CHAPTER 13. MARINE BIOLOGICAL RESOURCES

13.1 INTRODUCTION

This chapter contains a discussion of the potential environmental consequences associated with implementation of the alternatives within the region of influence (ROI) for this resource. For a description of the affected environment for all resources, refer to the respective chapter of Volume 2 (Marine Corps Relocation – Guam). The locations described in that volume include the ROI for the utilities and roadway projects, and the chapters are presented in the same order as the resource areas contained in this volume.

13.2 ENVIRONMENTAL CONSEQUENCES

13.2.1 Approach to Analysis

13.2.1.1 Methodology

Utilities

The methodology for identifying, evaluating, and mitigating impacts to marine biological resources was based on federal laws and regulations including the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), Magnuson-Stevens Act (M-SA), Section 404(b)(1) of the Clean Water Act (CWA), and Executive Order (EO) 13089, *Coral Reef Protection*. Significant marine biological resources include all special-status species including species that are ESA-listed as threatened and endangered or candidates for listing under ESA, species protected under the MMPA, or species with designated EFH or Habitat Areas of Potential Concern (HAPC) established under the M-SA. The M-SA defines EFH as "...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." 'Waters' include aquatic areas and their associated physical, chemical, and biological properties that are used by fish. 'Substrate' includes sediment, hard bottom, structures underlying the waters, and associated biological communities. 'Necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem, and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle (16 USC 1801 et seq.). Additionally, at least one or more of the following criteria established by the National Marine Fisheries Service (NMFS) must be met for HAPC designation: 1) the ecological function provided by the habitat is important; 2) the habitat is sensitive to human-induced environmental degradation; 3) development activities are, or will be, stressing the habitat type; or 4) the habitat type is rare. It is possible that an area can meet one HAPC criterion and not be designated an HAPC. The Western Pacific Regional Fisheries Management Council (WPRFMC) used a fifth HAPC criterion, not established by NMFS, that includes areas that are already protected, such as Overlay Refuges (WPRFMC 2005). Section 404(b)(1) Guidelines (Guidelines) of the CWA is in essence a Memorandum of Agreement (MOA) between the United States (U.S.) Environmental Protection Agency (USEPA) and U.S. Department of the Army (Army), to articulate policies and procedures to be used in the determination of the type and level of mitigation necessary to demonstrate CWA compliance. The MOA is specifically limited to the Section 404 regulatory program and does not change substantive Section 404 guidance. The MOA expresses the intent of the Army and USEPA to implement the objective of the CWA to restore and maintain the chemical, physical, and biological integrity of the Nation's waters, including special aquatic sites (SAS). SAS are those sites identified in 40 CFR 230, Subpart E (i.e., sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes). They are geographic areas, large or small, possessing special ecological characteristics of

productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region.

In general, the main intentions of the three federal acts listed above are as follows:

- The ESA establishes protection over and conservation of threatened and endangered species and the ecosystems upon which they depend, and requires any action that is authorized, funded, or carried out by a federal entity to ensure its implementation would not jeopardize the continued existence of listed species or adversely modify critical habitat.
- The MMPA was established to protect marine mammals by prohibiting take of marine mammals without authorization in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.
- The M-SA requires NMFS and regional fishery management councils to minimize, to the extent practicable, adverse effects to EFH caused by fishing activities. The M-SA also requires federal agencies to consult with NMFS about actions that could damage EFH.
- The CWA Guidelines set forth a goal of restoring and maintaining existing aquatic resources, including SAS (i.e. coral reefs, wetlands etc.).

The ESA, MMPA, and M-SA require that NMFS and/or the USFWS be consulted when a proposed federal action may adversely affect an ESA-listed species, a marine mammal, EFH or HAPC. In addition, while all habitats are important to consider, 'coral reef ecosystems' are perhaps the most important habitats and the analysis of this SAS is included under EFH. As a note, EO 13089 also mandates preservation and protection of U.S. coral reef ecosystems that are defined as "… those species, habitats and other natural resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction and control of the U.S.".

The CWA guidelines and the subsequent MOA require the USEPA and Army to implement the objectives of the CWA. For dredging activities, the U.S. Army Corps of Engineers (USACE) first makes a determination that potential impacts have been avoided to the maximum extent practicable (striving to avoid adverse impacts); remaining impacts would be mitigated the extent appropriate and practicable by requiring steps to reduce impacts; and finally, compensate for aquatic resource values. This sequence is considered satisfied where the proposed mitigation is in accordance with specific provisions of a USACE and USEPA approved comprehensive plan that ensures compliance with the compensation requirements of the Guidelines Determination of Significance.

13.2.1.2 Determination of Significance

This section analyzes the potential for impacts to marine biological resources from implementation of the action alternatives and the no-action alternative. Factors considered in the analysis of potential impacts to marine biological resources include: (1) importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource; (2) proportion of the resource that would be affected relative to its occurrence in the region; (3) sensitivity of the resource to proposed activities; and (4) duration of ecological ramifications. The factors used to assess significance of the effects to marine biological resources include the extent or degree that implementation of an alternative would result in permanent loss or long-term degradation of the physical, chemical, and biotic components that make up a marine community. The following significance criteria were used to assess the impacts of implementing the alternatives:

- The extent, if any, that the action would diminish suitable habitat for a special-status species or permanently lessen designated EFH or HAPC for the sustainment of managed fisheries.

- The extent, if any, that the action would disrupt the normal behavior patterns or habitat of a federally listed species, and substantially impede the Navy's ability to either avoid jeopardy or conserve and recover the species.
- The extent, if any, that the action would diminish population sizes or distribution of special- status species or designated EFH or HAPC.
- The extent, if any, that the action would be likely to jeopardize the continued existence of any special-status species or result in the destruction or adverse modification of habitat of such species or designated EFH or HAPC.
- The extent, if any, that the action would permanently lessen physical and ecological habitat qualities that special-status species depend upon, and which partly determines the species' prospects for conservation and recovery.
- The extent, if any, that the action would result in a substantial loss or degradation of habitat or ecosystem functions (natural features and processes) essential to the persistence of native flora or fauna populations.
- The extent, if any, that the action would be inconsistent with the goals of the Navy's Integrated Natural Resources Management Plan (INRMP).
- The MMPA generally defines harassment as Level A or Level B, and these levels are defined uniquely for acts of military readiness such as the proposed action. Public Law 108-136 (2004) amended the MMPA definition of Level A and Level B harassment for military readiness events, which applies to this action.
- Level A harassment includes any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild.
- Level B harassment is now defined as "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behaviors are abandoned or significantly altered." Unlike Level A harassment, which is solely associated with physiological effects, both physiological and behavioral effects may cause Level B harassment.

ESA specifically requires agencies not to "jeopardize" the continued existence of any ESA-listed species, or destroy or adversely modify habitat critical to any ESA-listed species. Under Section 7, "jeopardize" means to engage in any action that would be expected to reduce appreciably the likelihood of the survival and recovery of a listed species by reducing its reproduction, numbers, or distribution. Section 9 of the ESA defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect.

Effects determination for EFH are either "no adverse effect on essential fish habitat" or "may adversely affect essential fish habitat" (WPRFMC 2005). Pursuant to 50 CFR 600.910(a), an "adverse effect" on EFH is defined as any impact that reduces the quality and/or quantity EFH. Adverse effects to EFH require further consultation if they are determined to be permanent versus temporary (NMFS 1999). To help identify Navy activities falling within the adverse effect definition, the Navy has determined that temporary or minimal impacts are not considered to "adversely affect" EFH. 50 CFR 600.815(a)(2)(ii) and the EFH Final Rule (67 FR 2354) were used as guidance for this determination, as they highlight activities with impacts that are more than minimal and not temporary in nature, opposed to those activities resulting in inconsequential changes to habitat. Temporary effects are those that are limited in duration and allow the particular environment to recover without measurable impact (67 FR 2354). Minimal effects are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions (67 FR 2354). Whether an impact is minimal would depend on a number

of factors (Navy 2009a):

- The intensity of the impact at the specific site being affected
- The spatial extent of the impact relative to the availability of the habitat type affected
- The sensitivity/vulnerability of the habitat to the impact
- The habitat functions that may be altered by the impact (e.g., shelter from predators)
- The timing of the impact relative to when the species or life stage needs the habitat

The analysis of potential impacts to marine biological resources considers direct, indirect, and cumulative impacts. The *Council on Environmental Quality (CEQ)*, *Section 1508.08 Effects,* defines direct impacts as those caused by the action and occurs at the same time and place, while indirect impacts occur later in time or farther removed in distance, but are still reasonably foreseeable. CEQ defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other action".

Direct impacts may include: the removal of coral and coral reef habitat, the "taking" of special-status species, increased noise, decreased water quality, lighting impacts resulting from construction or operation activities.

Indirect impacts, for the purposes of this evaluation, may include any sedimentation/siltation of coral reef ecosystems resulting from construction or operational activities (i.e., dredging, resuspension of sediment via propeller wash), recreational activities in the vicinity of the resource that may lead to impacts to special-status species and EFH.

If marine biological or aquatic resources could be significantly impacted by proposed project activities, potential impacts may be reduced or offset through implementation of appropriate Best Management Practices (BMPs) and/or mitigation measures. "Significantly" as used in NEPA Per (per 43 FR 56003, Nov. 29, 1978; 44 FR 874, Jan. 3, 1979) requires considerations of both context and intensity:

- Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.
- Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

    1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect will be beneficial.
    2. The degree to which the proposed action affects public health or safety.
    3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
    4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places (NRHP) or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973.
10. Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

Impacts associated with the fouling communities within Inner Apra Harbor (repair of waterfront facilities) were not included in the Habitat Equivalency Analysis (HEA) Volume 9. These communities are not considered to be coral reef (per USACE definition of what constitutes a coral reef), and therefore are not subject to compensatory mitigation.

Off Base Roadways

The approach to analysis for assessing potential impacts of proposed road projects is the same as the approach to analysis described above for utilities.

The affected environment for marine biological resources for the proposed roadway improvement projects on Guam is described in Volume 2 Chapter 11. Many of the road projects proposed do not occur near streams or marine environments, therefore, no direct or indirect impacts to marine biological resources (i.e., marine flora, invertebrates and associated EFH, fish and associated EFH, special-status species, and non-native species introductions) are anticipated. Projects were excluded from further analysis if they were proposed in areas not adjacent to or away from coastlines and drainages so that direct and indirect effects of the new road would not impact marine resources downstream. As an example, the proposed relocation of Route 15 does not occur over any, streams or drainages areas and would be surrounded by ample corridors of vegetation. These two factors would obviate inclusion in the analysis because they mitigate the effects associated with increased impervious cover and runoff.

However, some of the proposed projects include bridge refurbishing near Apra Harbor, where the proposed improvements would occur near streams that may impact coastal waters. Because these projects may indirectly affect marine biological resources downstream they will be discussed in this section where appropriate. In summary, only indirect impacts from certain GRN projects are anticipated and analyzed.

13.2.1.3 Issues Identified During Public Scoping Process

The following analysis focuses on possible effects to marine biological resources that could be impacted by the proposed action. As part of the analysis, concerns relating to marine biological resources that were

mentioned by the public, including regulatory stakeholders, during scoping meetings were addressed. A general account of these comments includes the following:

- Potential impacts on the Apra Harbor marine environment from aircraft carrier berthing, fully documenting impacts from dredging (acreage and ecosystem characteristics of affected area, depth of dredging operations, duration of affects)
- Potential impacts to endangered species (including nesting habitats), species of concern, and federal trust species such as corals and marine mammals
- Potential impacts from military expansion from all project sites on the marine resources, including removal or disturbance of the marine habitat
- Impacts to culturally significant marine-related areas for subsistence fishing and beliefs
- Increased "high impact" recreational use that would damage the ecosystem and impact fish habitat (e.g., Sasa Bay Marine Reserve)
- Increased land runoff impacting beaches and marine life (erosion and sediment stress)
- Increased anthropogenic factors impacting the coral reef ecosystem and concerns about the education and training that would be provided for newly arriving military and their dependents regarding reef protection
- Potential mitigation measures and non-structural alternatives to avoid and minimize impacts to coral reefs

13.2.2 Power

13.2.2.1 Interim Alternative 1 (Preferred Alternative)

Interim Alternative 1 would recondition existing combustion turbines and upgrade T&D systems and would not require new construction or enlargement of the existing footprint of the facility. This work would be undertaken by the GPA on its existing permitted facilities. Reconditioning would be made to existing permitted facilities at the Marbo, Yigo, Dededo No. 1, and Macheche combustion turbines. These combustion turbines are not currently being used up to permit limits. T&D system upgrades would be on existing above ground and underground transmission lines. This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

It is anticipated that these units would require general overhaul, capabilities testing, and controlled startup that could take up to 12 months. The amount of reconditioning would not be known until the units are inspected and tested. Upgrades would also be required to the distribution system. No direct impact to marine biological resources is expected by this alternative. Indirect impacts include increased maritime traffic transporting construction materials into Apra Harbor for distribution. This "vessel movement" impact is described in detail in Volume 2, Chapter 11.

Alternative 1 would result in less than significant impacts to marine biological resources. Table 13.2-1 summarizes the sensitive months for certain species at Apra Harbor. This table used in concert with Figure 13.2-1 would minimize impacts to ESA-listed and sensitive EFH species.

Potential Mitigation Measures

No measures identified at this time.

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

Species	*Status*	*Location*	*Months*
Green Sea Turtle	ESA-listed, Threatened	see Figure 13.2-1 and 2	Nesting (Jan – Mar)
Hawksbill Sea Turtle	ESA-listed, Endangered	see Figure 13.2-1 and 2	Nesting (Apr – Jul)
Green and Hawksbill Sea Turtles	ESA-listed	see Figure 13.2-1 and 2	Foraging (Jan – Dec)
Adult Bigeye Scad	EFH-CHCRT	see Figure 13.2-1	Jun – Dec
Scalloped Hammerhead	EFH-PHCRT	aircraft carrier turning basin - see Figure 13.2-1	Spawning (Jan – Mar)
Juvenile Fish*	EFH	Sasa Bay and other nearshore environments	Nursery (Jan – Dec)
Hard Corals	EFH-PHCRT	Apra Harbor	Full Moon Spawning (July-Aug)

Legend: CHCRT = Current Harvested Coral Reef Taxa; PHCRT = Potentially Harvested Coral Reef Taxa.
Note: *Includes barracudas, emperors, goatfishes, groupers, mullets, parrotfishes, puffers, snappers, surgeonfishes, wrasses, and small-toothed whiptails.

13.2.2.2 Interim Alternative 2

Interim Alternative 2 is a combination of reconditioning of existing permitted GPA facilities, an increase in operational hours for existing combustion turbines, and upgrades to existing T&D systems. Interim Alternative 2 would not require new construction or enlargement of the existing footprint of the facility. Reconditioning would be performed on the existing permitted GPA facilities at the Marbo, Yigo, and Dededo combustion turbines. This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

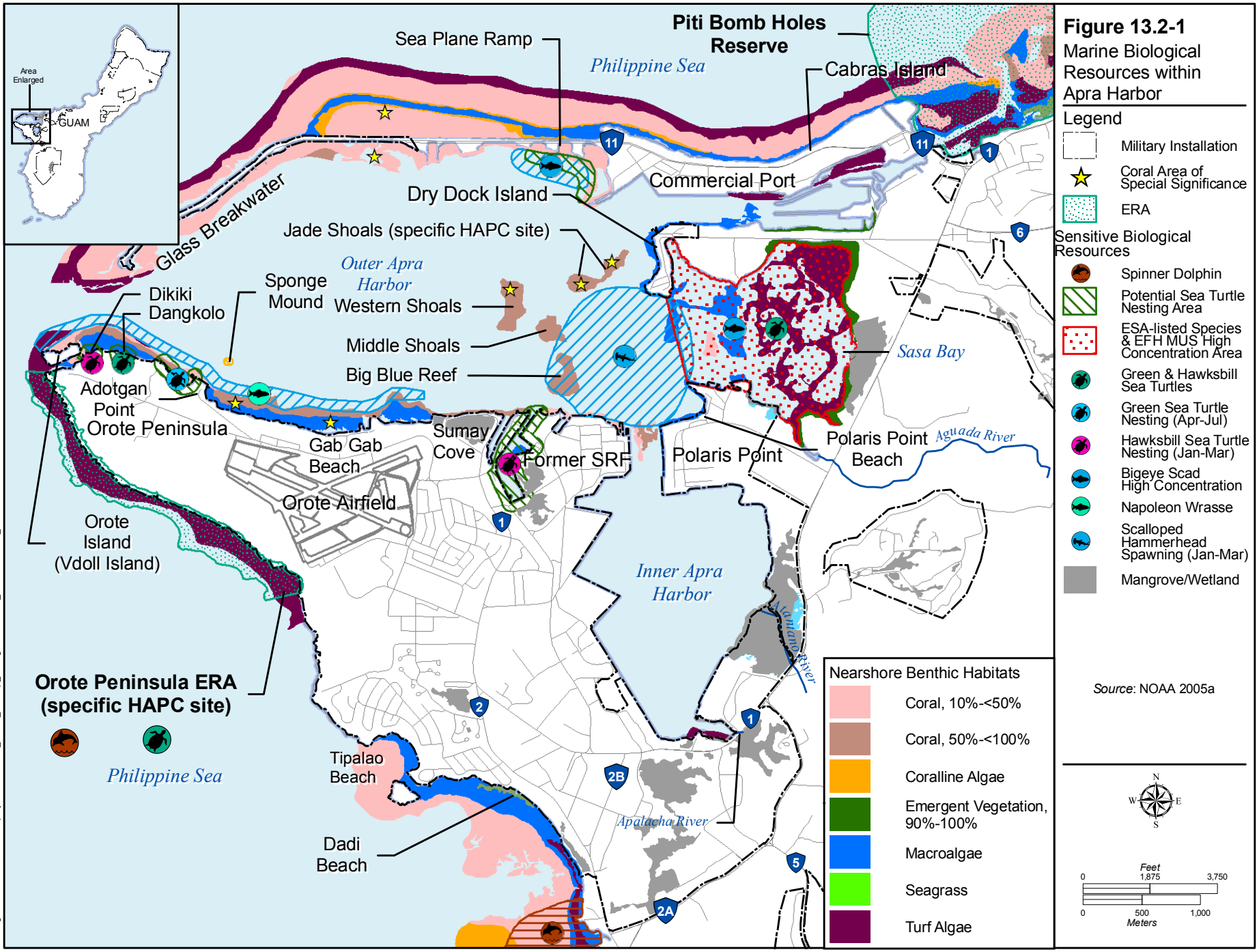
Upgrades would also be required to the distribution system consisting of new 34.5 kilovolt (kV) lines for Yigo to Harmon and Dededo to Andersen and Harmon and other lines. Road upgrades would also occur but would be minimal. Impacts to the area include subgrade construction, cut/fill activities, and brush clearing that are not associated with the marine environment.

No direct impact to marine biological resources is expected by this alternative. Indirect impacts include increased maritime traffic transporting construction materials into Apra Harbor for distribution. This "vessel movement" impact is described in detail in Volume 2 Chapter 11.

Interim Alternative 2 would result in less than significant impacts to marine biological resources. Figure 13.2-1 summarizes the sensitive months for certain species at Apra Harbor. This table used in concert with Table 3.2-1 would minimize impacts to ESA-listed and sensitive EFH species.

Potential Mitigation Measures

No measures identified at this time.



13.2.2.3 Interim Alternative 3

Interim Alternative 3 is a combination of reconditioning existing GPA permitted facilities at Marbo, Yigo, and Dededo and upgrades to the Department of Defense (DoD) power plant at Orote. Upgrades would be made to existing T&D. The proposed reconditioning to the existing power generation facilities at Marbo, Yigo, and Dededo would not require new construction or enlargement of the existing footprint of the facility. For the Orote power plant, upgrades would include a new fuel storage facility to facilitate longer run times between refueling. This would disturb approximately 1 acre (4,047 square m). This alternative supports Main Cantonment Alternatives 1 and 2 and Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Activities associated with Interim Alternative 3 include upgrades to existing GPA permitted facilities at Marbo, Yigo, and Dededo. It is anticipated that these units would require general overhaul, capabilities testing, and controlled startup that could take up to 1 year. The amount of reconditioning necessary to meet operation for baseload or intermediate load generation duty would not be known until the units are inspected and tested. Upgrades would be required to the distribution system as well, including burial of upgraded 34.5-kV line from Yigo to Harmon and Dededo to Andersen and Harmon. Impacts to the area include subgrade construction, cut/fill activities, and brush clearing that are not associated with the marine environment.

No direct impact to marine biological resources is expected by this alternative. Indirect impacts include increased maritime traffic transporting construction materials into Apra Harbor for distribution. This "vessel movement" impact is described in detail in Volume 2 Chapter 11. Interim Alternative 3 would result in a less than significant impact to marine biological resources. Table 13.2-1 summarizes the sensitive months for certain species at Apra Harbor. This table used in concert with Figure 13.2-1 would minimize impacts to ESA-listed and sensitive EFH species.

Upgrade Department of Defense (DoD) Orote Power Plant

Activities associated with Interim Alternative 3 also include upgrading the DoD Orote Power Plant. The distribution upgrades would consist of 34.5-kV line and 115-kV line to Piti, new capacitor bank at the Orote substation (13.8 kV), and new Orote substation with 112-megavolt ampere power transformer. Impacts to the area include subgrade construction, cut/fill activities, and brush clearing.

The location of the Orote Power Plant and proposed upgrades, although in close proximity to Inner Apra Harbor shoreline, is not anticipated to impact marine biological resources as long as compliance with all federal, Commonwealth of the Northern Mariana Islands (CMNI), and military orders, laws, and regulations (see Volume 1, Chapter 4) takes place. No direct impact to marine biological resources is expected by this alternative. Indirect impacts include increased maritime traffic transporting construction materials into Apra Harbor for distribution; however, would be negligible with adherence to maritime measures and Navy policies. This "vessel movement" impact is described in detail in Volume 2, Chapter 11.

Therefore, there would be minimal impacts to marine flora and invertebrates, no adverse effects to fish and EFH, no significant adverse impacts to special-status species (i.e. the action would not "jeopardize" or "take" an ESA-listed or marine mammal species per ESA Section 7 and 9 or Section 3 [16 USC 1362] of MMPA), and minimal impacts regarding introduction of non-native species into the marine environment with appropriate maritime policies.

Interim Alternative 3 would result in a less than significant impact to marine biological resources. Table 13.2-1 summarizes the sensitive months for certain species at Apra Harbor. This table used in concert

with Figure 13.2-1 would minimize impacts to ESA-listed and sensitive EFH species.

Potential Mitigation Measures

No measures identified at this time.

Summary of Impacts

Table 13.2-2 summarizes the impacts. A text summary is provided below.

Table 13.2-2. Summary of Potential Impacts to Marine Biological Resources-Power

*Interim Alternative 1**	*Interim Alternative 2*	*Interim Alternative 3*
Marine Biological Resources		
LSI • Indirect impacts from increased barge traffic	LSI • Indirect impacts from increased barge traffic	LSI • Indirect impacts from increased barge traffic • Indirect impacts from runoff, decreasing water quality
Fish and EFH		
LSI • Indirect impacts from increased barge traffic • Indirect impacts from runoff, decreasing water quality	LSI • Indirect impacts from increased barge traffic • Indirect impacts from runoff, decreasing water quality	LSI • Indirect impacts from increased barge traffic • Indirect impacts from runoff, decreasing water quality
Special Status Species		
LSI • Indirect impacts from increased barge traffic	•LSI • Indirect impacts from increased barge traffic	LSI • Indirect impacts to sea turtles from increased barge traffic • Indirect impacts from runoff, decreasing water quality
Non-native Species		
LSI • Indirect impacts from increased barge traffic	LSI • Indirect impacts from increased barge traffic	LSI • Indirect impacts from increased barge traffic

Legend: LSI = Less Than Significant Impact. *Preferred Alternative.

All the Alternatives have potential long-term impacts on marine biological resources through increased maritime shipments, transfer and handling of construction- and operation-related materials in Apra Harbor. The following is a summary of those impacts for each Alternative.

- Interim Alternative 1 does not have the potential to affect marine biological resources, except through increased maritime shipments and associated activities
- Interim Alternative 2 does not have the potential to affect marine biological resources, except through increased maritime shipments and associated activities
- Interim Alternative 3, considering its close proximity to Inner Apra Harbor, this alternative has the potential to affect, but not significantly affect marine biological resources, specifically marine flora and invertebrates, EFH, and sea turtles. This potential increased affect, over existing conditions, can be further reduce/or eliminated by the implementation and enforcement of appropriate federal and local CWA regulations, permits and BMPs (see Volume 1, Section 4). A less than significant impact is assumed from short-term disturbances to the nearshore marine waters from potential stormwater run off during construction-related activities and pollution spills from industrial activities, and increased disturbances from vessel movements

13.2.3 Potable Water

As discussed in Volume 6 Chapter 2, potable water alternatives are not distinguished as interim or long-term but are basic alternatives that address both interim and long-term potable water demand.

13.2.3.1 Basic Alternative 1 (Preferred Alternative)

Basic Alternative 1 would consist of installation of up to 22 new potable water supply wells at Andersen Air Force Base (AFB), rehabilitation of existing wells, interconnection with the GWA water system, and associated T&D systems. A new 5 MG (19 ML) water storage tank would be constructed at ground level at Finegayan.

New Water Supply Facilities

Activities associated with Basic Alternative 1 include constructing up to 22 wells in the Andersen AFB area. Two wells located at the Naval Hospital would be rehabilitated to supplement the local supply and to the Navy island-wide water system. Impacts to the areas include subgrade construction, cut/fill activities, and brush clearing. No structures would be modified or demolished for this action.

New Water Storage and Distribution Facilities

Many components are associated with the new water storage and distribution facilities for Basic Alternative 1. These include constructing pumps at each well station, installing two treated water transmission mains (including a connection to the GWA system), constructing a network of water distribution pipes on both DoD and non-DoD lands, and installation of one grade level water storage tank at Finegayan. Impacts to the areas include tree removal, cut/fill activities, and subgrade construction.

No direct impact to marine biological resources is expected by this alternative. Indirect impacts include increased maritime traffic transporting construction- and operation-related materials into Apra Harbor for distribution. This "vessel movement" impact is described in detail in Volume 2 Chapter 11. Therefore, this action would result in a less than significant impact to marine biological resources.

Potential Mitigation Measures

No measures identified at this time.

13.2.3.2 Basic Alternative 2

Basic Alternative 2 would consist of installation of up to 20 new potable water supply wells at Andersen AFB, up to 11 new potable water supply wells at Barrigada, rehabilitation of existing wells, interconnection with the GWA water system, associated transmission and distribution systems upgrades. Additionally, new 3.6 MG (13.6 ML) and 1 MG (3.8 ML) water storage tanks would be constructed at ground level at Finegayan and Barrigada, respectively.

New Water Supply Facilities

Activities associated with Alternative 2 are the same as for Basic Alternative 1 for the new water supply facilities. Impacts to the areas include subgrade construction, cut/fill activities, and brush clearing.

The construction-related activities associated with this alternative are not associated with the marine environment; therefore, no impacts would occur to marine biological resources.

New Water Storage and Distribution Facilities

Many components are associated with the new water storage and distribution facilities for Alternative 2. These include constructing pumps at each well station, installing two treated water transmission mains

(including a connection to the GWA system), construct a network of water distribution pipes on both DoD and non-DoD lands, and two grade level water storage tanks (one at Finegayan and one at Air Force Barrigada). Impacts to the areas include tree removal, cut/fill activities, and subgrade construction.

Volume 6, Chapter 2 figures provide the proposed project locations in relation to the marine environment on Andersen AFB, Finegayan, Andersen South, and Barrigada. This alternative and its actions are not associated with the marine environment. No direct impact to marine biological resources is expected by this alternative. Indirect impacts include increased maritime traffic transporting construction and operation-related materials into Apra Harbor for distribution. This "vessel movement" impact is described in detail in Volume 2 Chapter 11. Therefore, this action would result in a less than significant impact to marine biological resources.

13.2.3.3 Summary of Impacts

Table 13.2-3 summarizes the impacts. A text summary is provided below.

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

*Basic Alternative 1**	*Basic Alternative 2*
Marine Biological Resources	
LSI • General overall indirect impact from increased barge traffic into Apra Harbor	LSI • General overall indirect impact from increased barge traffic into Apra Harbor

Legend: LSI = Less Than Significant Impact. *Preferred Alternative.

Basic Alternatives 1 and 2 do not have construction or operation-related actions that are associated with the marine environment; however there would be an associated increase in barge traffic into Apra Harbor carrying construction- and operation-related materials. Therefore Alternative 1 and 2 would result in less than significant impacts to marine biological resources.

13.2.4 Wastewater

13.2.4.1 Basic Alternative 1a (Preferred Alternative) and 1b

Basic Alternative 1 (Alternative 1a supports Main Cantonment Alternatives 1 and 2; and Alternative 1b supports Main Cantonment Alternatives 3 and 8) combines upgrade to the existing primary treatment facilities and expansion to secondary treatment at the Northern District Wastewater Treatment Plant (NDWWTP).The difference between Alternatives 1a and 1b is a requirement for a new sewer line from Barrigada housing to NDWWTP for Alternative 1b. Because Basic Alternative 1 a and 1b differ only in the placement of on-shore sewer lines which would not result in a difference in wastewater characteristics or difference in discharges to the marine environment, the alternatives are assessed together for potential marine resource impacts.

The NDWWTP is designed to provide primary treatment for an average daily flow of 12 million gallons per day (mgd) (45 million liters per day [mld]) with peak hourly flow of 27 mgd (102 mld). The proposed Marine Corps relocation would increase the average and peak wastewater flows to 11.54 mgd and 25.97 mgd (43.67 mld and 98.30 mld), respectively, at the completion of the DoD buildup. During the buildup, there would be a higher flow estimated at 12.8 mgd (46.6 mld) at the peak year of 2014.

The potential affects to marine biological resources associated with only the increased discharge flows described earlier are evaluated below.

Figure 13.2-2 provides the existing outfall extension in relation to sensitive marine biological resources in the area. Potential receptors of ocean outfall effluent constituents include a wide variety of marine flora and fauna living in or near coastal or marine waters, including humans (addressed in Public Health and Safety, Chapter 18).

The Navy is conducting a study to evaluate potential impacts on water quality and the marine environment from the GPA NDWWTP wastewater discharge at its new ocean outfall. The study, *Draft Guam Northern District Outfall Assessment, October 2009* was still in draft form at the time of this Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) publication, but will be finalized before publication of the FEIS. Pertinent data and information from the draft study was used in this DEIS, along with other available information, to evaluate the water quality and marine environment impacts in this Chapter. The study assesses impacts to the receiving marine environment resulting from the primary and secondary treatment and disposal of wastewater, including additional wastewater loadings associated with the military buildup on Guam.

Effluent from the proposed Northern District WWTP discharges into marine waters through a new ocean outfall. Computer modeling was conducted to predict how water quality might be affected by the discharge in the immediate vicinity of the outfall (termed "nearfield") and further away from the outfall (termed "farfield"). Environmental and biological impact assessments were also performed. Parameters used to assess the environmental impacts on the receiving marine waters include:

- Comparison with the Guam Water Quality Standards (GWQS)
- Effects to the ecological life and environment of the receiving marine waters

Comparison with the Guam Water Quality Standards

In nearshore tropical marine waters, phosphorus appears to be more limiting for primary production (Hawarth et al. 1995), while tropical open ocean is nitrogen-limited (Corredor et al. 1999). Nutrients regulated under the Guam Water Quality Standards include ammonia, nitrate, nitrite, and orthophosphate. These utilized by phytoplankton for primary production.

Initial dilution (nearfield) and farfield modeling performed in the study indicates that the discharge of 12 MGD of primary treated effluent from a new NDWWTP outfall will impact the receiving water quality in the vicinity of the facility's outfall. For the study, plume models were developed with ocean and wind data collected through field visits and used to develop the theoretical ambient receiving water conditions near the outfall. The initial dilution factor for the new NDWWTP outfall has been determined by the study to be 300, despite GWA's use of 200 as the basis of design for the new outfall. The resulting ambient water quality conditions based on this modeling are summarized in Table 13.2-4.

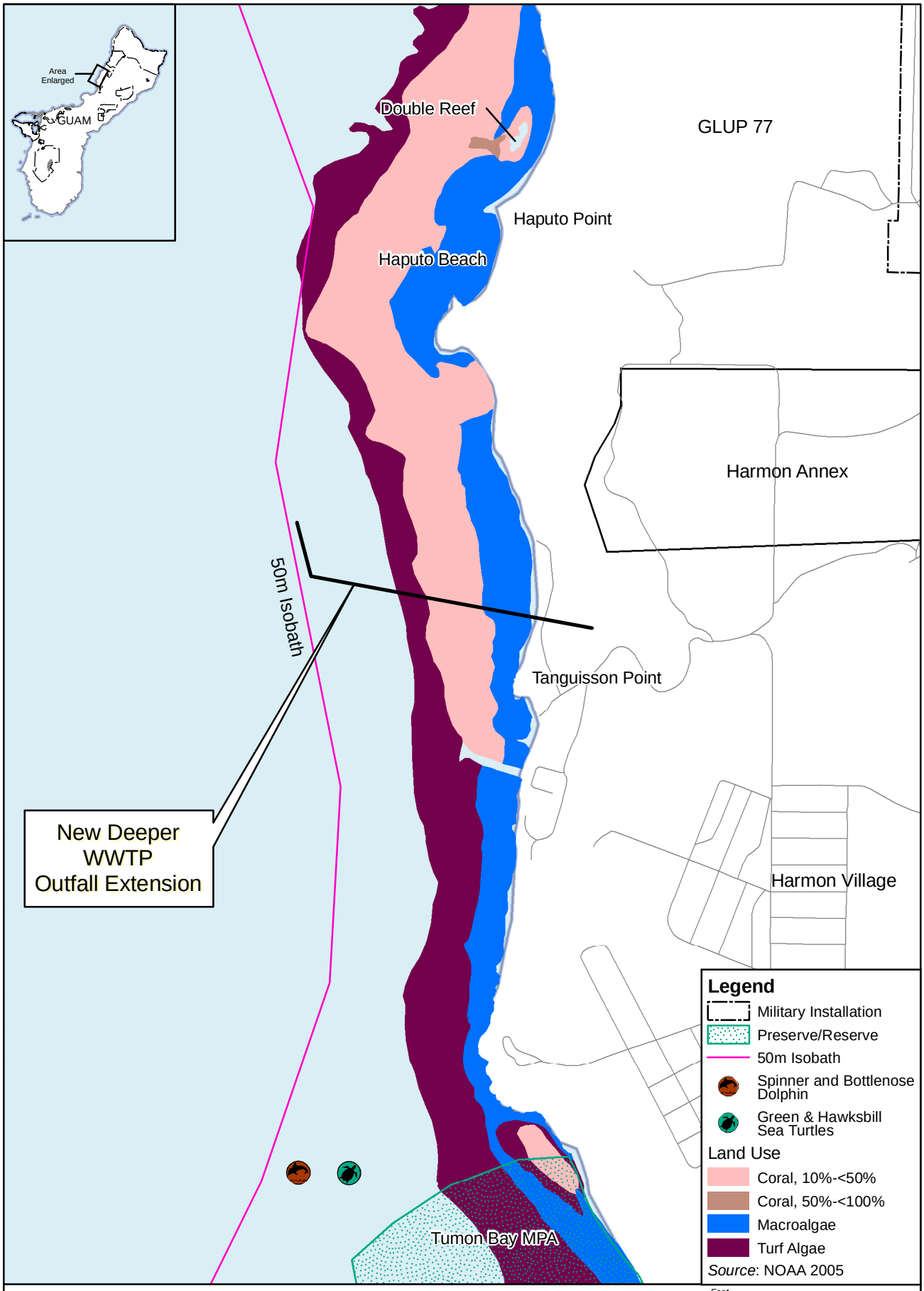


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Figure 13.2-2
NDWWTP Outfall Extension and Sensitive Marine Biological Resources

Table 13.2-4. Comparison of Guam Water Quality Standards to Modeled Primary and Secondary Treatment Effluent at NDWWTP"

Constituents Regulated by the GWQS	*Unit*	*GWQS for Marine-2 Waters*	*Background* [1]	*Primary Treatment*		*Secondary Treatment*	
				End of Pipe	*After Initial Dilution*[2]	*End of Pipe*	*After Initial Dilution*[2]
Enterococcus	MPN/100ml	104	0	240000	800	15	0.1
Turbidity	NTU	1	0.25	59	0.4	16	0.3
TSS	mg/L	20	5.6	80	5.8	9	5.6
Ortho-P	µgP/L	50	5	2620	13.7	1640	10.5
Nitrate+Nitrite	µgN/L	200	1.1	9	1.1	14900	50.8
Ammonia	µgN/L	20	0	18400	61.3	3500	11.7
Total Sulfide	µg/L	5	0	140	0.5	140	0.5
Lead	µg/L	8.1	0	4.94	0	4.43	0
Copper	µg/L	3.1	0	68.3	0.2	54.6	0.2
Zinc	µg/L	86	0	276	0.9	72.6	0.2
Total Nitrogen	µgN/L	None	151	47600	309.2	23950	230.3
Total Phosphorus	µgP/L	None	13	3850	25.8	3760	25.5

[1] Background concentrations in receiving waters not influenced by the existing NDWWTP discharges.
[2] Initial dilution for NDWWTP outfall = S10 = 300

Modeling results shown in Table 13.2-4 indicate that water quality standards for *Enterococcus* (a bacteria) and Ammonia will be exceeded for discharge of primary treated effluent from the new NDWWTP. *Enterococcus* levels in the surfacing plume at the new NDWWTP outfall are predicted to be 800 colonies per milliliter (NPN/100ml), and would exceed the water quality standard of 104 MPN/100ml. Ammonia levels in the surfacing plume at the new NDWWTP outfall are predicted to be 61 micrograms per liter (µgN/L), and would exceed the water quality standard of 20 µgN/L.

On September 30, 2009 USEPA Region 9 issued a denial of the secondary treatment variance that had been allowed for the NDWTP. USEPA Region 9's decision document about this denial included information on water quality impacts from the current NDWWTP discharge. That decision document found that the discharge of 12MGD will likely attain the applicable water quality criteria for Dissolved Oxygen (based on Biological Oxygen Demand loading), Total Suspended Solids, Turbidity, pH, Temperature and Salinity at and beyond the Zone of Initial Dilution, assuming that a new diffuser is installed on the new outfall as has been proposed by GWA. The USEPA also noted that primary treatment alone does not reduce bacteria levels to the extent that would be required to meet GWQS for *Enterococci*. USEPA did not have information necessary for adequately assessing whether the proposed discharge will meet water quality criteria for nutrients at the site.

As shown in Table 13.2-4, modeling results from the *Draft Guam Northern District Outfall Assessment, October 2009* validate USEPA's conclusion that upgrading the NDWWTP to secondary treatment would result in all water quality standards being met. This includes water quality standards that would not be met with just primary treatment, namely *Enterococcus* and Ammonia. With secondary treatment installed at the NDWWTP, *Enterococcus* levels are expected to be 0.1 MPN/100ml, well below the water quality standard of 104 MPN/100 ml. Ammonia levels are expected to be 11.7 µgN/L, well below the water quality standard of 20 µgN/L.

GWA has expressed a need to expand the NDWWTP to 18 MGd to meet future projected wastewater flows from natural population growth after the completion of the military buildup on Guam (e.g.: beyond the year 2019). A detailed assessment of water quality impacts that could occur for an 18 MGd wastewater treatment plant were not evaluated in this study. Although a detailed assessment has not been conducted, the treatment system for a larger 18 MGd plant would have the same treatment processes as a 12 MGd plant, and would be required to meet the same pollutant removal efficiencies, and meet water quality standards at the discharge. Therefore, it is expected that the impacts to water quality from an 18 MGd plant would be the same as for a 12 MGd plant.

Effects to the Ecological Life and Environment of the Receiving Marine Waters

The three components of sewage effluent found to be most detrimental to marine life and coral reefs are nutrients, sediments, and toxic substances. Tropical ocean waters are typically characterized as low in nutrients and particulates. Therefore, the discharge of high levels of nutrients and particulates may have detrimental impacts to the receiving marine waters.

The following analysis from the *Draft Guam Northern District Outfall Assessment, October 2009* is derived from a review of existing studies performed by others in the vicinity of the NDWWTP outfall, supplemented by investigations performed at other marine outfalls located in Guam and Hawaii.

Water Column Impacts

The nearfield plume analysis indicates that the discharge from the diffuser rises quickly, with minimal horizontal dispersion before reaching the surface. The elapsed time for this initial mixing and rise of the fluids is short, occurring in minutes. Therefore, there is minimum interaction with the extant assemblage of organisms in the water column.

Phytoplankton may assimilate some nutrients present in the farfield plume. Since phytoplankton requires several days to replicate and the plume will likely disperse over a wide area in a matter of hours, however, the increase in biomass is not likely to be a concern. The low phytoplankton biomass (based on the low level of chlorophyll α) also suggests that any increase resulting from phytoplankton productivity will be rapidly grazed by herbivorous zooplankters. Therefore, detectable changes in phytoplankton or herbivorous zooplankton biomass are not anticipated.

Enterococcus and ammonia in the surfacing plume will exceed the GWQS. These anticipated constituent concentrations are based on the modeling results and do not take into account the degradation of constituents, die-off of organisms, or uptake of the pollutants by existing aquatic life.

Enterococcus in the discharge plume will eventually be diluted to near zero. Unfavorable conditions provided by the marine environment will likely destroy these bacteria and most others from the wastewater. Factors such as pH, temperature, solar (UV) radiation, predation, osmotic stress, nutrient deficiencies, particulate levels, turbidity, oxygen concentrations, and microbial community composition affect bacteria inactivation.

The toxicity of ammonia is dependent on pH. Dissolved in water, ammonia will react with hydrogen ions (H+) to form non-toxic ammonium ions (NH4 -). When mixed with the higher pH level of the receiving marine water, ammonia present in the wastewater discharge will increase in toxicity. Toxicity is still a function of concentration and, since the initial dilution of ammonia in the rising primary treatment plume is around 60 µgN/L, this value is nearly two orders of magnitude (or about 1/100) of the concentration found to be toxic to most fishes (USEPA 1972). Secondary treatment brings this concentration down to just over half of the Guam Water Quality Standard of 20 µgN/L.

Marine Flora, Invertebrates, and Associated Essential Fish Habitat

Benthic impacts are associated with the sedimentation of particulates entrained in the discharge plume. Sources of the particulates in the wastewater discharge plume include particulates in the effluent, particulates produced in the environment from nutrient enrichment, and natural seston.

Based on several studies performed on deep ocean outfalls off Oahu in the Hawaiian Islands, no significant impacts have been reported on the benthic faunal. Impacts to polychaete assemblage and the crustacean and soft bottom communities were found to be limited. Since the conditions off Tanguisson Point are similar to those off the Oahu deep ocean outfalls, adverse impacts to the receiving marine waters are not anticipated with the discharge of effluent from the NDWWTP outfall. Additionally, the nearfield plume analysis indicates that the discharge from the diffuser rises quickly, with minimal horizontal dispersion before reaching the surface. The elapsed time for this initial mixing and rise of the fluids is short; occurring on a time scale of minutes, so the impact associated with sedimentation and ammonia concentrations is not anticipated to be significant. The impacts associated with increased wastewater treatment flows from this alternative would be long-term; however, due to the analysis above and the fact that flora and invertebrates are generally more resistant to ammonia toxicity than fish (Ankley et al. 1996), and the operational goal of expansion to secondary treatment by 2015) would considerably improve water quality and is anticipated to meet GWQS, the impacts would be negligible. Therefore, Interim Alternative 1a would result in less than significant impacts to Marine Flora, Invertebrates, and Associated EFH.

Fish and Associated EFH

As reported above, the nearfield plume rises quickly with minimal horizontal dispersion before reaching the surface; therefore, minimal interaction occurs with the extant assemblages of organisms in the water column. Phytoplankton may assimilate some of the nutrients present in the near and farfield plume; however, phytoplankton requires several days to replicate, and the plume would likely disperse over a wide area in a matter of hours. The increase in biomass is not likely to be a concern, considering the low phytoplankton biomass around Guam and the vicinity (based on the low levels of chlorophyll), any increase resulting from phytoplankton productivity would be rapidly grazed by herbivorous zooplankton and fish. Detectable changes in phytoplankton or herbivorous zooplankton biomass are not anticipated, but should be monitored (Navy 2005, Navy 2009).

Detrimental impacts to the coral reef ecosystems associated with excessive nutrient-loading, bacteria, and sediment abrasion have been documented in Johannes 1975, Pastorok and Bilyard 1985, Smith et al. 1981. Long-term potential impacts to marine flora and invertebrates in the surrounding area from increased outfall discharges (12 mgd [45 mld] to 24 mgd [91 mld]) include increased turbidity, decreased water quality, and sedimentation in an undefined area adjacent to the diffuser and north based on wind and current data studies at the site (Navy 2009 ES-5 to ES-9). However, these impacts are dependent on the flushing properties of the receiving waters and characteristics of the sediments (Navy 2009). Pastorok and Bilyard (1985) studied the impacts of sewage effluent on the coral reef ecosystem. The findings of this paper indicated that the discharge of sewage had little or no impact on the coral reef ecosystems in well-flushed waters along open coasts (Navy 2009).

Most of the literature describing negative impacts of sewage discharge on coral reefs is limited to studies of lagoons or embayment environments with relatively long residence times that can result in buildup of nutrients and sediments to detrimental levels (Johannes 1975, Pastorok and Bilyard 1985, Smith et al. 1981). In coastal areas, discharge of treated sewage effluent may have no negative effect on coral community structure and may in fact enhance coral growth and benefit coral reef community by providing nutrient subsidies and additional surface area that is suitable for settlement and growth.

Figure 13.2-3 shows two photographs taken off Tanguisson Point in 1994 that are associated with the two diffuser ports of the Tanguisson sewage outfall (NDWWTP outfall). The outfall diffuser that was made up of 17 elevated diffuser ports (with 33-ft [10-m] separation) was aligned parallel to shore at a depth of about 66 ft (20 m). At this time period, the NDWWTP was reportedly discharging 3 to 4 mgd (11 to 15 mld) of primary treated domestic effluent, coral colonies, predominantly *Porities* (*Synaraea*) *rus* have covered the discharge ports and adjacent reef areas that were excavated for placement of the diffuser pipe in the 10 years since the outfall was constructed. Effective engineering design of diffusers that maximizes dispersion, mixing, and dilution of treated plumes, and placement of outfalls in open coastal areas with high rates of water exchange appear to be important factors in preventing negative impacts to coral reef communities (Dollar 1994).

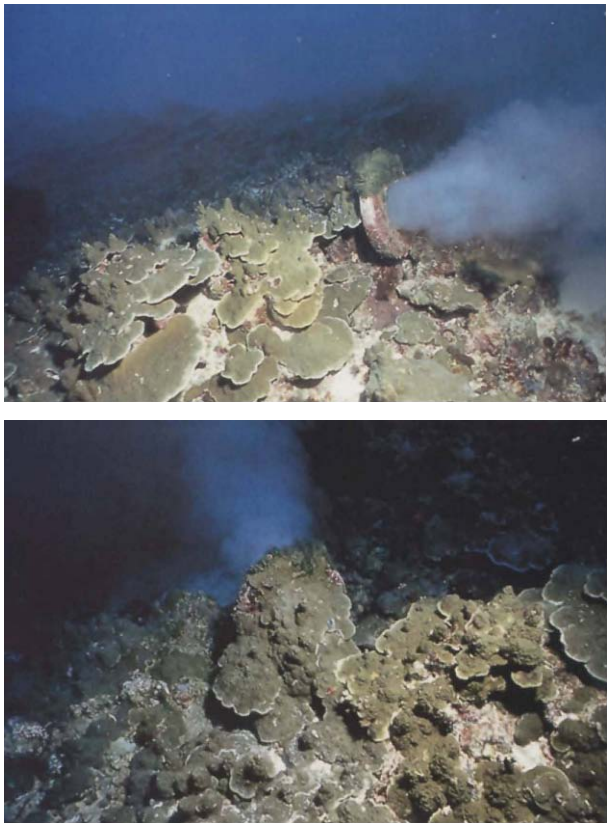

Photo credit: Dollar, S. SOAEST, UH 1994.

Figure 13.2-3. Former Tanguisson Point Primary WWTP Outfall and Coral Growth

It is anticipated that motile animals would exit the area during any in-water work being performed, but return shortly after; therefore, short-term and localized impacts from increased turbidity and noise are expected to fish and EFH.

Increasing the flow from 12 mgd (45 mld) to 17.63 mgd (66.74 mld) would result in higher nutrient and particulate values in the surfacing plume and ammonia levels from 67 µgN/L to 88 µgN/L. The biological impacts associated with this increase may be significant to finfish species. These increased impacts may be mitigable to less than significant by installation and redesign of the diffuser system; however, anticipated ammonia levels are still estimated to be above GWQS, until NDWWTP expansion to secondary treatment. Additionally, combined effects of ammonia and other stressors, such as low dissolved oxygen and high temperature, are highly complex and can be difficult to separate from the toxic effects caused by ammonia alone, especially in sensitive finfish species (Ankley et al. 1996). The impacts associated with increased wastewater treatment flows from this alternative may adversely affect EFH, specifically finsfish species, until GWQS are met with the anticipated operational expansion goal to secondary treatment by 2015. Therefore, Basic Alternative 1a may adversely affect Fish and Associated EFH in the short term until the secondary treatment capability would be installed and operational.

Special-Status Species

The four special-status species identified in Volume 2 (green and hawksbill sea turtles, and spinner and bottlenose dolphins) are anticipated to occur in the area. Since these species are air breathing, increased turbidity should not adversely impact their respiration or biological functions (NOAA 2007). Sea turtles may forage in shallower waters but not at the new deeper NDWWTP outfall; therefore, any affect would be short-term and negligible as they pass through the area. Sea turtles and marine mammals would most likely exit the areas during any in-water work. Appropriate construction and maritime mitigation measures would be implemented by the Navy during in-water outfall expansion activities accordingly for the protection of marine mammals and ESA-listed sea turtles (see Volume 7). No evidence exists that special-status species would be significantly impacted from actions under this alternative.

The short-term and periodic impacts associated with Basic Alternative 1 actions are likely to affect, but are not likely to adversely affect, ESA-listed sea turtles. Basic Alternative 1 would not "jeopardize" or "take" ESA-listed sea turtles as defined under Sections 7 and 9 of ESA. No serious injury or mortality of any marine mammal species (spinner dolphins) is reasonably foreseeable and no adverse effects on the annual rates of recruitment or survival of any of the species and stocks is expected with the implementation of Basic Alternative 1.

Therefore, Basic Alternative 1 would result in less than significant impacts to Special-Status Species.

Non-native Species

No vessel operation or in-water construction work is anticipated with this alternative; however, if outfall extension is performed under this alternative, the following is appropriate.

Potential impacts to the marine habitat associated with the coastal areas from non-native marine organisms, pathogens, or pollutants taken up with ship ballast water (or attached to vessel hulls) are a real threat.

The impacts from introduction may be lessened or even prevented through mitigation measures and existing Navy and U.S. Coast Guard policies. The Navy would also prepare a Regional Biosecurity Plan with Risk Analysis to address terrestrial and marine non-native species threats and mitigation measures (see Volume 7 for more details).

Potential Mitigation Measures

See Volume 7 for a comprehensive list for in-water construction activities and for vessels underway.

A Biosecurity Risk Assessment & Biosecurity Plan (or non-native species plan) would be developed in conjunction with the National Invasive Species Council (USFWS, U.S. Department of Agriculture, Guam Division of Aquatic and Wildlife Resources, and other interested parties to facilitate a comprehensive approach to control non-native species export, import, and spread. The plan would be comprehensive for all Marine Corps and Navy actions on Guam, including those being proposed in the (EIS/OEIS) for Marine Corps actions on Guam and CNMI.

13.2.4.2 Summary of Impacts

Table 13.2-5 summarizes the impacts. A text summary is provided below.

Table 13.2-5. Summary of Potential Impacts to Marine Biological Resources-Wastewater

*Basic Alternative 1a**	*Basic Alternative 1b*
Marine Flora and Invertebrates	
LSI • Long-term, minimal impacts from decreased water quality and siltation. Increased nutrients may improve flora production	LSI • Long-term, minimal impacts from decreased water quality and siltation. Increased nutrients may improve flora production
Fish and EFH	
SI • Short-term, localized significant impacts from decreased water quality, exceeding GWQS for multiple constituents, specifically ammonia nitrogen. • Short-term, may increase herbivore foraging area from nutrient loading LSI • Long-term, assumes operational goal of expansion to secondary treatment by 2015	SI • Short-term, localized significant impacts from decreased water quality, exceeding GWQS for multiple constituents, specifically ammonia nitrogen. This component can be toxic to sensitive finfish species • Short-term, may increase herbivore foraging area from nutrient loading LSI • Long-term, assumes operational goal of expansion to secondary treatment by 2015
Special-Status Species	
LSI • Short-term, localized impacts from decreased water quality • Long-term, localized minimal impacts from decreased water quality	LSI • Short-term localized impacts during in-water work • Long-term, localized minimal impacts from decreased water quality
Non-Native Species	
LSI • Potential introduction during in-water construction phase	LSI • Potential introduction during in-water construction phase

Legend: SI = Significant Impact, LSI = Less Than Significant Impact. *Preferred Alternative.

Basic Alternative 1 has the potential to significantly impact fish and EFH, specifically finfish, due to elevated concentration levels of ammonia nitrogen within the near and farfield plume exceeding GWQS.

Additional data to assess whether or not a long-term, chronic, or cumulative adverse effect on marine organisms would occur at the site is needed and may include the following:

- Monitoring of benthic communities in the plume track and adjacent areas
- Tissue studies of bioaccumulation in the food chain
- Monitoring of primary production and nutrient uptake and cycling
- Tracer studies of the sources of ammonia nitrogen (and possibly other nutrients) being utilized by phytoplankton

13.2.5 Solid Waste

13.2.5.1 Basic Alternative 1 (Preferred Alternative)

The Preferred Alternative for solid waste would be the continued use of Navy Landfill at Apra Harbor until Layon Landfill is opened, which is scheduled for July 2011. No construction or changes in current operations would occur besides an increase in the volume of solid waste.

This alternative and its actions are not associated with the marine environment; therefore, no impacts would occur to marine biological resources. Although close in proximity to Agat Bay, continued use of the Apra Harbor landfill should not change any current impact to the nearshore environment.

Therefore, Alternative 1 would result in less than significant impacts to marine biological resources.

Potential Mitigation Measures

No mitigation measures are deemed necessary.

13.2.5.2 Summary of Impacts

Table 13.2-6 summarizes the potential impacts of Alternative 1. A text summary is provided below.

Table 13.2-6. Summary of Potential Impacts to Marine Biological Resources-Solid Waste

Basic Alternative 1
LSI • Indirect impacts from increased barge traffic • Indirect impacts from runoff, infiltration, potentially decreasing water quality

Legend: LSI = Less Than Significant Impact. *Preferred Alternative.

Alternative 1 would have less than significant impacts to marine biological resources.

13.2.6 Off Base Roadways

As discussed in Volume 6 Chapter 2.5, some Guam Road Network (GRN) projects involve road widening, bridge replacements, new road construction or roadway realignment, and pavement strengthening projects. This section addresses the potential indirect impacts of the proposed GRN projects to marine biological resources and also describes mitigation measures to avoid or minimize these potential impacts. As discussed in Volume 6 Chapter 6.6, all proposed roadway improvements would occur above elevation 3.5 ft (1.1 m) mean lower low water (GUVD04 vertical datum). The high tide line has been estimated at 2.7 ft (0.8- m) above mean lower low water; therefore, no direct impacts to marine environments are anticipated for any proposed improvement project in any of the four regions. Based on the criteria described in the Methodology Section, no projects within the North region would have the potential to affect marine biological resources; therefore, no analysis is required. Table 13.2-7 describes the direct and indirect impacts for each type of roadway project (non-widening pavement strengthening, intersection improvements, projects that require vegetation removal [e.g. roadway widening, new road construction, and roadway realignment projects], military access point modification or construction, and bridge replacements). Figure 13.2-4, Table 13.2-8, Table 13.2-9, Table 13.2-10 list the roadway projects and potential indirect and/or direct impacts on marine biological resources for the Central, Apra Harbor, and South regions, respectively.

Table 13.2-7. GRN Project Type and Potential Impacts to Marine Biological Resources

Project Type[1]	*Type of Impact Evaluated*	*Potential Impact Description*[2]
Pavement Strengthening	Indirect impacts - construction phase	No impact in areas without an impervious surface and/or drainage connection with marine environments (e.g. northern Guam). Uncontrolled runoff in other areas (Central, Apra Harbor, and South Regions) may impact marine communities down stream or down gradient during the construction phase. Sedimentation and non-point pollution inputs into marine waters, particularly near termini of rivers and stormwater outflows.
Intersection Improvements		
Roadway Widening, New Road Construction (Finegayan Connection), Military Access Point Modifications / Construction, & Road Realignment (Route 15)	Direct impacts	None: New road construction (Finegayan Connection) and Route 15 realignment would occur in upland areas with no direct removal or disturbance of marine communities.
	Indirect impacts- construction phase	None: New road construction (Finegayan Connection) and Route 15 realignment would occur in upland areas of northern Guam with no impervious surface and/or drainage connection with marine environments.
	Indirect impacts- operational phase	
Bridge Replacements (Agana, Atantano, Fonte, Laguas, & Sasa Bridges)	Direct impacts	None: Bridge proposed for replacement span riverine habitats with no direct removal or disturbance of marine communities.
	Indirect impacts - construction phase	Uncontrolled runoff may impact marine communities down stream during the construction phase. Sedimentation and non-point pollution inputs into marine waters, particularly near termini of rivers and stormwater outflows
	Indirect impacts- operational phase	Alteration of the hydraulic conveyance due to the new bridge design may impact downstream marine communities.

Note 1: The GRN project descriptions are included in Volume 6 Chapter 2.5.
Note 2: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

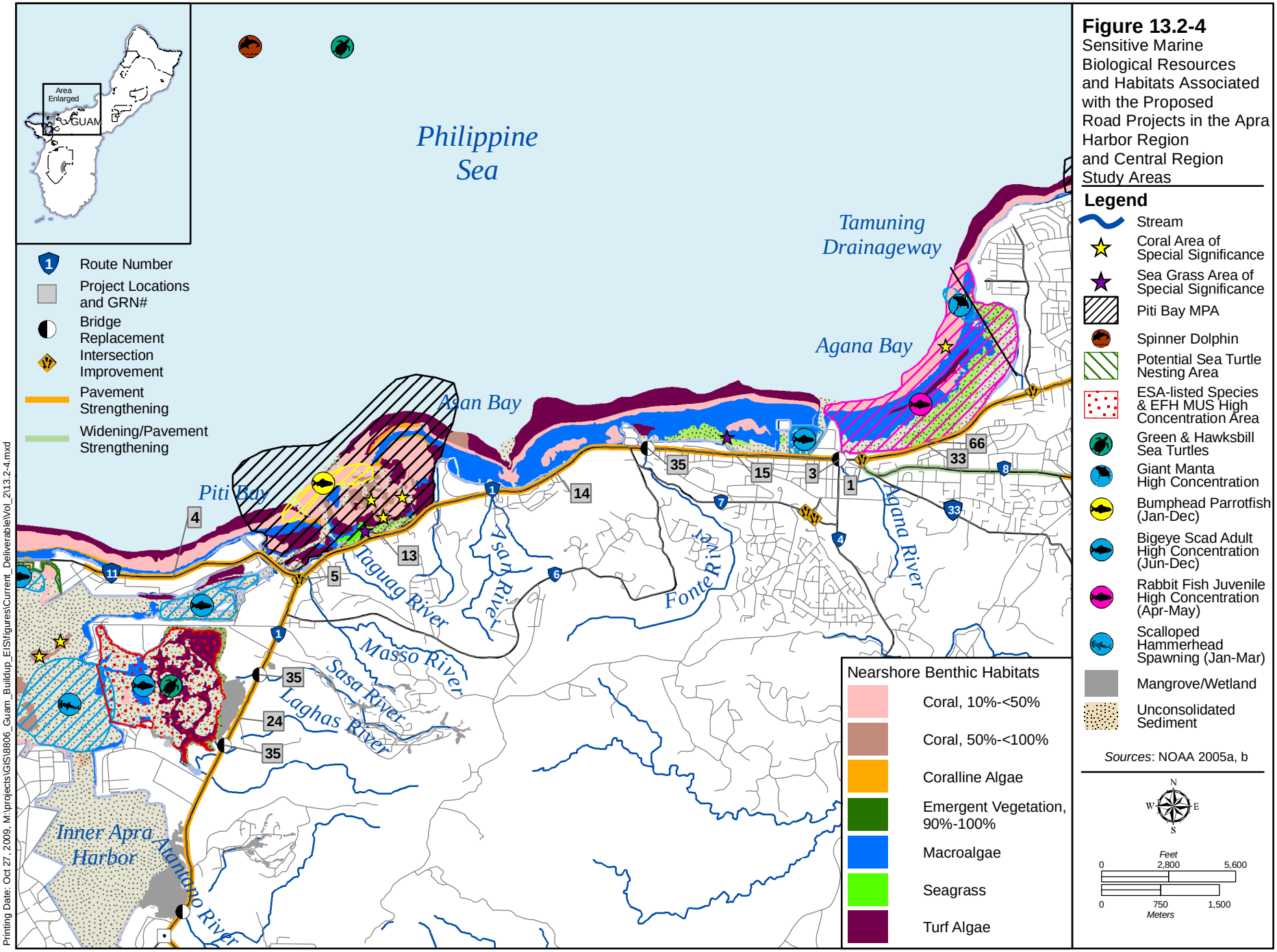

Figure 13.2-4
Sensitive Marine Biological Resources and Habitats Associated with the Proposed Road Projects in the Apra Harbor Region and Central Region Study Areas

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Table 13.2-8. Central Region GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
1	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of East Hagatna Bay.	None: The proposed road and intersection improvements in the Central region are all proposed to occur in upland non-marine environments. Therefore, no direct effects to marine environments are anticipated.
2	x	x	x	x		
3	x	x	x	x		
6	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Tumon Bay via stormwater drainages.	
7	x	x	x	x		
11	x	x	x	x	None: the proposed roadway improvement along Chalan Lujuna would occur over pervious limestone substrates and limited potential for non-point source pollutant inputs into marine communities.	
12	x	x	x	x	None: the proposed roadway improvement along Route 15 would occur over pervious limestone substrates and limited potential for non-point source pollutant inputs into marine communities.	
13	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Asan Bay and Piti Bay, including Piti Bomb Holes Marine Preserve.	
14	x	x	x	x		
15	x	x	x	x		
16	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Hagtna Bay via stormwater drainages.	
17	x	x	x	x		
18	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Tumon Bay via stormwater drainages.	
19	x	x		x		
20	x	x		x		
21	x	x	x	x		
28	x	x	x	x		
29	x	x	x	x		
30	x	x	x	x	None: the proposed roadway improvement along Route 10 would occur over pervious limestone substrates and limited potential for non-point source pollutant inputs into marine communities.	
31	x	x		x		
32	x	x	x	x	None: the proposed roadway improvement along Route 15 would occur over pervious limestone substrates and limited potential for non-point source pollutant inputs into marine communities.	

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
33	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Tumon Bay via impervious surfaces, stormwater drainages, and/or Agana River drainages that terminate at Tumon Bay and Tumon Bay Marine Preserve.	
35	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Sasa Bay Marine Preserve (via Laguas and Sasa Rivers) and Inner Apra Harbor (via Fonte and Atantano Rivers).	None: The proposed bridge replacements occur over riverine (non-marine) environments; therefore, no direct effects to marine environments are anticipated.
36	x	x	x	x	None: Potential for uncontrolled runoff from the Route 15 realignment; however, runoff would attenuate due to thick vegetation and highly pervious limestone. No surface stormwater drainage connection to marine communities around Pagat Point.	None: The proposed road and intersection improvements in the Central region are all proposed to occur in upland non-marine environments. Therefore, no direct effects to marine environments are anticipated.
44	x	x	x	x	None: Potential for uncontrolled runoff; however, runoff from the access gate construction area would attenuate due to thick vegetation and highly pervious limestone. No surface stormwater drainage connection to marine communities around Pagat Point.	
46	x	x	x	x		
47			x		None: the access gate at Barrigada (Navy) would occur over pervious limestone substrates and limited potential for non-point source pollutant inputs into marine communities.	
48			x			
49			x		None: the access gate at Barrigada (Air Force) would occur over pervious limestone substrates and limited potential for non-point source pollutant inputs into marine communities.	
49A				x		
63			x			
74			x			
113	x	x	x	x		

Note [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

Table 13.2-9. Apra Harbor GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
4	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation inputs into marine communities of Outer Apra Harbor (to the south) and outside the breakwater.	None: The proposed road and intersection improvements in the Apra Harbor region are all proposed to occur in upland non-marine environments. The addition of the weigh station associated with GRN #4) would also occur in upland non-marine environments. Therefore, no direct effects to marine environments are anticipated.
5	x	x	x	x		
24	x	x	x	x	Portions of the proposed roadway improvements along Route 1 are adjacent to Sasa Bay Marine Preserve (on the west side of Route 1) and freshwater wetlands (on the east side of Route 1) Potential for runoff during the construction phase into Sasa Bay and Sasa River, Laguas River, Aguada River, and Atantano River, which terminate at Sasa Bay or Inner Apra Harbor. Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation.	
26	x	x	x	x	Portions of the proposed roadway improvements along Route 2A are adjacent freshwater wetlands formed by the Atantano River. Potential for runoff during the construction phase into the wetlands and other stormwater drainages that terminate at Inner Apra Harbor. Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation.	
50	x	x	x	x	Potential for uncontrolled runoff during the construction phase, non point-source pollutants and/or sedimentation into marine communities of Inner Apra Harbor.	

Note [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

Table 13.2-10. South Region GRN Projects, Alternatives, and Potential Impacts

GRN #	*Alternatives*[1]				*Potential Impact Type and Description*[2]	
	1	*2*	*3*	*8*	*Indirect*	*Direct*
25	x	x	x	x	Although most of the portions of the proposed roadway improvements along Route 5 are adjacent residential areas (e.g. Apra Heights), some portions have potential for construction runoff into freshwater wetlands formed by the Namo River near the Agat Commercial Center. The Namo River terminates at Agat Bay.	None: The proposed road and intersection improvements in the South region are all proposed to occur in upland non-marine environments. Therefore, no direct effects to marine environments are anticipated.
27	x	x	x	x		
52	x	x	x	x	Potential for runoff during the construction phase into upper reaches of the Namo River.	
110	x	x	x	x	None: The proposed intersection improvement for Route 2 and 12 would occur near commercial and light industrial areas (e.g. Agat Commercial Center). Runoff or noise during the construction phase would not impact terrestrial biological resources.	

Note [1]: The GRN project descriptions and alternatives are described in detail in Volume 6 Chapter 2.5.
Note [2]: Mitigation measures are included later in this chapter that minimize or avoid potential direct or indirect impacts

13.2.6.1 Alternative 1

Year 2014 (Peak Construction and Population)

North

None of the proposed roadway projects within the North region would have the potential to directly or indirectly impact marine biological resources (i.e., marine flora and invertebrates, fish and EFH, special-status species, and non-native species introductions). Runoff from these projects would attenuate due to thick vegetation and highly pervious limestone and none are proposed to occur within the marine environment.

Central

Because no GRN project is proposed to occur within marine environments in the Central region, no direct impacts would occur to marine biological resources. The proposed road improvement projects for Alternative 1 in the Central region that have the potential to indirectly impact marine biological resources include GRN # 1, 2, 3, 6, 7, 13 - 21, 28, 29, 33, and 35. Impacts from construction activities may include loss of sediment into coastal waters and non-point source inputs into marine environments. Particular areas of concern are designated marine preserve areas, such as Sasa Bay Marine Preserve, Piti Bomb Holes Marine Preserve, and Tumon Bay Marine Preserve, although non-designated bays are also important marine environments. As discussed within this chapter, the downstream termini of drainages and rivers that would potentially carry pollutants and sediments into marine environments are important, although degraded, marine communities.

Apra Harbor

Because no Apra Harbor region GRN projects are proposed to occur associated with the marine environment, no direct impacts to marine biological resources would occur; all proposed projects (GRN # 4, 5, 24, 26, and 50) within the Apra Harbor region have the potential to indirectly impact marine biological resources through runoff or pollutants carried downstream. Portions of the proposed roadway

improvements along Route 1 are adjacent to Sasa Bay Marine Preserve (on the west side of Route 1) and freshwater wetlands (on the east side of Route 1). These projects have the potential for runoff during the construction phase into Sasa Bay and Sasa River, Laguas River, Aguada River, and Atantano River, which terminate at Sasa Bay or Inner Apra Harbor. Other areas of concern include Outer Apra Harbor (south side of Route 11), and open water to the north of Route 11).

South

Because no South region GRN projects are proposed to occur within marine environments, no direct impacts to marine biological resources would occur; projects (GRN # 25, 27, and 52) within the South Region have the potential to indirectly impact marine biological resources. Although most of the portions of the proposed roadway improvements along Route 5 are adjacent residential areas (e.g. Apra Heights subdivision), some portions have potential for construction runoff into freshwater wetlands formed by the Namo River near the Agat Commercial Center. The Namo River terminates at Agat Bay, which would be considered a pathway for inputs into Agat Bay.

Year 2030

North

None of the proposed roadway projects within the North Region would have the potential to impact marine biological resources.

Central

In the long-term, none of the proposed roadway projects within the Central Region would have the potential to impact marine biological resources because there would be no net increase in impervious cover over existing conditions after the construction is complete.

Apra Harbor

In the long-term, none of the proposed roadway projects within the Apra Harbor Region would have the potential to impact marine biological resources because there would be no net increase in impervious cover over existing conditions after the construction is complete.

South

In the long-term, none of the proposed roadway projects within the South Region would have the potential to impact marine biological resources because there would be no net increase in impervious cover over existing conditions after the construction is complete.

In conclusion, implementation of Alternative 1 would not substantially impact marine biological resources within the North, Central, Apra Harbor, or South regions. Any potential affects from construction

Potential Mitigation Measures

The indirect impacts to marine environments associated with road improvement projects would be mitigated with actions that avoid or minimize effects associated with the construction and operational phases of each roadway project. These mitigations are in development as part of a cooperative effort between GEPA, Federal Highway Administration (FHWA), and FHWA design contractors. As part of this effort, each GRN project would have specific mitigation measures that cater to the individual project type and environmental context (e.g. adjacency to sensitive ecological areas, slope of surrounding terrain). The specific mitigative actions would be completed as the GRN project designs near completion.

The CNMI and Guam Stormwater Management Manual (CNMI and Guam 2006) provide examples of BMPs that would be included in the planning, design, and construction for all proposed road improvement projects. A Storm Water Runoff Drainage System Plan is required for a Grading Permit by the Guam DPW when the area to be graded is more than 5,000 square ft (464 square meters) or a proposed cut or fill is greater than 5.0 ft (1.5 m) in height. This stormwater plan would describe the potential impacts and proposed mitigation associated runoff and drainage. Standard procedures and BMPs would minimize sediment runoff during construction, and there would not be a net gain in impervious cover associated with the roads analyzed under Alternative 1 for potential impacts to marine biological resources. These BMPs are required for FHWA-funded projects and include such measures as silt fencing installation and other stormwater pollution prevention planning measures. Because the Navy has determined that Alternative 1 road construction would not cause significant impacts to marine biological resources (i.e., marine flora, invertebrates and associated EFH, fish and Associated EFH, special-status species, and non-native species introductions), no specific mitigation measures are proposed.

13.2.6.2 Alternative 2 (Preferred Alternative)

Proposed road projects under Alternative 2 are the same as the proposed road projects under Alternative 1, with the exception of military access point locations at NCTS Finegayan. The difference in locations of these access gates does not vary the potential impact of Alternative 2 relative to Alternative 1. Therefore, impacts to marine biological resources for Alternative 2 are the same as those for Alternative 1 for each region.

Potential Mitigation Measures

The mitigation measures for Alternative 2 are the same as those for Alternative 1.

13.2.6.3 Alternative 3

The proposed road projects under Alternative 3 are the same as the proposed road projects under Alternative 1, except that Alternative 3 includes GRN #38, 39, 47, 48, 49, 63, and 74, and it excludes GRN #19, 20, 31, 38A, 39A, 41, and 124. GRN # 47 and 48 are associated with new access to Barrigada (Navy); however, these projects would occur in upland areas where stormwater runoff would be expected to attenuate before reaching marine habitats. Gate locations for Alternative 3 are the same for Alternative 1, except that NCTS Finegayan Main Gate and commercial gate locations (GRN # 38 and 39) are in different locations than the Main Gate and commercial gate locations in Alternative 1 (GRN # 38A and 39A). Again, these gate locations are within upland areas where stormwater runoff would be expected to attenuate before reaching marine habitats. Therefore, impacts to marine biological resources of Alternative 3 are similar to Alternative 1 for each region.

Potential Mitigation Measures

The mitigation measures for Alternative 3 are the same as those for Alternative 1.

13.2.6.4 Alternative 8

The proposed road projects under Alternative 8 are the same as those under Alternative 1 with the exception of the military access gate location at Barrigada (Air Force). The impact conclusion for this gate location project included as part of Alternative 8 (GRN # 49A) is the same for the access gate project included as part of Alternative 3 (GRN # 49); therefore, impacts to marine biological resources of Alternative 8 are similar to Alternative 1 and Alternative 3 for each region.

Potential Mitigation Measures

The mitigation measures for Alternative 8 are the same as those for Alternative 1.

13.2.6.5 Firing Range Options

The alternatives described in Volume 2, Chapter 2, for the relocation include the Main Cantonment action alternatives with either a Firing Range Option A or B. Option A would require the realignment of Route 15 (GRN #36), while Option B does not require realignment of Route 15. Neither option would impact marine biological resources.

13.2.6.6 Summary of Impacts

Table 13.2-11 summarizes the potential impacts of each alternative. The proposed road projects in the North and South regions would not directly or indirectly impact marine biological resources. Only projects within the Apra Harbor and Central regions were assessed for potential impacts to marine biological resources, and the projects within these study areas do not require construction within coastal waters.

Table 13.2-41 Summary of Potential Impacts

Potentially Impacted Resource	*Alternative 1*	*Alternative 2**	*Alternative 3*	*Alternative 8*
Marine Flora, Invertebrates and Associated EFH	LSI	LSI	LSI	LSI
Fish and Associated EFH	LSI	LSI	LSI	LSI
Special-Status Species	LSI	LSI	LSI	LSI
Non-native Species Introductions	LSI	LSI	LSI	LSI

Legend: LSI = Less Than Significant Impact.* Preferred Alternative