CHAPTER 3. PREFFERED ALTERNATIVES: SUMMARY OF IMPACTS

3.1 INTRODUCTION

Chapter 3 summarizes the combined construction and operational direct and indirect impacts of the preferred alternatives for Guam and Tinian that were presented in previous volumes. These impacts are compared to the recent trends in resources to determine whether the preferred alternatives would adversely impact the overall health of each resource. Many public comments on the Draft EIS referring to cumulative impacts were actually comments on the combined impacts of the proposed actions. The concern of these comments was the impacts described in Volumes 2 through 6 addressed impacts of individual components of the proposed actions and did not address the combined impacts of the proposed actions. The combined impacts of all proposed actions are described in this chapter. This chapter also includes a section on potential secondary impacts due to the preferred alternatives and a section summarizing the Clean Water Act (CWA) Section 404 actions under all alternatives.

Chapter 4 of this volume presents the cumulative impacts analysis, which assesses the combined impacts of the preferred alternatives (presented in this chapter) with the impacts of other past, present, and reasonably foreseeable future actions across Guam and Tinian.

3.2 PREFERRED ALTERNATIVES' DEFINITION

The term "preferred alternatives" is defined as the alternatives that an agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors.

Herein, the term preferred alternative refers to all the components of preferred alternatives described in previous volumes for the Marine Corps relocation, Navy transient aircraft carrier wharf, and Army AMDTF, as a whole. The greatest impacts to resources would occur when all of the preferred alternatives occur concurrently. To assess a maximum potential adverse effect, it is assumed that proposed construction actions would occur during a compressed time period. However, it is assumed that all operational activities would commence only upon completion of construction. In other words, there would be no overlap between construction and operation phases of the preferred alternatives. Both the construction and operation impacts are described.

The construction impacts would presumably peak in 2014, therefore, that is the point of reference used to describe the construction impacts under the preferred alternatives for each resource. This is the point of maximum population and ground disturbance with maximum potential impact to resources, and presents the starkest contrast. It is also assumed that the mitigation measures and Best Management Practices (BMPs) that are proposed for construction impacts are completed prior to the operational phase. In other words, the construction impacts are reduced to less than significant once the operational phase begins.

The steady-state level of operations would begin at the conclusion of construction and would continue unchanged for an undetermined amount of time into the future. This operations phase represents the long-term impact of the preferred alternatives in isolation of other reasonably foreseeable future actions.

Relative to the construction phase, the operations phase would generally have less impact on the island resources, especially those resources that are sensitive to population levels.

3.3 PREFERRED ALTERNATIVES' IMPACTS COMPARED TO NO ACTION

3.3.1 Methodology

The methodology for comparing the preferred alternatives' impacts to no action consists of the following steps:

1. Summarize the combined preferred alternatives' impacts from Volumes 2 through 6:
    a. Consolidate the findings of the preferred alternatives' impact analyses by resource area, as presented in previous volumes of the EIS. This was prepared assuming an anticipated construction peak in 2014, a post-construction operational steady-state, the proposed construction actions would occur in a compressed time period, and that all operational activity would commence upon completion of construction. A second assumption is the proposed mitigation for construction impacts would be completed before the operational period commences.
    b. For Guam only: Review the preferred alternatives' findings from Step 1 for each resource and list the highest level of adverse impacts indentified among the volumes. This list represents a summary of the preferred alternatives' impacts for Guam. This summary impact assessment is warranted for Guam's proposed actions because there may be additive impacts associated with the preferred alternatives as a whole that are not apparent in the project-specific analysis of previous volumes.
    c. Tinian is geographically distant from Guam and is not expected to be influenced by Guam's summary impacts. There are far fewer proposed actions on Tinian than Guam and a separate summary of impacts is not warranted. The preferred alternatives' impacts in Volume 3 are essentially a summary of impacts for Tinian. These findings are reiterated in this Chapter.
2. Describe "no action" for each resource. "No action" means the proposed activities would not take place; the resulting environmental effects from taking no action are compared with the effects of allowing the proposed activity or an alternative activity to go forward.
    a. Island-wide resource health trends are described for Tinian and Guam, in the absence of any of the preferred alternatives described in this EIS. There are key natural and anthropogenic (human-influenced) stressors that are triggered by key events or repetitive practices/behaviors over time. A review of stressors often reveals trends in resource success or health that lead to the existing affected environment, as described in resource sections of Volumes 2 through 6. Under no action, each resource is described in terms of its capacity to accommodate additional effects or stress.
    b. The time period designated for describing the resource trends begins at the conclusion of World War II (WWII). WWII was selected because it is the single-most significant event in modern history and had profound environmental impacts on the Mariana Islands. Volume 7, Chapter 1, provides an overview of key events. The resource descriptions are often qualitative and based on best available information. They are intended to provide insight on the current situation on each island that may be influenced by the preferred alternatives. Other past, present, and reasonably foreseeable future actions are further addressed in the cumulative impacts assessment provided in Chapter 4 of this volume.
3. Compare the summary of preferred alternatives' operational impacts described in Steps 1 and 2, to no action described in Step 3, to determine whether the preferred impacts would influence the trends in resource health.

The comparison of the preferred alternative impacts to no action meets, in part, the Council on Environmental Quality (CEQ) guidance on cumulative impacts analysis as described in *Considering Cumulative Effects Under the National Environmental Policy Act (NEPA)* (CEQ 1997) and *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis* (CEQ 2005). One principle in the guidance documents states that "cumulative effects analysis should be conducted within the context of resource, ecosystem, and community thresholds - levels of stress beyond which the desired condition degrades." Thus, "each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters."

This methodology is applied to each resource and described in the following sections. The findings for Tinian and Guam are discussed under each resource. Tables summarizing the impacts during construction and operation are presented in each resource section.

3.3.2 Geological and Soil Resources

3.3.2.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-3 and 3.3-4 summarize the preferred alternatives' construction and operation impacts to geological and soil resources on Guam and Tinian. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. It is assumed that all of the proposed construction actions would occur during a compressed time period, and that all operational activity would commence upon completion of construction.

Most impacts on geological and soil resources are less than significant during construction and operation. During site planning in Northern Guam, avoidance of known sinkholes was required to prevent significant impacts to unique geological features. Significant and mitigable impacts are identified for construction and operation, due to the presence of sinkholes. The sinkholes that are deemed dangerous would be fenced off and educational warning signs put in place to warn of potential danger as a proposed mitigation measure for potential impacts during operations. A buffer zone of vegetation would remain around them through construction and operation to prevent further erosion or expansion on Tinian and Guam. A survey by a licensed geologist is required prior to construction to ensure that all sinkholes have been identified. If additional sinkholes are discovered, the significance of these sinkholes would be evaluated and projects would be designed in consideration of these sinkholes as appropriate. With implementation of mitigation, less than significant impacts to sinkholes would occur.

Construction activities on Tinian and Guam would include clearing, grading, and grubbing, demolition of existing road pavement, earthwork, and landscaping. Temporary loss of vegetation would occur; however landscaping would replace it. Ground disturbance would be much less on Tinian than on Guam. With the implementation of best management practices (BMPs), including requirements for stormwater compliance, there would be no significant impacts from soil erosion during construction or operation. Major features of topography or landscape (i.e., hills and mountains) would not changed substantially by the preferred alternatives, and potential structural damage from seismic ground shaking and fault rupture at all locations under the preferred alternatives would be minimized by adherence to UFC 3-310-04 Seismic Design for Buildings (USACE 2007).

Construction on previously disturbed land, such as Apra Harbor and South Finegayan, would lessen impacts to soil and geological resources. Liquefaction (i.e., conversion of soil into a fluid-like mass during a seismic event) is a risk at Apra Harbor, but impacts due to development would not be significant.

The preferred alternatives would have an overall less than significant impact on geology and soils during construction with implementation of proposed mitigation for sinkholes. For utilities and off-base roadways there would be no impacts during operations.

Operational risks would be limited to geologic hazards. There would be a high risk of liquefaction at Apra Harbor and Naval Base Guam. Structures would be constructed to meet UFC 3-310-04 Seismic Design for Buildings criteria and applicable military requirements for munitions storage facilities to reduce risk of damage to structures from seismic hazards. The risk cannot be reduced to zero; therefore, a less than significant impact would remain.

Table 3.3-1. Summary of Preferred Alternatives' Construction Impacts – Geology and Soils

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Topography	LSI	LSI	LSI	LSI	LSI	LSI	NI	LSI	LSI	LSI
Geology	SI-M	NI	SI-M	NI	SI-M	SI-M	NI	LSI	SI-M	SI-M
Soils	LSI	LSI	LSI	LSI	LSI	LSI	NI	LSI	LSI	LSI
Geologic Hazards	LSI	LSI	LSI	LSI	LSI	LSI	NI	LSI	LSI	NI
Geology and Soils Construction Impact Summary:									**SI-M**	**SI-M**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

Table 3.3-2. Summary of Preferred Alternatives' Operation Impacts – Geology and Soils

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Topography	NI	NI	NI	LSI	LSI	LSI	LSI	NI	LSI	NI
Geology	SI-M	NI	SI-M	NI	SI-M	SI-M	LSI	NI	SI-M	LSI
Soils	LSI	NI	NI	LSI	LSI	LSI	LSI	NI	LSI	LSI
Geologic Hazards	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	LSI	LSI
Geology and Soils Operation Impact Summary:									**SI-M**	**LSI**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

3.3.2.2 No Action

Impacts to geological and soil resources would continue as a byproduct of naturally occurring and anthropogenic activities that result in land disturbance. Soil erosion and changes to topography can be caused by a number of factors including wildlife such as ungulates; wildfires; and even construction projects that did not employ BMPs. Guam has a history of wildfires set by hunters to attract game; the resulting reduction in groundcover from these wildfires increases soil run-off in stormwater and would

continue to occur under no action. Stressors affecting geological and soil resources would continue to occur without implementation of the preferred alternatives.

Historical factors that have contributed to increased erosion and stormwater runoff, loss of vegetation, changes to landscape and topography, diminished slope stability, loss of agriculturally productive soil, or increased vulnerability to a geologic hazard on Guam include:

- Construction practices that do not include the use of BMPs and SOPs and do not adhere to Guam and USEPA regulations;
- Increases in impervious surfaces from construction;
- Illegal burning of savanna and forest by hunters;
- Construction completed on agriculturally productive soil;
- Construction completed in areas with karst geologic features without proper survey by a geologist to avoid sinkholes;
- Construction completed in areas such as Apra Harbor, where there is high risk of liquefaction; and
- Erosion caused by feral ungulates.

These factors contribute to the baseline condition of soil, watersheds, and reefs surrounding the proposed action areas and contribute to the magnitude of impacts to geological and soil resources of current and future actions. Since WWII, this trend has improved with the adoption of federal non-point source discharge (NPDES) regulations, but the increase in erosion and the ongoing effects of historical influences are likely to continue into the future. Continuation of activities contributing to excessive soil erosion would cause a significant impact under no action. Future construction projects would have a less than significant impact because BMPs would be required for erosion and stormwater management. Other measures to address the ongoing problems include ungulate control, planting exposed soils, enforcement of existing policies and laws, and passing new laws to reduce stressors.

Surface runoff and sediment loss from soil erosion are major contributors to the reduction in surface water quality, especially in Southern Guam. A study of the Ugum watershed on Guam indicates that soil erosion from vegetated savanna grassland in the watershed is approximately 70 tons/hectare/year, but can be as high as 547 tons/hectare/year in unvegetated sloping sites known as "badlands" (U.S. Geological Survey [USGS] 2001). Agricultural lands in the Ugum watershed were estimated to have an average soil erosion loss of 45 tons/hectare/year (USGS 2001). Additional problems associated with soil erosion island-wide include loss of soil productivity at the eroded site, reduced water storage capacity in streams and lakes, and loss of wildlife habitat.

Many geological phenomena, such as earthquakes, tsunamis, and volcanic eruptions, originate in areas where tectonic plates meet (USGS 2008). The Marianas are positioned where the Philippine and Pacific Plates converge. Earthquake activity is common on Guam and across the entire Mariana Island chain (Lander, et al. 2002). Seismic activity can trigger landslides, tsunamis, and liquefaction. All of these events are unpredictable and could occur anywhere on Tinian or Guam. Building codes potentially mitigate future hazards that may result from seismic activity.

3.3.2.3 Comparison of Preferred Alternatives to No Action

The preferred alternatives would have a less than significant impact on geology and soils during construction and operation with implementation of proposed mitigation. This assumes adherence to BMPs and stormwater management principles. Under no action, the same principles would apply during construction, and future development would result in less than significant impacts.

The other factors that contribute to island-wide soil erosion would continue, including ungulate removal of vegetation, existing badlands, and exposed soils. The island-wide no action trend of increasing erosion over time due to the factors identified above would continue with significant but mitigable impacts.

The preferred alternatives for Tinian would not significantly impact topography at the specific site of the proposed action and there would be no significant effect on island-wide topography (i.e., hills and mountains). Under no action, there potentially would be localized impacts to topography from planned construction activities, which also would be considered less than significant.

Geologic hazards include earthquake activity on Guam and Tinian, as well as sinkholes and karst features that may limit areas that potentially could be developed on either island. Under the preferred alternatives, geological surveys continue to ensure that construction is not planned in areas where geological hazards could lead to structural problems. Known sinkholes would be avoided and a buffer zone of vegetation would be left around sinkholes as a mitigation measure to prevent further erosion or expansion. A survey by a licensed geologist is required prior to construction to ensure that all sinkholes have been identified. If additional sinkholes are discovered, the significance of these sinkholes would be evaluated and projects would be designed in consideration of these sinkholes as appropriate. There may be impacts in localized areas of construction, but island-wide there would be no operational impact. During preferred alternatives operation or no action, there would continue to be a risk to geological resources. The preferred alternatives would be implemented in accordance with BMPs and regulations; however, under the no action erosion prone areas are likely to persist. All construction is required to meet local seismic design regulations; therefore, the risks are minimized.

3.3.3 Water Resources

3.3.3.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-3 and 3.3-4 summarize the preferred alternatives' construction and operation impacts to water resources on Guam and Tinian. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. It is assumed that all of the proposed construction actions would occur during a compressed time period, and that all operational activity would commence upon completion of construction. Significant construction-related indirect impacts (construction workforce and induced population) to all water resources were identified. During operations, stormwater would be managed on-site. There is the potential with the overall increases in developed areas and maneuver training that there would be less than significant impacts to groundwater, nearshore and wetland water quality. Wastewater improvements at the NDWWTP on Guam would result in a beneficial impact of improved water quality; however, there would be a significant adverse indirect impact from wastewater to all water resources categories associated with increased population, particularly in the south and central regions of Guam. There may also be an issue associated with leachate impact on groundwater as a result of existing and continued Navy landfill operations. The leachate from the existing Navy sanitary landfill may impact the groundwater at a less than significant level. The landfill is located over aquifers not used for supplying drinking water, thus any leachate that might percolate into the aquifer would not affect regional potable groundwater quality or quantities.

Table 3.3-3. Summary of Preferred Alternatives' Construction Impacts – Water

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Surface Water/ Stormwater	LSI	LSI	LSI	LSI	LSI	LSI	NA	LSI	LSI	LSI
Groundwater	LSI	LSI	LSI	LSI	LSI	LSI	NA	LSI	LSI	LSI
Nearshore Water	SI-M	SI-M	LSI	LSI	LSI	LSI	NA	LSI	SI-M	LSI
Wetlands	LSI	NI	NI	NI	NI	NI	NA	LSI	LSI	NI
Water Resources Construction Impact Summary:									**SI-M**	**LSI**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, ( ) = Indirect (workforce population and induced) population impact, NA = Not Applicable (no construction)

Table 3.3-4. Summary of Preferred Alternatives' Operation Impacts – Water

Potential Impacts Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Surface Water/ Stormwater	LSI	LSI	LSI	NI	LSI	NI (SI)	NI	LSI	LSI (SI)	LSI
Groundwater	LSI	LSI	LSI	NI	LSI	LSI (SI)	LSI	LSI	LSI (SI)	LSI
Nearshore Water	LSI	LSI	LSI	NI	LSI	LSI (SI)	NI	LSI	LSI (SI)	LSI
Wetlands	NI	NI	NI	NI	NI	NI (SI)	NI	NI	NI (SI)	LSI
Water Resources Operation Impact Summary:									**LSI (SI)**	**LSI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, ( ) = Indirect (workforce population and induced) population impact

Surface Water/ Storm Water.

Once constructed, the combined preferred alternatives would add approximately 883 acres (357 ha) of impervious surface area to Guam's existing 12,280 acres (4,970 ha) of developed impervious surface area (see Table 3.3-5), representing an increase of approximately 7% of total development-related impervious surface area on the island. Increases in stormwater would be managed by existing or new stormwater infrastructure; stormwater flow paths would continue to mimic area topography. Stormwater would continue to be managed in accordance with laws, regulations, and plans that would minimize potential impacts to groundwater and nearshore waters to less than significant.

During construction, the preferred alternatives could result in temporary increases in stormwater runoff that would be managed through the implementation of BMPS, and the impacts would be less than significant. Roadway-specific BMPs, as identified in the CNMI and Guam Stormwater Management Manual (CNMI and Guam 2006) would be included in the planning, design, and construction for all road

projects. Through the development and implementation of site-specific BMPs, LID measures, and facility-specific plans and procedures, there would be no increased risk from environmental hazards or to human health. A Comprehensive Drainage and Low Impact Development Implementation Study was prepared for the potential Main Cantonment site at Finegayan. The study provides design recommendations for capturing, treating, and routing the 95% exceedance stormwater flows. Conditions of the Construction General Permit would be followed for non-DoD property. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection needs, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater subbasins.

Table 3.3-5. Guam Impervious Surface Area Island-Wide and on Military Lands: Existing and Preferred Alternatives

	Island Wide*		Military Lands	
	Acres	Percentage	Acres	Percentage
Total land area	134,765	100%	34,435	100%
Existing impervious surface area from development	12,280	9%	3,244	9%
Addition of impervious surface area from Preferred Alternatives	883	<1%	883	3%
Total impervious surface area with Preferred Alternatives	**13,163**	**10%**	**4,127**	**12%**

Note: *Includes military lands
Sources: NOAA 2007, Department of Commerce et al. 2007

Groundwater

While groundwater production rates would increase, implementation of sustainability practices would reduce the amount of groundwater needed per capita, which would help minimize impacts to groundwater availability. The resulting total annual groundwater production would be at or less than the sustainable yield and would be monitored to ensure sustainable yields are not exceeded. Increased groundwater production potentially could impact cave and pool water levels; potential impacts to these systems could require review and/or permitting by the U.S. Army Corps of Engineers (USACE). There is the potential for leaching of lead and other chemicals from ammunition into groundwater at firing range locations. BMPs would be applied that would reduce these impacts to less than significant. Monitoring groundwater chemistry and overlying sediments would ensure that no harm to existing or beneficial uses and no damage to structures, utilities, or other facilities would result from potential soil settlement or saltwater intrusion. Dredged material dewatering sites would not be located over areas with groundwater used for potable water production; dredge effluent that percolates into the underlying soils would not affect the quality or quantity of groundwater available for drinking.

Nearshore Water

Under the preferred alternatives, there are planned dredging projects in Apra Harbor that would temporarily impact the water quality of nearshore waters. BMPs would limit the impacts to the dredge area. The Army Corps of Engineers Section 404 and 401 permit conditions would require water quality mitigation measures and monitoring during in-water work, such as dredging, to verify the effectiveness of those measures. Non-compliance would result in stopping work until water quality levels meet acceptable levels. These nearshore impacts are considered significant but mitigable.

Ships are required to strictly comply with fuel transfer and ballasting procedures to ensure ballast water does not become contaminated with oil or any other waste. Ships using self-compensating fuel tanks are required to ensure adequate margin is preserved to prevent inadvertent discharges of oil with the

compensating water. Compliance with the relevant laws and procedures would ensure that no significant impact to nearshore water would occur from point-source discharges under the proposed action.

There may be less than significant indirect impacts to wetlands and nearshore waters due to sedimentation on Guam. The use of BMPs, including Low Impact Development (LID), during construction would prevent short- and long-term increases in sediment loading, including sediment loading to Apra Harbor. Construction-related impacts to nearshore water are considered significant but mitigable to less than significant. For further assessment of impacts to nearshore waters and inner and outer Apra Harbor see Section 3.5, *Summary of Clean Water Act Section 404 Actions – All Proposed Actions and Alternatives*.

Wetlands

With the implementation of the proposed mitigation measures to compensate for potential direct and indirect impacts to wetlands resulting in loss of wetland function, there would be no reduction in wetland area or functionality on Guam. For assessment of combined wetlands impacts see Section 3.5, *Summary of Clean Water Act Section 404 Actions – All Proposed Actions and Alternatives*.

Tinian. During construction, water quality impacts on Tinian are anticipated to be similar to those on Guam, but the scale of the proposed construction is much smaller on Tinian and no in-water work is proposed. A direct impact to a potential jurisdictional wetland (Table 3.3-3) from filling would be avoided by adjusting the range layout. There would be less than significant impacts to water resources during operation.

3.3.3.2 No Action

Guam and Tinian

The stressors on water quality include construction-related discharge, sewage overflow, animal waste, sediment erosion, saltwater intrusion into aquifers, leaky septic systems, feral ungulates, human disturbance of soils, erosion, and invasive plants.

Surface Water/Stormwater

The identified stressors impacting surface water availability and quality on Guam and Tinian (e.g., construction-related discharges, sewage overflows, animal waste, and sediment erosion) would continue to exist. These threats to surface water would continue to be monitored by federal and Guam/Tinian agencies, and appropriate regulatory action would continue to occur in order to maximize surface water quality and availability. In time, surface water quality would be expected to slowly improve as point and non-point sources of pollution are identified, and pollution loading to surface waters is reduced.

Groundwater

The identified stressors impacting groundwater availability and quality on Guam and Tinian (e.g., saltwater intrusion and leaky septic systems) would continue to exist. These threats to groundwater availability and quality would continue to be monitored by federal and Guam/Tinian agencies to minimize potential impacts, and appropriate regulatory action would continue to occur in order to protect groundwater resources. Monitoring for saltwater intrusion, coordination among water users, as well as potential protective designations for groundwater resources are expected to ensure there would be a dependable, safe supply of groundwater for Guam/Tinian users. In time, groundwater quality would be expected to slowly improve on Guam as point and non-point sources of pollution are identified, and pollution loading to surface waters is reduced, all within the framework of increasing the understanding of the Northern Guam Lens Aquifer (NGLA).

Nearshore Waters

Numerous sources of pollutants are currently present on Guam and Tinian that stress surface water resources. These sources include municipal and industrial point sources of pollutants, sewer system overflow and failure, agricultural runoff (carrying animal wastes, fertilizers, and pesticides), urban runoff, erosion from stream beds, construction sites, and derelict land, leaks and spills, and landfill leachate. The identified near shore marine water quality concerns for Guam include copper, aluminum, nickel, e*nterococci* bacteria, total residual chlorine, biochemical oxygen demand, and total suspended solids. The identified nearshore water quality concerns for the marine waters of Tinian only include e*nterococci* bacteria at one nearshore location (Unai Chulu). These contaminants can be attributed to one or more of the sources listed above and would persist. Threats to nearshore water quality would continue to be monitored by federal and Guam/Tinian agencies to minimize potential impacts, and appropriate regulatory action would continue to occur to protect nearshore waters. In time, nearshore water quality would be expected to slowly improve as point and non-point sources of pollution are identified and pollution loading to nearshore waters is reduced.

Wetlands

The identified stressors impacting wetlands on Guam and Tinian (e.g., feral ungulates, human disturbance, invasive plants species, sedimentation, and erosion) would continue to occur. These threats to wetland areas are a concern, and are therefore monitored by federal and Guam/Tinian agencies to protect wetland areas. Appropriate regulatory action would continue to occur to protect wetland areas. In time, wetland quality would be expected to slowly improve as point and non-point sources of pollution are identified; however, the extent of wetlands (by acreage) may not significantly increase because the focus is currently on reducing potential future losses.

3.3.3.3 Comparison of Preferred Alternatives to No Action

Under no action, the identified primary threats to surface waters, groundwater, nearshore waters, and wetlands, would continue on Guam and Tinian. Over time, more development and ground disturbance would occur on non-federal lands. Local and federal regulations applied to all development projects would mitigate potential development impacts on wetlands and water.

There would continue to be feral ungulates and invasive plant species that contribute to erosion but the operation of the preferred alternatives would not exacerbate the impacts on water quality due to soil erosion.

During operations, the preferred alternatives would not appreciably alter the existing trends in surface water, ground water, nearshore water, or wetland health.

3.3.4 Air Quality

3.3.4.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-6 and 3.3-7 summarize the preferred alternatives' construction and operation impacts to air quality on Guam and Tinian. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The sulfur content of fuels since 1992 has decreased in general although Guam has been granted an exemption from using low sulfur fuel (see Volume 6, Section 7.2). DoD is currently working with relevant stakeholders, including EPA GEPA, GPA, and fuel suppliers, to determine an appropriate strategy for implementing an island wide switch to low sulfur fuel. There are several on-going logistics, economics, contracts, and regulatory issues, which must be resolved before an island wide switch to ultra low sulfur fuel

can be realized. When the island-wide plan is implemented for ultra low sulfur fuel, the actual sulfur content for construction activities and highway diesel vehicles on Guam may be far lower than the level used in the analysis.

The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the table. It is assumed that all of the proposed construction actions would occur during a compressed time period, and that all operational activity would commence upon completion of construction. For air quality, construction data are shown for a range of years and not just the peak construction year.

Table 3.3-6. Summary of Preferred Alternatives' Construction Impacts – Air Quality

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Air Quality	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Air Quality Construction Impact Summary:									**LSI**	**LSI**

Legend: LSI = Less than significant impact

Table 3.3-7. Summary of Preferred Alternatives' Operation Impacts – Air Quality

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Air Quality	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Air Quality Operation Impact Summary:									**LSI**	**LSI**

Legend: LSI = Less than significant impact

During construction and operation of facilities on Guam and Tinian, air quality impacts would be less than significant. Construction and operation emissions from the preferred alternatives would be below the significance criterion of 250 tons per year (TPY) for air pollutants adopted in the EIS, with an exception for the operational carbon monoxide (CO) emission level that primarily would be generated from on-road vehicle operations. Unlike criteria pollutants, there is no established impact significance threshold for greenhouse gas (GHG) emissions, inclusive of CO_2, therefore, the predicted GHG emissions levels provided in this study only fulfill NEPA disclosure purposes, whereas predicted criteria pollutant emissions are regulated under the NAAQS.

As discussed in Volume 2, Chapter 5, Air Quality, the EIS selected the "major stationary source" definition of 250 TPY or more of any air pollutant subject to regulations under the Clean Air Act [CAA] from the Prevention of Significant Deterioration (PSD) program. The PSD limits are used as the criteria for determining the potential significance of air quality impacts for locations that are in attainment. Neither the PSD permitting program nor the General Conformity Rule (GCR) are applicable to mobile sources and non-major stationary sources in attainment areas. Therefore, the analysis of construction and operational incremental emissions from these sources in attainment areas and the significance criteria selected (250 TPY) are solely for the purpose of informing the public and decision makers about the relative air quality impacts from the preferred alternative and the alternatives under NEPA. However, since the 250 TPY

threshold was selected in the context of the *de minimis* threshold established in the GCR, providing only an indication of a potentially significant impact; a formal impact analysis should be conducted if the threshold may be exceeded.

Based on a more refined CO concentration modeling analysis for on-road vehicle operational impacts as described in Volume 6, no exceedances of the CO National Ambient Air Quality Standards (NAAQS) were predicted at the location with the anticipated highest emissions. Therefore, the preferred alternatives would not result in a significant CO impact, even though the island-wide emissions would exceed 250 TPY.

Sulfur dioxide (SO_2) emissions would also be well below the 100 TPY *de minimis* level used as the threshold for emissions within the two non-attainment areas. Consequently, the preferred alternatives would result in a less than significant impact on air quality.

GHG emissions into the atmosphere are a concern because they contribute to global warming by trapping re-radiated energy. As described in Volumes 2 through 6, GHG emissions in terms of CO_2 equivalents were predicted for the following three source categories:

- Mobile fossil fuel combustion sources including construction equipment,
- Stationary fossil fuel combustion sources, and
- Solid waste landfill.

Within Volumes 2 through 6, the total quantity of GHG emissions are expressed in terms of CO_2 equivalents as well as methane when specifically quantified for landfill operations. Since the change in climate conditions caused from CO_2 equivalent compounds (CO_2 Eq) by the burning of fossil fuels is a global effect, it is required that the air quality impact analysis be assessed cumulatively on a global or regional scale. The total potential CO_2 Eq emissions under the preferred alternatives are presented in the cumulative impacts analysis (Section 4.4 of this Volume).

CO_2 is not a criteria pollutant and the 250 TPY significance threshold is not applicable to CO_2. However, it should be noted that, beginning January 2, 2011, the PSD and Title V permitting regulations will be applicable to GHG emitters (see Section 4.4.1 for details). CO_2 is discussed for all regions of influence (ROI) on Guam and combined with CNMI GHGs at the end of this section because the entire geographic region is a more appropriate scale for evaluation of potential impacts.

A detailed emissions analysis of the preferred alternative and its impact on air quality (evaluating for each individual ROI – North, Central, Apra Harbor, and South) is presented in Volume 9, Appendix I, Section 3.5, Regional Emissions under Preferred Alternatives.

Criteria Pollutants

Construction activities for the Marine Corps relocation would include:

1. The development of airfield, waterfront, ground and other training sites; housing; quality of life facilities; and operational and administrative facilities (Volume 2, Alternative 2);
2. Aircraft carrier berthing and dredging (Volume 4, Alternative 1 [Polaris Point]);
3. The co-location of the Army AMDTF with the U.S. Marine Corps facilities (Volume 5, Alternative 1); and
4. The utilities and off-base roadways in each Guam ROI (Volume 6, Alternative 1).

The annual construction emissions likely would be dominated by the Main Cantonment and roadway activities. The construction criteria pollutant emissions for Guam are summarized in Table 3.3-8; and do not exceed 250 TPY of criteria pollutants in any single year.

Table 3.3-8. Guam Annual Emissions – Preferred Alternatives

Activity	*Year*	*Total Annual Pollutant Emissions (TPY)*						
		SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Construction	2011	59.3	85.0	17.3	13.5	86.6	24.5	16654.9
	2012	74.6	111.1	21.3	16.8	109.5	38.4	20889.6
	2013	116.1	156.4	32.4	36.7	167.4	56.5	32659.7
	2014	63.0	118.8	26.3	15.9	97.0	43.3	20419.7
Construction /Operation	2015	138.9	3053.2	99.6	61.0	234.1	248.0	61307.4
	2016	124.6	3016.0	82.0	55.1	210.7	229.0	57289.0
Operation	2017 and on	119.9	2996.9	76.1	53.1	201.0	221.7 – 223.0	56087.5 – 60267.2

Legend: PM =particulate matter; PM_{10}= particle size of 10 micrometers or less; $PM_{2.5}$ = particle size less than 2.5 micrometers; NOx = nitrogen oxides; VOC= volatile organic compounds; CO_2 = carbon dioxide.

Operational activities are limited to 1) airfield, vessel, and ground training and on base vehicle activities associated with the Marine Corps Guam (Volume 2, Alternative 2), 2) aircraft carrier berthing (Volume 4, Alternative 1), and 3) utility and off-base vehicle operations (Volume 6, Alternative 1).

The emissions associated with these operations in any year would be below 250 TPY of criteria pollutants, except for CO at a projected level of approximately 3,000 TPY, as shown in Table 3.3-8. The CO exceedances of 250 TPY primarily would result from off-base vehicle operations and to a lesser extent, on-base vehicle operations.

As discussed in Volume 6 for roadway projects, vehicular CO emissions are of local (microscale) concern with potential impacts concentrated around heavily congested intersections. Although the Guam-wide CO emissions are predicted to exceed 250 TPY under operational conditions, further microscale dispersion modeling performed at the intersections with the highest anticipated levels of emissions (Volume 6) indicated that no exceedances of the CO NAAQS would occur. Therefore, potential CO impacts would be less than significant under the preferred alternatives. Table 3.3-9 lists the intersections with the highest levels of emissions on Guam that were analyzed for CO concentrations. Consequently, overall potential air quality impacts would be less than significant under the preferred alternative.

Table 3.3-9. Intersections Selected for CO Microscale Impact Analysis – Preferred Alternatives

ROI	*Intersections*
North	Route 1/25
	Route 9/Andersen AFB North Gate
Central	Route 1/8
	Route 4/7A
	Route 16/27
Apra Harbor	Route 1/2A
South	Route 5/2A

CAA General Conformity Applicability Analysis

The 1990 amendments to the CAA (CAAA) require federal agencies to ensure that their actions conform to the State Implementation Plan (SIP) in a nonattainment area. The GCR is applicable to the proposed activities in Piti and Tanguisson SO_2 nonattainment areas. Therefore, a subsequent general conformity applicability analysis is required.

The *de minimis* emissions level established by the USEPA is 100 TPY of SO_2, and is applicable to the two non-attainment areas on Guam, Piti and Tanguisson. If the sum of direct and indirect emissions of a pollutant is above the *de minimis* level, a formal, general conformity determination is required for that pollutant. The net increase in SO_2 emissions due to the components of the preferred alternatives located within the two SO_2 non-attainment areas was predicted for operational and construction activities. As summarized in Tables 3.3-10 and 3.3-11, annual SO_2 emissions under the preferred alternatives would not exceed the *de minimis* criterion of 100 TPY of SO_2 in either the Tanguisson or the Piti non-attainment areas; thus a formal, conformity determination is not required. The record of non-applicability is included in this Final EIS.

Table 3.3-10. Preferred Alternative Total Annual SO_2 Emissions – Tanguisson Non-attainment Area

Activity	*Year*	*SO_2 (TPY)*
Construction	2011	2.1
	2012	3.2
	2013	4.1
	2014	4.1
Construction/Operation	2015	11.4
	2016	9.8
Operation	2017 and on	8.3
de minimis level		***100***

Legend: SO_2= sulfur dioxide, TPY = tons per year

Table 3.3-11. Preferred Alternative Total Annual SO_2 Emissions – Piti Non-attainment Area

Activity	*Year*	*SO_2 (TPY)*
Construction	2011	0.4
	2012	0.4
	2013	0.4
	2014	0.4
Construction/Operation	2015	1.0
	2016	1.0
Operation	2017 and on	0.9
de minimis level		***100***

Legend: SO_2= sulfur dioxide, TPY = tons per year

Greenhouse Gases

The predicted construction CO_2 emissions range from about 16,655 to 32,660 TPY from 2011 to 2014 (see Table 3.3-8) and the predicted operational CO_2 emissions range from about 54,664 to 58,844 TPY from 2017 on (Table 3.3-8). Climate change assessment and a detailed estimate of CO_2 Eq is provided in the cumulative impacts analysis in Section 4.4 of this volume.

Since the preferred alternatives would mostly involve the relocation of the military operations (i.e., training exercises) already occurring in the West Pacific region, energy consumption from activities in the region is unlikely to change significantly; the predicted net increase in CO_2 emissions (Table 3.3-8) is considered overly conservative and provided only for NEPA disclosure. Therefore, overall global GHG emissions are likely to remain near the current levels on a regional scale; and are particularly applicable under the operational conditions resulting in an insignificant impact to global climate change.

Tinian

On Tinian, all air emissions would be far below the significance threshold of 250 TPY for air pollutants subject to regulations under the CAA for both construction and operation as shown in Table 3.3-12. Therefore, air quality impacts are considered less than significant for all areas under Alternative 1.

Table 3.3-12. Tinian Training Activity Annual Emissions – Alternative 1

Activity	*Pollutant (TPY)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
Construction	0.3	1.1	0.1	0.1	0.7	0.3	108.7
Operation	**Barge**						
	0.2	0.8	0.1	0.1	4.2	0.1	NA
	Vehicle						
	0.0	0.0	0.1	0.0	0.0	0.0	2.0
	Total						
	0.2	0.8	0.2	0.1	4.2	0.1	2.0

Legend: CO = carbon monoxide, CO_2= carbon dioxide, NO_x= nitrogen oxides, SO_2= sulfur dioxide, PM_{10}= particulate matter less than 10 microns in diameter, $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter, VOC= volatile organic compound, TPY= tons per year, NA = Not applicable

MSAT Analysis

Mobile source air toxics (MSAT) are hazardous air pollutants, seven of which have been identified by the USEPA as mobile source pollutants of concern. These seven pollutants are: napthalene, acrolein, benzene, 1-3 butadiene, formaldehyde, polycyclic organic matter (POM) and diesel PM plus diesel exhaust organic gases (DPM+DEOG). As part of the National Environmental Policy Act (NEPA) process, MSATs require review and evaluation as they could affect the quality of the human environment.

An initial MSAT analysis for this project indicated that it would have a low potential for MSAT effects. However, USEPA requested that an MSAT analysis based on the methodology described in the research report "Analyzing, Documenting, and Communicating the Impacts of Mobile Source Air Toxic Emissions in the NEPA Process" prepared for the American Association of State Highway and Transportation Officials (AASHTO) (ICF International 2007) be performed. Given the unusual scale of the proposed relocation as compared to other DoD actions and to accommodate USEPA's request as part of the NEPA disclosure process, this additional MSAT analysis was performed (Parsons Brinkerhoff 2010) using the methodology based on the AASHTO report, and is summarized in this section and detailed in Volume 9 Appendix I, Attachment B.

MSAT levels are predicted to increase under the preferred alternatives compared to the no-action alternative. However, based on the MSAT analyses performed, there would be no significant carcinogenic or non-carcinogenic impacts at any of the locations. In addition, given future reductions in overall MSAT levels due to USEPA-mandated regulations, projected MSAT levels, even with the predicted VMT increases under the build alternatives, are expected to be lower.

3.3.4.2 No Action

The future traffic growth would likely result in an increase in mobile source emissions on Guam. However, the improvement of mobile source engine emissions in the future, per CAA requirements, would contribute to a reduction of the overall mobile source emissions. Therefore, the air quality conditions affected by mobile source operations under no action would likely remain the same or improve slightly, as compared to the existing conditions.

Under no action, there could be new construction of small-scale projects on-island that would not occur concurrently, and continued operation of existing stationary sources. Air pollutant emissions would essentially remain the same as they are now, or improve slightly if a cleaner fuel becomes available on Guam in the future.

GovGuam has not collected ambient air quality data since 1991. Therefore, no existing ambient air quality data are available to represent current air quality conditions, with respect to the criteria pollutants for which the NAAQS were established. Historical data are available for 1972 through 1991, when ambient air quality data were collected at a number of sites through a USEPA-sponsored monitoring program. The monitored pollutants were total suspended particles (TSP), SO_2, nitrogen dioxide (NO_2), and nitrogen monoxide (NO). In 1991, PM_{10} was monitored in addition to TSP.

Prior to 1991, TSP was monitored at 20 sites, SO_2 at 14 sites, NO_2 at five sites, and NO at one site. In 1991, PM_{10} was monitored at four sites. In addition to the historical monitoring identified above, the GPA established a network of five stations to measure SO_2 at locations that are not downwind, or close to any major electrical generating units during normal trade wind conditions. Data were collected from the fall of 1999 through the summer of 2000. All of the observed SO_2 concentrations were below the 24-hour NAAQS.

Because there are no comprehensive ambient background air quality levels from recent monitoring available for Guam, the existing background air quality conditions around Guam can be defined based on the current ambient air quality attainment status in effect for Guam:

- Attainment for all criteria pollutants, except for SO_2.
- Two SO_2 nonattainment areas within a 2.1 mi (3.5 km) radius around Piti and Tanguisson power plants.

Except for power generating facilities, there are no significant sources of air emissions on Tinian. However, military training vessels, on-road vehicles, and open burnings are sources of emissions that contribute to the existing ambient air quality background conditions on Tinian. While there are no air monitoring stations on Tinian, it can be assumed that ambient air quality is good, has remained constant in recent years, and is in compliance with air quality standards. These assumptions are based on the small number of emission sources on the island, and the island is currently designated as an attainment area for all criteria pollutants. Air quality conditions on Tinian, under no action, would be expected to remain the same as compared to the existing condition.

3.3.4.3 Comparison of Preferred Alternatives to No Action

Under the Guam preferred alternatives, there would be less than significant effects on criteria pollutants from all construction and operation components including those in existing nonattainment areas. The GHG effects would also be considered less than significant. Under no action, the existing nonattainment conditions would persist for some years into the future until the power plants are upgraded. The air quality impacts from construction and operation of the preferred alternative on Tinian would be less than significant, and there would be no impact from no action. The good air quality of Tinian would continue into the future with or without the preferred alternatives.

3.3.5 Noise

3.3.5.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-13 and 3.3-14 summarize the preferred alternatives' construction and operation impacts of noise on Guam and Tinian as presented in previous volumes. For Guam, the greatest level of impact

identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. It is assumed that all of the proposed construction actions would occur during a compressed time period, and that all operational activity would commence upon completion of construction.

There would be adverse impacts associated with construction of the preferred alternatives on Guam and Tinian. The impacts would be temporary. Temporary noise barriers are proposed to mitigate construction noise, where practicable.

Table 3.3-13. Summary of Preferred Alternatives' Construction Impacts – Noise

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Construction	SI-M	LSI	LSI	LSI	LSI	LSI	NI	LSI	SI-M	LSI
Noise Construction Impact Summary:									**SI-M**	**LSI**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact; NI = No impact.

Table 3.3-14. Summary of Preferred Alternatives' Operation Impacts – Noise

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Wastew ater*	*Solid Waste*	*Off-base Road-ways*		*Training*
Airfield Operations	LSI	NA	NA	NA	NA	NA	NA	NA	LSI	LSI
Aviation Training	LSI	NA	NA	NA	NA	NA	NA	NA	LSI	LSI
Ground-based Training	SI	NA	NA	NA	NA	NA	NA	NA	SI	LSI
Other Operations	NA	LSI	LSI	NI	NI	NI	NA	NA	LSI	NA
Utilities and Off-base Roadways	SI-M*	NA	SI-M*	NI	NI	NI	LSI	SI-M*	SI-M	NI
Noise Operation Impact Summary:									**SI**	**LSI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact; NA = not applicable; *North and Central Guam

Aviation operations would raise noise levels locally, but only as the aircraft fly overhead. Noise levels associated with the preferred alternatives would increase locally by one or two decibels (dB) at the day-night noise level (DNL) around the Andersen AFB airfield.

Operational noise generated by the Route 15 ranges would result in a significant impact on the community beyond DoD property. The Route 15 training ranges would result in noise levels that are considered incompatible with residential use. Proposed mitigation measures include maintaining existing foliage,

which would serve as a noise buffer, and the construction of noise barriers. The most effective measure would be constructing berms at the Route 15 training range locations, which would reduce noise levels by 10-15 dB. Although construction of berms at the Route 15 training range locations would reduce the noise levels, noise levels would not be reduced to a less than significant impact for all sensitive receptors. Construction of berms to reduce noise levels at the Route 15 training range locations is assumed in the summary of impacts.

Hand grenade range operations at Andersen South would result in areas exposed to noise levels considered incompatible with residential use and impacts would be considered significant. Mitigation measures to avoid this significant impact are not proposed because engineered controls aimed to reduce the low frequency sound generated from hand grenades is not feasible. Should innovative and new technologies become available and are applicable to Guam in the future they would be considered as mitigation measures.

Operational noise due to roadways could be mitigated by soundwalls that meet FHWA and DPW feasibility and reasonableness criteria. Roadway noise would be a significant impact in the north and central areas of Guam. Noise walls are a potential mitigation that would reduce the severity of roadway noise, but they would have adverse impacts on views.

With the exception of traffic associated with increased population, Guam island-wide noise impacts would not occur for construction or operation because noise is generated at a source and then diminishes the farther the receptor is away from the source. Receptors in the northern part of Guam would not hear noise generated in the south and vice versa; as a result, there would be no island-wide noise impacts.

The construction and operational impacts on Tinian would be less than significant due to the distance of the proposed ranges to residential receptors in the southern portion of Tinian.

3.3.5.2 No Action

Unlike some other potential impacts, most human activities generating noise are localized and do not affect the entire islands of Guam or Tinian. Traffic could be considered an exception; while individual vehicle noise is localized, island-wide population increases would be accompanied by increased numbers of motor vehicles on the roadway network, with some resulting island-wide increases in ambient noise. The sources of noise that influence ambient noise include the commercial airport and Andersen Air Force Base airfield, industrial facilities, military training range activities, and traffic. Most of the noise impacts are temporary. Industrial noise, such as noise emitted during power generation, would expose sensitive receptors, such as workers in an industrial environment, for longer periods of time but is subject to Occupational Safety and Health Administration (OSHA) regulations to protect the hearing of sensitive receptors. There is no island-wide noise level monitoring and historic trends in noise are not documented island-wide. Ambient noise levels would generally increase with an increase in noise generating activities and the assumption is there has been an increase in noise levels island-wide over time with the increase in industrial activity, airfield activity and traffic.

Regionally, northern Guam would continue to experience noise from Andersen AFB aircraft, Northwest field training, small arms firing at NCTS Finegayan, traffic, and construction projects as they are undertaken. In central Guam, A. P. Won Pat Guam International Airport (IAP) operations, construction activities, and traffic would continue to create noise. Near Apra Harbor, industrial activities, construction and traffic would continue to be the major noise sources. In southern Guam, Naval Munitions Site (NMS) activities, construction and traffic would continue to generate noise. The Guam 2030 Transportation Plan would improve off-base roadways, but significant noise impacts are not anticipated once construction is complete. Large population and traffic increases and significant noise impacts would not be anticipated.

On Tinian, the major noise generators would continue to be Tinian Airport operations, current military activities, and traffic. Air operations conducted by the military during World War II from Tinian may represent the loudest period in Tinian's history, but the noise impacts were temporary.

3.3.5.3 Comparison of Preferred Alternatives to No Action

Significant, direct, and long-term noise impacts to residential receptors would result from the firing range alternatives proposed near Andersen South along Route 15. Construction noise under the preferred, or no-action, would not be a long-term impaction because construction activities would be temporary in nature and localized. Construction noise impacts would be short-term, ceasing when the construction project is completed. An impact would only emerge when multiple construction activities occur in a compressed time period, are immediately adjacent to one another, and in proximity to sensitive receptors. Construction would be localized and would occur predominately during daylight hours, with no noise impact island-wide.

Long-term noise impacts would be related to the increased traffic on the Guam roadway network. Traffic noise would be most evident in northern and central Guam, around Apra Harbor, and even less in southern Guam. Overall, the island would experience an increase in traffic noise due to the increased number of motor vehicles on the island.

3.3.6 Airspace

3.3.6.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-15 and 3.3-16 summarize the preferred alternatives' construction and operation impacts to airspace over Guam and Tinian. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. Airspace impacts would not occur during construction, and are only applicable to operations.

Table 3.3-15. Summary of Preferred Alternatives' Construction Impacts – Airspace

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Air Space	NI	NI	NA	NI	NI	NI	NI	NI	NI	NA
Airspace Construction Impact Summary:									**NI**	**NA**

Legend: NI = No impact; NA= Not applicable

Table 3.3-16. Summary of Preferred Alternatives' Operation Impacts – Airspace

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Airspace	LSI	NI	NI	NI	NI	NI	NI	NI	LSI	NI
Airspace Operation Impact Summary:									**LSI**	**NI**

Legend: LSI = Less than significant impact, NI = No impact

The preferred alternatives for Guam and Tinian would have less than significant impacts on airspace. There would be a 46% increase in airfield operations at Andersen AFB; however, there would be no resultant interference with local general aviation flights, no new airspace requirements, and no measureable change in airspace management procedures.

A new Special Use Airspace (SUA) in the vicinity of Northwest Field would be required for training, but would not require any changes to existing arrivals or departures from the IAP. There would be no en route low-altitude airways. The impact of this airspace action on air traffic control and airspace users is anticipated to be minimal and less than significant.

For the proposed ground firing range on the east coast of Guam that has .50 caliber machine gun training capability, SUA would have to be established to overlay the Surface Danger Zone (SDZ) footprint. It would require a slight reduction in airspace surrounding the IAP. There would be no significant reduction in the amount of navigable airspace available for the IAP, and no change to en route airways. Additionally, there would be no restrictions on access to and no effect on the use of the airport or airfield available for public use; nor would there be any effect on airport or airfield arrival or departure traffic flows due to the increase in military aircraft assigned to Guam. Establishment of any Special Use Airspace would be a Federal Aviation Administration (FAA) action, and the DoD would provide a formal aeronautical proposal for establishment of Restricted Airspace over the proposed ground firing ranges on the eastern side of Guam. Any modification of approach or departure procedures at Guam International Airport would be accomplished as part of the FAA's establishment of Restricted Airspace.

There would be an increase in aircraft operations in the north and south portions of Tinian, but it would be within the capacity of existing airspace use. There would be no new SUA, and no impacts to existing arrival and departure patterns from either the Tinian or Saipan airports. There are no en route low-altitude airways, and no Instrument Flight Rule procedures would have to change. Approach and departure patterns associated with the airports and airfields would not be restricted, nor would they be required to change.

Established aviation procedures, rules governing flight operations in both controlled and uncontrolled navigable airspace, and existing SUA make future adverse effects on public health and safety extremely unlikely. Aircrews for military participants and nonparticipating aircraft would be responsible for using "see and avoid" techniques to avoid hazards. There would be no difference in the effects identified for the preferred alternatives discussed in each volume.

3.3.6.2 No Action

Because there are multiple and sometimes competing demands, the FAA considers all aviation airspace requirements in relation to airport operations, federal airways, jet routes, military flight training activities, and other special needs to determine how the National Airspace System can best be structured to satisfy all user requirements. Significant impacts are avoided prior to FAA approval.

No additional military or civilian airspace requirements have been identified outside of the preferred alternatives. There is a periodic review of the Mariana Island Range Complex (MIRC) airspace requirements that would address future airspace needs should the training mission requirements change.

Since WWII, Guam and Tinian air traffic has fluctuated due to tourism levels for civilian aviation and military mission requirements (world events) for military aviation. These fluctuations are within the capacity and capability of the FAA airspace system.

3.3.6.3 Comparison of Preferred Alternatives to No Action

Preferred alternatives and no action would both result in less than significant impacts to airspace. All future proposals would be subject to the same FAA approval process that is aimed at avoiding significant airspace impacts.

3.3.7 Land and Submerged Land Use

3.3.7.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-17 and 3.3-18 summarize the preferred alternatives' construction and operation impacts to land ownership and use on Guam and Tinian. The findings from previous volumes are listed.

The land use impact analysis is generally based on operational impacts. The exceptions are 1) off-base roadways where a slightly different methodology was applied (Volume 6) and 2) proposed actions that involve temporary upland placement of dredged materials (Volumes 2 and 4). For Volumes 3, 5 and most of 6, the assumption is that land use impacts are long-term, although they would be initiated in the short-term construction phase. The construction staging and disturbed area would be situated on previously disturbed land or within the project footprint. The construction phase impacts for land ownership and use are described as not applicable for Volumes 3, 5 and 6 (utilities) and no impact for Volumes 2, 4 and 6 with the exception of off-base roadways, which would result in a significant but mitigable impact.

For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables.

Table 3.3-17. Summary of Preferred Alternatives' Construction Impacts – Land Ownership/Use

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Land Ownership	NI	NI	NA	NA	NA	NA	NA	NA	NA	NA
Land Use	NI	NI	NA	NA	NA	NA	NA	SI-M	SI-M	NA
Land Ownership/Use Construction Impact Summary:									**SI-M**	**NA**

Legend: SI-M = Significant impact mitigable to less than significant, NI = No impact, NA= Not applicable

Table 3.3-18. Summary of Preferred Alternatives' Operation Impacts – Land Ownership/Use

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Land Ownership										
Land	SI	NI	NI	NI	NI	LSI	NI	SI-M	SI	LSI
Submerged Land	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Land Use										
DoD land	LSI	NI	NI	NI	NI	NI	NI	NI	LSI	SI
DoD submerged lands	BI	NI	NI	NI	NI	NI	NI	NI	BI	NI
Non-DoD land	SI	NI	NI	NI	NI	NI	NI	SI-M	SI	NI
Non-DoD submerged lands	SI	NI	NI	NI	NI	NI	NI	NI	SI	NI
Land Ownership Summary:									**SI**	**LSI**
Land Use Summary:									**SI**	**SI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI= beneficial impact

Land ownership and use impacts are assumed to occur over the long-term or operational phase, except roadway construction on Guam would have a significant mitigable adverse impact on roadway use. The Traffic Management Plan (TMP) would identify and provide alternate traffic routes, construction materials hauling routes, bus stops, transit routes and operation hours, pedestrian routes, as well as residential and commercial access routes to be used during the construction period. The TMP would mitigate construction phase impacts to less than significant.

There would be a significant impact due to forced sale of land to the federal government for main cantonment and firing ranges on Guam. As described in the approach to analysis in Volumes 2 through 6, it is assumed landowners are not interested in selling their land. Although there may be landowners who are interested in selling their land, the assumption of significant impact remains until negotiations are complete. There would also be relocations and land acquisition, or long-term leases for roadway improvements.

Firing range land use within DoD property boundaries is incompatible with adjacent land uses in the vicinity, due to noise. Significant impacts to land use consistency were identified due to increased noise generated by a grenade range at Andersen South and the Route 15 firing range complex. The grenade range impacts are not mitigable to a less than significant impact. Proposed mitigation for Route 15 ranges includes noise berms and foliage that would reduce noise impacts for most sensitive receptors. There would also be significant impacts associated with incompatibility of noise generated by the Route 15 training range with future residential development in the adjacent community.

Less than significant impacts on land use are anticipated from LCAC noise generated at Apra Harbor. Less than significant impacts are anticipated from aviation training at Orote Peninsula, NWF and NMS.

Access to GovGuam submerged lands, and natural and cultural resources in the range areas, would be restricted during training resulting in a significant impact to land use; however, no submerged lands would be acquired at Guam or Tinian. A beneficial land use impact was identified under submerged land use because an existing firing range at NCTS Finegayan would no longer be used, and the associated surface danger zone over submerged land would be eliminated.

There is no change in land ownership or lease covenant proposed on Tinian. On Tinian, many and possibly all of the agricultural/grazing permits within the Lease Back Area (LBA) would be terminated, thereby causing a significant impact on consistency with the Farmland Protection Policy Act (FPPA) of 1981. FPPA applies to designated prime and important farmlands, which do not include the lease areas. The DoD has determined that the Guam and CNMI Military Relocation is exempt from FPPA regulations because the action is undertaken by a federal agency for national defense purposes (section 1547(b) of the Act, 7 U.S.C. 4208(b)). Current permits within the LBA account for 2,552 ac (1,032 ha) of the 11,956 ac (4,838 ha) of the agricultural-designated land on Tinian (including grazing land, crop land, plantation orchard and mixed agricultural). In total that represents approximately 21% of the agricultural lands on the island. The project description was updated in the Final EIS to reflect the DoD's commitment to retain as many of the leases as possible. The leases are subject to termination at military discretion. Access to the SDZs for harvesting or recreation is permitted during non-training periods. The decrease in public access to the Military Lease Area (MLA) would be an adverse impact, but is considered less than significant because it is federally controlled land. No significant impact on agricultural productivity was identified on Guam.

3.3.7.2 No Action

DoD land ownership in 1950 was estimated at 58% of Guam (Rogers 1995). DoD land control has decreased over the past three decades as a result of the Guam Excess Land Act of 1994, and Base Closure and Realignment (BRAC) recommendations. Figure 8.1-3 of Volume 2 shows the military land use in the 1960s compared to current landholdings. The former Naval Air Station Agana was closed in 1995, and the DoD transferred or released ownership of it to GovGuam and other government agencies as a result of BRAC. In 1997, BRAC realigned Naval Base Guam, which included the release of surplus/excess DoD military property determined to be excessive in the Guam Land Use Plan. Areas east of Route 15 in proximity to the proposed firing range complex were released. The previous Naval Facility at Ritidian Point was transferred to the U.S. Fish and Wildlife Service (USFWS). Other DoD parcels also have been, or are currently in the process of being transferred to GovGuam. In addition, the Navy outleased the Former Navy Ship Repair Facility located within the Apra Harbor Naval Base to GovGuam for utilization as a commercial shipyard facility. The trend has been to release federal lands. Outside of the preferred alternatives, there are no other planned land acquisitions identified for military use on Guam. Submerged lands ownership has not changed substantially since 1975. As lands were released through BRAC, adjacent submerged lands were not released. There are a few exceptions, such as DoD releasing nearshore submerged lands at Ritidian Point.

Ideally, community plans, zoning, and building codes direct land development and use on Guam and Tinian. Historically, there has been limited success. There was an economic development boom in the 1980s when community plans were not implemented according to a master plan, and the result was spot zoning and mixed uses (e.g., a "massage parlor" [prostitution] proliferation in Tamuning). In the early 1990s many zoning variances and permits were issued without long-range land use planning. Senators passed laws to rezone individual properties to bypass the permit process (Rogers 1995).

Community plans do not accelerate development, they guide land development in accordance with community values. The *North and Central Guam Land Use Plan* (Bureau of Statistics and Plans 2009) addressed the EIS preferred alternatives based on preliminary notional plans, including development of the

NCTS Finegayan area, but has not been adopted by the legislature. The proposed military land use would be consistent with this plan. Once the EIS record of decision (ROD) is published, the community plan may have to be revisited to capture the final development decisions.

The *North and Central Guam Land Use Plan* designates uses of lands that were once designated agricultural, but there are other areas reserved for agricultural use. As pressure for development increases and the interest in farming (by younger generations) decreases there is continued pressure to develop agricultural lands; community plans and zoning served to retain sufficient lands for agricultural use. The general trend on Guam is a decrease in agricultural land use, as development increases.

There is a substantial amount of development identified in the *North and Central Guam Land Use Plan* for residential communities, village centers, and resorts/hotels; this plan is a guidance document and does not specify when the growth would occur. Any development would result in a loss of open space, however there is open space reserved in the *North and Central Guam Land Use Plan*.

Apra Harbor would continue to be an active Navy commercial harbor requiring infrastructure improvements to address existing deficiencies, new missions, and increased efficiency. These improvements are consistent with existing facilities.

After WWI, Tinian became a protectorate of Japan and was used to produce sugarcane. During WWII, the island was transformed into a military base first by the Japanese, and the local population was relocated. The U.S. expanded the military base primarily in the northern part of the island. After WWII, population migrated back to Tinian. In the 1970s, gambling was permitted on-island, and the Tinian Dynasty Hotel and Casino opened. It is the only casino on-island. The military leasing of land began in 1975 and some lands were ceded back to the CNMI. In the 1990s, there was a tuna transshipment industry on island. The amount of MLA on Tinian has remained relatively constant since 1975 and is likely to remain the same in the near future. There are also federal submerged lands along the coast of the leased areas; no change is anticipated to submerged land ownership.

There are two resorts planned for Tinian that could significantly impact agricultural lands. The CNMI government controls land use. The Department of Public Lands is required to designate some Tinian public lands for homestead villages. There are proposals to create additional homestead villages. A master plan is currently being prepared for Tinian that would presumably ensure the planned land uses are consistent with community values, and would result in consistent zoning.

3.3.7.3 Comparison of Preferred Alternatives to No Action

The impact of the proposed increase in federal land reverses the recent trend established through BRAC to reduce DoD lands on Guam. The preferred alternatives would re-acquire a portion of the lands south of NCTS Finegayan and the areas east of Route 15. The comments received during the scoping period did not support an increase in federal land on-island; an increase is considered to be an adverse impact. The impacts of the proposed island-wide increase in federal land are addressed in the Land Acquisition Impact Study portion of the Socioeconomic Impact Assessment Study in Volume 9, Appendix F, and in the Land Acquisition Impact section of the Socioeconomic and General Services chapter 16 of Volume 2.

From the individual land owner and business owner perspective, the forced sale of property to the federal government would occur under the no action for roadway and utility improvements; however, the number of land owners affected would be fewer than under the preferred alternative.

The removal of the SDZ on the west coast of NCTS Finegayan has a beneficial impact due to the popular SCUBA sites that are located near the submerged lands. Under no action, the SDZ would remain, and

submerged land access would be limited to non-training days. Under no action, there would not be any new public area restrictions to land or submerged land.

The preferred alternative land uses are generally consistent and compatible with adjacent land uses and land use plans. As the notional plans under the preferred alternative become more refined, the community land use plans could be revised to include a greater land use buffer from the federally-controlled boundaries. Also, under no action, community plans that included the expansion of the federally-controlled land would have to be revised. Under no action, gradual declines in agricultural land use continue on Guam, but the preferred alternatives would not contribute to that decline except for an agricultural lease at Andersen South.

The preferred alternative on Tinian would have an impact on agricultural/grazing leases. There are planned resorts that could also impact agricultural land use under no action.

3.3.8 Recreational Resources

3.3.8.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-19 and 3.3-20 summarize the preferred alternatives' construction and operation impacts to recreational resources on Guam and Tinian. The impacts to recreational use are mostly long-term impacts, although there are short-term significant impacts during construction-related activities that impede access to recreational resources. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables.

Table 3.3-19. Summary of Preferred Alternatives' Construction Impacts – Recreation

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Access to recreational resource	SI	LSI	NI	NI	NI	NI	NI	SI-M	SI	LSI
Recreational Resource Use:										
Reduction of recreational opportunities	SI	LSI	NI	NI	NI	NI	NI	NI	SI	LSI
Conflicts between different recreational uses	LSI	NI	NI	NI	NI	NI	NI	NI	LSI	LSI
Substantial deterioration to recreational resources	NI	NI	NI	NI	NI	NI	NI	NI	NI	LSI
Recreational Resources Construction Impact Summary:									**SI**	**LSI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

Table 3.3-20. Summary of Preferred Alternatives' Operation Impacts – Recreation

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Access to recreational resource	SI	SI-M	NI	NI	NI	LSI (SI)	NI	BI	SI (SI)	LSI
Recreational Resource Use:										
Reduction of recreational opportunities	SI	SI-M	LSI	NI	NI	LSI (SI)	NI	NI	SI (SI)	LSI
Conflicts between different recreational uses	LSI	SI-M	LSI	NI	NI	LSI (SI)	NI	NI	SI-M (SI)	LSI
Substantial deterioration to recreational resources	LSI	SI-M	LSI	NI	NI	LSI (SI)	NI	BI	SI-M (SI)	LSI
Recreational Resources Operation Impact Summary:									**SI (SI)**	**LSI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact, ( ) = Indirect (workforce population and induced) population impact

Implementation of preferred alternatives would result in a new, permanent population comprised of the Marines, Army personnel, civilian workers, dependents, and a temporary population formed by construction personnel on Guam. All of these people would become potential users of Guam's recreational resources and would contribute to an increase in the number of users of the existing DoD, federal, and public recreational resources on Guam. The constant increase in the number of visitors to public parks, despite the absence of the proposed actions, suggests the parks and other public recreation sites are likely to be significantly impacted when the Marines, their dependents, and temporary construction population arrive in Guam. The transient population associated with the aircraft carrier could temporarily add to the impact; however, shuttle bus service would alleviate impacts on access.

Loss of public access and use of recreational resources such as the Guam International Raceway, Marbo Cave (spelunking and offshore fishing), Pagat Trail and associated trails, and *suruhana* activities during construction and operation are significant.

The increased number of users of the recreational resources (refer to Appendix G: EIS Resource Technical Appendix, Recreational Resources) would result in increased competition for the available opportunities at different recreational resources. Most of the popular recreational resources attract a constant flow of off-island and resident (including military and dependents) users. The degree of impact on each recreational resource is likely to be higher on weekends and holidays as well as during vacation months from July through March (except for January) when the island receives a greater number of off-island visitors. To meet the quality of life (QOL) requirements of relocating the Marines, their dependents, and civilian employees, a wide range of recreational facilities are proposed at the Main Cantonment site by the Marine Corps Community Service (MCCS). The planned QOL facilities are expected to relieve potential impacts

to the existing recreational resources on DoD, federal, and public properties by providing viable recreational use options to the potential users. By providing comparable and alternate recreational resources, impacts to recreational resources on Guam would be alleviated, thereby benefitting the residents and off-island tourists. The implementation of preferred alternatives would result in the loss of some recreational resources in the lands adjacent to Route 15, which would be acquired for training activities and ranges. Currently, mitigation measures are proposed in Volume 2 Chapter 9 (Recreational Resources) to partially restore recreational resources that would otherwise be lost.

Impacts to marine recreational resources would likely be temporary during the proposed wharf construction involving dredging at Polaris Point, which is anticipated to be eight to 12 months. The transient aircraft carrier wharf would cause notable impacts on the existing Morale, Welfare and Recreation (MWR) facilities and marine recreational activities within Apra Harbor. Other potentially affected areas include popular tourist regions such as Tumon/Tamuning villages and MWR facilities on other DoD installations. The surge in recreational users, which mostly would be visiting sailors, would increase competition for the available opportunities at existing facilities (e.g., gym usage) and could potentially cause conflicts among recreational uses. Although there are significant impacts associated with the visiting aircraft carrier, the population is transient, and the impacts could be mitigated to less than significant.

Proposed mitigation measures to reduce impacts to recreation include:

- Preparation of a Recreational Carrying Capacity Analysis Management Plan that addresses recreational use, demand, preference, conflicts, and conditions.
- DoD would offer resources in the form of time and donation or use of equipment to assist the volunteer conservation officer (VCO) at Andersen AFB.
- Collaboration with the Guam Division of Aquatic and Wildlife Resources (GDAWR) to establish outreach programs and docent programs for the five marine preserves and other environmentally sensitive areas on Guam.
- The Marine Corps could provide for improvements and maintenance of Tanguisson Beach, along with management of the coastline to the north of Hilaan that contains significant natural, cultural, scenic, and recreational resources.
- Establishment of outdoor recreation areas on NCTS Finegayan. This would also mitigate impacts to biological resources.
- To compensate for potentially significant impacts to beach and ocean recreational resources of the proposed actions on Guam, DoD is proposing to improve Hoover Beach at the Seaman Service Club Organization in Piti. The existing beach pilings, shelter, and bathroom are proposed to be improved. Available recreational activities include kayaking, snorkeling, and beach combing.

3.3.8.2 No Action

Since the completion of the 1990 Guam Comprehensive Outdoor Recreation Plan (GCORP) by GovGuam, Department of Parks and Recreation, some outdoor recreational activities have kept pace with population shifts while other activities have become more popular. The following outdoor recreational activities have become more popular since 1990 (GCORP 2006):

- Walking at the Paseo in Hagatna and along Tumon Beach
- Kayaking, particularly within Tumon Bay
- Baseball, particularly organized teams
- Basketball, particularly organized teams
- Football, particularly organized teams

- Soccer, particularly organized teams
- Swimming (pool), particularly organized teams
- Golf, particularly for youth
- Skateboarding

Even if the proposed relocation of the Marines to the island of Guam were not to occur, it is likely the effects described in Table 3.3-20 (Summary of Preferred Alternatives Operation Impacts - Recreation) would still occur on a smaller scale. This is due to the fact that Guam would continue to receive tourists. In addition, the local civilian and military population would continue to use the public recreational resources. The impacts to the public recreational resources would continue to be centered on the need for improved facilities, more facilities, more funding, and better facility management (GCORP 2006). Seventeen organizations involving various sports associations, civic, and private organizations participated in a survey conducted by the GovGuam, Department of Parks and Recreation, which is included in the 2006 GCORP. Specific comments included:

- Need for better facilities
    - Need for better maintenance and cleanliness of the facilities
        - "The bathrooms are disgusting"
        - Need to privatize facility maintenance
        - Implement the Adopt-a-Park program
    - Need to air condition the Dededo Sports Complex
- Need for more facilities
    - Need for a lifeguard tower at Matapang Beach
    - Need for public track and field facilities
    - Need for more sports facilities in the South (Guam)
- Need for more funding
    - Need for more funding of events
    - Need for a deposit for use of facilities
    - Need for facility fees
        - Need to extend Guam Visitors Bureau (GVB) grants beyond just non-profit organizations
- Need for better facility management
    - Need for consistent government support of sports
        - "DPR (Department of Park and Recreation) is short-sighted."
        - Need to empower lifeguards
        - Need to privatize lifeguards
        - Need for smarter management
        - Need for more sports partnerships with federation
- Need for better communication system
    - Need for a government sports liaison
    - Need to educate public about safety
    - Need for radio coordination with emergency personnel

- Need for a flag system
- Need for 911 emergency phone boxes

- Need for more access to facilities
  - Issue keys to organizations

3.3.8.3 Comparison of Preferred Alternatives to No Action

Under the preferred alternatives, impacts to recreational resources would be largely long-term and singularly affecting the use aspect of each recreational resource. The proposed action would accelerate the deterioration of recreational resources. The new permanent population resulting from the implementation of the preferred alternatives would result in users competing for the available recreational opportunities (e.g., longer wait for service/enjoyment at recreational resource). Other impacts include conflicts between uses (e.g., surfers and body boarders competing for waves; pedestrians, bicyclists, and equestrians competing for the use of a trail), and increased deterioration of recreational resources resulting from frequent use by more persons. The preferred alternatives would adversely affect the access aspect of recreational resources, short term or long term with the exception of lands to be acquired along Route 15 for training purposes. Resources there (e.g., Pagat Trails and a series of trails linked to them, *suruhana* activities, offshore fishing, and spelunking at Marbo Caves) would be inaccessible during training for health and safety reasons. This impact is mitigable through establishment of an ecological restoration area and permitting access when there is no live-fire training.

Under no action, the most notable difference from the preferred alternative would be that the aforementioned loss of use at Route 15 lands would not occur. It is likely future developments would limit recreational uses on Guam, but impacts to recreational resources would be more gradual than under the preferred alternatives. Impacts to the recreational resources would occur to a lesser degree under no action. Nevertheless, it is recommended that a recreational resource carrying capacity study be conducted and a recreational resource management plan completed to decelerate deterioration to Guam's recreational resources.

3.3.9 Terrestrial Biological Resources

3.3.9.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-21 and 3.3-22 summarize the potential construction and operation impacts to terrestrial biological resources on Guam and Tinian with implementation of the preferred alternatives. The summary is based on the findings from previous volumes, which are listed in the tables.

Table 3.3-21. Summary of Preferred Alternatives' Construction Impacts – Terrestrial Biological Resources

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Wast e-water*	*Solid Waste*	*Off-base Roads*		*Training*
Vegetation	SI	NI	SI	NI	LSI	LSI	NI	LSI	SI	LSI
Wildlife	LSI	SI-M	SI	NI	LSI	LSI	NI	LSI	SI	SI-M
Special-Status Species	SI	SI-M	SI	NI	SI (SI-M)	LSI	NI	SI	SI (SI-M)	SI-M
Terrestrial Biological Resources Construction Impact Summary									**SI (SI-M)**	**SI-M**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, ( ) = Indirect (workforce population and induced) population impact.

Table 3.3-22. Summary of Preferred Alternatives' Operation Impacts – Terrestrial Biological Resources

Resource Category	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste-water*	*Solid Waste*	*Off-base Roads*		*Training*
Vegetation	LSI	NI	LSI	NI	NI	NI	NI	LSI	LSI	LSI
Wildlife	LSI	LSI	LSI	NI	NI	NI	NI	LSI	LSI	SI-M
Special-Status Species	SI-M	SI-M	SI-M	NI	NI	NI	NI	SI-M	SI-M	SI-M
Terrestrial Biological Resources Operation Impact Summary									**SI-M**	**SI-M**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact.

A summary of direct impacts for all preferred alternatives in this EIS for vegetation communities on Guam and Tinian is shown in Table 3.3-23. There are no reliable estimates for the amount of primary limestone forest remaining on Guam - the vegetation type that is the most threatened from historical losses and that is prime habitat for many of the threatened and endangered species. Other vegetation types are not rapidly being lost on Guam, although ravine forest in most areas is being degraded by invasive plant species.

Table 3.3-23. Potential Direct Impacts to Guam and Tinian Vegetation Communities with Implementation of the Preferred Alternatives

Island	*Limestone Forest, Primary (ac [ha])*	*Limestone Forest, Disturbed (ac [ha])*	*Scrub/Shrub Tangantangan (ac [ha])*	*Ravine Forest (ac [ha])*	*Savanna (ac [ha])*
Guam	28 (11)	1,549 (627)	482 (195)	4.3 (1.7)	20 (8.1)
Tinian	0	173 (70)*	68 (27)	0	0

Note: *Tinian forest is classified as mixed introduced forest.

The preferred alternatives would significantly impact terrestrial biological resources on Guam and Tinian during construction activities - due primarily to the removal of habitat. A determination of impact under NEPA and the Endangered Species Act (ESA) (in parentheses) is provided below for each species in the project area. Volumes where these species are evaluated are listed in brackets.

Guam

ESA- and Guam-listed Species:

- Mariana fruit bat – significant impact, (may affect, is likely to adversely affect); the impact under NEPA would be mitigated to less than significant. [V2, V5 V6]
- Micronesian kingfisher - significant impact to habitat (may affect, is likely to adversely affect).[V2, V5, V6]
- Mariana crow - significant impact (may affect, is likely to adversely affect); the impacts under NEPA would be mitigated to less than significant.[V2, V5, V6]
- Guam rail - less than significant impact to habitat (may affect but is not likely to adversely affect). [V2, V5, V6]
- Mariana common moorhen – less than significant impact (may affect but is not likely to adversely affect). [V4]
- Mariana swiftlet – less than significant impact (may affect but is not likely to adversely affect). [V2]
- Green sea turtle – less than significant impact (may affect but is not likely to adversely affect). [V4]
- Hawksbill sea turtle – less than significant impact (may affect but is not likely to adversely affect). [V4]
- Fire tree (*Serianthes nelsonii*) – less than significant impact (may affect but is not likely to adversely affect). [V2, V5, V6]

ESA Candidate and Guam-listed Species:

- Guam tree snail - significant impact mitigated to less than significant. [V2]
- Humped tree snail - significant impact mitigated to less than significant. [V2]
- Fragile tree snail - significant impact mitigated to less than significant. [V2]

ESA Candidate Species (not Guam-listed):

- Mariana eight-spot butterfly - significant impact mitigated to less than significant. [V2]

Guam-Listed Only Species:

- Micronesian starling - less than significant impact. [V2, V5, V6]
- Pacific slender-toed gecko –significant impact mitigated to less than significant. [V2]
- Moth skink - less than significant impact. [V2]
- *Heritiera longipetiolata* - significant impact mitigated to less than significant. [V2]

Other Indirect Impacts on All Special-status Species

Other indirect effects on all species would occur as a result of the proposed construction. Movement of construction personnel, equipment, and supplies could result in the movement and spread of invasive plant and animal species to Guam, within Guam, and to other locations from Guam. Invasive species would affect special-status species or degrade habitat and therefore would result in potential indirect impacts from actions proposed. Invasive species impacts for construction would be similar to those for operations but shorter-term. Special-status species impacts would be significant but numerous proposed mitigation measures, such as preparation and implementation of the MBP and Hazard Analysis and Critical Control Points (HACCP) planning, as specified under proposed mitigation in Section 10.2.2.6, would be implemented to reduce impacts to less than significant.

There would be impacts to wildlife in those areas where public access is restricted, because no hunting would be allowed to control the ungulate population. An ungulate management plan will be finalized by the DoN for DoD lands on Guam to include specific management and control of ungulates that would reduce the impacts to less than significant.

Tinian

ESA- and CNMI-Listed Species:

- Mariana fruit bat – less than significant impact (may affect, but is not likely to adversely affect).
- Micronesian megapode - significant impact mitigated to less than significant (may affect, but is not likely to adversely affect).
- Mariana common moorhen - significant impact mitigated to less than significant (may affect but is not likely to adversely affect).
- Mariana swiftlet – less than significant impact (may affect, but is not likely to adversely affect).
- Green sea turtle and hawksbill sea turtle - less than significant impacts (may affect, but is not likely to adversely affect).

ESA Candidate Species:

- Humped tree snail – no impact.

CNMI-Listed Only Species:

- Micronesian gecko – less than significant impact.

A summary of direct impacts for all preferred alternatives for special-status species habitat is shown in Table 3.3-24. The table includes an estimate of island-wide acreages. The loss ranges from 1% to 6% and is due to clearing of vegetation of special-status species habitat required by the proposed construction projects. Because most species are currently very restricted in range (such as the Mariana crow with only two individuals known left on Guam, as well as the Micronesian kingfisher and Guam rail that exist only in captivity) only habitat would be affected; not individual species. An exception is the fruit bat, which, although the main colony on Andersen AFB is thought to have fewer than 50 individuals, disperses throughout forested areas on Andersen AFB to feed at night. All fruit bats throughout the Mariana Islands have been determined to be a single population; the best estimate of the total number of individuals remaining is several thousand. During operation, there would be noise impacts from training that may significantly impact the endangered Mariana fruit bat, Micronesian kingfisher, and Mariana crow, either at present, if they re-occupy, or are re-introduced to recovery habitat in the future.

Table 3.3-24. Potential Direct Impacts on Special-Status Species Habitat – Preferred Alternatives

Loss	*Overlay Refuge* (ac [ha])*	*Recovery Habitat (ac [ha])**			
		Bat and Kingfisher	*Crow*	*Rail*	*Serianthes Tree*
Island Total = No Action	21,690 (8,778)	28,655 (11,596)	27,124 (10,977)	49,564 (20,058)	11,722 (4,744)
Loss due to Preferred Alternatives Construction	1,469 (594)	1,559 (631)	1,557 (630)	1,268 (513)	643 (260)
% Loss on Island Due to Preferred Alternatives	6.7%	5.4%	5.7%	2.6%	5.5%

*Note: *Each habitat category and species habitat is considered independently of others and is not additive.*

In addition to loss of habitat from clearing, additional habitat would be impacted by noise and disturbance from operations, including general facility operation and from aircraft takeoff and landings. The Mariana fruit bat would be indirectly affected by noise, lighting, or human activity at Andersen AFB because it is

present, or potentially present, in operational areas. The amount of recovery habitat indirectly affected, using a 492 ft (150 m) distance would be 602 ac (109 ha). Other birds and fruit bats are not currently present (or rarely present) in other project areas, therefore most or all impacts would be at some future time when the species returned to the area.

Other potential direct impacts to the Guam-listed Pacific slender-toed gecko and *Heritiera longipetiolata* tree would be mitigated to less than significant. Indirect impacts that would be mitigated to less than significant include potential feral pig and deer damage, threats to listed species from uncontrolled pets, invasive species damage, and potential wildfires caused by training. Of greatest concern is the potential for unintentional introduction of the BTS from Guam to other islands throughout the Pacific. Preferred alternatives would vastly increase the movement of personnel, aircraft, equipment and supplies from Guam to other locations, thereby increasing the likelihood of introducing this species if no precautions are taken. This concern would be addressed using various measures, as summarized in Section 7.2.

A Micronesia Biosecurity Plan (MBP) is being developed to address potential invasive species impacts associated with this EIS as well as to provide a plan for a comprehensive regional approach. The MBP will include risk assessments for invasive species throughout Micronesia and procedures to avoid, minimize, and mitigate these risks. It is being developed in conjunction with experts within other Federal agencies including the National Invasive Species Council (NISC), U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS), the US. Geological Survey, Biological Resources Discipline (USGS-BRD), and the Smithsonian Environmental Research Center (SERC). It will include brown treesnake (BTS) control measures to prevent BTS movement off Guam and management within Guam. For actions being proposed in this EIS, the Navy will implement specific biosecurity measures to supplement existing practices on Guam and Tinian. These would include BTS control to address potential unintentional transport off Guam, including inspection requirements and procedures. For additional information on the MBP and existing and interim measures for invasive species control, please refer to Volume 2, Chapter 10, Section 10.2.2.6.

3.3.9.2 No Action

Sambar deer and feral pigs were introduced to Guam in the 1770s and late 1600s respectively. The introduced ungulates significantly impact native forests by consuming seeds, fruits and foliage and trampling plants. Feral pigs cause damage by wallowing and rooting. WWII physically destroyed extensive areas of habitat as do periodic tropical storms. About 50 years ago, the BTS was inadvertently introduced to Guam, and shortly thereafter became the primary cause of the elimination of 9 out of every 12 native forest birds. The BTS has also severely impacted native reptiles on the island. There is a high risk under both no action and the preferred alternative of the BTS being accidentally transported to other Pacific islands; but under no action, there may be less attention and focus on the problem. Post WWII, tangantangan was planted to reduce erosion and they have spread to the point of replacing indigenous plants in some areas.

Under no action, existing stressors that degrade habitat quality would remain, and the present declining trends in the health of terrestrial biological resources would continue. Stressors include non-native, invasive plants, animals and diseases, wildfires, and poaching. Introduction of some non-native species and diseases to Guam and Tinian has had a devastating effect on the native plants and animals.

Under no action, limestone forest areas would continue to degrade via invasive plants, in particular the canopy tree *Vitex*. The BTS, ungulates, and other invasive plants and animals would continue to degrade and/or prevent the recovery of the natural flora and fauna in the project areas. Poaching, which presently

occurs on military lands, would continue because many of the military lands, particularly the Navy lands, are not fenced.

On Tinian, disturbance of native forests from livestock occurred during Spanish occupation of Tinian (Fosberg 1960). Subsequent Japanese occupation cleared additional forested lands for sugarcane production. During WWII, the sugarcane plantations and most remaining native vegetation were destroyed by military campaigns and construction (Baker [1946] as cited in USFWS [2005]). As reported in USFWS (2005), after the war the DoD may have seeded the island with tangantangan, a non-native invasive tree, to reduce erosion. Based on the most recent vegetation mapping, it is estimated that only 2.6% of the island is still dominated by native limestone vegetation.

Existing Plans and Procedures

Under no action, existing DoD and non-DoD conservation measures would continue. Ongoing efforts to manage terrestrial resources on military lands would continue in accordance with the Joint Region Integrated Natural Resource Management Plans (INRMP), which include measures mandated by Biological Opinions and voluntary DoD conservation measures that are not regulatory requirements. The INRMPs is required to be updated every five years.

There are environmental restrictions and requirements for training operations that are included in the COMNAV Marianas Training Handbook (COMNAV Marianas Instruction 3500.4, June 2000). The Instruction contains guidance for developing an Environmental Protection Annex in support of a major military exercise plan, training requirements, BTS control and interdiction, monitoring and monitoring reports, emergency procedures, environmental monitor checklists, and an environmental awareness pocket card. There are also stand-alone BTS Interdiction and Control Plans that are implemented by the military services.

The USFWS has published recovery plans for the ESA-listed species present on Guam and in the CNMI. As funds become available, local and federal agencies conduct projects to further the recovery of listed species.

GovGuam agencies captive-breed endangered birds (Guam rail, Mariana crow, and Micronesian kingfisher), control predators and invasive species (mainly snakes and cats) in support of released birds, and promote the recovery of habitat for other species of concern. Education programs are given to school and community groups encouraging the preservation of Guam's natural resources. The Government also works to prevent the introduction of invasive species to Guam by providing technical assistance for import permits and aiding the development of policies and action groups to prevent the introduction of invasive species. Other work involves monitoring of native species populations on Guam, providing information, guiding management activities, and reviewing development project plans.

A Micronesia Biosecurity Plan (MBP) is being prepared that covers basic principles that would be applicable even under no action. The DoN and GovGuam would decide whether to implement the MBP if there were no Marine Corps relocation.

ESA-listed Threatened and Endangered Species Population Trends

The threatened Mariana fruit Bat (fanihi), a subspecies of a bat found in other areas of Micronesia, formerly resided throughout the Mariana Islands, and in forested areas on Guam that previously occupied most of the island. Mariana fruit bat populations have declined over the years, especially in the southern islands. In 1958, a maximum of 3,000 bats were believed to be on Guam. Fewer than 1,000 bats were believed to exist in 1972, and less than 100 bats from 1974 to 1977. During an intensive island-wide

survey in 1978, it was concluded that fewer than 50 fruit bats survived. The most recent counts indicate that fewer than 50 bats remain on Guam.

The Mariana fruit bat was first listed as endangered only on Guam, in the belief that bats on Guam formed a separate population from those in the CNMI. Recent studies have indicated that the bats move from one island to another, linking these colonies as a single population. In 2005, the Mariana fruit bat was listed as threatened throughout its range. Mariana fruit bats have been used as food since humans first arrived on the islands; the consumption of bats represents a significant cultural tradition. Although hunting of bats has been illegal under federal and local law in both Guam and the CNMI since the 1970s, hunting remains a chronic threat.

The kingfisher population on Guam was federally listed as an endangered species in 1984, but by 1988 it was close to becoming extinct along with the majority of Guam's other avifauna as a direct result of predation by the introduced BTS. Kingfishers were last reported in southern Guam in the 1970s. A USFWS survey conducted in 1981 estimated the total population remaining in northern Guam to be 3,023. Surveys in 1984/1985 indicated the kingfisher population probably had fewer than 50 individuals. The remaining kingfishers were brought into captivity, with plans for their eventual reintroduction back into the forests of Guam. The captive population reached 100 individuals in 2008. Research and management efforts continue to eventually reestablish a wild population either on Guam or one of the islands of the CNMI.

Historically on Guam, the endangered Mariana crow has been found throughout forested areas, and was considered common into the early 1960s. A USFWS survey estimated only 357 crows in 1981, mostly in the northern cliffline forests. The last born Guam crow was observed in 2000. Currently, two crows that were translocated from Rota, as eggs and/or chicks, are found on Guam. Although predation by introduced BTS is now widely accepted as being responsible for this dramatic decline, other factors such as infertility, predation by rats and monitor lizards, and mobbing by introduced drongos, may cumulatively be preventing recovery.

The endangered Guam rail is a flightless bird previously found more frequently in scrubby second growth or mixed forest than in uniform tracts of mature forest. Before the 1970s, the Guam rail occurred island-wide and was distributed in all habitats except wetlands. The population declined severely from 1969-1973, and the rail disappeared from southern Guam in the mid 1970s. In an attempt to save the species, 21 birds were caught in the wild in the mid-1980s and placed in captive breeding, both in the continental U.S. and on Guam. The Guam rail only occurs in the wild as a small population introduced onto Rota by GDAWR; it occurs only in captivity on Guam.

Although the Tinian monarch is no longer ESA listed, the species is currently being monitored in accordance with the post-delisting monitoring plan. The Tinian monarch is an endemic species found only on Tinian that nests in limestone forest, secondary forest, and tangantangan forest habitats. It was federally delisted in 2004 (USFWS 2004). The population of this species has been in decline recently. The monarch currently inhabits approximately 62% of the land area on Tinian, of which approximately 70% is secondary and tangantangan vegetation, and less than 3% is native limestone forest.

Habitat Trends

The USFWS (2008) estimated recovery or suitable habitat available in 2004 on Guam, and habitat loss for endangered species from past actions at Andersen AFB from 2004 to 2008. These losses are:

- Mariana fruit bat – 5.5 % removed from a 2004 baseline habitat available of 12,026 ac (4,867 ha).

- Micronesian kingfisher – 5.6 % removed from a 2004 baseline habitat available of 12,026 ac (4,867 ha).
- Mariana crow – 6.5 % removed from a 2004 baseline habitat available of 10,774 ac (4,360 ha).
- Guam rail – 2.1 % removed from a 2004 baseline habitat available of 12,172 ac (4,926 ha).

3.3.9.3 Comparison of Preferred Alternatives to No Action

The preferred alternatives would contribute to the trend in degradation of terrestrial biological resources, primarily through a loss of habitat. Unless other stressors are controlled, the listed species would not recover. There are many acres of suitable habitat on non-federally controlled land; however, acreage on non-federally controlled land is not large enough alone to achieve recovery goals that are outlined in approved recovery plans. The majority of the recovery habitat for the Mariana crow and the Guam Micronesian kingfisher is located on DoD lands. Land would become a limiting factor if too much recovery habitat is lost. Habitat on DoD lands in conjunction with non-federal lands is necessary to ensure enough physical space with appropriate vegetation types to ensure foraging, breeding, and sheltering of listed species are available once threats are controlled or abated.

The proposed mitigation for preferred alternatives' impacts to ESA-listed species, as summarized in the volumes of this EIS, will be described in detail in the Biological Opinion and incorporated into future INRMP updates. The non-DoD efforts to halt or reverse the trend would continue under no action, but would increase under preferred alternatives. While there has been some success, it is unlikely under no action conditions and funding levels, that the trend in resource health would be halted or reversed in the near future.

3.3.10 Marine Biological Resources

3.3.10.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-25 and 3.3-26 summarize the preferred alternatives' construction and operation impacts to marine biological resources on Guam and Tinian. The findings from previous volumes are listed in the tables. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables.

Table 3.3-25. Summary of Preferred Alternatives' Construction Impacts – Marine Biological Resources

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste-water*	*Solid-Waste*	*Off-base Road-ways*		*Training*
Marine Flora, Invertebrates, and associated EFH	LSI	SI	NI	LSI	LSI	LSI	NI	LSI	SI	LSI
EFH	LSI	SI	NI	LSI	LSI	LSI	NI	LSI	SI	LSI
Special-Status Species	SI	SI	NI	LSI	LSI	LSI	NI	LSI	SI	LSI
Non-Native Species	SI-M	SI-M	NI	LSI	LSI	LSI	NI	LSI	SI-M	LSI
Marine Biological Resources Construction Impact Summary:									**SI**	**LSI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

Table 3.3-26. Summary of Preferred Alternatives' Operational Impacts – Marine Biological Resources

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste-water*	*Solid-Waste*	*Off-base Road-ways*		*Training*
Marine Flora, Invertebrates and Associated EFH	NI	LSI	NI	LSI	NI	LSI/BI	LSI	LSI	LSI	LSI
EFH	LSI	LSI	NI	LSI	NI	LSI/BI	LSI	LSI	LSI	LSI
Special-Status Species	LSI (SI-M)	LSI	NI	LSI	NI	LSI/BI	LSI	LSI	LSI (SI-M)	LSI
Non-Native Species	SI-M	LSI	NI	LSI	NI	LSI	LSI	LSI	SI-M	LSI
Marine Biological Resources Operation Impact Summary:									**SI-M (SI-M)**	**LSI**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Preferred Alternatives would result in a net beneficial localized impact near the wastewater discharge because there would be an improvement in terms of Guam Water Quality Criteria (GWQC) for multiple constituents from NDWWTP upgrades. The summary impacts to marine biological resources would be significant but mitigable to less than significant.

Construction Impacts

Under the preferred alternatives, in-water and land–based construction related to proposed Marine Corps actions would result in significant adverse impacts on some marine biological resources in Inner and Outer Apra Harbor. The adverse impacts are related to the following: (1) permanent removal of coral reef habitat by dredging, with an adverse effect on Essential Fish Habitat (EFH) and Management Unit Species (MUS) present within the coral reef habitat; (2) long-term adverse impacts from removal of live hard/bottom EFH. Although anticipated to recover in time, the size of the area, context and intensity, and cumulative effects elevates this impact "above minimal," with an adverse effect on those EFH habitats and MUS present; (3)

initial adverse indirect impacts from cumulative sediment deposition levels within 40 ft (12 m) of the direct impact areas based on oceanic sediment deposition modeling, and; (4) noise effects above NMFS established levels on ESA-listed sea turtles from pile driving activities within Inner and Outer Apra Harbor.

Other impacts would be short-term, periodic and localized; therefore minimal, with implementation of the BMPs summarized in Chapter 2. These impacts in Apra Harbor are due to increased sediment in the water column (> 40 ft. [12 m]) outside the dredged area, various noise sources that are expected to have minimal effect, soft bottom community dredge and fill operations, increased frequency of construction-related tug and barge traffic, and increased potential for non-native species introduction.

Land-based construction activities in Guam have the potential to impact coastal water quality. Impacts would be less than significant with implementation of BMPs. Impacts to fish, sea turtles, and infaunal or epifaunal organisms in or on the soft sediment, would be short-term and localized. The impacts would be less than significant.

Introduction of non-native invasive species in the marine environment during in-water construction could have a significant impact. This would be mitigated to less than significant through implementation of the MBP and further minimized and avoided through existing Navy hull and ballast water management. The construction of the Navy's new aircraft carrier berthing in Outer Apra Harbor would result in significant direct impacts to marine biological resources. After all efforts to minimize and avoid the impacts of the aircraft carrier project, there would still be unavoidable adverse impacts associated with dredging coral reef ecosystems, pile driving and fill operations in Outer Apra Harbor. Sessile reef species, some crustacean MUS, site-attached reef fish, pelagic egg/larval stages of bottomfish, and pelagic MUS may also be affected.

Various compensatory mitigation proposals are being considered, including watershed management projects and artificial reef construction. BMPs and mitigation measures proposed for in-water and land-based construction that are in Chapter 2.

There could be significant noise-related impacts to ESA-listed sea turtles from the pile driving component of the Outer and Inner Apra Harbor wharf improvement projects. A take is not anticipated because turtle occurrence in the inner harbor is extremely rare, but due to the turbidity of the water in the project area, observers may not see sea turtles approaching the area. Consequently, turtles could be exposed to noise levels that exceed NOAA's criterion for Level B Take, and therefore the action may affect, and is likely to adversely affect ESA-listed sea turtles.

There would be less than significant direct, indirect and cumulative impacts from turbidity, decreased water quality, and other disturbances from dredging activities to ESA-listed sea turtles (foraging, resting, nesting or swimming), EFH FEP MUS, and soft bottom community during vessel movements (Outer and Inner Apra Harbor), dredging, and in-water construction activities of wharves (pile driving) and LCAC and AAV operations facilities within Inner Apra Harbor. See Table 11.2-11 in Volume 2 for EFHA summary. A beneficial mid-term impact to water quality may be seen from the removal of the fine benthic sediment within Inner Apra Harbor.

As identified in the 10 April 2008 Federal Register, 40 CFR Part 230, the final U.S. Army Corps of Engineers (USACE) compensatory mitigation rule, permit applicants are required to mitigate to no net loss of ecological services and function. Compensatory mitigation for the direct dredging removal of coral, and coral reef habitat associated with the aircraft carrier berthing would be implemented by the DoD through USACE Section 10/404 permitting.

Operational Impacts

Impacts would be less than significant from direct and indirect effects associated with an increase in non-recreational Apra Harbor ship traffic. Marine flora, invertebrates, and essential fish habitat (EFH) would experience long-term, localized, infrequent minor impacts from the increased noise, re-suspension of sediment during vessel movements, and the potential for increased discharges of pollutants into the water column. Introduction of non-native invasive species in the marine environment during in-water operation activities could have a significant impact. This would be mitigated to less than significant through implementation of the MBP and further minimized and avoided through existing Navy hull and ballast water management. Less than significant indirect long-term population-level impacts or reduction in the quality and/or quantity of EFH were identified associated with recreational activities, including recreational fishing, diving, and boating. Existing Navy policies and plans (e.g. INRMPs) helped avoid and minimize potential adverse impacts. Future DoD educational programs and mitigation measures will help minimized indirect population-level impacts. Potential impacts from increased flows to wastewater treatment plants, particularly in central and southern Guam where WWTPs are in disrepair. The Navy anticipates short-term, localized more than minimal impacts to marine biological resources near these outfalls, however a beneficial long-term impact when GWA brings their WWTPs into compliance as directed by the USEPA Stipulated Order.

There would be long-term indirect impacts to EFH (coral and coral reef ecosystems) and significant impacts to special status species from increased recreational activities at Haputo ERA and Andersen AFB. This is mitigable to less than significant through increased efforts toward ERA regulations enforcement at Haputo and Orote, and enforcement of other ESA, MMPA, and EFH requirements and policies.

There would be short-term, periodic, and localized minimal impacts on sea turtle behavior during increased operation activities and vessel movements in Apra Harbor that would be less than significant with continued implementation of BMPs and Navy vessel policies.

Significant impacts, mitigated to less than significant from the potential introduction of non-native species would be expected since the DoD would adopt appropriate measures recommended by the MBP working groups during the MBP development to reduce the likelihood of introduction and spread of invasive marine organisms. Some example measures may include clarifying biosecurity requirements for all Navy vessels (including chartered Military Sealift Command [MSC] ships), improving hull husbandry documentation, and incorporating mandatory BMPs, including specific criteria to ensure low levels of biofouling and ballast water management, into contractual agreements with vessels chartered to support the military build-up. Avoidance and minimization measures include the fact that vessels operating within Apra Harbor would comply with U.S. Coast Guard (USCG) and Navy requirements and practices for ballast water and hull management.

Wastewater treatment plant upgrades at NDWWTP (and other WWTPs per USEPA SO and Guam WRMP) would result in long-term, localized net beneficial impacts to marine biological resources from improved water quality over existing conditions, although still exceeding Guam water quality criteria (GWQC) standards for some constituents. These impacts are considered to be beneficial.

Construction and improvements of roadways around Apra Harbor and other coastal areas, especially associated bridge work, may indirectly impact biological resources through increased runoff or pollutants discharged into marine waters or carried downstream and discharged. Implementation and proper management of permit-required construction BMPs would reduce these potential impacts to less than significant.

When considered in conjunction with all other preferred alternatives, the overall operational impacts to marine biological resources are considered significant, however mitigable to less than significant. Specifically, indirect impacts to special-status species from increased recreational boating in Apra Harbor and around Guam.

The Navy anticipates that the Government of Guam and federal resource agencies on Guam will enforce laws to protect coral reefs and sensitive marine habitats from increased recreational stress and behavior inconsistent with local resource management plans. Therefore, the proposed action and indirect induced growth would have no adverse effects to EFH.

As identified in Volume 2, Chapters 9 and 14, Recreational Resources and Marine Transportation, the proposed mitigation measures and BMPs would help alleviate these "growth-related" impacts to marine biological resources. The summary of operational impacts to marine biological resources would be significant, but mitigable to less than significant, with the exception of wastewater impacts in central and south Guam, which are not considered to be mitigable to less than significant.

Tinian

Due to increased barge traffic through Tinian Harbor supporting the proposed action, and increased runoff created from land-based construction and operation activities, the marine environment may experience elevated turbidity levels and increased levels of vessel noise. These impacts are anticipated to be short-term and localized, therefore minimal, resulting in less than significant impacts. Construction-related BMPs would be required and managed appropriately during construction to provide protection of coastal waters. Positive impacts to sea turtles and EFH may be seen from restricted access to coastal areas (specifically, nesting beaches and coral areas of special significance) on Tinian.

3.3.10.2 No Action

Guam

Stressors on marine biology include anthropogenic (human-induced) and natural events (i.e., storms and bleaching). Declining health of a resource is typically a response to an increased human population and associated industrial and commercial operations that affect the natural environment. Examples of stressors include overfishing, increased pollutants released directly to the marine environment or indirectly from land, point and non-point source discharges of stormwater and wastewater treatment plant outfalls, invasive species, recreational activities, diseases, coral bleaching, and storms. Other anthropogenic sources of stress on the marine environment include deliberate damage to marine resources by the human population on Guam, including military personnel; examples include destructive fishing methods such as dynamite fishing and deliberate collection of corals and live rock for aquarium use.

Other future construction on Guam may also impact marine resources. The land use plan for North and Central Guam designates areas for resort and high density development that would require utility upgrades. Under no action, the marine biological impacts could be as described for the preferred alternatives, but the impacts would be gradual over a longer period of time.

The *State of Coral Reef Systems in Guam* (Burdick et al. 2008) is the source of information provided below on Guam's coral reef health and trends, unless stated otherwise. The article provides background on resource trends and stressors data from 2004 to 2007.

Under no action, current trends would continue. The vitality of many of Guam's reefs has declined over the past 40 years. The average live coral cover on the fore reef slopes was approximately 50% in the 1960s, but by the 1990s had dwindled to less than 25% live coral cover, with only a few sites having over 50% live cover. The health of Guam's coral reefs varies significantly across the island. In general, reefs in

the northern part of the island and southern reefs at sufficient distances from rivers are relatively healthy, while large sections of reef in the south, particularly those near river mouths are in poor to fair condition. Currently harvested fish greater than 10 inches (>25 cm) are uncommon to rare on Guam, and while their numbers are slightly higher on northern reefs, abundance of medium and large sized fish is still very low compared to other islands in the Mariana Archipelago. The ability of some reefs on Guam to recover from their current degraded state and from acute disturbance events, such as crown-of thorns starfish outbreaks, storms and bleaching events, is likely hindered by poor water quality, low herbivorous fish abundance (due to fishing pressure on target stocks), and low coral recruitment.

In the past, Guam's reefs have recovered after drastic declines. However, continued degradation of water quality, crown-of-thorns starfish outbreaks, low abundance of target fish species, and other persistent stressors currently affecting Guam's reefs, have made the reefs less resilient.

Generally, Guam's reefs have been spared from severe and widespread coral mortality associated with large-scale bleaching events; however, observations in 2006 and 2007 suggest that bleaching events on Guam's reefs may become more frequent and severe in the coming decades. There were bleaching events in 1994, 1996, 2006, and 2007 from which the impacts are difficult to assess but appear to have coincided with elevations in sea surface temperature. Baseline surveys in 2006 and 2007 suggest that disease may be causing at least partial mortality in a significant number of colonies on Guam's reefs. White Syndrome may be the most prevalent disease, and the source of greatest tissue mortality.

Large offshore waves associated with storm-driven winds can cause physical damage to a reef. Storm surge and wave inundation can increase local sea levels by more than 40% of an offshore, significant wave height. Stormwater laden with sediments, nutrients, debris and other anthropogenic inputs, can be detrimental to coral reef ecosystems.

Sedimentation of nearshore habitats, primarily a result of severe upland erosion, is one of the most significant threats to Guam's reefs. It is most prevalent in southern Guam, where steep slopes, underlying volcanic rock, barren areas, and areas with compromised vegetation contribute large quantities of the mostly lateritic, clay-like soils to coastal waters. The excess sediment flows into coastal waters where it combines with organic matter in sea water to form "marine snow," often falling to the seafloor and smothering corals and other sessile organisms.

The southern reefs are subject to more anthropogenic activities than the northern reefs. In the south, there has been an increase in wildland arson, clearing and grading of forested land, inappropriate road construction methods, recreational off-road vehicle use, as well as grazing by feral ungulates. These sources of disturbance have all accelerated rates of sedimentation and appear to have exceeded the sediment tolerance of coral communities in these areas resulting in highly-degraded reef systems.

Wildfires set by poachers are believed to be the main cause of soil erosion. Despite being illegal, intentionally-set fires continue to burn vast areas of southern Guam. An average of over 700 fires has been reported annually between 1979 and 2006, burning over 115,000 ac (46,558 ha) during this period. The devastating effects of illegally-set wildfires in southern Guam are exacerbated by the drought-like conditions associated with El Niño events.

Coastal pollution also contributes to the decline of reefs. Three of Guam's sewage treatment outfall pipes continue to discharge within 660 ft (200 m) of the shallow reef crest, in depths of 66-83 ft (20-25 m) and in areas where corals are found. Stormwater leakage into aging sewer lines during heavy rains forces the sewage treatment plants to divert untreated wastewater directly into the ocean outfall pipes. Additionally, since Super Typhoon Pongsona impacted Guam in 2003, effluent from the Hagatna sewage treatment plant has been partly discharging into a shallow coral reef area, due to a break in the outfall line.

Nonpoint source pollutants in the north often infiltrate basal groundwater which discharges into springs along the sea-shore and subtidally on the reefs. Pollutants include nutrients from septic tank systems, sewage spills, livestock and agricultural areas, as well as chemical discharge from urban runoff, farms and illegal dumping. Algal blooms in Tumon Bay are attributed to fertilizers applied to landscaping. The DoD recently completed restoration of five sites contaminated with toxic chemicals from operations dating to WWII on Guam, and continues to assess and restore another 15 sites that are mostly situated on or near shorelines.

SCUBA diving, snorkeling, and related water activities continue to be very popular for both tourists and residents; some of the more popular sites have already exceeded their annual threshold, above which coral cover loss and coral colony damage levels may increase more rapidly. Popular dive sites are often adversely impacted when numerous inexperienced divers visit the site within a short period. Broken pieces of coral, and colonies damaged by kicking, grabbing, and standing are often observed in these areas. Other impacts, such as trampling of coral and other benthic organisms, increased turbidity, and alterations of fish behavior from fish feeding, are also regularly observed. These behaviors and associated damage are also routinely observed at popular boat diving sites, such as Blue Hole, Hap's Reef, Finger Reef, and Western Shoals.

Guam's coral reef fisheries are economically and culturally important, and target a large number of reef fish and invertebrates. Reef-related fishing methods currently used on Guam include hook and line, cast net (talaya), spear fishing with snorkel and SCUBA, gill net (tekken), surround net, trolling, drag net (chenchulu), hooks and gaffs, jigging, spincasting, and bottom fishing. Despite improvement in gear and technology, Guam's fishery catches have declined over the last few decades. A recent re-estimation of small-scale fishery catches for Guam suggests that catches have declined up to 86% since 1950.

Two fishing methods used on Guam have raised particular concern: the use of SCUBA and artificial light for night spear fishing, and the use of monofilament gill nets. These methods have been banned or heavily restricted in most of the region - including the CNMI. Abandoned gill nets also cause physical damage to the reef; DAWR regularly removes nets from nearshore reefs.

Ship groundings on Guam's reefs are inevitable due to the frequency of typhoons affecting the island. For example, the October 2004 grounding of a foreign longliner at Western Shoals, a popular dive site, caused substantial damage to an area of high coral cover.

While not a major threat, marine debris continues to impact Guam's reefs. Several monitoring, assessment, and research activities have been conducted on Guam since 2004. These activities measure several aspects of Guam's reef community that are important to coral reef management, such as benthic habitat, water quality, biological communities associated with coral reefs (e.g., fishes and macroinvertebrates) and socio-economic information (Burdick et al. 2008).

Maintenance and construction dredging occurs infrequently in Outer Apra Harbor. The shipping channel is at sufficient depth and has not been subject to dredging. Historically, Guam has served as a port of call since the 16th century, first catering to the ships of Spain, and after the Spanish-American War, to American interests. By the beginning of the 20th century, the U.S. had established the island as its western Pacific coaling and shipping station. Except for the two-year occupation of Guam by the Japanese during World War II, the U.S. Naval Administration ran the port until 1951, when command was transferred to the Department of Commerce.

As described in Volume 2, Section 2.11, the Glass Breakwater project was constructed in 1944 with 2 million cubic yards (1.5 million cubic meters [m^3]) of soil and coral extracted from adjacent Cabras Island. This completely altered the barrier reef system by restricting the exchange of water between Apra Harbor

and the open ocean. With an average height of approximately 15 ft (4.6 m) above mean sea level, the Glass Breakwater is the largest artificial substrate in the Marianas.

Table 3.3-27 lists key dredging events in Outer Apra Harbor that impacted coral reefs. Maintenance dredging events in Outer Apra Harbor have not been identified. Maintenance dredging events also occur periodically in Inner Apra Harbor. The combined area of coral reef and lagoon in nearshore waters is estimated to be 26,685 ac (10,800 ha). There is a similar area offshore beyond the territorial boundary (Burdick et al. 2008).

Table 3.3-27. Outer Apra Harbor Construction Dredge Events

Year	*Owner*	*Location*	*Dredge Depth (ft)*	*Coral Loss Area (acres estimate)*
1945	Navy	Creation of Inner Apra Harbor, Glass Breakwater and navigation channel[1]	ND	> 50
ND	PAG	Pier 3,4,5,6[2]	34-38	ND
1966	PAG	Hotel[2]	34	12
ND	PAG	Fuel Pier -Golf[2]	50	ND
ND	PAG	Fuel Pier -F-1[2]	70	ND
1989	Navy	Kilo Wharf[5]	45	7.4
2009	Navy	Kilo Wharf[3]	47	5
2008	Navy	Alpha/Bravo Wharf[4]	40	7
2010-2012	PAG	Commercial Port Modernization: F-6 and F-7 (new) [2]	51	ND
2012	Navy	Navy aircraft carrier (Proposed Action)	51.5	25

Notes:
[1] HEA and Supporting Studies (Volume 9, Appendix E of this EIS);
[2] Port Authority of Guam 2009;
[3] NAVFAC Pacific 2007;
[4] NAVFAC Pacific 2006;
[5] NAVFAC Pacific 1983.
ND = no data

Despite alterations to Apra Harbor since the liberation of Guam during WWII, the outer harbor "…holds a vibrant and thriving marine community including well-developed reefs with some of the highest coral cover on Guam, and a diverse biota of algae, invertebrates, and fish. In this regard, the harbor is unlike most other major ports, which tend to become greatly degraded for marine life" (Paulay et al. 1997). The outer harbor also supports diverse populations of macro-invertebrates, finfish, and moderate numbers of the threatened green sea turtle.

Tinian

The stressors affecting Tinian's marine resources are similar to those described for Guam, and include both anthropogenic and natural events such as storms and bleaching. Stresses on the marine environment increase as a function of an increased human population and effects of associated industrial and commercial operations on the natural environment; therefore, although anthropogenic stressors are active on Tinian, there is less pressure on the reefs due to relatively less population and land development. Stressors may include overfishing, increased pollutants, point and non-point source discharges from stormwater and wastewater treatment plant (WWTP) outfalls, invasive species, recreational activities, diseases, coral bleaching, and storms, which have all contributed to the degradation of marine biological resources. There also are two resort developments proposed for Tinian that would have the potential to impact marine biological resources.

Existing Plans and Procedures

Under no action, existing DoD and non-DoD conservation measures would continue. Ongoing efforts to manage marine resources on military submerged lands would continue in accordance with Air Force and Navy INRMPs - which include measures mandated by Biological Opinions and permit conditions, and voluntary DoD conservation measures that are not regulatory requirements. The INRMPs are updated every five years.

Guam and Tinian both have government agencies responsible for coastal management that draft and implement plans and programs to address historical impacts and prevent future impacts. GovGuam has marine preserves and DoD has coastal reserves that include the Haputo and Orote ERAs. Federal agencies such as the National Oceanic and Atmospheric Administration (NOAA) and National Marine Fisheries Service (NMFS) fund a variety of projects, including reef assessments that are implemented as funding becomes available.

There are environmental restrictions and requirements for training operations included in the COMNAV Marianas Training Handbook (COMNAV Marianas Instruction 3500.4, June 2000). The instruction contains guidance for developing an Environmental Protection Annex in support of major military exercises, training requirements, BTS control and interdiction, monitoring and monitoring reports, emergency procedures, environmental monitor checklists, and an environmental awareness pocket card.

Erosion control measures are required for construction and are regulated by federal and local laws. These measures, if enforced, reduce the sediment and pollutant discharge into coastal waters.

A biosecurity plan is currently being prepared that covers basic principles that would be applicable even if the preferred alternatives were not implemented. GovGuam would decide whether to implement the plan if there were no preferred alternatives constructed.

Special–status Species

USFWS and/or NMFS ESA-listed and candidate species and marine mammals not listed under ESA are considered special-status species. The species relevant to the EIS are green and hawksbill sea turtles, common bottlenose dolphin, and spinner dolphin. The baseline condition of these resources is described in Volume 2, Section 2.11.

Threats to green sea turtles include direct harvesting of eggs or adults, beach cleaning and replenishment, recreational activities, debris, incidental take from fishing, and foraging habitat (e.g. seagrass) degradation. The survival status in the Pacific Region continues to decline, except for populations in the Hawaiian Islands.

The hawksbill sea turtle is subject to similar threats as the green sea turtle, although this species is not commonly taken for human consumption. The population on Guam is almost extirpated; there was one sighting in 1991. No nesting turtles have been recorded in the CNMI. There are however, historic reports of hawksbill nesting activity on beaches in northern and central (Apra Harbor) Guam (NAVFAC Pacific 2005).The spinner dolphin is expected to regularly occur all around Guam, except in Apra Harbor where there are few occurrences of this species. Spinner dolphins are behaviorally sensitive and avoid areas that have a large amount of anthropogenic usage.

3.3.10.3 Comparison of Preferred Alternatives to No Action

There would be additional military transient and commercial ship traffic under the preferred alternatives, but standard operating procedures would minimize the impact to special status species. A key assumption is that the construction BMPs and proposed compensatory mitigation measures are implemented resulting

in less than significant operation impacts from these non-recreational vessels. The habitat equivalency analysis (Volume 9, Appendix E) prepared for the aircraft carrier berthing estimates that if artificial reefs are the compensatory mitigation, there would be a replacement of 85% of natural reef functions and services within ten years of deployment (on average - some specific areas may recover faster, others more slowly). There would also be a delay in the recovery under watershed management compensatory mitigation projects. The operational phase impact assessment assumes 100% restoration. There would likely be future dredging projects that result in coral loss, but none have been identified that are of the magnitude described for the preferred alternatives. These impacts would also require compensatory mitigation.

During operation, the preferred alternatives would have a direct significant impact on marine biological resources, mitigated to less than significant. The preferred alternatives would not add to the long-term degradation of marine resources. Two areas of concern for long-term localized impacts are at WWTP outfalls, and increased use of sensitive marine protected areas/ecological reserve areas, both of which are considered less than significant indirect impacts based on interim actions by GWA, USEPA and other GovGuam and Federal resource agencies. There would continue to be anthropogenic and natural impacts that degrade the marine environment and historical events to recover from that are unrelated to the preferred alternatives. Conservation measures and plans for federally-controlled and GovGuam submerged lands would continue to minimize and reverse the impacts on marine biology, as funding becomes available.

3.3.11 Cultural Resources

3.3.11.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-28 and 3.3-29 summarize the preferred alternatives' construction and operation impacts to cultural resources on Guam and Tinian. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. The overall summary of impacts during peak construction is significant but mitigable for both islands. During operation, the overall cultural impact of the preferred alternatives is significant and mitigable for both islands. Mitigations for impacts to modern Chamorro culture and practices are discussed under Socioeconomics/General Services.

It is assumed that all of the proposed construction actions would occur in a compressed time period, and that all operational activity would commence upon completion of construction.

Table 3.3-28. Summary of Preferred Alternatives' Construction Impacts – Cultural Resources

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impact*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Archaeological Resources	SI-M	NI	SI-M	SI-M	SI-M	NI	NI	LSI	SI-M	SI-M
Architectural Resources	NI	NI	NI	NI	NI	NI	NI	LSI	LSI	NI
Submerged Resources or Objects	NI	NI	NI	NI	NI	NI	NI	LSI	LSI	NI
Traditional Cultural Properties	NI	NI	NI	NI	NI	NI	NI	LSI	SI-M	NI
Cultural Resources Construction Impact Summary:									**SI-M**	**SI-M**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

Table 3.3-29. Summary of Preferred Alternatives' Operation Impacts – Cultural Resources

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impact*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road -ways*		*Training*
Archaeological Resources	SI-M	NI	SI-M	NI	NI	NI	NI	LSI	SI-M	LSI
Architectural Resources	NI	NI	NI	NI	NI	NI	NI	LSI	LSI	NI
Submerged Resources or Objects	NI	NI	NI	NI	NI	NI	NI	LSI	LSI	NI
Traditional Cultural Properties	SI-M	NI	SI-M	NI	NI	NI	NI	LSI	SI-M	LSI
Cultural Resources Operation Impact Summary:									**SI-M**	**LSI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

During construction on Guam, there are potential significant adverse direct impacts to approximately 31 historic properties on Guam, and 9 on Tinian; all such impacts would be mitigated to less than significant through mitigation. The proposed mitigation measures would be conducted in accordance with Section 106 consultation with the State Historic Preservation Office (SHPO) that would require avoidance, survey, monitoring during construction, data recovery, public education, and/or historic property awareness training of DoD personnel.

There would be significant adverse indirect impacts to three traditional cultural properties; all impacts would be mitigated to less than significant through public education, development of access procedures,

and implementation of preservation plans. Impacts under NEPA to natural resources of cultural concern, such as those collected by healers or traditional artisans, would be avoided if possible. However, in places where they cannot be avoided, DoD would work with consulting parties to provide access to these resources. There would be no adverse impacts to architectural or submerged historic properties during construction or operation for either island.

Impacts during operation would include accidental or inadvertent damageto archaeological historic properties. In general, historic properties on DoD-managed lands receive protection from cultural resource management plans and various DoD laws and regulations. However, accidental damage may occur and would be mitigated through historic property awareness training of personnel working and living in the area to avoid impacts to historic properties.

Direct impacts within the surface danger zones to historic properties from firing ranges (Guam and Tinian) are unlikely. Almost all munitions would be contained within the impact area, which includes large earthen berms. Potential effects of munitions rounds/fragments to features or artifacts in the SDZ would be negligible and less than significant. Indirect impacts to sites would include restricting public access to some historic properties during operations. Initially, the preferred alternatives would have a greater burden on the SHPO than the no action, due to the number of DoD management plans that would require consultation. However, in the long run, there would be a far less burden on SHPO with the preferred alternatives because the DoD would continue to manage large tracts of land on Guam and could afford the historic properties on those lands a higher level of protection than if they were not under DoD protection.

3.3.11.2 No Action

Potential impacts to historic properties include accidental or intentional damage, intentional and inadvertent disturbance from construction activities, and deterioration resulting from erosion. Many WWII l historic sites were established on Guam and Tinian, but the war itself resulted in the loss of cultural sites. The trend since the conclusion of WWII is a decline in cultural resources due to the impacts listed.

Currently, over 1,000 archaeological sites have been identified on Guam, with others yet to be identified. Many of these sites are still relatively intact, although past construction activity has resulted in the destruction of other archaeological sites. Data that were recovered through the excavation of these sites remains accessible. Likewise, future intentional removal of archaeological sites through construction can be mitigated through data recovery if the historic properties are eligible under criterion D. Removal of buildings that are historic properties can also be mitigated through detailed recordation. These potential impacts to historic properties would be significant and mitigable in the future. However, the absence of the preferred alternatives could also result in a decrease in significant off-installation (private) impacts to cultural resources.

There are local and federal laws and regulations to protect historic properties. For example, under no action, there are fines for vandalism. There are challenges to law enforcement due to the large number of sites to manage island-wide. These potential impacts continue to be significant, but mitigable into the future.

In the absence of the preferred alternative, there is a potential for significant but mitigable impact on cultural resources. Cultural resources would continue to decline in the future. In the absence of the preferred alternative the public would have access to all cultural resources as they do now..

3.3.11.3 Comparison of Preferred Alternatives to No Action

Some historic properties would be lost during construction of the preferred alternatives; however, once the proposed mitigation is implemented for this loss, impacts would be reduced to a less than significant level.

During operation, there could continue to be loss due to inadvertent or accidental damage to the preserved archaeological sites, but overall the impact to historic properties on DoD land would be less than significant due to site management. Under no-action, in the absence of any aspect of the preferred alternatives, there would continue to be potential for direct significant impacts to historic properties on non-DoD land due to construction activities, vandalism, erosion, and plant overgrowth of above ground features. . Direct impacts would be significant but mitigable, if proposed mitigation measures similar to those proposed for the EIS are applied.

3.3.12 Visual Resources

3.3.12.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-30 and 3.3-31 summarize the preferred alternatives' operation impacts to visual resources on Guam and Tinian. The visual impacts are considered long-term impacts; therefore, the short-term construction phase impacts are not applicable. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. During operation, the overall impact to the visual resources under the preferred alternatives would be significant but mitigable to less than significant for both islands.

Table 3.3-30. Summary of Preferred Alternatives' Construction Impacts –Visual Resources

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-Base Road-ways*		*Training*
Visual	NI	NI	LSI	NI	NI	NI	NI	SI-M	SI-M	SI-M
Visual Resources Construction Impact Summary:									**SI-M**	**SI-M**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact

Table 3.3-31. Summary of Preferred Alternatives' Operation Impacts – Visual Resources

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Andersen AFB	LSI	NA	NI	NA	NA	NA	NA	NA	LSI	NA
NCTS Finegayan	SI-M	NA	SI-M	NA	NA	NA	NA	NA	SI-M	NA
Non-DoD lands (North)	SI-M	NA	NA	NA	NA	NA	NA	NA	SI-M	NA
Andersen South	SI-M	NA	NA	NA	NA	NA	NA	NA	SI-M	NA
Non-DoD lands (Central)	SI-M	NA	NA	NA	NA	NA	NA	NA	SI-M	NA
Barrigada	LSI	NA	NI	NA	NA	NA	NA	NA	LSI	NA
Apra Harbor	LSI	LSI	NA	NA	NA	NA	NA	NA	LSI	NA
Naval Base Guam	LSI	NA	NI	NA	NA	NA	NA	NA	LSI	NA
South	LSI	NA	NA	NA	NA	NA	NA	NA	LSI	NA

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Views along Highway 3 adjacent to/near Finegayan	SI-M	NA	NA	NA	LSI	NI	NA	NA	SI-M	NA
Views from Route 2, Route 2a, and nearby Afilieje Beach Park	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Existing visual quality changes to a more urban visual character	NA	NA	NA	NA	NA	NA	NA	SI-M	SI-M	NA
Removal of vegetation in residential areas, changing the visual character	NA	NA	NA	NA	NA	NA	NA	LSI	LSI	NA
Views from Mount Lasso	NA	NA	NA	NA	NA	NA	NA	NA	NA	SI-M
Views along Broadway	NA	NA	NA	NA	NA	NA	NA	NA	NA	SI-M
Views along 8th Avenue	NA	NA	NA	NA	NA	NA	NA	NA	NA	SI-M
Visual Resources Operation Impact Summary:									**SI-M**	**SI-M**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, NA= Not applicable

It is assumed that all of the proposed construction actions would occur in a compressed time period, and that all operational activity would commence upon completion of construction.

Impacts to visual resources would result from altering the views or scenic quality associated with particularly significant and/or publicly recognized vistas, viewsheds, overlooks, or features; substantially changing the light, glare, or shadows within a given area; and substantially affecting sensitive receptors. Since the preferred alternatives would result in different levels of impacts in different areas, Table 3.3-31 is subdivided by location, with the exception of roadways, which uses a general impact description.

The military buildup would result in substantial changes to the visual environment at specific locations in Guam. For instance, off-base roadways and intersections widened by the Guam Roadway Network (GRN) projects would add an increased urban character to the views of the roadways. Those traveling on the roadway would likely find the wider pavement sections very noticeable. Pedestrians and those living or working adjacent to the roadway or intersection would likely find the changes very noticeable as well. However, it is not anticipated that these viewers would be highly sensitive to the individual changes given the cumulative nature of the roadway visual quality changes. Potable water supply, storage, and treatment would also introduce new features into the landscape. The height of the current DoD landfill at Apra Harbor would be nearly doubled under the preferred alternative for solid waste, causing significant effects to nearby and distant public viewpoints and sensitive receptors. These effects would be reduced to a level of less than significant with implementation of appropriate mitigation measures, including notable grading

and re-vegetation. Impacts to the visual environment from the preferred alternatives would primarily be considered less than significant; in cases where impacts were deemed to be significant, the proposed mitigation measures would reduce their impacts to less than significant. The proposed mitigation measures would include compliance with design guidelines for all buildings, in keeping with the Guam archetype, by implementing a landscape plan focused on retention of mature specimen trees during construction, establishing a variety of vegetation in keeping with Guam's native flora, and using native flora to create a natural-appearing "screen" between public roadways and buildup areas. In addition, a landscape plan could be developed and implemented and mature specimen trees could be retained during construction (where possible). To maintain the existing visual appearance, land clearing and grading should be minimized to the extent possible on lands proposed for ranges uses.

3.3.12.2 No Action

Urban development is likely the most notable cause of change in visual environments; the degree and nature of the proposed development as well as where a project is proposed, correspond with the resulting visual environment. For example, a single-family subdivision proposed on a hillside, where the view of the hillside was enjoyed from the existing scenic points or designated viewing areas, the resulting visual environment may mean that the existing views would be altered as seen from the existing viewing points. Natural disasters such as typhoons and earthquakes contribute to the degradation of the appearance of existing developments. Some developments are abandoned and fall into disrepair with adverse impact on visual resources. During strong economic conditions there is a tendency for increased development or property improvement. Conversely, during hard economic times buildings are not maintained or are abandoned. The visual resources trend over time is not linear, but is influenced by critical events. In general, there is a trend toward degradation of visual resources. As such, even if the proposed relocation of the Marines and their dependents would not occur, there is likelihood that changes to the existing visual environments may occur throughout the island of Guam.

Of all the DoD properties on Guam, Andersen AFB would likely experience some change in its visual environment, with the implementation of the planned ISR/Strike Town and other associated structures. There are no developments proposed on NCTS Finegayan, Former FAA parcel, Andersen South, Navy/Air Force Barrigada; as a result the existing conditions would remain under this Alternative. Under no action, a notable change at Apra Harbor would be that the proposed build-up of the existing landfill - up to 100 ft (30 m) - would no longer occur; thereby eliminating an adverse impact to the existing visual resource. No changes are expected at the NMS in South Guam.

There are several medium- (approximately 150 units) to large-scale single-family subdivisions (approximately 400 units) and some construction proposed on private properties, in Yigo and Central Guam; as well as condominium and resort developments in Tumon/Tamuning that would presumably result in an altered visual environment, from semi-rural to urban and/or suburban to urban. Over time, the visual environment in these areas would become less natural in appearance. There are no developments proposed in South Guam, no change to the existing visual condition is expected.

<u>Tinian</u>

There are new resorts planned for Tinian; preliminary plans suggest the resorts would add urban attributes to the existing semi-rural environment on Tinian in the form of tall and/or large structures. Without the preferred alternatives on Tinian, the viewshed from the overlook at Mount Lasso, which would have been affected the most from the preferred alternative developments, would remain in its existing condition.

3.3.12.3 Comparison of Preferred Alternatives to No Action

Under no action for both islands, there is always the potential for development of large, massive facilities in areas that are currently open space. The preferred alternative on Guam also assumes development of other large facilities not proposed in this EIS. These effects are additive across each island. The impacts are considered less than significant because valued viewsheds would not be lost. In addition, development on non-federal land would occur in accordance with master plans and zoning codes, and presumably would be consistent with community development goals that specifically set aside areas for open space. Although there would be some changes to the landscape, the preferred alternatives would have no island-wide impact on the visual environment. With the implementation of the proposed mitigation measures as previously identified, summary impacts would be less than significant.

3.3.13 Marine Transportation

3.3.13.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-32 and 3.3-33 summarize the preferred alternatives' construction and operation impacts to marine transportation resources on Guam and Tinian. For the purposes of this assessment, marine transportation consists of the movement of military and commercial vessels into and out of port. The findings from previous volumes are listed. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. The overall summary of marine transportation impacts during peak construction is less than significant for Guam and no impact for Tinian. During operation, the overall summary of marine transportation impacts for the preferred alternative are less than significant for Guam and no impact for Tinian.

It is assumed that all of the proposed construction actions would occur in a compressed time period, and that all operational activity would commence upon completion of construction.

Table 3.3-32. Summary of Preferred Alternatives' Construction Impacts – Marine Transportation

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Marine Transportation	LSI	LSI	NI	NI	NI	LSI	NA	NA	LSI	LSI
Marine Transportation Construction Impact Summary:									**LSI**	**LSI**

Legend: LSI = Less than significant impact, NI = No impact , NA = Not applicable

Table 3.3-33. Summary of Preferred Alternatives' Operation Impacts – Marine Transportation

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Marine Transportation	LSI	LSI	NI	LSI	NI	NI	NI	NA	LSI	NI
Marine Transportation Operation Impact Summary:									**LSI**	**NI**

Legend: LSI = Less than significant impact, NI = No impact, NA = Not applicable

Impacts to marine transportation would occur at Apra Harbor. The preferred alternatives would result in an increased number of vessels visiting the Harbor primarily during the period of 2010 through 2018. To facilitate the berthing of the escort combatant ships, it would be necessary to dredge Sierra Wharf to remove approximately 327,000 cy (250,000 m^3) of sediment. It has not been determined whether the dredged material would be disposed of in the proposed ocean dredged material disposal site offshore of Guam, or at an upland disposal site on DoD land on Guam. It is anticipated that a total of approximately 127 trips would be needed to the ocean disposal site to transport the dredged material from Sierra Wharf. This activity would result in less than significant impacts to marine transportation.

Under the preferred alternatives for a transient aircraft carrier wharf, there would be a cumulative total of up to 63 visit days per year. Approximately 150 trips for a tug and scow to the ocean disposal site would be conducted to transport the dredged material from Polaris Point over a six- to nine-month period. The proposed activities that would have less than significant impact on navigation are: 1) dredging that would be conducted in or adjacent to the main channel, 2) relocation of the buoys, 3) relocation of the range lights for Outer Apra Harbor, 4) a security barrier installed around the aircraft carrier, 5) restrictions on navigation during aircraft carrier transits into and out of Apra Harbor in accordance with security requirements, and 6) installation of floating security barriers around the aircraft carrier while it is at the wharf. This activity would not result in significant impacts to marine transportation.

To minimize the impacts of the proposed dredging on the maritime community, a Notice to Mariners would be published prior to the start of the dredging to identify the location and duration of dredging, and temporary navigational aids may be deployed. The impacts on Navy ship traffic would be addressed through scheduling and communications between Port Operations and the contractors.

The projected average number of containers to be handled each year during the period 2008 through 2018 is 153,636. This quantity is about twice the average number of containers handled during the period of 1995 through 2008 (86,558). The average number of container ships that visited the Port of Guam each year over the period of 1995 through 2008 is 124. The maximum number of containers to be handled during the period of 2008 through 2018 is 190,000 (in the year 2015). If the number of containers per ship remains the same as during the period of 1995 through 2008 (average of 706 containers per ship), there would be approximately 269 container ships visiting the Port of Guam during 2015.

The projected average tonnage of break-bulk cargo to be handled each year during the period of 2008 through 2018 (180,409) is about 45 percent more than the tonnage of break-bulk cargo that was handled during the period of 2003 through 2008 (125,565). The average number of break-bulk cargo ships that visited the Port of Guam each year over the period of 1995 through 2008 is 290. The maximum tonnage of break-bulk cargo to be handled during the period of 2008 through 2018 is 291,400 (in the year 2012). If

the tonnage of break-bulk cargo carried by each ship remains the same as during the period of 2003 through 2008 (average of 548 tons per ship), there would be approximately 532 break-bulk ships visiting the Port of Guam during 2012.

Preferred alternatives on Guam would have less than significant impacts because the annual number of vessels visiting the Port of Guam has decreased by 1,902 vessels during the period of 1995 to 2008. With implementation of the preferred alternatives, the peak years for shipment of containers and break-bulk cargo to the Port of Guam do not coincide. The peak year for the shipment of break-bulk cargo is 2012 while the peak year for shipment of containers is 2015. In 2015, the number of vessels shipping break-bulk cargo would reduce from the peak of 532 (in 2012) to 262. It is expected that the addition of up to 269 container vessels (2015), up to 532 break-bulk vessels (2012), and 277 trips to the ocean disposal site to transport the dredged material from Sierra Wharf and the new wharf at Polaris Point, would result in less than a significant impact on marine transportation in Apra Harbor.

There is no construction or modification of existing Tinian Harbor facilities under the preferred alternative. If equipment is moved by barge, one single barge would be able to carry the equipment necessary to support the estimated 200 to 400-Marine training evolution. The movement of this barge once per month would result in less than significant impact to marine transportation in Tinian Harbor. Impact to roadways would be less than significant due to modified access to the MLA during training.

3.3.13.2 No Action

Under no action, the number of military vessels visiting Guam would not change from current conditions. The aircraft carrier would continue to visit Apra Harbor at Kilo Wharf with great impacts to ordnance operations. There would be security restrictions, including security barriers, at Kilo Wharf that would restrict navigation at the entrance to Outer Apra Harbor. As new ships and military missions change, there is the potential for an increase in military marine traffic. The number of non-military vessels visiting the Port of Guam would continue to vary with the economy, but would not be expected to change greatly. Therefore, no action would result in no impacts on marine transportation in Apra Harbor. There have been plans to improve the commercial port prior to the discussions on the military build-up. Improvements are being funded prior to the build-up construction and would have occurred without the build-up; however, the timing of the improvements may have been different without the proposed build-up.

The Inner Tinian Harbor was built in 1944 by U.S. Navy Engineers. The harbor was the center for fish transshipment in the 1990s. The number of vessels (military and non-military) visiting the Tinian Harbor varies with the economy. The Tinian Dynasty Hotel & Casino operates Tinian shipping and the ferry service between Saipan and Tinian. Currently there are only one to two trips per day, which is a decrease over the peak six trips per day in the 1970s. Marine transportation would continue to decline, or remain at about the current level, unless there are increases in tourism, military mission, or other industry. As described in Volume 7 Chapter 4, Cumulative Impact Assessment, there are two large-scale, planned resorts for Tinian. Construction of these projects may increase ship traffic at Tinian's port. There may be an increase in ferry traffic due to the additional tourists drawn to the island to visit these two new resorts. There may also be an increase in military use of Tinian in the future that would contribute to the marine traffic. The port needs improvements which may be provided as part of future projects that involve an increase in use.

3.3.13.3 Comparison of Preferred Alternatives to No Action

The total number of commercial (non-fishing) vessels visiting the Port of Guam has decreased substantially from 1995 (763 vessels) to 2008 (436 vessels). Assuming a channel occupancy time of one hour for passage of a vessel into and out of the harbor, channel occupancy has declined from 17 to 9.7

percent. Even after allowing for military vessels (including priority vessels, such as aircraft carriers) and weather interruptions, the harbor's navigation channels appear to have a substantial capacity for additional vessels. Because the annual number of vessels visiting the Port of Guam has decreased by 1,902 vessels over the period of 1995 to 2008, it is expected that the addition of up to 269 container vessels (2015); up to 532 break-bulk vessels (2012); and 277 trips to the ocean disposal site to transport the dredged material from Sierra Wharf and the new wharf at Polaris Point would result in a less than significant impact on marine transportation in Apra Harbor.

Under the preferred alternatives, after construction, it is anticipated that the number of commercial vessels visiting the Port of Guam would be greater than under no action, to support the additional on-island population. The impact would be less than significant because the harbor has the capacity to handle the additional vessel traffic.

Less than significant impacts on Tinian marine transportation are anticipated under the preferred alternatives. However, no action may include new resort construction and operations that could result in an increase in harbor traffic.

3.3.14 Utilities and Roadways

3.3.14.1 Summary of Preferred Alternatives' Impacts

The utility and off-base roadway analysis in Volume 6, Chapter 2 is an analysis of the combined impacts of the preferred alternatives on utilities and off-base roadways and is summarized in this section of Volume 7. This section of Volume 7 differs from the other Volume 7 discussions of utilities and off-base roadways in that it focuses on the overall capacity of and impacts *to* existing utilities and roadways infrastructure relative to the new demand under the preferred alternatives, instead of focusing on the impacts on environmental resources *from* the individual utility and roadways infrastructure projects proposed to meet the additional demand. Impacts on environmental resources from the individual utility and roadways infrastructure projects are addressed in the individual resource chapters in Volume 6 and are summarized in the other sections throughout this chapter of Volume 7. The utilities and off-base roadway impacts analysis in this EIS are island-wide and based on the total proposed population increase on Guam associated with the Marine Corps, Navy and Army preferred alternatives, including associated workforce and induced populations.

Volume 6 details action alternatives to upgrade utility systems and improve roadways to meet future demands associated with the proposed military relocation. Proposed utilities systems action alternatives include installation of new supply wells and systems for potable water, improvements to the Northern District Wastewater Treatment Plant (NDWWTP), improvements to GPA power systems, and use of landfills. Roadways proposed actions include eight off-base roadway projects. Additionally, Volume 6 proposes mitigation measures for utilities and roadway infrastructure impacts. The mitigation measures are listed in Chapter 2 of this volume. The summary analysis presented in this section assumes implementation of the utilities and roadways preferred alternatives detailed in Volume 6.

Utility infrastructure is subject to impacts from the direct DoD population that would live and work at the new military relocation facilities (referred to as "direct impacts"). Utility infrastructure is also subject to indirect impacts from the off-base construction workforce and induced populations (referred to as "indirect impacts"). Additional indirect impacts of workforce housing are addressed in Section 3.4 of this volume. The population increases during operation are largely due to the Marine Corps preferred alternatives. The population and utility impacts associated with the Marine Corps proposed action are greater than the other two Navy and Army proposed actions.

The population during the peak construction period would have the greatest demand on utilities, therefore, utilities and roadways impacts presented in this section represent peak year impacts. The preferred alternatives include utilities and roadways repairs, upgrades and improvements, which are designed to address peak year demands, as detailed in Volume 6. This analysis is based on implementation of these utilities and roadways infrastructure components. Tables 3.3-34 and 3.3-35 summarize the preferred alternatives' direct and indirect impacts to utilities and off-base roadways on Guam and Tinian. The impacts in the table represent the greatest impact assessed for each utility and for roadways associated with the peak construction period.

Table 3.3-34. Summary of Preferred Alternatives' Impacts – Utilities and Roadways

Resource Categories	*Guam*	*Tinian*
	Volume 6	*Volume 3*
	Military Relocation	*Training*
Utilities		
Power	LSI (LSI)	LSI
Water	LSI (SI)	LSI
Wastewater	SI-M (SI)	LSI
Solid Waste	LSI (LSI)	LSI
Utilities Summary of Impact	**SI-M (SI)**	**LSI**
Off-base Roadways Impacts	**SI-M**	**LSI**
On-base Roadways Impacts	**SI-M**	**LSI**

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, ( ) = Indirect (workforce population and induced) population impact

As indicated in Table 3.3-34, less than significant impacts would occur on Tinian. On Guam, significant but mitigable direct impacts would occur, and significant indirect impacts would occur. The utilities and roadways impacts resulting from implementation of the preferred alternatives are summarized below.

Guam

Power

Existing and proposed power systems would be adequate to support the military relocation. The preferred alternative would result in less than significant direct and indirect impacts. Table 3.3-35 summarizes the impacts from Volume 6 Chapter 3 of impacts to power systems resulting from implementation of the preferred alternatives under the military relocation. See Volume 6 Chapter 3 for more details.

Table 3.3-35. Summary Impacts for Power

Potentially Affected Resource	*Power Basic Alternative*
Power	LSI (LSI)

Legend: LSI = Less than significant impact; ( ) = Indirect (workforce population and induced) population impact

Water

Direct impacts to potable water systems from the preferred alternatives would be less than significant because DoD would install a new water system to meet its water needs. Indirect impacts to the Guam Water Authority (GWA) system would be significant as a result of the following:

- The existing GWA water supply would be inadequate to meet the water demands from the workforce housing and induced population. This would be mitigated by DoD providing excess water capacity to GWA.

- The existing GWA system for transmitting bulk water to areas of Guam, and distributing water to customers, would be inadequate to meet the water demands from the workforce housing and induced population. This would be partially mitigated by DoD constructing new transmission lines and interconnects to deliver bulk water to the GWA system where demands are greatest. However, mitigation of the GWA distribution system servicing customers is the responsibility of GWA and would not be undertaken by DoD.

Direct and indirect impacts to the Northern Guam Lens Aquifer would be less than significant as the sustainable yield of the aquifer is sufficient to support the DoD, construction workforce, and induced populations.

Indirect impacts associated with GWA's inadequate distribution system cannot be mitigated by DoD and some customers may experience inadequate water service during the construction phase.

Table 3.3-36 summarizes the impacts to water systems resulting from implementation of the preferred alternatives under the military relocation as identified in Volume 6, Chapter 3. See Volume 6 Chapter 3 for more details.

Table 3.3-36. Summary of Impacts for Water

Potentially Affected Resource	*Preferred Alternative*
DoD Water System (direct impact)	LSI
GWA Water System (indirect impact)	SI-M
Supply	SI-M
Transmission	SI-M
Distribution	SI
NGLA (combined direct and indirect impact)	LSI

Legend: DoD = Department of Defense; GWA = Guam Waterworks Authority; LSI = less than significant impact; NGLA = Northern Guam Lens Aquifer; SI-M = Significant impact mitigable to less than significant

Wastewater

DoD proposes to utilize the GWA owned and operated NDWWTP, to treat the wastewater from the direct DoD population in the area. The NDWWTP currently does not have sufficient capacity or treatment capability to treat the increased wastewater flows from the DoD population, resulting in a significant impact to the plant. DoD proposes to initially repair and upgrade the existing primary treatment capability at the plant, then upgrade the plant to secondary treatment capability. This would result in improved water quality and long-term beneficial impacts. DoD also proposes to utilize the existing Navy Apra Harbor Wastewater Treatment Plant, which has sufficient capacity to treat the increased wastewater flows from the DoD population in the surrounding area.

Less than significant and significant indirect impacts to the GWA owned and operated Hagatna Wastewater Treatment Plant (WWTP) would result from increased wastewater from the construction workforce and induced populations. The plant has insufficient capacity to treat the wastewater. This results in periodic effluent permit violations which would be more frequent with increased flows.

There would be less than significant indirect impacts to other GWA owned and operated wastewater treatment plants from increased wastewater from the construction workforce and induced populations. This is because the relative increase in flow to these plants would be negligible. There would be significant indirect impacts to GWA wastewater collection systems from increased wastewater from the construction

workforce and induced populations because these wastewater collection systems are currently inadequate to handle the flows they receive today.

Table 3.3-37 summarizes the impacts from Volume 6 Chapter 3 of impacts to wastewater systems resulting from implementation of the preferred alternatives under the military relocation. See Volume 6 Chapter 3 for more details.

Table 3.3-37. Summary Impacts for Wastewater

Potentially Affected Resource	*Preferred Alternative*
NDWWTP Treatment Capacity (direct impact)	SI-M/BI
NDWWTP Effluent (Discharge) Quality (direct impact, short/intermediate term)	BI/BI
Apra Harbor WWTP Treatment Capacity (direct impact)	LSI
Apra Harbor WWTP Effluent (Discharge) Quality (direct impact)	LSI
Hagatna WWTP Treatment Capacity (indirect impact)	LSI
Hagatna WWTP Effluent (Discharge) Quality (indirect impact)	LSI
Southern Guam WWTPs (indirect impact)	LSI
GWA Collection Systems (indirect impact)	SI

Legend: BI = Beneficial impact; GWA = Guam Waterworks Authority; LSI = Less than significant impact; NDWWTP = Northern District Wastewater Treatment Plant; SI = Significant impact; SI-M = Significant impact mitigable to less than significant; WWTP = Wastewater Treatment Plant.

Solid Waste

Construction and operation of the preferred alternatives would result in less than significant direct and indirect impacts, assuming the short-term use of existing landfills and the future use of the new Layon landfill. Table 3.3-38 summarizes the impacts from Volume 6 Chapter 3 of impacts to solid waste systems resulting from implementation of the preferred alternatives under the military relocation. See Volume 6 Chapter 3 for analysis of impacts to solid waste management systems resulting from implementation of the preferred alternatives.

Table 3.3-38. Summary Impacts for Solid Waste

Potentially Affected Resource	*Preferred Alternative*
Construction & Demolition Debris Disposal Capacity at Landfills	LSI (LSI)
Solid Waste Disposal Capacity at Landfills	LSI (LSI)

Legend: LSI = Less-than-significant impact, ( ) = Indirect (workforce population and induced) population impact

Roadways

The impacts to roadways on Guam would be significant and mitigation is identified, but the mitigation may not be adequate to reduce impacts to less than significant. As of February 2010, eight off-base projects had been identified as having funding or reasonable expectation of being funded and these projects are considered part of the preferred alternatives. Additional traffic analysis was completed for 17

roadways and 42 intersections, assuming that only a limited number of these projects would be funded. These projects are either DAR-certified or determined to be DAR-eligible at this time (see Volume 1, Section 1.1.4 Project Location, Funding, and Setting). These additional projects are considered mitigation measures. The evaluation of the unfunded road projects for DAR eligibility and certification is continuing and the DoD, FHWA, and GovGuam continue to work cooperatively to develop a funding plan for the off-base roadway and intersection capacity projects.

Under the preferred alternatives, roadways improvements would be distributed across the island and implementation of these roadway projects would impact Guam-wide roadway conditions. The off-base roadways impacts would be significant for the north and central regions of Guam, as described in Volume 6, Chapter 4. The impacts to the Apra Harbor and South areas of Guam would be less than significant.

Due to the increase in traffic resulting from the preferred alternatives, the on-Base roadways impact would be significant but mitigable at Andersen AFB and at the Navy base. The traffic impact is less than significant at Andersen South, Barrigada, and NMS. Mitigation measures for Andersen AFB and Apra Harbor include road widening, restriping, or installation of traffic signals and other traffic control devices to help improve traffic operations.

Tinian

On Tinian, there would be less than significant impacts to utilities and roadways resulting from the preferred alternatives and no mitigation (improvements) are proposed. No supporting utility infrastructure facilities are proposed for the Tinian firing ranges. All training would be considered "expeditionary," in that the Marines would bring all necessary equipment to the ranges, set up temporary tents on-site, and remove all equipment following completion of the training activities. The only proposed use of on-island utilities would be for wastewater and use of the municipal water supply. A contract, portable toilet service would be used for human waste. Portable toilets would be contracted from a local company and the wastewater would be disposed in accordance with all applicable laws and regulations, as a requirement of the contract. The contractor would be directed to take the wastewater to the existing DoD septic tank/leach field system.

Potable water usage would be restricted to what could be delivered in trucks from the municipal water supply. It is not expected to exceed the available capacity of the municipal water system. Bottled potable water would be delivered to the construction workers during the construction period. Range fire-fighting would be performed by local fire fighting services, as augmented for a range fire-fighting role. Portable generators or solar-battery systems would be used to operate any equipment needed at the bivouac site. Water service would be provided via a water truck during operations. Estimated potable water consumption would be one gallon per person, per day, for drinking; additional water would be consumed for cleaning, bathing, etc. Solid waste would be collected and returned with the military unit, pending establishment of a certified landfill on Tinian. Solid waste would otherwise be back-hauled to Guam, and the DoD would not dispose of solid waste at the open dump operated by the CNMI Department of Public Works.

3.3.14.2 No Action

Guam

The following is a brief summary of information provided in the Affected Environment section of Volume 6, Chapter 3.

Power

Power demand forecasts, including all current and foreseeable projects, indicate that there is currently and would continue to be sufficient power generation capacity. The Guam Power Authority's Integrated Resource Plan indicates the need for a new base load power plant in 2017, however the assumptions for that need may or may not be realized. Alternative power sources (wind, solar, and geothermal) are forecast to be implemented in 2015.

Water

The baseline condition of the GWA water system is described in GWA's WRMP and in various other reports prepared for GWA and USEPA Region 9. The overall condition of the water system infrastructure (wells, reservoirs, treatment systems, storage tanks, and distribution lines and pump stations) is identified as poor in the WRMP and substandard in EPA reports, with substantial corrosion of infrastructure and failed or bypassed systems due to lack of maintenance or capital improvements. Problems with the GWA infrastructure result from the effects of natural disasters, poor or deferred maintenance, lack of upgrades and capital improvements, and vandalism. According to the WRMP, the water system infrastructure does not meet the basic flow and pressure requirements for all customers, and did not consistently comply with regulatory requirements. A 2003 Stipulated Order was issued to force correction of GWA's Safe Drinking Water Act violations and deficiencies, but compliance with the Order has been limited due to funding constraints. The condition of the GWA water systems and a history of compliance are outlined in Volume 6, Chapter 3.

Under the no-action scenario, current capacities of DoD water systems are adequate to meet current DoD demands for the foreseeable future. However, the projected off-base water demand for the Guam civilian population throughout 2010-2019, not including the effects of the military relocation, exceeds the current Guam Water Authority (GWA) water system capacity. Some of the currently planned improvements and expansion to the GWA water system would be required under no action to meet the terms of a 2003 Stipulated Order to GWA address potable water deficiencies. Should Ground Water Under Direct Influence (GWUDI) treatment become a future requirement, GWA would be faced with installing additional water treatment to be in compliance with Safe Drinking Water Act requirements.

Wastewater

As indicated above, GWA's wastewater infrastructure (treatment plants, collection piping, and pump stations) are identified as poor in the WRMP and substandard in EPA reports from a legacy of deferred maintenance and capital improvements. This, coupled with natural disasters (such as typhoons and flooding), has resulted in frequent sewage overflows at pump stations and collection piping, collapse of collection piping, and failure of treatment plant equipment. A lack of GWA resources, particularly restrictions on fees that can be collected from the public for sewer services and a poor bond rating for loans, has severely limited GWA's ability to adequately maintain and update their wastewater treatment system. As a result, GWA has experienced frequent violations of its National Pollution Discharge Elimination System (NPDES) permit conditions, including the inability to adequately treat wastewater and exceedances of the allowed pollutant levels in plant discharges. A 2003 Stipulated Order was issued by USEPA to force correction of GWA's Clean Water Act violations and deficiencies, but compliance with the Order has been limited due to funding constraints. The condition of the GWA wastewater systems and a history of compliance are outlined in Volume 6, Chapter 3.

Under no action, current NDWWTP would continue to require upgrades and maintenance to meet the terms of a 2003 Stipulated Order to GWA addressing wastewater deficiencies. Also, USEPA will not likely grant the secondary treatment waiver for the NDWWTP or the Hagatna WWTP. Thus, in the near

future, GWA may be required to upgrade these treatment plants to secondary treatment in addition to making repairs and upgrades to the existing primary treatment processes.

Solid Waste

Solid waste from DoD is presently disposed of at the Navy sanitary landfill or the Air Force landfill at Andersen AFB. Solid waste from non-DoD sources is disposed of at GovGuam facilities. The GovGuam Ordot landfill will be closed only after the new landfill is opened, and access roads will be upgraded by GovGuam to accommodate the transport of waste to the new disposal site.

The new GovGuam solid waste landfill is funded and currently under construction; it is scheduled to be completed and operational by July 2011. DoD would switch its use from its current landfills at Apra Harbor and Andersen AFB for municipal solid waste when this new landfill is completed. Solid waste that cannot be accepted by the new GovGuam landfill would continue to be disposed at the DoD landfill at Apra Harbor. The new GovGuam landfill is anticipated to be fully compliant with current municipal solid waste regulations and would have a life span of over 30 years, including the estimated impacts of the proposed DoD relocation.

Roadways

The *2030 Guam Transportation Plan* (Plan; GovGuam 2008) identified roadway improvement projects that would address roadway deficiencies on Guam; however, it does not address all of the roadway improvements identified in this EIS. The need for some of the projects identified in the Plan would be accelerated by the military build-up. The rate of improvements identified in the Plan is tied to the availability of funding. The condition of roadways on Guam has deteriorated, but the roadways are operational.

Tinian

Volume 3, Chapter 15 describes the island-wide utilities on Tinian. Power capacity has not been exceeded and demand may decrease in the future if the Dynasty Hotel closes. Currently, the quantity of water production from municipal wells easily meets the current average daily water demand. There is currently no centralized wastewater treatment system on Tinian. Most residents utilize personal septic tanks with leach fields or cesspools. The Tinian Dynasty Hotel and Casino has its own tertiary treatment plant. The IBB has its own septic tank/leach field system. DoD installed a septic tank/leach field in 1998-1999 in support of the "Tandem Thrust" training exercise (CNMI Division of Water Quality [DEQ] 1999). That exercise involved approximately 2,000 people for one week. Portable toilets are also used on Tinian and are provided by an on-island rental company. All municipal solid waste (including septage) is currently received at an open dumpsite located approximately 0.5 mile (mi) (0.8 kilometer [km]) north of San Jose, and west of 8th Avenue. The disposal site is operated as an open burning dump. Current practice is for waste pumped from septic tanks, cesspools, or portable sanitation devices to be discharged at an area adjacent to the existing open dumpsite as there is no separate disposal facility for this waste. The existing municipal solid waste dumpsite does not comply with the Resource Conservation and Recovery Act Subtitle D regulations for municipal solid waste landfills (40 Code of Federal Regulations Part 258). A new landfill and WWTP are anticipated to be constructed without implementation of the preferred alternatives. Periodically, roadways are repaired but repairs may lag due to insufficient funds.

3.3.14.3 Comparison of Preferred Alternatives to No Action

Although the preferred alternatives include utilities upgrades on Guam that would improve existing conditions, implementation of the preferred alternatives would increase demand on existing overburdened and deficient utilities on the island, particularly during peak construction. Increased demand on Guam's

utilities would result directly from military personnel and their families and also indirectly from construction workforce and induced populations. Significant direct and indirect impacts would occur to potable and wastewater systems on Guam. Although the significant direct impacts would be mitigable to less than significant, significant indirect impacts on Guam's water and wastewater utilities would not be mitigable to less than significant.

Roadway improvements are required on Guam either under the preferred alternatives or with no action. Although the preferred alternatives include off-Base roadways improvements, impacts to off-Base roadways resulting from the preferred alternatives would be significant. If roadways on Guam were allowed to deteriorate to the point of being closed in the near-term, the effect would be significant but mitigable. Proposed mitigation consists of roadway restoration. The evaluation of the unfunded road projects for DAR eligibility and certification is continuing and the DoD, FHWA, and GovGuam continue to work together to develop a funding plan for off-base roadway and intersection capacity projects.

Less than significant impacts would occur to utilities and roadways on Tinian; there would be no appreciable difference between the no action and the preferred alternatives on Tinian.

3.3.15 Socioeconomics and General Services

3.3.15.1 Summary of Preferred Alternatives' Impacts

Overall, socioeconomic impacts of the preferred alternatives would be island-wide in nature. Implementation of the proposed actions of the Marine Corps, Navy, and Army would result in both beneficial and adverse impacts. The significance of impacts would be increased by the suddenness of the activity, and the peaks in activity during the 2013-2015 timeframe, due to the overlap in the construction and operation phases of the preferred alternatives.

During the peak, many public services offered by GovGuam would need to increase professional staff to service the new population. Most of these agencies would need to rapidly expand their services and staff during the 2013-2014 peak (raising issues of availability of qualified workers), then cut back them back as construction ends. Agencies that deal with permitting and regulating growth are affected more by the initial requests for permits and then subsequent inspections and monitoring. For the agencies involved in development permitting, impacts on workloads would tend to be slightly earlier than for other agencies.

The peak growth period would be followed by a period of a population decline on Guam when construction ends, as a large part of the population influx due to construction work would likely leave the island at this time (although population levels would still represent an increase over pre-action levels). While quality of life might improve and public service agencies may be more equipped to handle this more manageable post-construction population "steady state," the ensuing dip in economic impact could result in an island-wide economic slowdown given the peak spending during the build-up period.

There would likely be sociocultural impacts. Crime and social order impacts would be felt because of the large increase in population, especially during the construction phase. There is potential for cultural conflict, especially in the opening years of the proposed action.

Federal regulations regarding land acquisition mitigate for the economic impacts experienced by individual landowners and occupants due to land acquisition. However, due to the extent the proposed land acquisition would mean an increase in federally owned or controlled land on Guam, and a reduction in access to lands of sociocultural and recreational importance, the overall socioeconomic impacts of land acquisition would be significant.

Table 3.3-39 and Table 3.3-40 provide a summary of the significance of implementing the proposed actions addressed in Volumes 2 through 6 for construction and operation phases, respectively. While the

relocation of the Marines to Guam and the related facilities and infrastructure would be the largest of the proposed actions, there are incremental impacts to socioeconomic factors from the transient aircraft carrier visits and Army proposed actions on Guam. The socioeconomic analysis included the combined direct and indirect impacts for Volumes 2, 3, 4 and 5. Volume 6 distinguishes between direct and indirect (workforce housing and induced population) impacts and identifies levels of significance for each.

Table 3.3-39. Summary of Preferred Alternatives' Construction Impacts – Socioeconomics and General Services

Resource Categories	*Guam*						*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*		*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Utilities*	*Off-base Road-ways*		*Training*
Population Impacts	SI/BI	LSI	SI/BI	SI/BI	SI-M	SI	NI
Economic Impacts	BI	BI	BI	BI	BI/LSI	LSI	SI
Public Service Impacts	SI	LSI	SI	SI	SI (BI)	SI (BI)	SI
Sociocultural Impacts	SI	SI	NI	NI	NI	SI	SI
Utility Rate Payer Impacts	NA	NA	NA	NA	LSI (SI)	SI (SI)	NA
Socioeconomics and General Services Construction Impact Summary:						**SI (SI)**	**SI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact, NA = not applicable, ( ) = Indirect (workforce population and induced) population impact; SI/BI = Population increases have inherently mixed impacts (both beneficial and adverse), because population growth fuels economic expansion but sudden growth also strains government services and the social fabric.

Table 3.3-40. Summary of Preferred Alternatives' Operation Impacts – Socioeconomics and General Services

Resource Categories	*Guam*						*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*		*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Utilities*	*Off-base Road-ways*		*Training*
Population Impacts	SI/BI	LSI	LSI	SI/BI	NI	SI	NI
Economic Impacts	BI	BI	LSI	BI	NI	BI	SI
Public Service Impacts	SI	LSI	LSI	SI	NI	SI	LSI
Sociocultural Impacts	SI	SI	NI	NI	NI	SI	SI
Land Acquisition Impacts	SI	NA	NA	NA	NA	SI	NA
Utility Rate Payer Impacts	NA	NA	NA	LSI (SI)	NA	LSI (SI)	NA
Socioeconomics and General Services Operation Impact Summary:						**SI (SI)**	**SI**

Legend: SI = Significant impact, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact; NA = not applicable; ( ) = Indirect (workforce population and induced) population impact; SI/BI = Population increases have inherently mixed impacts (both beneficial and adverse), because population growth fuels economic expansion but sudden growth also strains government services and the social fabric.

3.3.15.2 No Action

Guam

Historic Baseline

Guam's socioeconomic history has been heavily influenced by Spanish rule, Pre-WWII American occupation and the battles of WWII. Pre-European contact, Chamorro families were organized into matrilineal clans. Wealth was held largely in land and currency consisted of polished turtle shell pieces. The economy was based on subsistence fishing, and farming (Rogers 1995).

Chamorro society was altered during the Spanish Era (1521-1898), which began with Magellan's arrival in 1521 (permanent Spanish settlement began in 1668). The Spaniards compelled most Chamorro to live on Guam and Rota and prohibited the sailing of traditional *Proa* canoes. Fishing was limited to the coastal areas, while subsistence farming continued. The prime source of income in the 1840s was derived from the whaling industry, which declined in the late 1840s. During this time, under the Laws of the Indies, all lands technically belonged to the Spanish Crown. The Spanish granted Chamorros legal equality with all Spanish subjects in 1681, and in 1771 the governor made land available to all families for agricultural purposes. While this meant that much land remained in Chamorro families, this ownership became concentrated in the hands of more wealthy and influential families, descendants of Chamorro nobility that had married into Spanish families. The Catholic Church became a major landowner. Inheritance patterns also changed from matrilineal to patrilineal systems (Rogers 1995).

The Spanish Crown lands were seized by the United States during the Spanish-American War (1898). American sovereignty over Guam under international law officially began on April 11, 1899 when the Treaty of Paris was proclaimed law after being signed and ratified by both the U.S. and Spanish governments. Under American occupation, the economy was still subsistence-based. Some Chamorros worked as day laborers on large farms. Chamorro remained the predominant language in villages but English replaced Spanish in schools and government. Employment in government grew with the expanding bureaucracy. There were two civilian labor rates, one for Americans, and a lower one for Chamorros. (Rogers 1995). WWI had little social impact on the society. Government efforts to encourage more agriculture did not succeed and influenza killed 6% of the island population (Rogers 1995).

Volume 2, Chapter 16, Section 16.1.2 details recent socioeconomic trends on Guam (between 1950 and 2010). Guam's population rose in the 1950s and 1960s, plateaued between 1970 and 1990 and has since declined. This trend is expected to continue. The military population was highest in 1950 and lessened through the 1980s with an increase from the later 1980s through 1990s. This increase was attributable to cold war military spending and the closing of U.S. bases in the Philippines. Super typhoon Karen in the 1960s left many Guam residents homeless. Pan American clipper service from Japan sparked tourism businesses and support services. The economy stagnated in the 1970s to early 1980s, partly due to the 1973 oil embargo. During the 1980s, corresponding to the reduction in military population, military lands were released, including Naval Station Agana. Tourism peaked between 1995 and 1997 but ended with the Japanese financial crisis in 1997. Super typhoon Pongsona and the September 11 terrorist attacks affected the tourism market that was on the verge of recovery. In 2005, tourism was the second largest private industry.

Socioeconomics under No Action Alternative

Unlike most of the resources in this EIS, socioeconomic systems would not remain at baseline conditions if the preferred alternatives are not implemented. Economies and population levels change due to other reasons. Furthermore, the announcement of the intended relocation has already had socioeconomic

consequences, such that a decision not to follow through on the military relocation would have short-term effects associated with a reversal of those consequences.

Population under No Action Alternative

Project related population in-migration and associated demographic and household characteristic impacts would not occur. Overall Guam population could be expected to develop according to baseline trends which show Guam's population continuing to increase but at slower rates than the recent past. The 2010 Census will provide an update on population trends for Guam.

Guam Economy under No Action Alternative

In the short term, a decision not to implement the preferred alternatives would deflate any current speculative activity attributable to the preferred alternatives. Real estate values in particular would likely drop, thereby hurting investors, but increasing the affordability of housing. The contrast between the business community's expectations and no action would likely produce a period of pessimism about Guam's economic future.

Long term, the island's prospects would remain linked to international economic conditions and the health of its tourism industry. Conceivably, a smaller military profile might remove some barriers to growing the potential Chinese tourism market. Growth would resume, though probably with the same volatility experienced in recent decades.

Guam Public Services under No Action Alternative

The public service agencies would not face pressure to expand professional staffing; agencies involved in planning and regulating growth would not experience such a sharp increase in workload. Agencies that are required to implement major infrastructure developments – such as the ports and highways – would have substantially more time to implement long-term plans, rather than having to achieve much of their objectives over the next few years.

From a broad viewpoint, no action and the elimination of prospective long-term revenues expected from the preferred alternatives, GovGuam agencies would continue to face the difficult financial condition they have faced in recent years. At least for the foreseeable future, this would negatively impact the various service agencies because of budget cuts, and would probably represent the most important overall consequence for GovGuam.

Sociocultural Issues under No Action Alternative

To the extent that Guam experiences job losses, crime rates may rise in the short term. The political attention given to some contentious issues linked to public perceptions and concerns of the proposed action would likely recede. Military-civilian relations would likely remain at the current generally positive level.

The incentive for increased in-migration from the FAS would decrease, reducing potential sociocultural impacts. However, current incentives for providing support for those populations – both on Guam and the Micronesian states themselves – would be lessened, with detrimental implications for those populations.

Land Acquisition under No Action Alternative

Under no action, no land acquisition would occur. There would be no potential for effects on individuals, the community at large, or GovGuam.

Utility Rates under No Action Alternative

There would be no need for greater funding contributions from DoD for upgrades in wastewater treatment systems on Guam if the preferred alternatives are not implemented, i.e., no action is taken. Under no action, the lack of an increased demand for water would not put pressure on further developing the sole source aquifer in northern Guam. Similarly, no action would not increase demand for power. Existing Guam power plants would not benefit from any expansion in the rate payer base to help finance the maintenance, refurbishing or improvement of air quality aspects that currently exist. Some utility rate increases are already planned that would occur with or without the proposed actions.

Roadway Construction under No Action Alternative

Under no action, only roadway projects needed for organic growth on Guam would be constructed. Intensive construction activities would not result; therefore, there would be no potential for effects on neighborhoods and businesses. No action may also result in impacts from property acquisition and relocation associated with GovGuam planned projects, as opposed to DoD's planned projects. The proposed mitigation by GovGuam can be identified and implemented to reduce potential impacts to a less than significant level.

Tinian

Volume 3, Chapter 16, Section 16.1 provides an overview of recent socioeconomic trends for CNMI in general and Tinian in particular.

From a historical perspective, the island of Tinian is most well known as the forward base from where nuclear attacks on Japan were launched in 1945. Most residents moved from Tinian following the close of the war. In recent years the airstrip has become an attraction for Tinian's small tourism industry. However, Tinian has remained a quiet and lightly populated island.

The leasing of land (the MLA) from the CNMI by the federal government has been an economic factor since January 6, 1983. The lease agreement is effective for 50 years (until year 2028), with a 50 year renewal option. The CNMI and DoD have a leaseback agreement for a portion of the public lands (LBA lands) leased to the military. The CNMI government issues permits for the leaseback lands on Tinian for scattered small agricultural and grazing operations. The military has also ceded some lands in and around the West Field back to the local government of Tinian to build and operate the civilian airport. The portion of the MLA that is utilized by the military is called the Exclusive Military Use Area and is open to the public only during times when military training is not occurring. The LBA, on the other hand, is a joint use area at all times and military and civilian activities on this land must be compatible. The various military services have conducted sporadic training exercises on Tinian. While there is no permanent residential population on the military's land, it is usually available for resident food-gathering and recreation, and for tour business access to beaches and historical sites.

Tinian's economy is dominated by one existing casino, a small tourism trade centered on the island's role in WWII, and marine activities such as diving. In the early 1990s the island had a tuna transshipment and freezer facility, but this facility closed late in the decade when its owner entered bankruptcy. Agriculture on the island is primarily of a subsistence nature, though there is some small cash cropping of vegetables. Cattle-ranching has been promoted as a growth industry on Tinian but remains in its early stages. Both cattle ranching and tourism are dependent on access to the MLA. Household income on Tinian is derived mainly from CNMI government employment and a small retail trade sector. Casino gaming revenues enter the economy through tax revenues to the local government. The existing casino has been staffed almost

entirely with foreign guest workers, as longtime Tinian residents are more likely to seek work in the higher-paying government sector.

The Tinian casino and resort economy is reliant upon the Asian market. In the late 1970s, the people of Tinian decided to permit gambling on the island through construction of up to five casinos. The Tinian Dynasty Hotel and Casino, the only casino operating on Tinian, is at risk of closure for two reasons. The first is because a large percentage of its Chinese customer base is no longer visiting the casino. The second is because the availability of a foreign labor workforce is now threatened by re-federalization. Few of the current military personnel on Guam have spent rest and relaxation time on Tinian. The visitor population declined approximately 30% from 2005 to 2008. Insufficient transportation infrastructure is noted as a barrier to further tourism development throughout Tinian, and as a factor in the Tinian Dynasty's low occupancy rate and financial performance. The recent reduction in air travel and corresponding slump in tourist numbers on all the CNMI islands has led to less revenue going to any island. That, coupled with rising fuel and food prices, has made living on Tinian economically difficult for residents.

Under the no-action alternative, military training on a smaller scale would continue in the MLA, consistent with the existing Marianas Integrated Range Complex guidelines. No additional ranges or infrastructure would be built. Access to the MLA, for any social or economic reasons, would remain the same as at present. Wages would still rise to federal minimums. Federalization of the CNMI's immigration would restrict access to willing foreign laborers by the end of the transition period in 2014. Also, the global finance collapse appears likely to threaten future casino investment. Therefore, even without the development of additional ranges in the military lease area, Tinian's economy would still experience a contraction like the rest of the CNMI. However, the disappointment of expectations Tinian residents have long held about the benefits from a full-fledged military base may be especially acute if no action at all is taken, resulting in significant impacts to military-civilian relations.

3.3.15.3 Comparison of Preferred Alternatives to No Action

The proposed military relocation represents a large infusion of people, spending, and capital improvement projects within a short time period, and in a small place. Socioeconomic impacts would be felt island-wide and by all island inhabitants. Military spending for facilities and infrastructure would generate economic and social consequences that would peak in the middle of the next decade. Impacts over the longer term would return to current conditions, with the exception of a larger presence of the permanent military, and associated induced population, than has existed on Guam in recent years.

The next sections summarize the socioeconomic impacts that would occur, divided by the socioeconomic sub-categories population, economic, public service, sociocultural, land acquisition and roadway construction. The tables below provide a summary of the socioeconomic impacts identified on Guam in Volumes 2, 4, 5 and 6 with one exception. Volume 6, Chapter 17 utilizes a different methodology in determining the economic impacts of roadway construction which is consistent with FHWA methodology. The roadway construction impacts presented below have been normalized to be consistent with the impact methodology used in the other volumes of this EIS. This methodology is described in Chapter 2 of the Socioeconomic Impact Assessment Study (SIAS), located in Volume 9 Appendix F.

<u>Population Impacts - Guam</u>

Table 3.3-41 presents an estimate of the annual population increase of off-island people that would result from implementation of the preferred alternatives.

Table 3.3-41. Estimated Total Population Increase on Guam from Off-Island (Direct, Indirect and Induced)

Populations	*Construction*	*Operation*
Direct DoD Population[1]		
Active Duty Marine Corps	10,552	10,552
Marine Corps Dependents	9,000	9,000
Active Duty Navy[2]	0	0
Navy Dependents	0	0
Active Duty Army	50	630
Army Dependents	0	950
Civilian Military Workers	1,720	1,836
Civilian Military Worker Dependents	1,634	1,745
Off-Island Construction Workers (DoD Projects)[3]	18,374	0
Dependents of Off-Island Construction Workers (DoD Projects)	4,721	0
Direct DoD Subtotal	**46,052**	**24,713**
Indirect and Induced Population		
Off-Island Workers for Indirect/ Induced Jobs[3]	16,988	4,482
Dependents of Off-Island Workers for Indirect/Induced Jobs	16,138	4,413
Indirect/Induced Subtotal	**33,126**	**8,895**
Total Population	**79,178**	**33,608**

Notes:
[1] DoD population includes military personnel, dependents, and DoD civilian workers from off island.
[2] The Navy rows do not include increases from the transient presence of an aircraft carrier strike group (CSG).
[3] Population figures do not include Guam residents who obtain employment as a result of the proposed action.

The initial influx of military, military related, construction, and indirect/induced total population in 2010 is estimated to be approximately 11,000 people. This annual amount would be expected to grow substantially through the mid-decade, and peak at approximately 79,000 people. Following the completion of the majority of the relocation construction program, the population would decline from this peak, but would result in an increase over the current presence of DoD population on Guam by approximately 33,000 total people.

This rapid and substantial increase in population on Guam would create opportunities and problems. In the short term, there could be significant negative impacts caused by rapid population growth that would have to be managed by the government, as well as by responses from the private market sector. Over the longer term, it is probable that the larger "steady state" of DoD population would be accommodated on Guam, and that there would be beneficial effects from the stable presence of the military, their families, and related population.

Economic Impacts - Guam

Civilian Labor Force Demand

Labor force demand refers to the jobs and workers needed to fill them. This analysis includes civilian jobs only, including federal civilian workers, and other jobs from spin-off economic growth.

Table 3.3-42 demonstrates that the preferred alternatives would generate the summary of impacts of 43,278 workers at the 2014 peak, and would decline to about 6,930 after construction abates by 2017. This many jobs would be considered a significant beneficial impact on Guam. However, this rapid swing in the number of civilian jobs, suggests a sudden decline in economic activity. For many people on Guam, the end of construction would be a welcome return to normalcy; but some businesses would have to cut back, and many workers would have to out-migrate due to job loss.

Table 3.3-42. Impact on Civilian Labor Force Demand – Summary Impacts

Impact	*Construction*	*Operation*
Direct	33,871	5,355
Indirect	9,407	1,576
Total	**43,278**	**6,930**

Additional analysis suggests Guam residents would capture up to 2,700 of the direct on-site construction jobs plus about 3,200 of all other types of jobs during the construction peak of 2012 - 2014. In the later post-construction period, it is estimated that Guam residents would capture about 2,660 of the permanent jobs. These jobs do not currently exist on Guam and represent a beneficial value added effect as a result of the preferred alternatives.

Civilian Labor Force Income

Civilian labor force income refers to the cumulative gross (before deductions for taxes) wages and salaries earned by the civilian labor force. Table 3.3-43 demonstrates that the peak year figure would exceed $1.5 billion, falling back to about $278 million after construction ends in 2017. This clearly would represent a positive impact on Guam.

Table 3.3-43. Impact on Civilian Labor Force Income (Millions of 2008 $) – Summary Impacts

Impact	*Construction*	*Operation*
Direct	$1,095	$217
Indirect	$416	$60
Total	**$1,510**	**$278**

Civilian Housing Demand

The housing unit demand (required number of homes) in this section represents an estimate of the number of units that would be required for the in-migrating Guam civilian population. It excludes temporary, foreign construction workers entering on an H-2B work visa, people assumed to live in the barracks-style dormitory housing provided by contractors (as required by law), and active-duty military personnel, who are assumed all to be housed on base (or on board ship for the Navy action).

Table 3.3-44 demonstrates that the preferred alternative's summary of impacts on housing demand would be a demand for 11,893 new units in the peak year of 2014, falling to just 3,205 after construction ends in 2017.

Table 3.3-44. Demand for New Civilian Housing Units – Summary Effects

Impact	*Construction*	*Operation*
Direct	7,856	1,720
Indirect	4,037	1,485
Total	**11,893**	**3,205**

Civilian Housing Supply

Guam has an excess of vacant, available housing (about 2,800 units) to absorb some of the estimated housing demand. This housing is likely to accommodate private-sector housing demands in 2010. However, the excess capacity is projected to be less than demand in 2011; therefore, new private-market housing supply must be available in 2011, and new housing would have to be built through 2014.

Once the construction period is past its peak in 2015, and if this new housing is provided, the need for new housing construction would diminish to zero, and excess capacity would grow to approximately 8,688. These estimates are shown in Table 3.3-45.

Table 3.3-45. Demand and Supply Needed for New Civilian Housing Units – Summary Impacts

Demand	*Construction*	*Operation*
Combined Action Total Impact	11,893	3,205
Annual Change in Demand	2,452	0
Available Housing Supply (vacant, likely available)	2,787	2,787
Annual Construction Needed to Eliminate Housing Deficit	2,452	0
Over-Supply Future: Surplus Units if Supply Increases to Eliminate Deficit	0	8,688

The housing unit estimates summarized in Table 3.3-45 include the housing surplus in subsequent years; they assume the market will provide all the needed construction-period housing, and that no alternative uses (such as conversion to commercial use) are found for them.

The estimates in Table 3.3-45 are theoretical and are intended to suggest the amount of housing construction required to satisfy increased demand. The table estimates are not intended to imply that construction of new housing would fully respond to the demand, and eliminate a housing deficit. If it did, the result would be an over-supply of housing following the construction period. This sort of over-supply would drive housing prices down for residents, but would likely mean substantial losses for developers and landlords, as well as problems associated with maintenance of large numbers of unoccupied units.

The most likely outcome is a partial response of housing construction in relation to the demand. Nevertheless, this substantial increase in demand for housing, the probable response in supply of houses, and then a decline in demand, would be significant summary impacts of implementing the preferred alternatives.

Effects on Tourism

The summary of impacts on the island's primary private-sector industry would likely be mixed. Hotels would benefit considerably due to prospective increases in occupancy associated with more military-related business travel, visiting friends and family, construction supervisors, etc. Nonetheless, the general service sector could undergo a period of difficulty due to a loss of labor to higher-paying jobs and pressure for increased wages; thereby, impairing competition with inexpensive Asian destinations. Ocean-oriented tourism activities would be affected by increased use by others, and population expansion would increase competition for limited marine resources.

Selected Local GovGuam Revenues

Table 3.3-46 demonstrates that the approximate combined revenues accruing to GovGuam from its three primary sources: 1) gross receipts taxes; 2) corporate income taxes; and 3) personal income taxes could be as high as $423 million in 2014; declining to a stable figure of $104 million after construction ends in 2017.

Table 3.3-46. Impact on Selected GovGuam Tax Receipts (Millions of 2008 $) – Summary Impacts

Impact	*Construction*	*Operation*
Direct	$312.6	$69.4
Indirect	$110.7	$34.8
Summary Total	**$423.3**	**$104.3**

Generally, taxes are collected quarterly or annually and there may be a time lag between when government revenues from these sources are available and when they are needed to pay for services and infrastructure. Infrastructure costs would be heavily front-loaded in the timeframe. Revenue impacts would be significant and beneficial to GovGuam; and subject to the issues of timing and the peaks and valleys associated with construction ramp-up and decline.

Gross Island Product (GIP)

GIP for Guam represents the total market value of all final goods and services produced in a given year. It is equal to total consumer, investment, and government spending, plus the value of exports, minus the value of imports.

Table 3.3-47 shows the total effects could be as high as $1,080 million (nearly $1.1 billion) in 2014, declining to a stable figure of $187 million in 2017.

Table 3.3-47. Impact on Gross Island Product (Millions of 2008 $) – Summary Impacts

Impact	*Construction*	*Operation*
Direct	$544	$100
Indirect	$536	$87
Summary Total	**$1,080**	**$187**

Public Service Impacts - Guam

Public Education Service Impacts

The focus of public service analysis is to calculate the required number of key professional staff, based on service population impacts derived from analysis, as determined by surveys of all the GovGuam agencies discussed here and below (refer to Volume 9 Appendix F SIAS). For public education services, such as the Guam Public School System (GPSS) elementary, intermediate, and high schools, as well as the UOG and Guam Community College (GCC), this refers to teachers or non-adjunct faculty members.

Table 3.3-48 summarizes the combined requirements for these five educational programs due to all of the preferred alternatives from Volumes 2 through 6. It indicates a requirement for 619 teachers/faculty at the 2014 construction peak, and a more stable 148 total additional teacher/faculty for the steady-state operational phase.

Table 3.3-48. Additional Combined Public Education Professional Staff Required – Summary Impacts

Impact	*Construction*	*Operation*
Direct	448	118
Indirect	172	30
Total	**619**	**148**

Additional analysis indicates that the construction and operational phase requirements for the individual agencies are as indicated on Table 3.3-49.

Table 3.3-49. Professional Staff Requirements for Individual Public Education Service Agencies

Agency	*Construction Additional Staff Requirement*	*Steady-State(Operation) Additional Staff Requirement*
GPSS Elementary	290	67
GPSS Intermediate	123	29
GPSS High School	119	28
GCC	31	9
UOG	56	15

Public Health and Social Service Impacts

Based on estimated increases in service population, key professional staff requirements attributable to the preferred alternatives were calculated for Guam Memorial Hospital Authority (GMHA) – both physicians and "nurses and allied health professionals," the Department of Public Health and Social Services' Bureau of Primary Care (DPHSS BPC) medical providers and nursing staff, Bureau of Communicable Disease Control (CDC) communicable disease prevention specialists, Bureau of Family Health and Nursing Services (BFHNS) nursing personnel, the Department of Mental Health and Substance Abuse (DMHSA) mental health professionals, and the Department of Integrated Services for Individuals with Disabilities (DISID) social workers and counselors. Table 3.3-50 summarizes the impacts on all of these agencies due to the preferred alternatives. It indicates a requirement for 245 additional professionals at the 2014 construction peak, and a more stable 56 total professionals for the steady-state operational phase.

Table 3.3-50. Additional Combined Public Health and Social Service Professional Staff Required – Summary Impacts

Impact	*Construction*	*Operation*
Direct	190	44
Indirect	55	13
Total	**245**	**56**

Additional analysis indicates that the construction peak and post-construction steady-state operational phase requirements for the individual agencies are as follows (Table 3.3-51).

Table 3.3-51. Total Additional Professional Staff Requirements for Individual Public Health and Social Service Agencies

Agency	*Construction*	*Operation Additional Staff Requirement*
GMHA Physicians	19	2
GMHA Nurses, Allied Health Professionals	121	13
DPHSS BPC	19	7
DPHSS CDC	14	6
DPHSS BFHNS	10	4
DMHSA	56	22
DISID	6	2

Public Safety Service Impacts

Based on estimated increases in service population, key professional staff requirements attributable to the preferred alternative were calculated for the Guam Police Department (GPD) sworn police officers, Guam Fire Department (GFD) uniformed personnel, Department of Corrections (DoC) custody and security personnel, and the Department of Youth Affairs (DYA) youth service professionals.

Table 3.3-52 summarizes the combined requirements for all such agencies due to the total preferred alternatives action. It indicates a requirement for 318 additional professionals at the 2014 construction peak, and a more stable 116 total professionals for the steady-state operational phase.

Table 3.3-52. Additional Combined Public Safety Professional Staff Required – Summary Impacts

Impact	*2014*	*2020*
Direct	254	98
Indirect	64	18
Total	**318**	**116**

Additional analysis indicates that the construction and operational phase requirements for the individual agencies are as follows (Table 3.3-53).

Table 3.3-53. Professional Staff Requirements for Individual Public Safety Service Agencies

Agency	*Construction staff Requirement*	*Operational Additional Staff Requirement*
GPD	141	60
GFD	77	12
DoC	54	16
DYA	44	28

Other Selected General Services Impacts

The other services selected for analysis were the Guam Department of Parks and Recreation (GDPR), the Guam Public Library System (GPLS), and the Guam Judiciary.

Table 3.3-54 summarizes the combined requirements for these agencies due to the preferred alternatives. It indicates a requirement for 56 additional professionals at the 2014 construction peak, and a more stable 23 total professionals for the steady-state operational phase.

Table 3.3-54. Combined Additional Professional Staff Required for Other Selected General Service Agencies – Summary Impacts

Impact	*2014*	*2020*
Direct	44	19
Indirect	12	4
Total	**56**	**23**

Additional analysis indicates that the construction and operational phase requirements for the individual agencies are as follows (Table 3.3-55).

Table 3.3-55. Additional Professional Staff Requirements for Other Selected General Service Agencies

Agency	*Construction Staff Requirement*	*Operation Additional Staff Requirement*
GDPR	41	17
GPLS	13	5
Judiciary	3	1

Note: Totals may differ slightly from table above due to rounding.

Growth Permitting and Regulatory Agency Impacts

These agencies' work loads are driven by permit requests, generally in advance of actual population growth, as well as by associated monitoring and enforcement actions. The agencies analyzed were the Department of Public Works (DPW) building permits and inspection function, Department of Land

Management (DLM), Guam Environmental Protection Agency (GEPA), the Bureau of Statistics and Plans' (BSP) Coastal Management Program (CMP), GPA, GWA, GFD, GDPR's Historic Preservation Office (HPO), and the DPHSS Division of Environmental Health (DPHSS DEH). In addition, staffing implications for the Guam Department of Labor's (DoL) Alien Labor Processing and Certification Division (ALPCD) were calculated based on the estimated number of temporary foreign worker H-2B visa petitions to be processed.

Table 3.3-56 summarizes the combined requirements for all growth permitting agencies, due to the preferred alternatives. It indicates the peak construction year for increased number of required FTEs is 2012. At 2012, the requirement for additional permitting related FTEs would be 104; this requirement would decline to a more stable 23 total FTEs for the steady-state operational phase.

Table 3.3-56. Additional Combined Professional Staff (FTE) Required for Development Permitting Agencies

Alterative	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Preferred Alternatives	78	95	104	94	73	45	37	23	23	23	23

Note: This table does not distinguish between "direct" and "indirect" impacts as shown in previous tables, because that distinction is less appropriate for this analysis, as growth-related permit reviews occur in advance of the expected actual growth.

Additional analysis indicates that the construction and operational phase requirements for the individual agencies are as listed in Table 3.3-57.

Table 3.3-57. Additional Professional Staff Requirements for Permitting Agencies

Agency	*Construction Years*	*Construction Additional Staff Requirement*	*Steady-State(Operation) Additional Staff Requirement*
DPW	2011	11	1
DLM	2012	14	8
GEPA	2012	29	4
BSP CMP	2013	10	4
GPA	2010-2012	4	1
GWA	2011-2012	7	1
GFD	2011	14	2
GDPR HPO*	2010-2012	4	1
DPHSS DEH	2014	5	2
GDoL ALPCD	2012	16	0

Note: Totals may differ slightly from table above due to variation in peak years.
* The Programmatic Agreement in progress (further described in the Cultural Resources chapter) helps the SHPO with staffing issues by streamlining the Section 106 process. Because staffing requirements to meet federal regulations would be reduced by this agreement, freeing up current staff to work on non-federal projects, the staffing requirements noted in this table may not be as high.

Sociocultural Impacts - Guam

There would likely be impacts on crime and social order, especially during the construction phase, because of the large increase in population. While there is particular concern on Guam, due to media reports about Marine Corps personnel accused of rape and other crimes in Okinawa, the available evidence suggests that military crime rates have been generally low relative to other populations, including civilian populations.

"Community cohesion" refers to positive or negative interactions between individuals or groups. Community cohesion allows people to maintain connections to, and a sense of identification with, their communities. Because of the large influx of populations of different cultural background, including populations from the FAS and military populations, there is potential for cultural conflict, especially in the

opening years of the proposed action. There is potential to mitigate for these conflicts in the long term with cultural awareness and military-civilian outreach programming.

Finally, more non-Chamorro and local voters would potentially affect ongoing and future issues undergoing votes.

Land Acquisition Impacts - Guam

Land acquisition would have both economic and sociocultural impacts on individuals, the community and GovGuam.

While federal regulations regarding land acquisition automatically mitigate for the economic impacts experienced by individual landowners and occupants due to land acquisition, an increase in federally owned or controlled land on Guam, and a reduction in access to lands of sociocultural and recreational importance and possible impacts to the social fabric of the community would result in significant impacts.

Roadway Construction Impacts - Guam

Roadway Construction Effects on Neighborhoods and Businesses

At a neighborhood level, roadway construction can also affect local community cohesion. Because most of the roadway improvements would occur within the existing rights of way (ROW), they would not constitute any new physical or psychological barriers that would divide, disrupt, or isolate neighborhoods, individuals, or community focal points in the corridor. At certain locations, roadway improvements would require the acquisition of additional ROW; however, these would primarily occur adjacent to the existing ROW. Therefore, community cohesion effects would be minimal.

Roadway Construction Effects on Property Acquisition and Relocation

Acquisition of residential, nonresidential, and military property would be required. Residential and nonresidential units would require relocation. Federal and state laws require consistent and fair treatment of landowners (of the property to be acquired), including just compensation for their property. The Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended would be followed.

Roadway Construction Effects on Specific Public Services and Facilities

No adverse effects on public services and facilities are anticipated at the site-specific level.

Summary - Guam

As previously illustrated in text and tables, the socioeconomic impacts of the preferred alternatives would be felt on an island-wide basis and would be characterized by a sharp increase in activity and impacts (both positive and negative) in the 2012-2015 timeframe. Overall, the socioeconomic quality of life on Guam would be substantially impacted for several years. Eventually however, a large part of the population that came in for construction work would leave the island.

Summary impacts would include those associated with rapid population influx due to job opportunities (including large populations from the FAS of Micronesia). These include: shortages in housing and working facilities, public services, and qualified workers, as well as increases in the cost of living.

The Marine Corps component of the action would produce the largest and most significant impacts, due to its relatively greater magnitude. The other components of this action, when combined with the Marine Corps component, would produce an overall impact greater than its separate pieces. Particularly important examples include:

- The decline in overall economic activity following the various components' construction periods.
- The challenges in providing housing for the potential growth in private-sector employees. For example, the housing market would have little problem accommodating the Army action alone; however, the Marine Corps action would strain capacity during the boom period.

While differing in magnitude, each component's construction phase would produce the same types of impacts, summing to significant summary impacts. These would include an increase in economic activity, jobs, GIP, and tax revenue.

During the operational phase, the summary impacts would be characterized by a larger Guam population than now exists, although not so large as would have to be accommodated during the 2012-2015 boom period. Economic growth, job numbers, tax revenue, and requirements for housing and public services would all follow this trend. Each action component would contribute to these impacts relative to its size.

In addition the different characteristics of each action component would have different types of impacts, combining in unique ways during the operation phase.

- The Marine Corps component would continue to impact the island most significantly, increasing the island's permanent military population, and creating the potential for more crime and social disorder, as well as concern about loss of Chamorro and local political autonomy.
- The Aircraft Carrier Berthing component, on the other hand, would increase the military presence on the island in a less permanent, more cyclical manner – producing surges of sailors arriving on Guam for periods of shore leave. Thus, this component would influence civilian-military relations in a slightly different manner, especially as periods of shore leave would produce surges of populations on Guam that would be unfamiliar with the local culture.

Over the long term, Guam's economy and quality of life should be significantly enhanced by the preferred alternatives.

Summary - Tinian

Economic impacts to Tinian would be significant due termination of agricultural leases and loss of access to chili peppers in the training areas and within associated SDZs. There would be some increases in employment due to the construction and operational jobs related to the proposed action. Tinian may also see some benefits that are not noted in Volume 3 – increased population and improved economic conditions in the region could spur increased tourism to Tinian.

Public services on Tinian would not be impacted as population is not expected to increase. Sociocultural issues may be significantly impacted under the No Action Alternative as civilian-military relations may be impaired by a failure of the military to meet long-held expectations of holding a presence on the island.

Table 3.3-58 summarizes the impacts on socioeconomics and general services of all components of the preferred alternatives on Guam and Tinian. However, because socioeconomic impacts are island-wide in nature, the discussion is primarily generic rather than specific to alternatives.

Table 3.3-58. Summary of Preferred Alternatives' Impacts, Guam and Tinian

Resource	*Guam*		*Tinian*	
	Preferred Alternatives	*No Action*	*Preferred Alternatives*	*No Action*
Population Impact	SI/BI	NI	NI	NI
Economic Impact (Overall)	BI	NI	SI	NI
Labor Force	BI	NI	BI	NI
Labor Force Income	BI	NI	NI	NI
Standard of Living	BI	NI	NI	NI
Housing	SI	NI	NI	NI
Local Government Revenue	BI	NI	NI	NI
Local Business Opportunities	BI	NI	NI	NI
Tourism	BI	NI	LSI	NI
Gross Island Product	BI	NI	NI	NI
Utility Rate Payer	LSI (SI)	NI	NA	NA
Loss of agricultural Grazing land in Tinian LBA	NA	NA	SI	NA
Public Service Impact (Overall)	SI	NI	SI	NI
Public Education Services	SI	NI	NI	NI
Public Health and Social Services	SI	NI	NI	NI
Public Safety Services	SI	NI	SI	NI
Other Selected General Services	SI	NI	NI	NI
Growth Permitting and Regulatory Agencies	SI	NI	NI	NI
Sociocultural Impact (Overall)	SI	NI	SI	SI
Crime and Social Order	SI	NI	NI	NI
Chamorro Issues	SI	NI	NA	NA
Community Cohesion	SI	NI	SI	SI
Land Acquisition Impact	SI	NI	NA	NA
Roadway Construction Impacts				
Effects on Neighborhoods and Businesses	SI-M	NI	NI	NI
Property Acquisition and Relocation	SI-M	NI	LSI	NI
Site-Specific Public Services and Facilities Impacts	LSI	NI	NI	NI
Summary of Impacts	**SI(SI)**	**NI**	**SI**	**SI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, BI = Beneficial impact, NA = not applicable, ( ) = Indirect (workforce population and induced) population impact; SI/BI = Population increases have inherently mixed impacts (both beneficial and adverse), because population growth fuels economic expansion but sudden growth also strains government services and the social fabric.

3.3.16 Hazardous Materials and Waste

3.3.16.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-59 and 3.3-60 summarize the preferred alternatives' construction and operation potential impacts to soils, water, air, and biota that hazardous materials and hazardous waste would have on Guam and Tinian. The findings from previous volumes are listed. It is assumed that all of the proposed construction actions would occur during a compressed time period, and that all operational activity would commence upon completion of construction.

Table 3.3-59. Summary of Preferred Alternatives' Construction Impacts – Hazardous Materials and Waste

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Soils	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Waters (Ground & Surface)	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Air	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Biota	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Hazardous Materials and Waste Construction Impact Summary:									**LSI**	**LSI**

Legend: LSI = Less than significant impact

Table 3.3-60. Summary of Preferred Alternatives' Operation Impacts – Hazardous Materials and Waste

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Soils	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Waters (Ground &Surface)	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Air	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Biota	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Hazardous Materials and Waste Operation Impact Summary:									**LSI**	**LSI**

Legend: LSI = Less than significant impact

Guam

The preferred alternative for Guam includes the transport of all necessary supplies, materials, equipment, and expendable and non-expendable resources necessary to perform the Marine Corps, Navy, and AMDTF missions. Without any proposed DoD mission expansion, currently the Defense Reutilization and Marketing Office (DRMO) successfully arranges for the disposal of approximately 594,494 pounds (lbs) (269,658 kilograms [kg]) of hazardous waste annually from DoD Guam operations.

If PCBs, ACM and/or LBP are encountered during demolition, licensed contractors would be used for these projects and comply with all relevant local and federal regulations.

The DRMO, through its contractors, manages, stores, ships, and disposes of hazardous substances (i.e., hazardous materials, toxic substances, and hazardous waste) associated with all DoD installations and operations in Guam. DRMO maintains all required hazardous substances documentation. Furthermore, DRMO contracts with licensed firms for the disposal of these hazardous substances at permitted facilities, typically off-island. However, in the case of asbestos-containing materials (ACM), these materials are disposed of at federal facilities on Guam.

It is expected that the DoD preferred alternatives would result in increased transportation, handling, use, and disposal of hazardous materials and hazardous waste (i.e., an estimated increase of 50% for both).

Potential DoD-related impacts (i.e., to soils, waters, air, and biota) as a result of increases in the use of these substances on Guam from the preferred alternatives would be less than significant.

It is anticipated that the largest increases of hazardous materials would occur primarily from the use of petroleum, oil, and lubricants (POL). Potential hazardous waste increases would include herbicides, pesticides, solvents, corrosive or toxic liquids, paints, and aerosols. Despite expected DoD-related increases in hazardous materials and hazardous wastes, less than significant summary impacts would occur. This conclusion is predicated on the implementation of BMPs and standard operating procedures (SOPs) as discussed in Volumes 2 through 7 and that related plans, procedures, protocol, and permits are updated as necessary. These updates would occur in response to increased demands upon DRMO regarding hazardous substance transportation, handling, storage, usage, and disposal.

The various controls (i.e., BMPs and SOPs) in place to prevent unintended spills, leaks, or releases of these substances (see Volume 7, Chapter 2) include, but are not limited to:

- Spill prevention control and countermeasures plans
- Waste management plans
- Facility response plans
- Stormwater pollution prevention plans
- Hazardous material management plans (e.g., asbestos management plans and lead-based paint management plans, etc.)
- Mandatory personnel hazardous material and hazardous waste training
- Waste minimization plans
- Waste labeling, storage, packaging, staging, and transportation procedures
- DoD waste regulations
- Minimize the use of contaminated sites for new construction. When new projects are planned on sites where contamination and/or MEC has been identified, ensure that the risk of human exposure to contaminated media is minimized through the use of a site-specific health and safety plan, engineering and administrative controls, and appropriate PPE. In addition, as appropriate conduct Phase I and II Environmental Site Assessments prior to construction activities and ensure that designs consider and address contaminated sites as appropriate.
- Ensure that site planning and activities are conducted in accordance with Naval Ordnance Safety and Security Activity (NOSSA) Instruction 8020.15B Explosives Safety Review, Oversight, and Verification of Munitions Responses (DoN 2010).

Furthermore, the preferred alternative's potential increase in hazardous substances would produce less than significant secondary or external effects on Guam's hazardous substance management issues.

Tinian

The CNMI Department of Environmental Quality (DEQ) Hazardous and Solid Waste Management Branch regulates hazardous waste generated within the CNMI. In 1984, the CNMI DEQ adopted the federal hazardous waste regulations under RCRA and the hazardous and solid waste amendments. The CNMI does not have any hazardous waste regulations that are more stringent than USEPA regulations.

When DoD hazardous waste is generated, it is transported to Guam in accordance with DOT regulations to DRMO facilities. Once on Guam, the DRMO arranges for the subsequent transfer and disposal of the hazardous waste off-island at licensed hazardous waste facilities. In the case of ACM, these materials are disposed of at federal facilities on Guam.

For similar reasons described for Guam, the Tinian preferred alternative would result in less than significant summary impacts.

3.3.16.2 No Action

Generally speaking, the trend in hazardous material use is associated with increases in population and industrial activity.

Guam

There are few historical data for Guam on hazardous material, toxic substance, and hazardous waste handling; collectively referred to as hazardous substances. World War II established a high baseline of environmental releases; but overall, the trend in hazardous substance use is associated with increases in population and industrial activity. During the 1970s, there were numerous local and federal environmental regulations enacted to protect human health and the environment and to closely control and regulate the transport, storage, use and disposal of hazardous substances. While the trend in use of hazardous substances is expected to increase over time, regulations currently in place minimize the risk of release to the environment as well as the risk to human health. This trend would continue at a more gradual rate of increase. The impacts are largely related to human activities, but natural events such as typhoons and earthquakes can result in inadvertent releases of regulated hazardous substances.

From 2000 to 2008, the population of Guam rose approximately 1.6% on an average annual basis. This growth in population, and subsequent commercial development, resulted in an increased demand for the transportation, handling, use, and disposal of hazardous substances. The types of Guam businesses that require hazardous substance management and disposal include: ports, airports, hotels, power generation facilities, hospitals, automobile repair facilities, automobile junkyards, gas stations/fueling facilities, underground storage tanks (USTs), dry cleaners, industrial/commercial operations, etc.

These non-DoD generated hazardous substances would be managed in a similar fashion to DoD-generated hazardous substances (i.e., generally disposed of at permitted off-island facilities except, for ACM). In December 1998, the GEPA created its Hazardous Waste Management Program. This Program specifies requirements regarding hazardous substance permitting, collection and treatment, storage, and disposal. In addition, the program requires various inspection, compliance monitoring, enforcement, and corrective actions for hazardous waste-related activities and sites. Furthermore, Guam's *Hasso Guam! Household Hazardous Waste Collection Program*, a component of the Hazardous Waste Management Program, has been successful in collecting and disposing of various hazardous substances. For example, thousands of lead acid car batteries, and thousands of gallons of used paint, have been collected for safe disposal. In addition, under GEPA's Hazardous Waste Management Program, generators of hazardous waste are required to submit annual reports to the GEPA that document the generated hazardous substance quantities, waste codes, disposal facility information, and other pertinent information.

Under no action, the DoD proposed mission expansion on Guam would not occur. However, existing DoD-related hazardous substance management activities would continue. Because of the growth in Guam's population, and the subsequent growth in commercialization, increased quantities of hazardous substances would be required to be managed, even absent the preferred alternatives. The current non-DoD Guam hazardous substance infrastructure is subject to similar hazardous substance management requirements, as implemented by the DoD. Consequently, no action would result in less than significant hazardous substance impacts.

Tinian

For reasons previously described for Guam, the no action alternative on Tinian would result in less than significant impacts.

3.3.16.3 Comparison of Preferred Alternatives to No Action

No action and the preferred alternatives for both Guam and Tinian would result in less than significant impacts to soils, surface water, groundwater, air, or biota, with respect to hazardous materials and hazardous waste. Neither of the scenarios can be classified as having "no impact" because with all operations using hazardous substances, there is a possibility for inadvertent leaks, spills, or releases. Therefore, all the alternatives discussed for Guam and Tinian have been assigned a less than significant summary of impacts. Most of these controls, except the DoD-specific regulations, are also applicable to civilian actions. Prior to the enactment of hazardous waste regulations in Guam or Tinian, wastes were not always managed responsibly and resulted in impacts to the environment. Subsequently, adopted regulations have served to control the number of unauthorized spills, leaks, or release occurrences on Guam and Tinian.

Despite expected increases in hazardous substances, less than significant summary impacts would occur, if the controls discussed above are appropriately implemented. In summary, less than significant impacts (i.e., primary or secondary/external effects) are expected on Guam or Tinian, related to DoD or non-DoD operations relative to the hazardous substances management and disposal.

3.3.17 Public Health and Safety

3.3.17.1 Summary of Preferred Alternatives' Impacts

Tables 3.3-61 and 3.3-62 summarize the preferred alternatives' construction and operation impacts to public health and safety on Guam and Tinian. A text summary follows the tables. The public health and safety analysis included the combined direct and indirect impacts for Volumes 2, 3, 4 and 5. Volume 6 distinguishes between direct and indirect (workforce housing and induced population) impacts and identifies levels of significance for each. For Guam, the greatest level of impact identified among all the volumes is listed in the last Guam column. The summary of impacts for Tinian's preferred alternatives is listed in the far right column of the tables. It is assumed that all of the proposed construction actions would occur during a compressed time period, and that all operational activity would commence upon completion of construction.

Table 3.3-61. Summary of Preferred Alternatives' Construction Impacts – Public Health and Safety

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Operational Safety	NI	NA	NA	NA	NA	NA	NA	NA	NI	NI
Aircraft Mishaps	NI	NA	NA	NA	NA	NA	NA	NA	NI	NI
Explosive Safety	NI	NA	NA	NA	NA	NA	NA	NA	NI	NI
Electromagnetic Safety	NI	NA	NA	NA	NA	NA	NA	NA	NI	NI
Noise	LSI	LSI	NA	NA	NA	NA	NA	NI	LSI	LSI
Water Quality	SI	SI	SI	NA	NA	NA	NA	NI	SI	NI
Air Quality	LSI	LSI	LSI	NA	NA	NA	NA	NI	LSI	LSI
Health Care Services	SI	LSI	SI	NA	NA	NA	NA	NI	SI	NI
Notifiable Diseases	SI	LSI	SI	LSI	LSI	LSI	LSI	NI	SI	NI
Mental Illness	SI	LSI	LSI	NI	NI	NI	NI	NI	SI	NI
Hazardous Substances	NI	NI	NI	NA	NA	NA	NA	LSI	LSI	NI
Traffic Incidents	LSI	NI	NI	LSI	LSI	LSI	LSI	LSI	LSI	NI
Unexploded ordnance (UXO)	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Radiological Substances	NA	NI	NA	NA	NA	NA	NA	NA	NI	NI
Public Services (includes protective services)	SI	LSI	NI	NA	NA	NA	NA	NI	SI	NI
Public Health and Safety Construction Impact Summary:									**SI**	**LSI**

Legend: SI = Significant impact, LSI = Less than significant impact, NI = No impact, NA = Not applicable.

Table 3.3-62. Summary of Preferred Alternatives' Operation Impacts – Public Health and Safety

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste-water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Operational Safety	NI	NA	NA	NA	NA	NA	NA	NA	NI	LSI
Aircraft Mishaps	NI	NA	NA	NA	NA	NA	NA	NA	NI	LSI
Explosive Safety	NI	NA	NA	NA	NA	NA	NA	NA	NI	LSI
Electromagnetic Safety	NI	NA	NA	NA	NA	NA	NA	NA	NI	NA
Noise	SI	LSI	NA	NA	NA	NA	NA	NA	SI	LSI
Water Quality	SI	SI	SI	NA	LSI (SI)	NA	NA	LSI	SI (SI)	NI
Air Quality	LSI	LSI	LSI	LSI	NA	NA	NA	LSI	LSI	LSI
Health Care Services	SI	LSI	SI	LSI (LSI)	LSI (SI)	LSI (SI)	NI	NA	SI (SI)	NI
Notifiable Diseases	SI	LSI	SI	SI (SI)	SI (SI)	SI (SI)	NI	NA	SI (SI)	NI
Mental Illness	SI	LSI	LSI	NI	NI	NI	NI	NA	SI	NI
Hazardous Substances	NI	NI	NI	NA	NA	NA	NA	LSI	LSI	NI
Traffic Incidents	LSI	LSI	NI	LSI (LSI)	LSI (LSI)	LSI (LSI)	LSI (LSI)	LSI	LSI (LSI)	NI
UXO	LSI	LSI	LSI	NA	NA	NA	NA	LSI	LSI	LSI
Radiological Substances	NA	NI	NA	NA	NA	NA	NA	NA	NI	NA
Public Services (includes protective services)	SI	LSI	NI	NA	NA	NA	NA	NA	SI	NI
Public Health and Safety Operation Impact Summary:									**SI (SI)**	**LSI**

Legend: SI = Significant impact, LSI = Less than significant impact, NI = No impact, ( ) = Indirect (workforce population and induced) population impact

The preferred alternatives would have no impact on public health and safety related to operational safety, aircraft mishaps, explosive safety, or electromagnetic safety. Potential noise and air quality impacts on public health and safety resulting from construction and operations of the preferred alternatives would be less than significant.

Existing water supply distribution and wastewater treatment inadequacies could be exacerbated by the influx of construction workers and other induced population resulting in an increase in illness. The Guam Water Authority (GWA) water system infrastructure does not meet the basic flow and pressure requirements for all customers. These conditions can result in microbiological and other contaminants entering the distribution system potentially resulting in illness. GWA water distribution system problems also exist, which may result in customers receiving inadequate supply/service. The DoD acknowledges the existing sub-standard conditions of the potable water and wastewater treatment systems on Guam and the

interest to have DoD fund improvements to these systems. DoD's ability to fund infrastructure improvements is limited by federal law. However, to minimize adverse impacts associated with the proposed military relocation program, the DoD is leading a federal inter-agency effort to identify other federal programs and funding sources that could benefit the people of Guam. The DoD cannot repair GWA distribution system problems but would attempt to identify ways to address them via the federal interagency task force.

While groundwater production rates would increase, implementation of sustainability practices would reduce the amount of groundwater needed, which would help minimize impacts to groundwater availability. The resulting total annual groundwater production would be less than the sustainable yield and monitoring of groundwater chemistry would ensure no harm to existing or beneficial use. However, since it is doubtful that GWA could fund and implement required upgrades to the water system in time for the proposed DoD buildup, it is anticipated that public health and safety impacts from increased demand on potable water and potential water-related illnesses would be significant.

Air emissions of the preferred alternatives would be less than significant. Air pollution can harm individuals when it accumulates in the air in high enough concentrations. Sensitive populations include children, older adults, people who are active outdoors, and people with heart or lung diseases, such as asthma. Because air emission increases would be less than significant, it is anticipated that Guam Clinics and hospital would have adequate staffing to handle air quality-related illnesses; therefore, less than significant impacts to health care services are anticipated.

The population increase with the construction workforce and other induced population would have a potentially significant effect on health care service providers on Guam. During operations, when Guam's population decreases there would continue to be impacts from water- and air-related illness. There is no population increase proposed for Tinian; therefore, there would be no population-related impacts to health and health care services on Tinian.

A potential increase in disease occurrences due to the addition of approximately 21,262 personnel and dependents and 18,374 construction employees (peak construction force in 2014) are anticipated. A natural annual increase of 1.4% in the Guam population is also anticipated, resulting in a population of approximately 201,095 by the year 2019. With the increase in military and dependent personnel, the total Guam population would be approximately 222,357 in 2019. Using the average per capita rates for notifiable diseases on Guam, the potential increase in disease occurrences was estimated based on the natural increase in population and the anticipated arrival of military personnel and their dependants. The construction workforce visiting Guam from other countries to support construction requirements (peak construction force of 18,374 in 2014) would have the potential to contribute notifiable disease incidents during the construction period (2010 to 2016). The largest potential increase in disease occurrences is that of STDs (8% increase/77 new cases annually).

A potential increase in mental illness occurrences due to the addition of 21,262 personnel and dependents, the construction workforce, as well as the natural population increase, would be anticipated. Based on the average per capita rates for mental illness on Guam, the potential increase in mental illness occurrences was estimated based on the natural increase in population as well as the anticipated military personnel moving to Guam. Based on the anticipated 2019 population of Guam, the annual number of mental illness cases could increase by 20 to a total of 247 cases and this is considered a significant impact.

There is no population increase proposed for Tinian; therefore, there would be no population-related disease or mental illness impacts on Tinian. Public health and safety impacts related to hazardous substances would be less than significant.

It is estimated that the annual number of traffic accidents and fatalities could increase based on projected population increases but the impacts are less than significant. Several common factors appear to contribute to liberty incidents including: young personnel, late nights, impaired driving, and alcohol/drugs. Some of the actions that would be implemented to reduce traffic incidents during liberty include:

- Increase awareness training regarding the consequences of drugs and alcohol use;
- Declare specific off-base bars/clubs off-limits;
- Increase Shore Patrol activity; and
- Provide free shuttle bus runs to/from town.

On Guam, any ground disturbance has the potential to disturb UXO; however, there are established SOPs that would be implemented prior to and during construction, which would mitigate the impact to less than significant at the project sites. There would be no impact to public health and safety from radiological substances.

It is anticipated that the GPD and GFD would not be able to increase staffing to meet current service ratios unless the federal inter-agency task force succeeds in finding funding and/or other assistance to help upgrade deficiencies; therefore, significant impacts to police and fire service are anticipated. There is no population increase proposed for Tinian; therefore, there would be no impacts on police or fire services on Tinian.

The DoD acknowledges the existing sub-standard conditions of infrastructure, health care services and protective services on Guam and the interest to have DoD fund improvements to these services. DoD's ability to fund these services is limited by federal law. However, to minimize adverse impacts associated with the proposed military relocation program, the DoD is leading a federal inter-agency effort to identify other federal programs and funding sources that could benefit the people of Guam.

3.3.17.2 No Action

The trends in public health and safety are a function of changes in population and operation, or industries that involve dangerous materials (e.g., hazardous substances, live ammunition, electromagnetic energy, radiological substances). The socioeconomics section describes changes in population over time. As of the most recent U.S. Census of 2000, Guam's population was 154,805. In 2008, the U.S. Census Bureau provided a more recent estimate of Guam's population of 175,877. The island's population has grown significantly since becoming a U.S. Territory. From 1950 to 2000, Guam's population grew at an average rate of 21% per decade (about 2.1% annually). However, the Census Bureau projects that this growth would taper off, possibly due to outmigration rates observed around 2002; this is the same year as the estimates used in Table 3.3-64.

From 1970 to 2000, the population on Tinian increased, but it declined in subsequent years. The two new planned resorts would provide construction and operation employment that may lead to increases in the Tinian population, but in the near-term, population is expected to continue to decline. With the declining population, there would be an anticipated decrease in traffic accidents and notifiable disease incidents. There would be no increased electromagnetic energy risks, radiological risks, or expectations of aircraft mishaps.

Operational Safety

There are industries and operations in the civilian community on Guam and Tinian with inherent risks of accidents (e.g., law enforcement, heavy equipment operations and repair, manufacturing). The accident trends are expected to remain constant.

Aircraft Mishaps

On Guam and Tinian, no action would continue to include a risk of aircraft mishaps at the commercial and military airfields. The risk would increase with increased air traffic via an increase in tourism; the economy would continue to go through cycles of prosperity.

Explosive Safety

Ammunition is used by the civilian population either for recreation (e.g., target practice, hunting) or law enforcement on both islands; the trend in use is expected to remain the same. The military would continue to use ammunition on both islands, but only Guam has storage facilities that generate explosive safety arcs. The quantity of military ammunition stored is driven by mission requirements. The quantity of ammunition used by the civilian population is small relative to the military, and is likely to slowly increase with population growth.

Notifiable Diseases, Mental Health, Traffic Incidents

The increase in population growth on Guam would result in a proportionate increase in notifiable diseases, mental health issues, and traffic incidents. The Tinian health and public services are sub-standard due to lack of funding. This trend is likely to continue in the absence of economic development.

UXO

There are UXOs on non-federal lands in Guam as a result of WWII. The amount of UXO would not change appreciably over time. Earthmoving activities could disturb the UXO; excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions. Construction on Guam requires a health and safety plan; a response to inadvertent discovery of UXO would be included. The appropriate response would be to cease construction, clear the area, call the police, and call DoD explosive safety personnel. If UXO are uncovered during any other activity, the appropriate response would be to call the police.

Tinian was an active battlefield during WWII. As a result of the occupation and defense of the island by Japanese forces, and the assault by Allied/American forces to take the island, unexploded military munitions remain. The risks are similar to those described for Guam.

Radiological Substances

Hospitals and medical clinics use radiology as a diagnostic tool; transport, handling, and disposal of radiological substances are heavily regulated. Presumably, changes in population would result in the proportional changes in the medical use of radiological substances.

3.3.17.3 Comparison of Preferred Alternatives to No Action

On Guam, the potential increase in disease occurrences, mental illness, and traffic incidents, would be very low relative to no action, as shown in Tables 3.3-63 and 3.3-64.

Table 3.3-63. Potential Disease Occurrence Increase, Guam

Disease	*Average Rate*	*Annual Average 1997-2006*	*Preferred Alternative*	*No Action Increase(b)*	*Difference (a)*
AIDS	1/32,678	5	7	6	1
Cholera	1/163,389	1	1	1	0
Dengue	1/163,389	1	1	1	0
Hepatitis C	1/52,706	3.1	4	4	0
Malaria	1/163,389	1	1	1	0
Measles	1/90,772	1.8	2	2	0
Rubella	1/2,768,033	0.2	<1	<1	0
Typhoid Fever	1/233,412	0.7	<1	<1	0
STDs	1/243	671	915	838	77
TB	1/2,416	67.5	95	79	16

Notes: AIDS= Acquired Immune Deficiency Syndrome, STD= Sexually Transmitted Disease, TB= Tuberculosis,
(a) Difference between preferred alternative increase in average number of diseases per year and the no-action alternative increase. (b) Based on natural increase in population.

Table 3.3-64. Potential Traffic Accident Increase, Guam

Accidents	*Average Rate*	*Annual Average 2001-2005*	*Preferred Alternative Increase*	*No Action Increase(b)*	*Difference (a)*
Accidents	1/26	6,651	8,894	8,044	850
Fatalities	1/9,717	18	24	22	2

Notes: (a) Difference between Alternative 2, increase in average number of traffic accidents and fatalities per year and the No Action increase. (b) Based on natural increase in population.

In the absence of the preferred alternative, there are no other notable increases in health and safety risk anticipated on Guam. Under no action, there would continue to be a minor increase in population, and associated increases in disease and traffic incidents. The increases in population on Guam would also result in an increased need for public services (i.e., health care professionals, police, firefighters); anticipated personnel increases for these services would allow current service levels to be maintained. The trend would be the same as it has been in recent history.

On Tinian, there is no appreciable difference between the preferred alternatives and no action, with respect to health and safety issues. The increase in population due to the planned resorts may have a less than significant impact on the Tinian population, but the preferred alternatives would not.

The risk of a radiological or aircraft incident would be higher under the preferred alternative on Guam, as a result of aircraft carrier berthing on the island, and because more military aircraft would be in operation.

Under no action on Tinian, there would be no aircraft carrier berthing actions and the number of aircraft operations would be smaller (limited to minimal civilian and military aircraft operations).

The preferred alternatives on both Guam and Tinian would result in construction, and there would be an increased risk of uncovering UXO; but with appropriate health and safety plans, the risks would be less than significant. Under no action, although there is no significant construction planned, there is always a risk on Guam and Tinian of discovering UXO; therefore, UXO would continue to be a risk resulting in a less than significant impact.

Construction and operational activities associated with the preferred alternative would have the potential to increase noise levels and pollutant emissions, which could result in health impacts to individuals on Guam. The anticipated increases in noise and pollutants are considered less than significant. Because Guam clinics and hospital would increase staffing to meet current health care service ratios and would be capable

of handling a potential increase in air quality- and noise-related illnesses, less than significant impacts would be anticipated from construction and operational activities. The potential impacts of increased noise and pollution on Tinian would be less, due to less construction and fewer operational activities proposed on the island.

3.3.18 Environmental Justice and the Protection of Children

3.3.18.1 Summary of Preferred Alternatives' Impacts

Anticipated disproportionately high and adverse effects in terms of Environmental Justice and Protection of Children, relate to socioeconomics and public health and social services. The populations of interest are low income, racial minority, and children.

If a resource area did not have significant impacts, or impacts were mitigable to less than significant, as analyzed in each individual chapter in Volumes 2 through 6, then it was not further analyzed in the Environmental Justice and Protection of Children chapters. These resources are: geology and soils, water resources, air quality, airspace, biological resources, cultural resources, visual, marine transportation, and hazardous materials and waste.

Construction-related noise and traffic are reduced with implementation of noise and traffic reduction BMPs and proposed mitigation measures, as described in the noise chapter of each volume, Volume 6 for traffic, and as summarized in Volume 7 Chapter 2. Construction would not result in disproportionately high and adverse effects on populations of interest.

Table 3.3-65. Summary of Preferred Alternatives' Construction Impacts – Environmental Justice and the Protection of Children

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Wastewater*	*Solid Waste*	*Off-base Road-ways*		*Training*
Marine Biology	NA	NI	NA	NA	NA	NA	NA	NA	NI	NA
Traffic	NA	NA	NA	NI	NI	NI	NI	NI	NI	NA
Noise	NI	NI	NI	NI	NI	NI	NI	NI	NI	NA
Socio-economics	SI	NI	SI	NI	NI	NI	NI	NA	SI	NA
Public Health/ Public Safety	SI/NI	NI/NI	SI/NI	NI	NI	NI	NI	NI	SI/NI	NI
Environmental Justice Construction Impact Summary:									**SI**	**NI**

Legend: SI = Significant impact, NI = No impact on the entire island, NA = Not Applicable, SI/NI= different impact for public health and public safety.

Proposed roadway improvements would be a beneficial impact to low-income populations living near proposed roadway projects, particularly over the long-term operation of the preferred alternatives. Potentially significant impacts to public health care services and socioeconomics could result in disproportionately high and adverse effects on low-income populations and children of low-income families. These impacts could potentially be reduced with implementation of proposed mitigation measures identified in Volume 2, Chapter 16.

The DoD acknowledges the existing sub-standard conditions of social services on Guam and the interest to have DoD fund improvements to these services. DoD's ability to fund these services is limited by federal law. However, to minimize adverse impacts on public health care and protective services associated with the proposed military relocation program, the DoD is leading a federal inter-agency effort to identify other federal programs and funding sources that could benefit the people of Guam.

Significant impacts to low-income groups could occur on Tinian. Tinian ranchers would be disproportionately impacted by the proposed actions because their grazing rights in the leased land areas would end. Local workers who currently collect and sell wild chili-peppers in the leased area (most of whom are presumably part of the low-income population of the island) would also be disproportionately impacted because their access to these resources would be restricted.

Table 3.3-66. Summary of Preferred Alternatives' Operation Impacts – Environmental Justice and the Protection of Children

Resource Categories	*Guam*									*Tinian*
	Volume 2	*Volume 4*	*Volume 5*	*Volume 6*					*Summary of Impacts*	*Volume 3*
	Marine Corps	*Navy Aircraft Carrier*	*Army AMDTF*	*Power*	*Potable Water*	*Waste water*	*Solid Waste*	*Off-base Road-ways*		*Training*
Marine Biology	NA	NI	NA	NA	NA	NA	NA	NA	NI	NA
Traffic	NA	NA	NA	NA	NA	NA	NA	BI	BI	NA
Noise	NI	NA	NA	NI	NA	NA	NA	NA	NI	NA
Land Use	NI	NA	NA	NI	NA	NA	NA	NA	NI	SI
Recreational Resources	NI	NA	NA	NI	NA	NA	NA	NA	NI	NI
Socio-economics	SI	NI	NI	NI	NI (SI)	NI (SI)	NI	NA	SI (SI)	SI
Public Health/Public Safety	SI/NI	NI/NI	SI/NI	NI/NI	NI (SI)/ NI (SI)	NI (SI)/ NI(NI)	NI/NI	NI/NI	SI (NI)	NI
Environmental Justice Operation Impact Summary:									**SI (SI)**	**SI**

Legend: BI = Beneficial impact, SI = Significant impact, NI = No impact on the entire island, NA = Not applicable; ( ) = Indirect (workforce population and induced) population ; SI/NI= different impact for public health and public safety..

3.3.18.2 No Action

As discussed in Volume 2, U.S. Census (2000) statistics indicate that overall, the population on Guam has a higher percentage of racial minorities, low-income populations, and children, than the continental U.S. While Guam's demographic, social, and economic profile generally contrasts with that of the continental U.S., it is similar to that of other islands in the Pacific. The island has been occupied by foreign nations throughout its history, and its economic struggle has been a historical trend. If the preferred alternatives are not implemented, the potential impacts associated with them would not occur. Much of the island's population would likely continue to struggle with poverty and access to basic quality community services.

The island-wide population would not experience the long-term benefits from roadway infrastructure improvements. Existing inadequate roads and utilities would likely continue to deteriorate, having an adverse and disproportionate impact on disadvantaged residents of Guam.

No land would be acquired by the federal government, and cultural resources that would have had restricted access under the preferred alternative, would remain accessible to Chamorros. Recreational resources, such as the Guam International Raceway and Pagat Trail, would remain accessible to the public. No action would facilitate the continued existence and accessibility of several cultural and historic resources that are valued by residents of Guam.

Tinian's population when compared to a village on Guam with a similar demographic profile (Dededo), and the U.S. population as a whole, has a high percentage of racial minorities and households living in poverty. The trend is expected to remain the same or worsen in the absence of economic development.

3.3.18.3 Comparison of Preferred Alternatives to No Action

The summary impacts of the preferred alternatives would be both beneficial and adverse. The island of Guam is unique in that a majority of the population of Guam meets the criteria for being an Asian Pacific minority group in the context of the overall U.S. population. The majority of residents on Guam are Chamorros, who were the first known cultural group to inhabit the island. Even though Guam has been occupied by several western nations throughout history, the Chamorros have a long and rich cultural history on the island that continues to exist today. Chamorro cultural and historical resources can be found throughout the land, and are valued by the Chamorros as part of their culture and heritage. Because of international agreements that require the proposed action to focus on Guam, and not other locations within the U.S., the evaluation of environmental justice was on whether there are disproportionate adverse effects within the context of alternatives for facility location on Guam. Because of this, it would be impossible for there to be a disproportionate effect from an identified adverse impact based solely on the impact affecting a minority population. Therefore, the analysis for environmental justice on Guam considered whether there is a disproportionate adverse effect on a low-income population or children.

The existing condition of public health care and social services on Guam are sub-standard. Because of this, the population growth associated with the preferred alternative would adversely affect public health care services for low-income people and children of low-income families.

The current roadway infrastructure on Guam is in poor condition. Under no action, roadway infrastructure may improve, but probably over a much longer period of time. Roadway improvements, as part of the preferred alternatives, would have a beneficial impact on low-income residents living near the roadway projects. No action would include some of the roadway improvements described under the preferred alternatives, but the project schedule would be gradual and would extend beyond 2014. The island residents would benefit from roadway improvements island-wide in the long-term.

3.3.19 Summary of Preferred Alternatives' Impacts

Table 3.3-67 summarizes the post-construction operational impacts for each of the resources, as described in Sections 3.3.2 to 3.3.18. These findings are used in the cumulative impact assessment of Chapter 4. The preferred alternatives have potential to significantly impact fifteen resource areas on Guam, and five on Tinian, as indicated by **bold** typeface in the table.

Table 3.3-67. Summary of Operation Phase Impacts of Preferred Alternatives

Resource	*Guam*	*Tinian*
Geological and Soil Resources	**SI-M**	LSI
Water Resources	LSI (SI)	LSI
Air Quality	LSI	LSI
Noise	**SI**	LSI
Airspace	LSI	NI
Land/Submerged Land Ownership	**SI**	LSI
Land/Submerged Land Use	**SI**	**SI**
Recreational Resources	**SI (SI)**	LSI
Terrestrial Biological Resources	**SI-M**	**SI-M**
Marine Biological Resources	**SI-M (SI-M)**	LSI
Cultural Resources	**SI-M**	LSI
Visual Resources	**SI-M**	**SI-M**
Marine Transportation	LSI	NI
Utilities	**SI-M (SI)**	LSI
Off-base Roadways	**SI**	LSI
On-base Roadways	**SI-M**	LSI
Socioeconomics and General Services	**SI (SI)**	**SI**
Hazardous Materials and Waste	LSI	LSI
Public Health and Safety	**SI (SI)**	LSI
Environmental Justice and the Protection of Children	**SI (SI)**	**SI**

Legend: SI = Significant impact, SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, NI = No impact, ( ) = Indirect (workforce population and induced) population impacts, **bold** = significant impacts

3.4 ADDITIONAL SECONDARY EFFECTS

The Guam military relocation and buildup would have direct, indirect, and cumulative effects on the natural and built environment of Guam and Tinian. Indirect impacts resulting from induced population and workforce population are identified earlier in this chapter. This section addresses additional indirect effects that are also referred to as "secondary effects." CEQ regulations and guidelines define secondary effects as follows:

> "Secondary (Indirect) Effects: Effects which are caused by the action and later in time, or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate and related effects on air and water on other natural systems, including ecosystems" (40 CFR 1508.8 [b]).

The military relocation, including short term construction-related and longer term expanded facilities and military activities, would have consequences beyond the direct footprints of the proposed construction projects and extend in time beyond the construction period.

There are few secondary impacts identified for Tinian and they are related to socioeconomics. There would be construction job opportunities for Tinian residents on Guam to support the proposed actions. This would likely be a beneficial economic impact for the families of those workers, assuming some wages are sent to Tinian. There would be no anticipated labor drain on Tinian because there are few existing job opportunities on the island. Tinian's tourism may benefit from the increase in population on Guam associated with the proposed action. Agricultural activities would presumably increase outside the military lease areas to replace the agricultural activities lost when permits are terminated. Additional agricultural homesteads may be required.

A Compatibility Sustainability Study (CSS) is being prepared as a joint effort between GovGuam and the military. The program is managed by the Office of the Governor and is funded through a grant provided by DoD and the Office of Economic Adjustment. The CSS would likely address many of the secondary impacts anticipated under the preferred alternatives. The primary goal of the CSS is to reduce potential conflicts that could occur between military installations and the Guam community, while sustaining economic vitality, accommodating a targeted job development, protecting public health and safety, and maintaining the military mission. The CSS will examine existing land use, growth trends, and development potential. Recommendations and strategies will be developed to promote compatible land use planning. A series of community meetings will be held to collect public input into the process. More information is available online at the following address: http://www.one.guam.gov/. Key resources areas that are likely to be affected by secondary effects on Guam are described below.

3.4.1 Socioeconomics and General Services

Forecasts of economic activities prepared for this EIS include estimates of direct and indirect (secondary) population and employment growth as a consequence of the proposed military buildup. Estimates of indirect employment growth provide a reasonable indicator of secondary effects; new employment opportunities would also create wealth and disposable income that would stimulate spending on new business establishments, employee and family housing, as well as the continual purchasing of other goods and services. This spending and potential development would, in turn, have consequences on land use, and potentially other natural and built environmental systems.

The demand for civilian labor is projected to total up to 7,500 workers in 2010. At the peak of the construction and buildup, total civilian labor is projected to range between 43,000 and 44,000 in 2014. Following this peak, the demand for civilian labor related to the preferred alternatives would return to about 7,000 or so workers, into the foreseeable future. Of this total civilian labor force, approximately 25 to 30% would consist of indirect or secondary jobs. Thus, over 1,500 jobs would be the normal secondary effect of the buildup program and up to over 9,000 jobs would be considered an indirect consequence of the buildup program during the peak of the construction period.

The socioeconomic growth in the civilian sector may require additional education, medical care, police, and fire facilities. The Navy acknowledges that there is the potential for effects on social services, such as educational and medical facilities, due to the added demand on services from DoD military and civilian populations as well as demand from others coming to Guam as a result of potential induced growth that may result from the DoD proposed actions. Additionally, those potential impacts, resulting in increased demands on Guam social services, would also be affected by a possible shift in trained personnel from public and private facilities on Guam to the DoD facilities on Guam. Based upon a proposed 2014 completion date for the Marine Corps realignment effort, efforts have been made to quantify those impacts in the Final EIS. These estimates were prepared using the best available information, but were influenced by several variables, such as possible shifts of trained personnel from public and private facilities on Guam to DoD facilities, that cannot be ascertained at this time. Thus, the quantification of impacts presented in the Final EIS is less than certain. Because DoD may consider a modified timing and sequencing for the relocation of troops through force flow reduction, the quantification of socioeconomic impacts noted in the Final EIS may not occur. Because of difficulties in quantifying such impacts in normal circumstances, much less under a under force flow reduction mitigation scenario, those social service needs on Guam are best addressed by the independent, ongoing, work of the Office of Economic Adjustment in support of the Economic Adjustment Committee's (EAC) development of a Guam infrastructure plan for those social services.

3.4.2 Land Use Planning

A secondary impact of the preferred alternatives would be the need for additional land use planning and zone changes on Guam to reflect the increase in federal land area and changes in land use on federally-controlled land. These plans may have to include a buffer of open space outside the perimeter of federally-controlled lands to avoid impacts on civilian land use. GovGuam's BSP and DLM may have to hire more staff and fund additional land use planning documents.

Most of the secondary growth caused by the military expansion would likely occur in the northern and central part of Guam. The BSP anticipated these secondary effects, and in March 2009, completed the "*North and Central Land Use Plan*" (Plan). The Plan has not been adopted by the legislature. Once adopted, it would likely lead to changes in zoning codes. It was prepared through a public and stakeholder involvement program that intended to capture the vision of the community for future land use development. Implementation of the Plan would promote the quality of life that makes north and central Guam a desirable place to work, live, and visit. While the Plan considered the impacts of the Marine Corps relocation and other proposed actions on Guam, it did not have the advantage of the most current site plans that are presented in this EIS. The ongoing CSS planning effort will address these secondary impacts.

The zoning codes and building codes may have to be updated to include design and building height, and massing criteria to ensure the new civilian development is compatible with surrounding uses, and does not block important scenic views.

3.4.3 Natural Resources

Guam has a fragile, natural environment that has been substantially altered by natural and man-made events. The natural systems that provide functionally viable and valuable forest, coastal, and marine ecosystems, potentially would be impacted by secondary growth. A secondary impact of the buildup on federal lands would be the increased pressure to restore, protect, and preserve natural resources on non-federal lands. Local legislation may have to be more aggressive in providing environmental protection and enforcement. Local and federal agencies may also have to be more aggressive in applying for and obtaining grants and discretionary funds to support the local natural resource managers. Additional funds could be required for watershed management studies, managing geographic information system (GIS) databases, pilot studies, natural resource monitoring, and public education. Labor and facilities would be required to support the Micronesia Biosecurity Plan (described in Chapter 2) that is being developed. Insufficient budget and staff to enforce environmental management programs could be an adverse secondary impact.

3.4.4 Water Quality

The preferred alternatives would implement stormwater management and erosion control BMPs (Chapter 2) and meet regulatory requirements. The potential impacts of the preferred alternatives' construction and operation to surface water are described throughout this EIS. The increase in development on non-federal lands that may result from the increased military presence would require additional oversight by local agencies to ensure that BMPs are implemented and violations are reported and corrected in a timely manner. Additional staffing may be required for reviewing permits, inspections, collecting/testing water quality samples, and reporting of violations and corrective actions. This may be considered an adverse secondary impact on the agencies, but no long-term secondary impact to water resource health was identified.

3.4.5 Utilities

In response to comments from EPA, Guam agencies, and the legislature, DoD provided more detailed analysis of the indirect (workforce housing and induced) population increases. Workforce housing indirect impact is addressed below in Section 3.4.10. Assuming there would be increases in civilian populations and development on Guam, there would also be additional demand on utilities. Legislation may be warranted to set renewable energy programs and goals for the island and provide incentives. This may require additional staffing and budget, or an increase in user fees, resulting in adverse secondary impacts.

Protection of groundwater is a major priority and would be managed to avoid any adverse effects from secondary growth. The Guam Northern Lens Aquifer provides approximately 80% of the island's potable water supply. As much of the development created by secondary growth would be focused in this region, protection of groundwater resources in the Sole Source Aquifer area would be paramount. Demand-side programs may have to be developed to encourage water conservation, similar to the BMPs proposed for the preferred alternatives on federally-controlled land.

3.4.6 Emergency Preparedness

Disaster and emergency preparedness plans would have to be updated. Plans for providing emergency utilities, shelter, and food, based on the anticipated increases in the civilian population, would have to be updated. The secondary impacts can be mitigated to less than significant through planning.

3.4.7 Transportation

Commercial airports and harbors would benefit economically due to the secondary impact of increases in traffic. Policies and procedures may have to be revisited to ensure maximum efficiency and safety. Traffic flow patterns of people or goods through the facilities may require planning updates and additional staffing, but income-generating enterprises are accustomed to responding to economic cycles. The secondary impact would not be adverse.

3.4.8 Recreation, Cultural and Tourist Activities

The anticipated increase in civilians and tourists on Guam could put additional pressure on the use of recreational sites and visits to cultural sites, both of which are typical tourist and local population activities. The GDPR would require staffing and budget to prepare and implement a recreation plan. Additional dive/snorkeling sites and other recreational facilities may have to be constructed and maintained.

Secondary impacts associated with a larger population on Guam might include increased vandalism of recreational and cultural sites; not necessarily from the military and their dependents.

3.4.9 Cultural Ties to the Land

Volume 2, Section 1.1.2.4 describes the sociocultural value of land to Chamorros. Contemporary land issues on Guam with most relevance to the proposed action are federal land ownership and land access, with the cultural value of land underpinning both these issues.

Many members of the native Chamorro population of Guam and their elected or self appointed representatives feel that their culture is bearing an unfair burden of impact from the proposed action, especially in the continued loss of public and private land ownership and access to these lands. Importantly, these lands are sources of various attributes and resources with cultural significance.

Both land and submerged lands, and the resources that are available on or in those areas, have been identified as a source of health and sustenance for the Chamorro people. Volume 2, Chapter 12 Cultural

Resources identifies various plants traditionally used for medicinal purposes by the *suruhanu*, who are "spirit counselors" or "medicine men" of the native Chamorro culture, whose knowledge was passed down from previous generations (usually orally). Land on Guam also provides the value of cultural heritage and existence to the native Chamorro community. The inheritance of family properties is a continuing aspect of Chamorro culture that remains evident in the current land tenure system on the island.

Regardless of actual legal ownership designations, land on Guam also represents to native Chamorros a sense of place. The island of Guam is often referred to by them as *Tano y Chamorru* or the land of the Chamorro, a reference not to land ownership in the Western sense, but to spiritual ties that a people feel for their cultural birthplace – in other words, where they belong.

The land of the ancient Chamorro is still inhabited by the spirits of the ancestors today, and these *taotaomo'na* are believed to protect and watch over the people and the land. This land is also believed to be inhabited by *aniti* or spirits of the deceased who can bring misfortune if one disrespects the ancestors or the dead. Banyan trees or *tronkon nunu* are particularly avoided in the jungle, especially after dark, and permission to disturb these areas must be asked of the spirits who inhabit them. For those who fail to do so, "It is believed that the *taotaomo'na* that inhabit the space will cause them harm or make them fall ill if they do not show proper respect for the land." (Mendiola 2010) To disturb the land and its native jungle without spiritual permission therefore, is to disturb not only the resting place of the ancestors and the spirits of one's own deceased, but the very body of the gods Puntan and Fu`una who left this land and its resources to the Chamorro people.

The proposed action would have an adverse impact on the land and the Chamorro culture. The cultural ties to the land are also identified in Volume 7, Chapter 4 as a cumulative impact.

3.4.10 Workforce Housing

Analysis in Volumes 2 through 6 of the EIS and presented earlier in this chapter identifies the environmental impacts from the construction worker population associated with the proposed action. Volume 1, Section 4.15 identifies housing proposals for the construction workforce on Guam as an indirect impact of the proposed action and provides assessment of environmental impacts that would result from nine workforce housing proposals. This assessment includes figures illustrating the locations of the housing areas. The assessment identifies mitigation measures that could avoid or reduce impacts; these measures are listed in Volume 7, Chapter 2, Table 2.2-1 under the Workforce Housing category. Workforce housing is not proposed by and would not be constructed by DoD; however, DoD has influence over some mitigation measures associated with workforce housing through provisions in the acquisition process for projects included in the proposed action, as indicated in Volume 1, Section 4.15 and Section 2.4 of this volume. The assessment of workforce housing in Volume 1 is based on information in permit applications from private developers to GovGuam regulatory authorities. Several applications have been approved and one workforce housing project is under construction, as of the preparation of this EIS. The following is a summary of potential impacts from workforce housing identified in the assessment in Volume 1, Section 4.15:

Less than significant impacts. The following resources would have a less than significant impact (see Volumes 2 through 6 and the earlier assessment in this chapter for discussion of impacts from construction workforce population): geological and soil resources, water resources, air quality, noise, land and submerged land use (based on the assumption that any workforce housing development must satisfy GovGuam zoning and land use conditions and be approved by GovGuam in order to proceed), terrestrial biological resources, visual resources, socioeconomics and general services, public health and safety, and hazardous materials and waste.

Recreational Resources. Recreational resources in northern and central Guam would experience negative effects (e.g., crowding, deterioration of resources, competition for use/space, and etc.) associated with simply having more users on their resources. This includes effects to National Park Service units associated with the War in the Pacific National Historic Park. Increased visitation associated with direct, indirect, and induced population increases would affect park resources, values, facilities, and other users. Similar to the Marines and their dependents, heavier user presence is expected on weekends and holidays since workers would be working otherwise.

Marine Biological Resources. Indirect negative effects from increased recreational activities (high speed water craft/boating, fishing, tidal harvesting, diving, etc.) in the nearshore environment may be seen islandwide. Significant impacts to special-status species, such as sea turtles, and the coral reef ecosystems may occur from increased use of this resource by construction workers; the magnitude of impacts is directly related to the increase in recreational use. Damage to reefs may be long-term if caused by anchors, reef-walkers, or reckless dive or snorkel activities, resulting in an adverse effect on EFH.

Cultural Resources. Significant adverse impacts to archaeological sites could result from construction at the workforce housing sites, particularly impacts associated with ground excavation and soil removal. Vandalism of archaeological sites from the workforce population could be of particular concern with Area 1 workforce housing because of the site's location near the coast area, which has a high probability of containing archaeological sites. The workforce housing may remove natural resources of cultural concern (See Chapter 4, Cumulative Impacts). Mitigation measures may reduce cultural impacts.

Utilities. Currently, the water systems of GWA are considered barely adequate to meet current demands (see Volume 6 for detailed utilities analysis). Some of GWA's groundwater extraction wells have experienced increasing salinity and pumping from these wells has been ceased to allow the aquifer to locally relax and restore the fresh water/salt water separation. DoD has its own water system, which currently has excess water production capacity. As discussed in Section 4.3.2., above, DoD has been meeting with GWA and is establishing a memorandum of agreement for the transfer of the excess water to GWA via current and proposed interconnections between the two systems.

Areas 1 and 2 of the currently proposed workforce housing facilities would use the Northern District Wastewater Treatment Plant (NDWWTP).The other proposed locations would use the Hagatña Wastewater Treatment Plant (WWTP). Effluent from the NDWWTP is currently not meeting all NPDES permit requirements. Average daily influent is also very close to permitted limits, with peak daily influent exceeding permitted limits. Thus, the addition of workforce housing would exacerbate this exceedance and potentially cause exceeding the actual average daily influent. However, the original physical design capacity of the NDWWTP is 12 million gallons per day (MGd) average daily influent and 27 MGd peak daily influent. Current physical capacity has been estimated at approximately 7.96 MGd. Thus with permit modifications, the NDWWTP should be able to handle the increased demand from workforce housing even prior to implementation of the preferred wastewater alternative. Sewer collection systems serving the NDWWTP are aged and reportedly in poor shape. Thus, sewer upgrades and system expansions would be needed to serve the proposed workforce housing facilities. The Hagatña WWTP has recently been refurbished, but is still operating without meeting the requirements of its NPDES permit. The capacity of the Hagatña WWTP is adequate to handle the additional demand from the currently proposed workforce housing facilities; however, permit modifications are needed to allow for higher peak flows as the plant is currently exceeding those permitted levels. The effluent pump also requires repair as it is not operational. This can cause effluent backup during certain tidal conditions. The sewer collection system serving this area are aged and reportedly in poor shape. Thus sewer upgrades and system expansions would be needed to serve the proposed workforce housing facilities.

The financial and technical capabilities of GWA are deemed marginal and may not allow GWA to successfully prepare the infrastructure to provide adequate water and wastewater service to some of the proposed workforce housing facilities. For these reasons, the impacts of workforce housing on the water utility are assessed as significant. The GWA distribution system is not in good shape and may not be able to adequately deliver this additional water. Depending on the location of the selected workforce facilities, the localized GWA distribution system may require new installations, upgrades, and/or repair. DoD does not know enough specifics of the GWA water system to evaluate in detail which workforce housing facility locations would face the largest challenges in providing adequate water service.

Roadways. Impacts to roadways are addressed in Volume 6 and earlier in this chapter. There would be impacts to roadways and traffic from workforce housing, although these impacts would be minimized by GovGuam's requirements for employers to provide transportation to and from worksites and contract requirements imposed by the DoD. Table 4.15-3 in Volume 1 identifies the expected travel routes between the various workforce housing sites and NCTS Finegayan, where most of the proposed construction activity would occur. Areas 1 and 2 are located in the North Region, where the majority of the workforce is expected to be housed, allowing for a relatively short commute to Finegayan.

Environmental Justice and the Protection of Children. The proposed workforce housing would be located on an island with high percentages of minority and low income population and children as compared with the U.S. population. Potentially significant impacts related to workforce housing that may result in disproportionately high and adverse impacts to low-income populations include socioeconomics, potable water, and wastewater impacts. Potentially significant health and safety risks associated with socioeconomics, potable water, and wastewater impacts may also disproportionately affect children.

3.5 SUMMARY OF CLEAN WATER ACT SECTION 404 ACTIONS - ALL PROPOSED ACTIONS AND ALTERNATIVES

The summary of impacts on wetlands and jurisdictional waters of the U.S. for the preferred alternatives is contained in the Water Resources sections in Volumes 2 through 6 of this EIS by geographic locations and action proponent. A summary of all potential impacts to wetlands and jurisdictional waters of the U.S. is provided in this section.

Secondary effects could include 1) degradation of natural conveyance functions of waters of the U.S., 2) alteration of sediment mobilization, transport, and deposition processes, and 3) habitat fragmentation and degradation of ecosystem processes.

There are potential direct effects under some alternatives, due to filling of wetlands and the potential for increased turbidity from nearby construction. Most of the land-based construction is proposed in the north and central areas of Guam, which have far fewer wetlands and streams than the Apra Harbor and south Guam areas. BMPs and proposed mitigation measures to minimize and avoid impacts are summarized in Volume 7, Chapter 2. Table 3.5-1 summarizes the potential impacts for all alternatives, and the preferred alternatives are indicated by **bold** typeface. Figure 3.5-1 identifies the locations of these potential impacts for the preferred alternative only.

Three actions would occur at Apra Harbor: 1) Inner Apra Harbor wharf improvements and dredging, 2) Inner Apra Harbor ramps for the Landing Craft Air Cushion (LCAC) laydown area, and 3) new berthing for a transient aircraft carrier at the entrance to Inner Apra Harbor. Indirect temporary impacts to wetlands are anticipated during construction of GRN projects numbered 3 and 35, and a replacement water main.

Potential impacts to coastal caves due to the fresh water level fluctuations in the aquifer were identified as potential impacts to jurisdictional waters, but there are insufficient data to assess potential impacts. The

impacts would be associated with all alternatives. In the Draft EIS, potential wetlands were identified on Tinian within the preferred alternative footprint. These wetlands were not field verified or delineated and may not be jurisdictional wetlands. Field studies will confirm the location of the wetlands and the final design of the ranges would avoid impacts to the wetlands.

Table 3.5-1. Clean Water Act Section 404 Actions: Summary of Potential Impacts for All Alternatives

Volume	*Alternative*	*Component (Figure 3.5-1 ID#)*	*Type and Area (ac/ha) of Impact*				*Impacted Feature*
			Direct	*Indirect*	*Temp.*	*Perm.*	
Marine Corps – Guam (Vol. 2)	**All**	**LCAC Ramps (2)**	**0.02 ac (<0.01 ha) fill**			●	**Inner Apra Harbor**
	All	**Dredging –Sierra Wharf (1)**	**327,000 cy (250,000 m^3)**	**ND**	●	**-**	**Inner Apra Harbor**
	NMS Option A (improved)	NMS Access Road	No impacts				
	NMS Option B (unimproved)	**NMS Access Road**	**No impacts**				
	Main Cantonment Alt. 2	**No impacts**					
	Main Cantonment Alt. 3, 8	AF Barrigada	2.4 ac (1.0 ha) fill	-	-	●	Palustrine wetlands
Marine Corps Training-Tinian (Vol. 3)	**1**	**No impacts**					
	2	No impacts					
	3	No impacts					
Navy –Aircraft Carrier Wharf (Vol. 4)	**Polaris Point (Alt. 1)**	**Dredging (3)**	**608,000 cy (466,000 m^3)** **53 ac (21.5 ha) dredge footprint area**	**46 ac (18.7 ha) 200 m coral buffer**	**-**	**25 ac (10 ha) coral loss (2-dimensional)** **33 ac (13 ha) coral loss (3-dimensional)**	**Outer Apra Harbor**
	All	**Wharf Pilings & Riprap (3)**	**3.6 ac (1.4 ha) fill**	**-**	**-**	●	**Outer Apra Harbor**
	Former SRF (Alt. 2)	Dredging	479,000 cy (366,000 m^3) 44 ac (17.9 ha) dredge footprint area	47 ac (19.1 ha) 200 m coral buffer	●	24 ac (10 ha) coral loss (2-dimensional) 32 ac (13 ha) coral loss (3-dimensional)	Outer Apra Harbor

Volume	*Alternative*	*Component (Figure 3.5-1 ID#)*	*Type and Area (ac/ha) of Impact*				*Impacted Feature*
			Direct	*Indirect*	*Temp.*	*Perm.*	
Army (Vol. 5)	**1**	**No impacts**					
	2	No impacts					
	3	AF Barrigada	2.4 ac (1.0 ha) fill	-	-	●	Palustrine wetlands
Related Actions (Vol. 6)	**Power Interim 1**	**No impacts**					
	Power Interim 2	No Impacts					
	Power, Interim 3	No impacts					
	Water Basic Alt. 1	**Water main line (6)**	**-**	**ND**	●	**-**	**Palustrine wetlands**
	Water Basic Alt. 2	Water main line	-	ND	●	-	Palustrine wetlands
	Wastewater Basic Alt. 1a	**No impacts**					
	Wastewater Basic Alt. 1b	No impacts					
	Solid Waste	**No impacts**					
Related Actions (Vol. 6)	**Marine Corps-Guam All**	**Agana Bridge-GRN # 3 (5)**	**0.13/ 0.05**	**ND**	●	●	**Agana River between Agana Bridge and the river terminus (260-ft stream length) at West Hagatna Beach.**
		Antantano Bridge - GRN # 35 (4)	**0.12/ 0.05**	**ND**	●	●	**Antantano River between Antantano Bridge and river terminus (1,600-ft streambed length) at Inner Apra Harbor.**
		Aguada Bridge - GRN # 35 (4)	**0.09/ 0.04**	**ND**	●	●	**Aguada River between Aguada Bridge and river terminus (1,150-ft streambed length) at Sasa Bay**
		Asan Bridge # 2 - GRN # 35 (4)	**0.18/ 0.07**	**ND**	●	●	**Asan River between Asan Bridge # 1 and river terminus (320-ft streambed length) at Asan Bay.**
		Asan Bridge # 2 - GRN # 35 (4)	**0.16/ 0.06**	**ND**	●	●	**Asan drainage between culvert and drainage terminus (99 ft streambed length) at Asan Bay.**
		Fonte Bridge-	**0.27/ 0.11**	**ND**	●	●	**Fonte River between Anantano**

Volume	*Alternative*	*Component (Figure 3.5-1 ID#)*	*Type and Area (ac/ha) of Impact*				*Impacted Feature*
			Direct	*Indirect*	*Temp.*	*Perm.*	
		GRN # 35 (4)					**Bridge and river terminus (290-ft streambed length) at East Hagatna Beach.**
		Laguas Bridge -GRN # 35 (4)	**0.13/ 0.05**	**ND**	●	●	**Laguas River between Laguas Bridge and river terminus (800-ft streambed length) at Sasa Bay / Sasa Bay Marine Preserve.**
		Sasa Bridge-GRN # 35 (4)	**0.14/ 0.06**	**ND**	●	●	**Sasa River between Sasa Bridge and river terminus (1,600-ft streambed length) at Sasa Bay / Sasa Bay Marine Preserve.**

Legend: **Bold** = Preferred alternatives, ND = Not determined; temporary impacts not quantified; - = No impact; ● = impact; (2) = Figure 3.5-1 Location number.

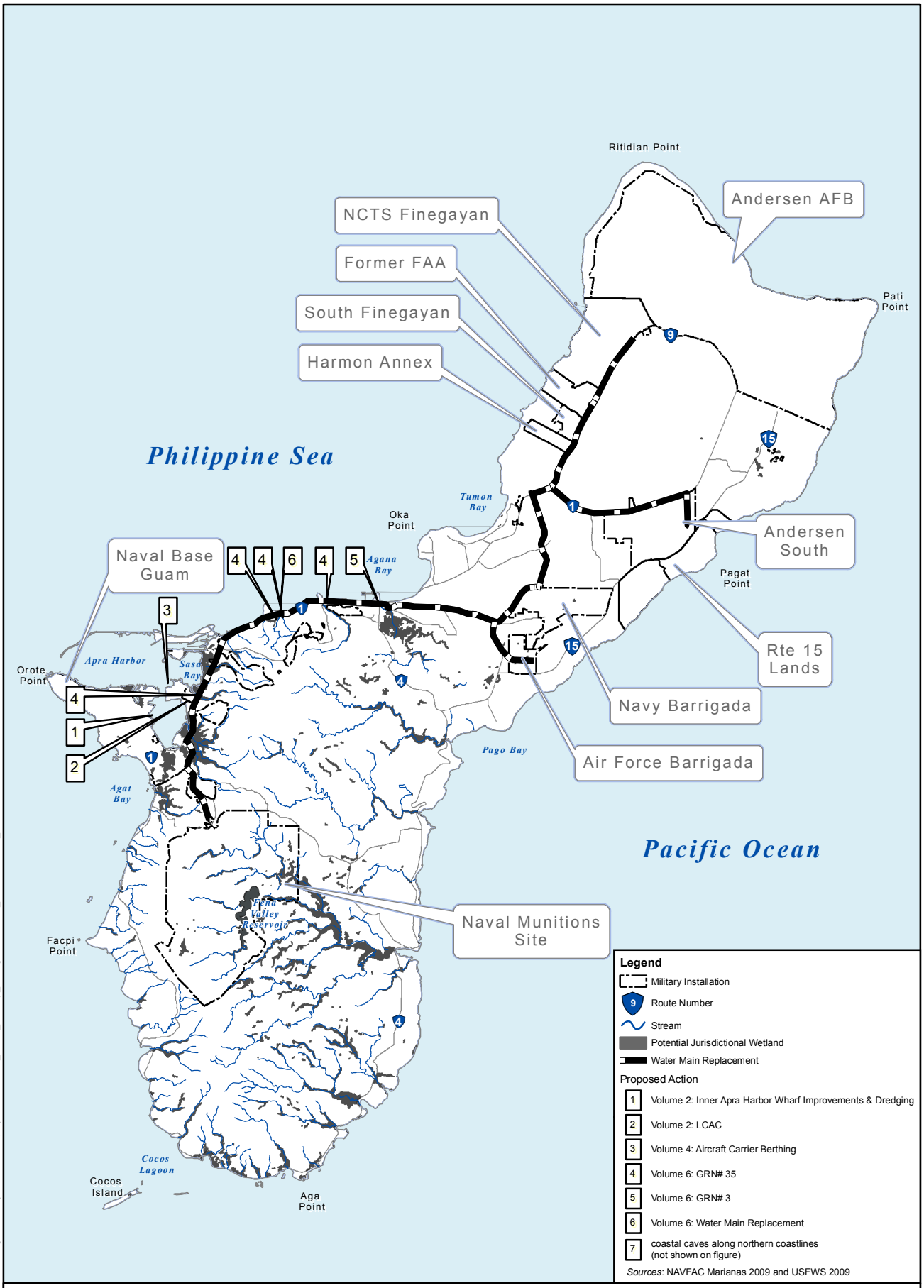

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Figure 3.5-1
Proposed Actions with Potential to Impact Wetlands and Jurisdictional Waters

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