternative 8.....	4-136
4.2-59. South Region – 2014 a.m. Peak Congestion Levels – Alternative 8.....	4-139
4.2-60. South Region – 2014 p.m. Peak Congestion Levels – Alternative 8.....	4-140
4.2-61. South Region – 2030 a.m. Peak Congestion Levels – Alternative 8.....	4-141
4.2-62. South Region – 2030 p.m. Peak Congestion Levels – Alternative 8.....	4-142
4.2-63. North Region – 2014 a.m. Peak Congestion Levels – No-Action Alternative.....	4-145

4.2-64. North Region – 2014 p.m. Peak Congestion Levels – No-Action Alternative 4-146

4.2-65. Central Region – 2014 a.m. Peak Congestion Levels – No-Action Alternative..... 4-147

4.2-66. Central Region – 2014 p.m. Peak Congestion Levels – No-Action Alternative 4-148

4.2-67. Apra Harbor Region – 2014 a.m. Peak Congestion Levels – No-Action Alternative 4-149

4.2-68. Apra Harbor Region – 2014 p.m. Peak Congestion Levels – No-Action Alternative..... 4-150

4.2-69. South Region – 2014 a.m. Peak Congestion Levels – No-Action Alternative 4-151

4.2-70. South Region – 2014 p.m. Peak Congestion Levels – No-Action Alternative..... 4-152

4.2-71. North Region – 2030 a.m. Peak Congestion Levels – No-Action Alternative 4-157

4.2-72. North Region – 2030 p.m. Peak Congestion Levels – No-Action Alternative..... 4-158

4.2-73. Central Region – 2030 a.m. Peak Congestion Levels – No-Action Alternative..... 4-159

4.2-74. Central Region – 2030 p.m. Peak Congestion Levels – No-Action Alternative 4-160

4.2-75. Apra Harbor Region – 2030 a.m. Peak Congestion Levels – No-Action Alternative 4-161

4.2-76. Apra Harbor Region – 2030 p.m. Peak Congestion Levels – No-Action Alternative..... 4-162

4.2-77. South Region – 2030 a.m. Peak Congestion Levels – No-Action Alternative 4-163

4.2-78. South Region – 2030 p.m. Peak Congestion Levels – No-Action Alternative..... 4-164

4.2-79. North Region– 2014 a.m. Peak Congestion Levels – Alternative 2 (with Limited Roadway
Projects)..... 4-176

4.2-80. North Region – 2014 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-177

4.2-81. North Region – 2030 a.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-178

4.2-82. North Region – 2030 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-179

4.2-83. Central Region – 2014 a.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-183

4.2-84. Central Region – 2014 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-184

4.2-85. Central Region – 2030 a.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-185

4.2-86. Central Region – 2030 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-186

4.2-87. Apra Harbor Region – 2014 a.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-190

4.2-88. Apra Harbor Region – 2014 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-191

4.2-89. Apra Harbor Region – 2030 a.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-192

4.2-90. Apra Harbor Region – 2030 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-193

4.2-91. South Region – 2014 a.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-196

4.2-92. South Region – 2014 p.m. Peak Congestion Levels – Alternative 2 (with Limited
Roadway Projects)..... 4-197

4.2-93. South Region – 2030 a.m. Peak Congestion Levels – Alternative 2 (with Limited Roadway Projects).....	4-198
4.2-94. South Region – 2030 p.m. Peak Congestion Levels – Alternative 2 (with Limited Roadway Projects).....	4-199
6.2-1. Location of Wetlands Adjacent to Proposed Waterline Replacement Corridor	6-10
7.2-1. Locations of Major Existing Electrical Generating Unit Sources on Guam.....	7-17
8.2-1. Typical A-Weighted Noise Levels	8-4
11.2-1. Potentially Affected Parkland in Central Region Sheet 1.....	11-11
11.2-2. Potentially Affected Parkland in Central Region Sheet 2.....	11-12
11.2-3. Potentially Affected Parkland in Central Region Sheet 3.....	11-13
12.2-1. Vegetation Impacts – Potable Water System under Basic Alternatives 1 and 2	12-7
12.2-2a. Special-Status Species Impacts – Potable Water System under Basic Alternatives 1 and 2	12-9
12.2-3. GRN Projects in the North Region Considered for Analysis – Map 1	12-28
12.2-4. GRN Projects in the North Region Considered for Analysis – Map 2	12-29
12.2-5. GRN Projects in the North Region Considered for Analysis – Map 3	12-30
12.2-6. GRN Projects in the North Region Considered for Analysis – Map 4.....	12-31
12.2-7. GRN Projects in the North Region Considered for Analysis – Map 5	12-32
12.2-8. GRN Projects in the North Region Considered for Analysis – Map 6.....	12-33
12.2-9. GRN Projects in the Central Region Considered for Analysis – Route 15 Relocation	12-34
12.2-10. GRN Projects in the Apra Harbor Region Considered for Analysis	12-35
13.2-1. Sensitive Marine Biological Resources and Habitats Associated with Apra Harbor	13-7
13.2-2. NDWWTP Outfall Extension and Sensitive Marine Biological Resources	13-24
13.2-3. Southern GWA WWTP Outfalls and Sensitive Marine Biological Resources	13-25
13.2-4. Southern GWA WWTP Outfalls and Sensitive Marine Biological Resources	13-26
13.2-5. Former Tanguisson Point Primary WWTP Outfall and Coral Growth.....	13-29
13.2-6. Sensitive Marine Biological Resources and Habitats Associated with the Proposed Road Projects in the Apra Harbor and Central Region Study Area.....	13-38
14.2-1. Proposed Utilities with Archaeological Probability Areas at Apra Harbor	14-6
14.2-2. Proposed Utilities with Archaeological Probability Areas at Andersen AFB and NCTS Finegayan	14-7
14.2-3. Proposed Utilities with Archaeological Probability Areas in Central Guam	14-8
14.2-4. Proposed Utilities with Archaeological Probability Areas in South Guam.....	14-9
14.2-5. Historic Properties in the APE.....	14-18
15.2-1. Key Viewpoint 1. GRN #57, Route 28 Widening	15-13
15.2-2. Typical Bridge Replacement Elevations	15-19
15.2-3. Key Viewpoint #2. GRN #36, Route 15 Roadway Realignment	15-23
17.2-1. Population With and Without Utilities	17-3
17.2-2. Civilian Labor Force Demand (Full-Time Equivalent Jobs) With and Without Utilities	17-4
17.2-3. Civilian Labor Force Income (Millions of 2008 \$s) With and Without Utilities	17-5
17.2-4. Housing Demand With and Without Utilities.....	17-6
17.2-5. Gross Receipts Tax Revenue With and Without Utilities	17-9
17.2-6. Income Taxes Revenue (Combined) With and Without Utilities.....	17-9

17.2-7. Gross Island Product (Millions of 2008 \$s) With and Without Utilities	17-10
21.1-1. Connectivity of the Guam Road Network	21-1
21.1-2. Roadways Connecting Military Lands on Guam.....	21-2
21.2-1. Known Historic Sites within the Area of Potential Effect.....	21-8
21.2-2. Agana Bridge #1	21-9
21.2-3. Proposed Use of Guam Seal Park.....	21-11
21.2-4. Proposed Use of Dededo Buffer Strip Park.....	21-12
21.2-5. Proposed Use of Chinese Park.....	21-13

List of Tables

<u>Table</u>	<u>Page</u>
1.1-1. Funding Status of GRN Construction Projects.....	1-8
2.0-1. Projected “Non-Project” Population Considered in the Analysis of Utilities.....	2-6
2.1-1. Estimated Department of Defense Power Demand for Guam.....	2-7
2.1-2. Power Supply and Demand on Guam (MW).....	2-9
2.1-3. Summary of Alternatives Evaluated for Power Systems.....	2-11
2.1-4. Proposed T&D Upgrades.....	2-22
2.1-5. Approaches Associated With Achieving 30% Reduction in Facilities Demand.....	2-26
2.2-1. Department of Defense Population Increases.....	2-27
2.2-2. Future DoD Industrial Demands.....	2-30
2.2-3. DoD Unaccounted for Water.....	2-30
2.2-4. Future DoD UFW.....	2-31
2.2-5. Projected Future DoD Water Demands.....	2-31
2.2-6. Water Demand Comparisons Using Conservation/Sustainability Measures for Main Cantonment Alternatives 1 and 2.....	2-34
2.2-7. Off-Base Indirect Population Estimates.....	2-34
2.2-8. Increases in Off-Base Domestic Daily Water Demand for 2014.....	2-36
2.2-9. 2014 Estimated Off-Base Water Demands.....	2-36
2.2-10. Estimated Off-base Water Demands by Year.....	2-37
2.2-11. GWA Baseline Gallons per Person per Day Estimate.....	2-37
2.2-12. Comparison between GWA Population and Water Demand Increases.....	2-38
2.2-13. Current On-Base DoD Potable Water Supply.....	2-39
2.2-14. Guam Waterworks Authority Water Supplies.....	2-40
2.2-15. Projected Future DoD Water Supply Requirements.....	2-40
2.2-16. Summary of Potable Water Alternatives.....	2-47
2.2-17. Basic Alternative 1—Proposed Water System Components.....	2-50
2.2-18. Basic Alternative 1—Proposed DoD Water Supply and Demand.....	2-50
2.2-19. Well Location Constraints.....	2-53
2.2-20. Historical Water Quality.....	2-57
2.2-21. Harmon and Tumon Sampling Points Downgradient of Andersen South Annex Operating Unit.....	2-57
2.2-22. Tumon Maui Well Groundwater Field Quality Parameters 2003-2007.....	2-57
2.2-23. Production Well MW-2 Groundwater Analytical Results, Andersen South Annex.....	2-58
2.2-24. MW-2 Groundwater Field Quality Parameters, 1996-2006.....	2-58
2.2-25. TCE and PCE Concentration Ranges in Wells with Detections above MCLs.....	2-60
2.2-26. Estimates of Sustainable and Available Yield for Subbasins in the NGLS.....	2-62
2.2-27. Basic Alternative 1—Proposed Well Details.....	2-63
2.2-28. Basic Alternative 2—Proposed Water System Components.....	2-65
2.2-29. Basic Alternative 2—Proposed DoD Water Supply and Demand.....	2-67
2.2-30. Alternative 2—Proposed Well Details.....	2-68

2.2-31. Desalination—Proposed Water System Components.....	2-70
2.3-1. Wastewater Treatment Facilities Servicing Areas of the Proposed Military Relocation	2-81
2.3-2. Existing Wastewater Treatment Capacities and Demand for Plants Direct Populations.....	2-81
2.3-3. Existing Wastewater Treatment Capacities and Demand for Plants, Indirect Populations	2-83
2.3-4. Current and Projected DoD Population at Completion of Military Relocation in Northern Guam for Main Cantonment Alternatives 1 and 2	2-86
2.3-5. Current and Projected Civilian and DoD Flows at Completion of Military Relocation for Main Cantonment Alternatives 1 and 2.....	2-86
2.3-6. Projected Peak Wastewater Flows for Main Cantonment Alternatives 1 and 2	2-87
2.3-7. Current and Projected DoD Population at Completion of Military Relocation in the Barrigada Area of Central Guam under Main Cantonment Alternatives 3 and 8	2-88
2.3-8. Current and Projected Civilian and DoD Flows at Completion of Military Relocation for Main Cantonment Alternatives 3 and 8.....	2-89
2.3-9. Summary of Alternatives Evaluated for Wastewater Systems in Support of Main Cantonment Alternatives 1 and 2	2-91
2.3-10. Summary of Alternatives Evaluated for Wastewater Systems in Support of Main Cantonment Alternatives 3 and 8	2-95
2.4-1. Projected Solid Waste Estimates	2-109
2.4-2. Solid Waste Projections versus Available Capacity (tons).....	2-112
2.4-3. Summary of Alternatives Evaluated for Solid Waste Disposal	2-114
2.4-4. Projected Solid Waste Generation Rates for the Military Relocation and Civilian Guam Population (by year)	2-123
2.4-5. Projected Diversion of C&D Debris and Green Waste Generation, All DoD Bases.....	2-124
2.4-6. Projected Average Daily Solid Waste Quantities and Composition, Total	2-126
2.5-1. Travel Projections for Heavy Military Vehicles.....	2-128
2.5-2. Structural Data for Bridges on Guam	2-131
2.5-3. Guam Road Network Projects by Island Region	2-140
2.5-4. Guam Road Network Construction Projects to be Completed Each Year.....	2-147
2.5-5. Typical Construction Activities	2-148
2.5-6. Alternative 1 GRN Projects	2-151
2.5-7. Alternative 2 GRN Projects	2-151
2.5-8. Alternative 3 GRN Projects	2-152
2.5-9. Alternative 8 GRN Projects	2-152
2.5-10. Government of Guam Roadway Capacity Improvement Projects.....	2-158
3.1-1. Example of the Information Presented in the Guam Power Authority Generation Status Report.....	3-2
3.1-2. Guam Power Authority Base-Load Generation Units	3-4
3.1-3. Cabras and Piti Generation Units	3-6
3.1-4. DoD Water Storage Facilities.....	3-16
3.1-5. Department of Defense Water Storage Capacity by Area	3-17
3.1-6. Recycling Equipment at Andersen AFB.....	3-36
3.1-7. Existing Utilities within Guam Road Network Routes.....	3-39
3.2-1. Projected Power Demand and Supply	3-48

3.2-2. Power Supply and Demand in 2014 and 2016.....	3-50
3.2-3. Summary of Basic Alternative 1 Impacts for Power	3-50
3.2-4. Potable Water Alternative 1 Proposed DoD Water Supply and Demand.....	3-51
3.2-5. DoD Water Supply and Demand Estimates Using Executive Order Compliance and Sustainability Factor.....	3-53
3.2-6. Projected Water Supply and Demand on the GWA Water System.....	3-55
3.2-7. GWA Water Supply and Demand Estimates by Region 2015	3-57
3.2-8. Construction Worker Housing Facilities	3-58
3.2-9. Total Well Withdrawal and Yield Estimates Projected for 2014 (Peak Year)	3-59
3.2-10. Summary of Potential Potable Water Impacts.....	3-67
3.2-11. Projected Wastewater Flows to the NDWWTP under Main Cantonment Alternatives 1 and 2	3-70
3.2-12. Projected Wastewater Flows to the NDWWTP under Main Cantonment Alternatives 3 and 8.....	3-73
3.2-13. Wastewater flow generated by USMC relocation induced population growth at each Southern Guam WWTP.....	3-76
3.2-14. Summary of Potential Wastewater Impacts.....	3-79
3.2-15. Summary of Potential Solid Waste Impacts	3-84
3.2-16. Utility Relocation within Guam Road Network Routes	3-85
3.2-17. Summary of Potential Roadway Projects Impacts.....	3-87
3.2-18. Summary of Proposed Mitigation Measures for Roadway Projects Impacts to Utility Relocations	3-87
4.1-1. Delay Thresholds for Level of Service.....	4-2
4.1-2. Intersections and Access Points – North Region.....	4-6
4.1-3. Existing ADT and Volume to Capacity Ratio Summary – North Region.....	4-9
4.1-4. Existing Level of Service and Delay Results – North Region.....	4-10
4.1-5. Fixed Route and DRS Areas – North Region.....	4-10
4.1-6. Monthly and Total Fiscal Year 2007 Guam Mass Transit Ridership (Passengers Boarding Each Route)	4-12
4.1-7. Intersections and Access Points – Central Region.....	4-16
4.1-8. Existing ADT and Capacity Summary – Central Region.....	4-17
4.1-9. Existing Level of Service and Delay Results – Central Region	4-21
4.1-10. Fixed Route and DRS Areas – Central Region.....	4-23
4.1-11. Monthly and Total Fiscal Year 2007 Guam Mass Transit Ridership (Passengers Boarding Each Route)	4-24
4.1-12. Roads with Existing Sidewalks	4-24
4.1-13. Roads with Intermittent Sidewalks.....	4-24
4.1-14. Intersections and Access Points – Apra Harbor Region.....	4-26
4.1-15. Existing ADT and Capacity Summary – Apra Harbor Region.....	4-27
4.1-16. Level of Service and Delay Results – Apra Harbor Region	4-27
4.1-17. Fixed Route and DRS Areas – Apra Harbor Region	4-31
4.1-18. Monthly and Total Fiscal Year 2007 Guam Mass Transit Ridership (Passengers Boarding Each Route)	4-31

4.1-19. Intersections and Military Access Points – South Region 4-33

4.1-20. Existing ADT Summary and Capacity – South Region 4-33

4.1-21. Existing Level of Service and Delay Results – South Region..... 4-34

4.1-22. Fixed Route and DRS Areas – South Region..... 4-38

4.1-23. Monthly and Total Fiscal Year 2007 Guam Mass Transit Ridership (Passengers Boarding
Each Route) 4-38

4.2-1. Roadway Widening Projects..... 4-43

4.2-2. 2030 Baseline Growth Rates 4-58

4.2-3. Alternatives 1 and 2 Future ADT and Volume to Capacity Ratio Summary – North Region..... 4-60

4.2-4. Alternatives 1 and 2 Future Level of Service and Delay Results – North Region 4-65

4.2-5. Alternative 1 and 2 Future ADT and Volume to Capacity Ratio Summary – Central
Region 4-67

4.2-6. Alternatives 1 and 2 Future Level of Service and Delay Results – Central Region 4-74

4.2-7. Traffic Generated by the Proposed Actions at the Naval Base Guam..... 4-76

4.2-8. Alternatives 1 and 2 Future ADT and Volume to Capacity Ratio Summary – Apra Harbor
Region 4-76

4.2-9. Alternatives 1 and 2 Future Level of Service and Delay Results – Apra Harbor Region 4-81

4.2-10. Alternatives 1 and 2 Future ADT and Volume to Capacity Ratio Summary – South
Region 4-82

4.2-11. Alternatives 1 and 2 Future Level of Service and Delay Results – South Region 4-83

4.2-12. Alternative 3 Future ADT and Volume to Capacity Ratio Summary – North Region..... 4-91

4.2-13. Alternative 3 Future Level of Service and Delay Results – North Region..... 4-96

4.2-14. Alternative 3 Future ADT and Volume to Capacity Ratio Summary – Central Region 4-98

4.2-15. Alternative 3 Future Level of Service and Delay Results – Central Region 4-105

4.2-16. Alternative 3 Future ADT and Volume to Capacity Ratio Summary – Apra Harbor Region... 4-106

4.2-17. Alternative 3 Future Level of Service and Delay Results – Apra Harbor Region..... 4-106

4.2-18. Alternative 3 Future ADT and Volume to Capacity Ratio Summary - South Region..... 4-111

4.2-19. Alternative 3 Future Level of Service and Delay Results – South Region..... 4-116

4.2-20. Alternative 8 Future ADT and Volume to Capacity Ratio Summary – North Region..... 4-122

4.2-21. Alternative 8 Future Level of Service and Delay Results – North Region..... 4-123

4.2-22. Alternative 8 Future ADT and Volume to Capacity Ratio Summary – Central Region 4-125

4.2-23. Alternative 8 Future Level of Service and Delay Results – Central Region 4-131

4.2-24. Alternative 8 Future ADT and Volume to Capacity Ratio Summary – Apra Harbor Region... 4-132

4.2-25. Alternative 8 Future Level of Service and Delay Results – Apra Harbor Region..... 4-137

4.2-26. Alternative 8 Future ADT and Volume to Capacity Ratio Summary – South Region..... 4-137

4.2-27. Alternative 8 Future Level of Service and Delay Results – South Region..... 4-138

4.2-28. No-Action Alternative Future ADT and Volume to Capacity Ratio Summary..... 4-144

4.2-29. No-Action Alternative Future Level of Service and Delay Results 4-153

4.2-30. No-Action Alternative Future ADT and Volume to Capacity Ratio Summary..... 4-155

4.2-31. No-Action Alternative Future Level of Service and Delay Results 4-165

4.2-32. Summary of Potential Impacts by Alternative for On Base Roads 4-166

4.2-33. Comparison of the No-Action Alternative, Alternatives 1 and 2, Alternative 3, and Alternative 8.....4-167

4.2-34. Comparison of Alternatives 1 and 2, Alternative 3, and Alternative 8.....4-168

4.2-35. Summary of Potential Impacts by Alternative on Roadway and Intersection Capacity**4-168

4.2-36. Summary of Off Base Roadway Projects Proposed Mitigation Measures4-169

4.2-37. Comparison of Estimated Population Decreases on Guam from Off-Island (Direct, Indirect and Induced) from Force Flow Reduction and Adaptive Program Management4-171

4.2-38. Alternative 2 (with Limited Projects) Future ADT and Volume to Capacity Ratio Summary – North Region.....4-174

4.2-39. Alternative 2 (with Limited Roadway Projects) Future Level of Service and Delay Results – North Region4-175

4.2-40. Alternative 2 (with Limited Roadway Projects) Future ADT and Volume to Capacity Ratio Summary – Central Region.....4-181

4.2-41. Alternative 2 (with Limited Roadway Projects) Future Level of Service and Delay Results – Central Region.....4-187

4.2-42. Alternative 2 (with Limited Roadway Projects) Future ADT and Volume to Capacity Ratio Summary – Apra Harbor Region4-189

4.2-43. Alternative 2 (with Limited Roadway Projects) Future Level of Service and Delay Results – Apra Harbor Region4-194

4.2-44. Alternative 2 (with Limited Roadway Projects) Future ADT and Volume to Capacity Ratio Summary – South Region4-195

4.2-45. Alternative 2 (with Limited Roadway Projects) Future Level of Service and Delay Results – South Region4-195

4.2-46. Comparison of Alternative 2 and Alternative 2 with Limited Roadway Projects4-200

4.2-47. Summary of Potential Impacts on Roadway and Intersection Capacity - Comparison of Alternative 2 and Alternative 2 with Limited Roadway Improvements**4-201

4.2-48. Comparison of Alternatives 2 and Alternative 2 with Limited Roadway Projects.....4-202

5.2-1. Typical Effects of Guam Road Network Roadway Project Construction Activities on Geological and Soil Resources..... 5-4

5.2-2. Activities Associated with Guam Road Network Roadway Project Types 5-6

5.2-3. Erosion Potential at Power Alternative Sites..... 5-9

5.2-4. Summary of Potential Power Impacts 5-10

5.2-5. Erosion Potential at Potable Water Sites 5-11

5.2-6. Summary of Potential Potable Water Impacts 5-13

5.2-7. Erosion Potential at Wastewater Alternative Sites 5-14

5.2-8. Summary of Wastewater Impacts 5-15

5.2-9. Summary of Potential Solid Waste Impacts 5-16

5.2-10. Summary of Potential Roadway Project Impacts 5-22

6.2-1. Summary of Potential Power Impacts 6-8

6.2-2. Summary of Potential Potable Water Impacts 6-15

6.2-3. Summary of Potential Wastewater Impacts 6-23

6.2-4. Summary of Potential Solid Waste Impacts 6-25

6.2-5. Bridge Replacements and Estimated Direct Impacts to Potential Waters of the U.S..... 6-28

6.2-6. Summary of Potential Roadway Project Impacts6-37

6.2-7. Summary of Proposed Mitigation Measures for Roadway Projects Impacts to Water Resources 6-38

7.2-1. Applicable Major Source and Major Modification Thresholds.....7-9

7.2-2. Impact Analysis Thresholds7-13

7.2-3. National Ambient Air Quality Standards7-14

7.2-4. Total Annual Construction Emissions – Basic Alternative7-18

7.2-5. Net Increase in Annual Emissions – Basic Alternative7-18

7.2-6. Predicted Criteria Pollutant Concentrations at Marbo.....7-19

7.2-7. Summary of Potential Air Quality Impacts – Power7-20

7.2-8. Total Annual Construction Emissions – Basic Alternative 17-20

7.2-9. Total Annual Construction Emissions – Basic Alternative 27-21

7.2-10. Summary of Potential Air Quality Impacts – Potable Water.....7-22

7.2-11. Total Annual Construction Emissions - Alternative 1a and 1b7-22

7.2-12. Summary of Potential Air Quality Impacts – Wastewater.....7-23

7.2-13. Total Annual Operation Emissions – Basic Alternative 1 / Apra Harbor.....7-24

7.2-14. Total Annual Operation Emissions – Basic Alternative 1 / Layon.....7-25

7.2-15. Summary of Potential Air Quality Impacts – Solid Waste.....7-25

7.2-16. Regional Annual Emission Burdens, Alternative 17-27

7.2-17. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 1, North Region7-27

7.2-18. Average Daily Traffic for Major Roadways in North Project Section under Alternative 17-28

7.2-19. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 17-29

7.2-20. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North Alternative 17-29

7.2-21. Estimated Construction Emission Burden – North, Alternative 17-30

7.2-22. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 1, Central Region.....7-30

7.2-23. Average Daily Traffic for Major Roadways in Central Project Section under Alternative 1.....7-31

7.2-24. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 17-32

7.2-25. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 17-32

7.2-26. Estimated Construction Emission Burden – Central, Alternative 17-32

7.2-27. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 1, Apra Harbor.....7-33

7.2-28. Average Daily Traffic for Major Roadways in Apra Harbor Project Section under Alternative 17-33

7.2-29. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 17-34

7.2-30. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 17-34

7.2-31. Estimated Construction Emission Burden – Apra Harbor, Alternative 17-34

7.2-32. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 1, South Region7-35

7.2-33. Average Daily Traffic for Major Roadways in South Project Section under Alternative 17-35

7.2-34. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 17-36

7.2-35. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 1	7-36
7.2-36. Estimated Construction Emission Burden – South, Alternative 1	7-36
7.2-37. Regional Annual Emission Burdens, Alternative 2	7-37
7.2-38. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 2, North Region	7-37
7.2-39. Average Daily Traffic for Major Roadways in North Project Section under Alternative 2	7-38
7.2-40. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 2	7-39
7.2-41. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North Region, Alternative 2	7-39
7.2-42. Estimated Construction Emission Burden – North, Alternative 2	7-39
7.2-43. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 2, Central Region	7-40
7.2-44. Average Daily Traffic for Major Roadways in Central Project Section under Alternative 2	7-40
7.2-45. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 2	7-41
7.2-46. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 2	7-41
7.2-47. Estimated Construction Emission Burden – Central, Alternative 2	7-42
7.2-48. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 2 Apra Harbor	7-42
7.2-49. Average Daily Traffic for Major Roadways in Apra Harbor Project Section under Alternative 2	7-42
7.2-50. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 2	7-43
7.2-51. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 2	7-43
7.2-52. Estimated Construction Emission Burden – Apra Region, Alternative 2	7-43
7.2-53. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 2, South Region	7-44
7.2-54. Average Daily Traffic for Major Roadways in South Project Section under Alternative 2	7-44
7.2-55. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 2	7-45
7.2-56. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 2	7-45
7.2-57. Estimated Construction Emission Burden – South, Alternative 2	7-45
7.2-58. Regional Annual Emission Burdens, Alternative 2 Constrained	7-46
7.2-59. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 2 Constrained, North Region	7-47
7.2-60. Average Daily Traffic for Major Roadways in North Project Section under Alternative 2 Constrained	7-47
7.2-61. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 2 Constrained	7-48
7.2-62. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North Region, Alternative 2 Constrained	7-48
7.2-63. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 2 Constrained, Central Region	7-49
7.2-64. Average Daily Traffic for Major Roadways in Central Project Section under Alternative 2 Constrained	7-49
7.2-65. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 2 Constrained	7-50

7.2-66. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 2
 Constrained.....7-50

7.2-67. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard
 Index, Alternative 2 Constrained Apra Harbor7-51

7.2-68. Average Daily Traffic for Major Roadways in Apra Harbor Project Section under
 Alternative 2 Constrained.....7-51

7.2-69. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 2
 Constrained.....7-52

7.2-70. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 2
 Constrained.....7-52

7.2-71. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard
 Index, Alternative 2 Constrained, South Region.....7-53

7.2-72. Average Daily Traffic for Major Roadways in South Project Section under Alternative 2
 Constrained.....7-53

7.2-73. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 2
 Constrained.....7-54

7.2-74. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 2
 Constrained.....7-54

7.2-75. Regional Annual Emission Burdens, Alternative 3.....7-54

7.2-76. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard
 Index, Alternative 3, North Region7-55

7.2-77. Average Daily Traffic for Major Roadways in North Project Section under Alternative 37-55

7.2-78. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 37-56

7.2-79. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North, Alternative 37-56

7.2-80. Estimated Construction Emission Burden – North, Alternative 3.....7-56

7.2-81. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard
 Index, Alternative 3, Central Region.....7-57

7.2-82. Average Daily Traffic for Major Roadways in Central Project Section under Alternative 3.....7-58

7.2-83. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 3.....7-58

7.2-84. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 3.....7-59

7.2-85. Estimated Construction Emission Burden – Central, Alternative 37-59

7.2-86. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard
 Index, Alternative 3 Apra Harbor.....7-59

7.2-87. Average Daily Traffic for Major Roadways in Apra Harbor Project Section under
 Alternative 37-60

7.2-88. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 37-60

7.2-89. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 37-61

7.2-90. Estimated Construction Emission Burden – Apra Harbor, Alternative 37-61

7.2-91. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard
 Index, Alternative 3, South Region7-62

7.2-92. Average Daily Traffic for Major Roadways in South Project Section under Alternative 37-62

7.2-93. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South, Alternative 37-63

7.2-94. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South, Alternative 37-63

7.2-95. Estimated Construction Emission Burden – South, Alternative 37-63

7.2-96. Regional Annual Emission Burdens, Alternative 8.....	7-63
7.2-97. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 8, North Region.....	7-64
7.2-98. Average Daily Traffic for Major Roadways in North Project Section under Alternative 8.....	7-64
7.2-99. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – North, Alternative 8.....	7-65
7.2-100. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – North, Alternative 8.....	7-66
7.2-101. Estimated Construction Emission Burden – North, Alternative 8.....	7-66
7.2-102. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 8, Central Region.....	7-67
7.2-103. Average Daily Traffic for Major Roadways in Central Project Section under Alternative 8.....	7-67
7.2-104. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Central, Alternative 8.....	7-68
7.2-105. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Central, Alternative 8.....	7-68
7.2-106. Estimated Construction Emission Burden – Central, Alternative 8.....	7-68
7.2-107. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 8 Apra Harbor.....	7-69
7.2-108. Average Daily Traffic for Major Roadways in Apra Harbor Project Section under Alternative 8.....	7-69
7.2-109. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 8.....	7-70
7.2-110. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – Apra Harbor, Alternative 8.....	7-70
7.2-111. Estimated Construction Emission Burden – Apra Harbor, Alternative 8.....	7-70
7.2-112. Estimated Project Related Impacts Compared to Cancer Risk Threshold and Hazard Index, Alternative 8, South Region.....	7-71
7.2-113. Average Daily Traffic for Major Roadways in South Project Section under Alternative 8.....	7-71
7.2-114. Predicted Worst-Case 1-Hour CO Concentrations (ppm) – South Region, Alternative 8.....	7-72
7.2-115. Predicted Worst-Case 8-Hour CO Concentrations (ppm) – South Region, Alternative 8.....	7-72
7.2-116. Estimated Construction Emission Burden – South, Alternative 8.....	7-72
7.2-117. Summary of Potential Impacts to Air Quality -Roadway Projects.....	7-72
8.2–1. Samples of Construction Noise Equipment.....	8-2
8.2–2. Activity Categories and Noise Abatement Criteria.....	8-6
8.2–3. Summary of Potential Noise Impacts – Power.....	8-8
8.2–4. Summary of Potential Noise Impacts – Potable Water.....	8-9
8.2–5. Summary of Potential Noise Impacts – Wastewater Projects.....	8-10
8.2–6. Summary of Potential Noise Impacts – Solid Waste Projects.....	8-11
8.2–7. Allowable Construction Noise Levels.....	8-12
8.2–8. Estimated Construction Noise Levels.....	8-13
8.2–9. Number of Potentially Impacted Receptors within the North Region, Alternative 1.....	8-14
8.2–10. Number of Potentially Impacted Receptors within the Central Region, Alternative 1.....	8-17
8.2–11. Predicted Future Noise and Barrier Analysis for Area 1.....	8-22
8.2–12. Predicted Future Noise and Barrier Analysis for Area 6.....	8-23
8.2–13. Predicted Future Noise and Barrier Analysis for Area 8.....	8-24
8.2–14. Predicted Future Noise and Barrier Analysis for Area 18.....	8-27

8.2-15. Predicted Future Noise and Barrier Analysis for Area 23 8-28

8.2-16. Predicted Future Noise and Barrier Analysis for Area 27 8-29

8.2-17. Predicted Future Noise and Barrier Analysis for Area 34 8-30

8.2-18. Predicted Future Noise and Barrier Analysis for Area 39 8-31

8.2-19. Predicted Future Noise and Barrier Analysis for Area 43 8-32

8.2-20. Predicted Future Noise and Barrier Analysis for Area 45 8-33

8.2-21. Predicted Future Noise and Barrier Analysis for Area 49 8-34

8.2-22. Predicted Future Noise and Barrier Analysis for Area 53 8-35

8.2-23. Summary of Potential Noise Impacts – Roadway Project 8-48

8.2-24. Summary of Potential Roadway Project Noise Impacts for the North Region..... 8-48

8.2-25. Summary of Potential Roadway Project Noise Impacts for the Central Region..... 8-49

8.2-26. Summary of Potential Roadway Project Noise Impacts with Proposed Abatement for the
North Region 8-51

8.2-27. Summary of Potential Roadway Project Noise Impacts with Proposed Abatement for the
Central Region..... 8-52

8.4-1. Summary of Impacts 8-54

8.5-1. Summary of Proposed Mitigation Measures 8-54

10.2-1. Summary of Potential Land and Submerged Land Use Impacts – Power 10-6

10.2-2. Summary of Potential Land and Submerged Land Use Impacts – Potable Water 10-8

10.2-3. Summary of Potential Land and Submerged Land Use Impacts – Wastewater 10-9

10.2-4. Summary of Potential Solid Waste Impacts 10-10

10.2-5. Summary of Potential Land and Submerged Land Use Impacts – Roadway Project..... 10-17

10.2-6. Summary of Potential Mitigation Measures for Roadway Projects Impacts on Land Use..... 10-18

11.2-1. Summary of Potential Impacts on Recreational Resources – Power..... 11-3

11.2-2. Summary of Potential Impacts on Recreational Resources – Potable Water 11-4

11.2-3. Summary of Potential Impacts on Recreational Resources – Wastewater 11-6

11.2-4. Summary of Potential Impacts of the Preferred Alternative – Solid Waste 11-7

11.2-5. Summary of Potential Impacts on Recreational Resources – Roadway Project..... 11-17

11.2-6. Summary of Proposed Mitigation Measures for Roadway Projects Impacts on Recreation.... 11-17

12.2-1. Summary of Potential Impacts on Terrestrial Biological Resources – Power (Basic
Alternative 1)..... 12-5

12.2-2. Potential Direct Impacts on Vegetation Communities with Implementation of Potable
Water Basic Alternative 1 (ac [ha])..... 12-6

12.2-3. Potential Impacts on Special-Status Species Habitat with Implementation of Potable
Water – Basic Alternative 1 (ac [ha])..... 12-11

12.2-4. Potential Direct Impacts on Vegetation Communities with Implementation of Potable
Water – Basic Alternative 2 (ac [ha])..... 12-13

12.2-5. Potential Impacts on Special-Status Species Habitat with Implementation of Potable
Water – Basic Alternative 2 (ac [ha])..... 12-13

12.2-6. Summary of Potential Impacts on Terrestrial Biological Resources - Potable Water..... 12-15

12.2-7. Summary of Proposed Terrestrial Biological Mitigation – Potable Water..... 12-16

12.2-8. Summary of Potential Impacts on Terrestrial Biological Resources – Wastewater 12-19

12.2-9. Summary of Potential Impacts on Terrestrial Biological Resources – Solid Waste..... 12-20

12.2-10. GRN Project Type and Potential Impacts on Terrestrial Biological Resources 12-21

12.2-11. North Region GRN Projects, Alternatives, and Potential Impacts 12-22

12.2-12. Central Region GRN Projects, Alternatives, and Potential Impacts..... 12-23

12.2-13. Apra Harbor GRN Projects, Alternatives, and Potential Impacts..... 12-26

12.2-14. South Region GRN Projects, Alternatives, and Potential Impacts 12-27

12.2-15. Potential Direct Impacts on Vegetation Communities with Implementation of Roadways
Alternative 1 12-36

12.2-16. Potential Direct Impacts on Special Status Species Habitat with Implementation of
Roadways Alternative 1 12-37

12.2-17. Potential Direct Impacts on Special Status Species Habitat with Implementation of
Roadways Alternative 1 12-40

12.2-18. Summary of Potential Impacts on Terrestrial Biological Resources, Roadway Projects 12-44

12.2-19. Summary of Proposed Mitigation Measures for Roadway Projects Impacts to Roadway
Biological Resources..... 12-44

13.2-1. Sensitive Months for Certain Species within Apra Harbor and Coastal Waters of Naval
Computer and Telecommunications Station Finegayan..... 13-6

13.2-2. Summary of Potential Power Impacts on Marine Biological Resources..... 13-9

13.2-3. Summary of Potential Impacts to Marine Biological Resources- Potable Water..... 13-15

13.2-4. Comparison of Baseline, Estimate Primary and Modeled Secondary Treatment Effluents
at NDWWTP Based on Projected Flows..... 13-19

13.2-5. Wastewater Treatment Plants in Southern Guam and the Associated Induced Population
Growths and Waste Water Flows..... 13-22

13.2-6. Summary of Potential Impacts to Marine Biological Resources-Wastewater..... 13-34

13.2-7. Summary of Potential Impacts to Marine Biological Resources-Solid Waste 13-37

13.2-8. GRN Project Type and Potential Impacts to Marine Biological Resources 13-39

13.2-9. Central Region GRN Projects, Alternatives, and Potential Impacts..... 13-40

13.2-10. Apra Harbor GRN Projects, Alternatives, and Potential Impacts..... 13-42

13.2-11. South Region GRN Projects, Alternatives, and Potential Impacts 13-43

13.2-12. Summary of Potential Impacts..... 13-46

14.2-1. Summary of Potential Impacts on Cultural Resources – Power 14-10

14.2-2. Summary of Potential Impacts on Cultural Resources – Potable Water 14-13

14.2-3. Summary of Potential Impacts on Cultural Resources – Wastewater 14-15

14.2-4. Summary of Potential Impacts on Cultural Resources – Solid Waste..... 14-16

14.2-5. Section 106 Effects in the North Region, Alternative 1 14-17

14.2-6. Section 106 Effects Central Area, Alternative 1..... 14-20

14.2-7. Section 106 Effects in the Apra Harbor Region from Alternative 1..... 14-21

14.2-8. Section 106 Effects on Known Historic Properties in the South Region from Alternative 1.... 14-21

14.2-9. Summary of Potential Impacts on Cultural Resources – Roadway Project..... 14-22

14.2-10. Summary of Proposed Mitigation Measures for Roadway Projects Impacts on Cultural
Resources 14-23

15.2-1. Summary of Potential Impacts on Visual Resources – Power..... 15-3

15.2-2. Summary of Potential Impacts on Visual Resources – Potable Water 15-5

15.2-3. Summary of Potential Impacts on Visual Resources – Wastewater	15-6
15.2-4. Summary of Potential Impacts on Visual Resources – Solid Waste	15-6
15.2-5. Guam Roads Network Projects Considered for Analysis, North Region	15-10
15.2-6. General Visual Quality per Road Corridor/Project Area, North Region.....	15-11
15.2-7. Guam Road Network Projects Considered for Analysis, Central Region	15-15
15.2-8. General Visual Quality per Road Corridor/Project Area, Central Region.....	15-17
15.2-9. Guam Road Network Projects Considered for Analysis, Apra Harbor Region.....	15-22
15.2-10. General Visual Quality per Road Corridor/Project Area, Apra Harbor Region	15-24
15.2-11. Guam Road Network Projects Considered for Analysis – South Region.....	15-26
15.2-12. Summary of Potential Impacts on Visual Resources – Roadway Projects	15-28
15.2-13. Summary of Proposed Mitigation Measures for Roadway Projects Impacts on Visual Resources	15-28
16.2-1. Summary of Potential Impacts to Marine Transportation – Power	16-2
16.2-2. Summary of Potential Impacts to Marine Transportation – Potable Water.....	16-2
16.2-3. Summary of Potential Impacts to Marine Transportation – Wastewater.....	16-3
16.2-4. Summary of Potential Impacts to Marine Transportation – Solid Waste	16-3
17.2-1. Construction Component Assumptions for Project Related Population Impacts	17-2
17.2-2. Population Increase related to Utilities.....	17-2
17.2-3. Civilian Labor Force Demand (Full-Time Equivalent Jobs), Utilities	17-3
17.2-4. Estimated Origin of Workers Connected to Utilities Construction	17-4
17.2-5. Estimated Numbers of On-Island Workers for Various Job Categories Other Than Direct On-Site Construction, Utilities	17-4
17.2-6. Impact on Civilian Labor Force Income (Millions of 2008 \$s), Utilities.....	17-5
17.2-7. Demand for New Civilian Housing Units, Utilities.....	17-6
17.2-8. Impact on Gross Receipts Tax Revenue (1,000s of 2008 \$s), Utilities	17-8
17.2-9. Impact on Corporate Income Taxes Revenue (1,000s of 2008 \$s), Utilities.....	17-8
17.2-10. Impact on Personal Income Taxes Revenue (1,000s of 2008 \$s), Utilities	17-8
17.2-11. Impact on Gross Island Product (Millions of 2008 \$s), Utilities.....	17-10
17.2-12. Additional Public Education Key Professionals Required, Utilities	17-11
17.2-13. Additional Public Health and Human Service Key Professionals Required, Utilities.....	17-11
17.2-14. Additional Public Safety Key Professionals Required, Utilities	17-12
17.2-15. Additional Key Professionals Required for Selected Other General Services, Utilities	17-12
17.2-16. Additional Growth Permitting Staff Required, Utilities	17-12
17.2-17. Summary of Potential Socioeconomic Impacts-Utilities.....	17-14
17.2-18. Proposed Mitigation Measures for Utilities.....	17-16
17.2-19. Summary of Right-of-Way Acquisitions and Estimated Residential and Non-residential Relocations	17-18
17.2-20. Impacts from Construction Investment in the Guam Road Network Projects (in millions of 2009 dollars)	17-27
17.2-21. Summary of Potential Roadway Project Impacts to Socioeconomics and General Services	17-27
18.2-1. Basic Alternative 1 Hazardous Material Consequences and Mitigation	18-10

18.2-2. Summary of Potential Hazardous Materials and Waste Impacts-Power 18-12

18.2-3. Basic Alternative 1 Hazardous Material Construction Consequences and Mitigation..... 18-15

18.2-4. Summary of Potential Hazardous Materials and Waste Impacts-Potable Water..... 18-16

18.2-5. Basic Alternative 1 Hazardous Material Construction 18-19

18.2-6. Summary of Potential Hazardous Materials and Waste Impacts-Wastewater..... 18-20

18.2-7. Hazardous Material Consequences and Mitigation 18-23

18.2-8. Summary of Potential Hazardous Materials and Waste Impacts-Solid Waste 18-24

18.2-9. Potential Effects from Contaminated Soils for GRN Roadway Project Types 18-26

18.2-10. Summary of Potential Hazardous Materials and Waste Impacts-Roadway Project..... 18-33

18.2-11. Summary of Proposed Mitigation Measures for Roadway Projects Impacts on Hazardous
Materials and Waste 18-34

19.2-1. Summary of Potential Public Health and Safety Impacts..... 19-14

19.2-2. Activities Associated with GRN Roadway Project Types..... 19-16

19.2-3. Summary of Potential Impacts to Public Health and Safety-Roadway Project..... 19-20

20.2-1. Summary of Potential Impacts – Comparison of Alternative 2 and Alternative 2
Constrained**..... 20-17

20.2-2. Summary of Potential Impacts: Power Alternatives..... 20-18

20.2-3. Summary of Potential Impacts: Potable Water Alternatives 20-19

20.2-4. Summary of Potential Impacts: Wastewater Alternatives 20-19

20.2-5. Summary of Potential Impacts: Solid Waste 20-20

20.2-6. Summary of Roadway Project Impacts 20-20

20.2-7. Summary of Proposed Mitigation Measures 20-21

21.2-1. Effects of All Alternatives on Known Historic Sites..... 21-14