CHAPTER 6. WATER RESOURCES

6.1 INTRODUCTION

Water resources as defined in this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) are sources of water available for use by humans, flora, or fauna, including surface and groundwater, nearshore waters, and wetlands. Surface water resources, including but not limited to lakes, streams and rivers, are important for economic, ecological, recreational, and human health reasons. Groundwater may be used for potable water, agricultural irrigation, and industrial applications. Groundwater is classified as any source of water beneath the ground surface, and is the primary source of potable water used to support human consumption. Consistent with the definition contained in 22 Guam Administrative Rule (GAR) 5105, nearshore waters are defined as all coastal waters lying within a defined reef area, all coastal waters of a depth of less than ten fathoms (60 feet [ft], 18.3 meters [m]), and all coastal waters greater than 10 fathoms up to 1,000 ft (305 m) offshore where there is no defined reef area. Nearshore waters can be directly affected by human activity, and are important for human recreation and subsistence. Wetlands are habitats that are subject to permanent or periodic inundation or prolonged soil saturation, and include marshes, swamps, and similar areas. Areas described and mapped as wetland communities may also contain small streams or shallow ponds, or pond or lake edges.

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 region of influence for the utilities and roadway projects, and the chapters are presented in the same order as the resource areas contained in this volume.

6.2 ENVIRONMENTAL CONSEQUENCES

6.2.1 Approach to Analysis

6.2.1.1 Methodology

Utilities

This section contains a discussion of potential environmental consequences associated with implementation of the alternatives within the region of influence for water resources. The environmental consequences of each alternative and the no-action alternative are presented in this section. The available literature was used to assess the existing conditions and to establish a baseline for the assessment, as described in the affected environment section (Volume 2 Chapter 4 Section 4.1-1). The methodology for identifying, evaluating, and mitigating impacts to water resources have been established based on federal and Government of Guam (GovGuam) laws and regulations as described in Volume 2 Chapter 4 Section 4.1.1.

The environmental consequences evaluation for water resources includes a qualitative and quantitative analysis of surface water, groundwater, nearshore waters, and wetlands to the extent possible given available project data. Environmental impact assessments were made and compared to baseline conditions, items of public concern, and significance criteria to determine the magnitude of potential impacts to water resources.

The proposed action analysis is separated in two main activities: construction and operations. Each of these activities has potential effects with associated impacts. The analysis of potential impacts considers both direct and indirect impacts. Direct impacts are those that may occur during the construction phase of the project and cease when the project is complete or those that may occur as a result of project operations following the completion of construction. Indirect impacts are those that may occur as a result of the completed project or those that may occur during operations but not as a direct result of the construction or operational action.

Sustainability Requirements and Goals

Implementation of the proposed action would be consistent with Navy policy in compliance with laws and executive orders whereby Department of Defense (DoD) entities are required to reduce demand for indoor water by as much as 20% and outdoor water use by 50% in the coming years. Concurrent with these mandates is the Navy/Marine Corps policy to pursue and facilitate Leadership in Energy and Environmental Design Silver certification for their facilities. Leadership in Energy and Environmental Design is a voluntary point system tool that measures the degree of sustainability features incorporated into a development.

Water resource sustainability is addressed in two categories: minimize water demand and maximize the quantity and quality of groundwater recharge. Elements identified to achieve minimum water use are:

- Water Conservation - identify and specify appropriate minimum water demand fixtures and devices
- Irrigation - minimize use of irrigation systems and water
- Grey Water Use - evaluate options for use of grey water for irrigation
- Rainwater Harvesting - investigate harvesting, storage and distribution systems

The quantity and quality of groundwater recharge is addressed in the existing UFC Low Impact Development (LID) Manual that would be followed. This manual includes specific Integrated Management Practices to be considered and included in the drainage design of the proposed action sites. In addition, National Pollutant Discharge Elimination System (NPDES) permitting requirements, Leadership in Energy and Environmental Design goals, and recent laws (e.g., the Energy Independence and Security Act of 2007), mandate certain drainage quantity and quality performance standards. Thus, the proposed action includes incorporating post-construction drainage quality, quantity, and velocity dissipation measures to approximate (or improve upon) pre-construction conditions at the property line.

Surface Water/Stormwater

Surface water issues include:

- Water quality
- Flooding
- Flow path alterations

Surface water quality impacts are evaluated by examining the potential increase of contamination including chemicals, heavy metals, nutrients, and/or sediments in the surface water as a result of the proposed action. The analysis is performed by comparing existing water quality data with possible increases in water quality contaminants in the surface water. Potential impacts to surface water quantity and velocity are analyzed by examining changes in drainage volumes and patterns associated with the proposed action.

Construction activities that result in disturbance of more than one acre of land require a construction

stormwater permit in order to mitigate pollutant impacts from contaminated runoff. Stormwater discharges from construction activity may contain elevated sediment concentrations, and spills and leaks of chemicals such as lubricants, fuels, or other construction materials that may increase pollutant loading in to the surface water. In addition, direct construction or alteration of stream channels or reservoirs may cause increased contamination by sedimentation or chemical constituents. Therefore, construction activities that result in disturbance of more than one acre of land are considered to have an impact to surface water.

Direct construction or alteration of stream channels or reservoirs may cause increased contamination by sedimentation or chemical constituents. If flow paths or patterns are altered, additional studies, such as instream flow analysis, would be conducted to ensure the human uses and/or biological services are preserved.

Operational effects include stormwater discharges that may increase the volume of sediment loading to the surface water as well as increase contaminants from vehicle maintenance, household discharge, privately-owned vehicles, and animal waste. Contamination of surface water from leaks or spills of hazardous, or otherwise regulated materials, is also a potential impact. Increased water usage may reduce the water availability in the reservoirs and/or reduce instream flows. Increased impervious areas may increase the runoff and increase the potential for flooding. Development in the floodplain may result in potential damage from flooding. Diversion of water courses for municipal water consumption may impact the ecological services that the resource provides.

Groundwater

Groundwater impact concerns include water quality and water quantity. Groundwater quality is assessed by examining the potential risk of a hazardous or regulated waste release, as well as approximating the amount of additional stormwater and associated non-point source pollution that enter the groundwater.

Construction activities that result in disturbance of more than one acre of land require a construction stormwater permit in order to mitigate pollutant impacts from contaminated infiltration. Stormwater discharges from construction activity may contain elevated sediment concentrations, and spills and leaks of chemicals such as lubricants, fuels, or other construction materials that may increase pollutant loading to groundwater resources.

The possible impacts connected with operational activities include increases of impervious areas, waste-generating activities, storage of potential contaminants, and landfill leaching. The direct impacts include an increase in polluted stormwater runoff and contamination from leaks or spills of hazardous or regulated materials. In addition, the increased water usage may increase the depletion of groundwater resources (see Volume 6, Chapter 3, Section 3.1.3, Potable Water). The potential impacts include decreases in groundwater recharge from increased impervious areas and saltwater intrusion from increased aquifer pumping.

Nearshore Waters

The nearshore water impact analysis focuses on water quality. Recreational nearshore issues are addressed in Volume 6 Chapter 11 Recreational Resources. The potential increases of contamination including chemicals, heavy metals, nutrients, and/or sediments in nearshore waters as a result of the proposed action are assessed by comparing existing water quality data with the projected changes in water quality.

Potential impacts associated with construction activities include construction spills and leaks that may

discharge to nearshore waters, an increase in stormwater discharge that may increase non-point source pollution, and physical impacts to nearshore waters from dredging.

Operation effects include potential non-point source and point-source pollution. The point-source pollution consists of chemicals, heavy metals, nutrients, and/or sediments that may runoff from the increase in impervious, urban areas. The point source pollution would be related to direct discharges to the nearshore waters such as wastewater effluent.

Wetlands

The wetland impact areas of concern include:

- Pollutants
- Loss of area
- Loss of functionality

The potential for pollutants to impact a wetland was evaluated by examining the risk of hazardous materials leaking or spilling and their proximity to the wetlands. The loss of area was assessed by the total amount of delineated wetland area that would be directly removed either in loss of area or function as a result of the proposed action. The wetland functionality refers to the ability of the wetland to trap sediment and nutrients, receive and retain water, maintain wildlife habitat (both flora and fauna), and provide recreational uses. The impacts to wildlife habitat associated with wetlands are addressed in Chapter 12, Terrestrial Biological Resources.

For construction activities, the effects associated with activities in close proximity to any designated wetland or activities in the wetlands themselves are considered. Runoff from nearby construction sites may contain increased chemicals, heavy metals, nutrients, and/or sediment that could adversely affect those wetlands. Wetland impacts could result from changes in land uses and/or spills or leaks from construction operations and equipment. Loss of functionality can also occur if construction operations occur directly within the designated wetlands. Loss of wetland area would occur if the proposed action involves the direct removal of wetlands.

The effects associated with operations include an increase in potential spills and leaks from hazardous materials that may be stored in close proximity to designated wetlands. An indirect impact to existing wetlands may occur by altering (i.e., diverting or restricting) the surface water flowing into the wetlands. Indirect impacts to wetlands could also occur as a result of altered sedimentation of watercourses or drainage conveyances connected to wetland areas.

Off Base Roadways

This section contains a discussion of potential environmental consequences associated with implementation of the alternatives within the region of influence for water resources. The environmental consequences of each composite alternative and the no-action alternative are presented in this section. The available literature was used to assess the existing conditions and to establish a baseline for the assessment, as described in the Water Resources section of Volume 2. The methodology for identifying, evaluating, and mitigating impacts to water resources have been established based on federal and local laws and regulations, Federal Highway Administration (FHWA) guidelines, and Guam Environmental Protection Agency (GEPA) guidelines.

The environmental consequences evaluation for water resources includes a qualitative and quantitative analysis of floodplains, runoff and drainage, and water quality of surface and groundwater resources to the extent possible given available project data. The assessment was set up to ensure compliance with

FHWA requirements by identifying (1) public water sources with emphasis on sole source aquifers; (2) watershed characteristics, including overall runoff and drainage flow patterns and floodplains; (2) surface water resource characteristics, including streams, lakes, and bays; (3) coastal resources, that are delineated in Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) as identified in Volume 2; (4) National Wild and Scenic Rivers, that do not exist within the vicinity of the study area; (5) areas within the Coastal Zone Management Program; (6) areas subject to the Coastal Barriers Resources Act, that do not exist within the vicinity of the study area; (7) wetlands, that are primarily discussed under the Marine Biology section; and (8) factors that influence percolation and infiltration into the groundwater. Environmental impact assessments were made and compared to baseline conditions in the various hydrologic regimes of the island for the various types of roadway projects to determine the magnitude of potential impacts to water resources. The proposed action analysis is separated in two main activities: construction impacts (year 2014) and long-term impacts (year 2030). Each of these activities has potential effects with associated impacts.

6.2.1.2 Determination of Significance

The following factors are considered in evaluating impacts to water resources:

- Reducing availability or accessibility of water resources
- Creating noncompliance with all applicable laws and regulations
- Increasing risk associated with environmental hazards or human health
- Decreasing existing and/or future beneficial use
- Increasing risk of flooding
- Depletion, recharge, or contamination of a usable groundwater aquifer for municipal, private, or agricultural purposes
- Increases in soil settlement or ground swelling that damages structures, utilities, or other facilities caused by inundation and/or changes in groundwater levels
- Reducing the amount of wetlands available for human use or ecological services
- Long-Term increased inundation, sedimentation, and/or damage to water resources

If an activity is deemed as having an impact, the activity then can be evaluated to determine if the impact is significant or insignificant. For significant impacts, a determination is made as to whether the impacts can be mitigated to less than significant impacts.

6.2.1.3 Issues Identified During Public Scoping Process

As part of the analysis, concerns related to water resources that were mentioned by the public, including regulatory stakeholders, during the public scoping meetings were addressed. These include:

- Describing water quality with respect to public health requirements, drinking water regulations, and applicable water quality standards
- Estimating quality and quantity of stormwater runoff to be generated by increased impervious surface, methods of contaminant removal, methods of runoff redirection to recharge the aquifer, and groundwater under the direct influence of surface water
- Accidental or intentional contamination of groundwater
- Capacity of water resources to meet agricultural needs
- Stormwater management controls to prevent pollution during construction and subsequent operations
- Construction that could potentially cause runoff and could pollute the beaches and destroy marine life
- Effects of training and dredging on sedimentation stress for the coral reefs and other marine life

- Identifying ways to monitor and mitigate indirect impacts from sediments on coral reefs

6.2.2 Power

6.2.2.1 Interim Alternative 1 (Preferred Alternative)

Interim Alternative 1 would recondition existing combustion turbines and upgrade transmission and distribution (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.

Reconditioning Guam Power Authority (GPA) Facilities

The proposed reconditioning of existing combustion turbines and upgrading T&D systems refurbishment would not impact surface water, groundwater, nearshore water, or wetlands because no new construction would occur under Interim Alternative 1. The DoD reconditioning of the GPA facilities would not involve additional storage of fuels or materials that would be exposed to rain events. GPA would continue to follow their Spill Prevention Control and Countermeasure Plan to prevent or control spills that might occur during operations to minimize potential impacts to water resources. Stormwater would continue to be managed by GPA through an existing USEPA stormwater multi-sector general permit. This multi-sector general permit requires the development of a Stormwater Pollution Prevention Plan (SWPPP) that incorporates best management practices (BMPs) to control pollutants. Therefore, this portion of the alternative would have no impacts on water resources.

Upgrades to Transmission and Distribution (T&D) Lines

Proposed upgrades to existing T&D lines associated with this alternative would include installation of new underground power lines. This would involve land disturbing activities greater than an acre in size that would trigger the requirement for a construction stormwater permit. Therefore, this portion of the alternative would result in impacts on water resources. These impacts would be minimized through the use of BMPs as required through the construction stormwater permit. Therefore, there would be less than significant impacts to water resources.

Summary of Interim Alternative 1 Impacts

Interim Alternative 1 would affect water resources. These impacts would be minimized through the use of BMPs as required through a construction stormwater permit and SWPPP with associated BMPs; therefore, these impacts are less than significant.

Potential Mitigation Measures

No mitigation measures related to water resources are needed for Interim Alternative 1.

6.2.2.2 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.

Reconditioning GPA Facilities and T&D Upgrades

The activities that would potentially impact water resources under this alternative are the same as Interim Alternative 1. Therefore, see Interim Alternative 1 for the impact analysis to water resources.

Summary of Interim Alternative 2 Impacts

The activities that would potentially impact water resources under this alternative are the same as Interim Alternative 1. Therefore, see Interim Alternative 1 for the impact analysis to water resources.

Potential Mitigation Measures

No mitigation measures related to water resources are needed for Interim Alternative 2.

6.2.2.3 Interim Alternative 3

Interim Alternative 3 is a combination of reconditioning existing GPA permitted facilities at Marbo, Yigo, and Dededo and upgrades to the DoD power plant at Orote. Upgrades would be made to existing T&D systems. 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 ac (4,047 square meters). 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.

Reconditioning GPA Facilities

The activities that would potentially impact water resources under this portion of the alternative are the same as Interim Alternative 1. Therefore, see Interim Alternative 1 for the impact analysis to water resources for this portion of the alternative.

Upgrade DoD Orote Substation

Construction

Under Interim Alternative 3, the proposed construction of the new Orote substation would result in the potential for a temporary increase in stormwater runoff, erosion, and sedimentation. This would involve land disturbing activities greater than an acre in size that would trigger the requirement for a construction stormwater permit. Therefore, this portion of the alternative would result in impacts on water resources. These impacts would be minimized through the use of BMPs as required through the construction stormwater permit. No wetlands are located in the construction area. Impacts to water resources associated with this portion of the alternative would be less than significant.

Therefore, construction activities associated with Interim Alternative 3 would result in less than significant impacts to water resources.

Operation

The operational phase of Interim Alternative 3 would result in a minor increase in the area of impervious surface, which would result in an associated relatively minor increase in stormwater discharge intensities and volume. This increase would be accommodated by stormwater infrastructure, and stormwater flow paths would continue to mimic area topography. The increase in impervious surface would not significantly decrease aquifer recharge rates, as no diversion or restriction of surface water flow would occur.

The Orote power facility is currently covered under the USEPA Stormwater multi-sector general permit. This multi-sector general permit requires the development of a SWPPP that incorporates BMPs to control pollutants. Additionally, facility-specific LID measures would be identified and developed as part of project design. Together, these actions would minimize potential water quality impacts from facility operation, to include the transportation, storage, and use of fuel on surface and groundwater resources. While alterations to the watershed have the potential result in indirect impacts that could alter nearshore water quality, these potential effects would be minimized by complying with all applicable orders, laws and regulations. No wetland areas would be affected by operations, as no delineated wetland areas are located near the proposed power substation. Therefore, operations associated with Interim Alternative 3 would result in less than significant impacts to water resources.

Summary of Interim Alternative 3 Impacts

Under Interim Alternative 3, there would be no reduction in the amount of wetlands on Guam, and there would be no reduction in the availability or accessibility of water resources. Increases in stormwater would be managed by stormwater infrastructure and stormwater flow paths would continue to mimic area topography, and no construction would occur in a flood zone. There would be no increase in flooding risk. With the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) through the USEPA multi-sector stormwater permit, and the implementation the LID measures and facility-specific plans and procedures there would no increased risk from environmental hazards or to human health. All actions would be implemented in accordance with all applicable federal, GovGuam, and military orders, laws, and regulations (Volume 8 Table 3.1-1). Therefore, Interim Alternative 3 would result in less than significant impacts to water resources.

Potential Mitigation Measures

No mitigation measures related to water resources have been identified for Interim Alternative 3.

6.2.2.4 Summary of Impacts

Table 6.2-1 summarizes the potential impacts of each interim alternative. A text summary is provided below.

Table 6.2-1. Summary of Potential Power Impacts

*Interim Alternative 1**	*Interim Alternative 2*	*Interim Alternative 3*
Construction Impacts		
WR: NI	WR: NI	SW: LSI • temporary increase in stormwater runoff, erosion, and sedimentation GW: LSI • increased potential for local groundwater contamination NW: LSI • minor increase in runoff volume and pollutant loading potential WL: NI
Operation Impacts		
WR: NI	WR: NI	SW: LSI • temporary increase in stormwater runoff, erosion, and sedimentation GW: LSI • increased potential for local groundwater contamination NW: LSI • minor increase in runoff volume and pollutant loading potential WL: NI

Legend: LSI = Less Than Significant Impact, NI = No Impact, SW= Surface Water/Stormwater, GW=Groundwater, NW = Nearshore Waters, WL = Wetland. * Preferred Alternative
Note: Potential impacts under Long-term Alternatives 2 and 3 would be analyzed under future NEPA documentation; potential impacts listed herein are general and not final.

Implementation of the power interim alternatives would have no or less than significant impacts to water resources as there would be limited construction or change in operations under these alternatives. Stormwater would continue to be managed in accordance with laws, regulations, and plans which would reduce potential impacts to groundwater and nearshore waters. Land disturbing activities greater than an acre in size that would trigger the requirement for a construction stormwater permit. These impacts would be minimized through the use of BMPs as required through the construction stormwater permit. General construction BMPs (Volume 2 Chapter 4 Table 4.2.1) would be implemented to reduce the potential for erosion, runoff, sedimentation, and associated surface water quality impacts, which would also reduce potential impacts to groundwater and nearshore water resources. No impacts to wetlands would occur.

6.2.3 Potable Water

Chapter 3 Section 3.2.3 (Volume 6) describes the potential impacts from the potable water alternatives that could impact groundwater resources. These impacts relate to withdrawal of groundwater from the Northern Guam Lens Aquifer that would be required to meet the DoD water need on-base, and impacts related to further capacity needs that will result from off-base construction workforce housing and induce population. Please refer to this section for a detailed assessment of these impacts and associated mitigations and best management practices. This chapter and section focuses on other potential impacts to water resources, including groundwater, that could result from the construction and operation of potable water systems in support of the proposed action.

As discussed in greater detail in Section 3.2.3, the Navy recently initiated a study to determine optimal well and well field configurations needed to upgrade and integrate the DoD water systems to meet the future Marine Corps and other DoD water demands and to meet future regulatory requirements. The study would develop groundwater source well design criteria for projects that represent the best value water system improvements that would enable the DoD water systems on Guam to meet future DoD potable water requirements. The study results would be incorporated into the final EIS/OEIS.

6.2.3.1 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

Construction

Under Basic Alternative 1, proposed well construction activities would result in the potential for a temporary increase in stormwater runoff, erosion, and sedimentation. Construction would involve land disturbing activities greater than an acre in size that would trigger the requirement for a construction stormwater permit. Therefore, this portion of the alternative would result in impacts on water resources. These impacts would be minimized through the use of BMPs as required through the construction stormwater permit. General construction BMPs (Volume 2 Chapter 4 Table 4.2.1) would be implemented to reduce the potential for erosion, runoff, sedimentation, and associated surface water quality impacts, which would also reduce potential impacts to groundwater and nearshore water resources. Proposed construction activities would not occur within the 100-year flood zone.

Based on a preliminary review of GIS data, the proposed water main construction footprint associated with Alternative 1 appears to occur through and/or adjacent to several delineated and NWI-indicated wetlands (Figure 6.2-1). Specifically, based on GIS analysis, the proposed water main line construction corridor (for the purposes of this analysis, we assumed a 24 ft [7.3 m]-wide corridor) would overlap approximately 1.27 acres (0.51 ha) of NWI-indicated wetlands. Upon discovering this potential area of direct impact, a TEC biologist surveyed the entire proposed water main course to ground truth the GIS data. Upon inspection, it was determined that the proposed water main line construction footprint would occur in previously disturbed areas within the existing utility easement, outside of the identified potential wetland areas. No direct impacts to delineated or NWI-indicated wetlands would occur.

The Navy would strive to avoid directly impacting, to the greatest extent possible, the delineated and NWI-indicated wetland areas adjacent to the water main footprint in the design and construction phases of the water main; however, for the purposes of this analysis at this time, it is assumed indirect, temporary impacts would occur. During construction, indirect impacts to nearby wetland areas would be minimized by incorporating site-specific appropriate BMPs (Volume 2 Chapter 4 Table 4.2.1) that would reduce the potential for indirect construction impacts to these wetland areas. Therefore, construction activities associated with Alternative 1 would result in less than significant impacts to water resources.

Operation

The proposed new water wells that would draw from the Andersen and the Agafa-Gumas sub-basins are underdeveloped (as compared to the southern sub-basins). The proposed resulting withdrawals associated with the new and existing wells under Alternative 1 (including Guam Waterworks Authority and Andersen AFB planned expansions) would not exceed sustainable levels. The remaining three wells would be installed in the Finegayan sub-basin. As with the other sub-basins, the additional demand on this resource would not exceed the estimated sustainable yield. However, the planned withdrawal rate for the Agafa-Gumas and the Finegayan sub-basins is only slightly below or equal to the estimated sustainable yield so close monitoring of these water sources would occur to ensure these rates are sustainable.

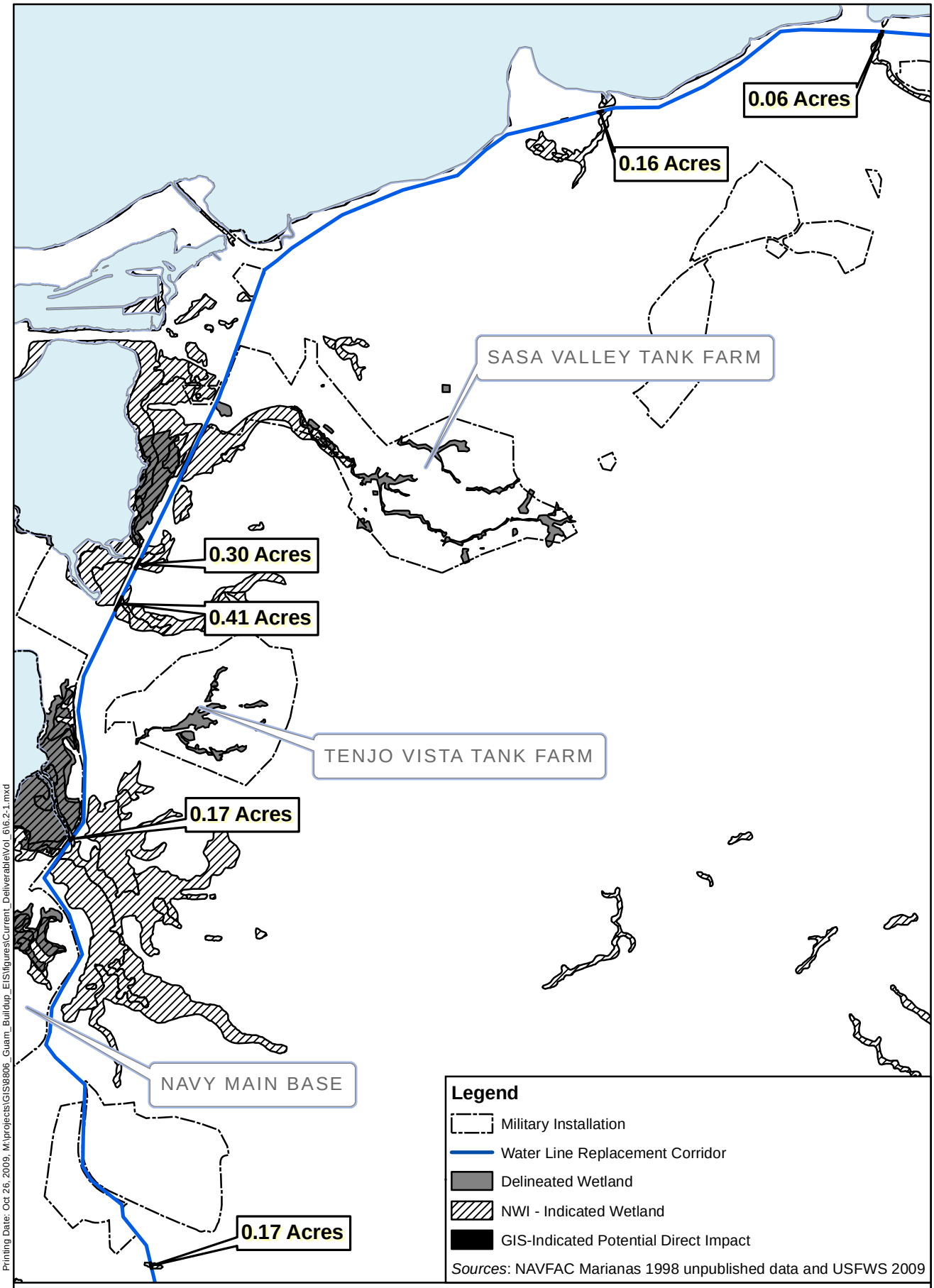

Figure 6.2-1
GIS-Indicated Potential Direct Impacts to NWI-Indicated Wetlands under Basic Alternative 1

There are numerous caves near the shoreline on Guam that provide flow paths for groundwater to the ocean. These caves commonly form along the water table surface and are thus sensitive to changes in groundwater table elevation (Taborosi et al. 2003). The cave and pool systems that have the greatest probability of being impacted by increased groundwater withdrawals are those along the northern shoreline. Each cave and pool system is unique and the actual impact is dependent on the hydrology for each system; in the absence of site-specific cave hydrogeology studies, this analysis relies on general aquifer-wide analysis. Increased groundwater withdrawals could potentially impact water levels in these caves by potentially decreasing the amount of fresh groundwater entering the cave system. The cave and pool systems may be considered jurisdictional waters of the U.S.; thus, any potential impacts to the system would be discussed and potentially permitted by the USACE.

The impact of increased groundwater withdrawals on the pools and caves would likely be dampened by the dynamics of the overall freshwater lens system. Increasing pumping would decrease the thickness of the freshwater lens, but majority of the thinning occurs as a shallowing of the bottom freshwater lens rather than a drop in the elevation of the water table. The Ghyben-Herzberg principle (described in Volume 2, Section 4.1.1.3) states that for every foot the top of the groundwater table drops the mid-point of the freshwater/saltwater transition zone becomes 40 feet (ft) shallower. Also, the average sea level itself imposes a constant boundary condition (as average for tidal fluctuations) that water table would remain slightly above the ocean level. Thus, due to the boundary imposed by ocean and the dynamics of the freshwater lens, the change in water table elevation near the coast where the pools and caves would likely experience very little change due to increase groundwater withdrawals. The majority of the recharge would still flow to the ocean.

Implementation of Basic Alternative 1 would be in compliance with all federal, GovGuam, and military orders, laws, and regulations, and would include the implementation of BMPs and facility-specific LID measures to be identified and developed as part of project design. These actions would minimize potential water quality impacts from facility operation, to include the transportation, storage, and use of fuel on surface and groundwater resources. While alterations to the watershed have the potential to result in indirect impacts that could alter nearshore water quality, these potential effects would be minimized by complying with all applicable orders, laws and regulations. No wetland areas would be affected by operations, as the segments of the water line would be buried in the areas where the line would cross wetland areas and there would be no change to existing hydrology; water flow to wetland areas would not change. Therefore, operations associated with Alternative 1 would result in less than significant impacts to water resources.

New Water Storage Facilities

Construction

Under Basic Alternative 1, the construction of the new facilities would involve land disturbing activities greater than an acre in size that would trigger the requirement for a construction stormwater permit. Therefore, this portion of the alternative would result in impacts on water resources. These impacts would be minimized through the use of BMPs as required through the construction stormwater permit. General construction BMPs (Volume 2 Chapter 4 Table 4.2.1) would be implemented to reduce the potential for erosion, runoff, sedimentation, and associated surface water quality impacts, which would also reduce potential impacts to groundwater and nearshore water resources. Proposed construction activities would not occur within the 100-year flood zone. No wetlands are located in the construction area. Therefore, construction activities associated with Basic Alternative 1 would result in less than significant impacts to water resources.

Operation

The operational phase of Basic Alternative 1 would result in a minor increase in the area of impervious surface that would result in an associated relatively minor increase in stormwater discharge intensities and volume. This increase would be accommodated by stormwater infrastructure, and stormwater flow paths would continue to follow area topography. The increase in impervious surface would not significantly decrease aquifer recharge rates, as no diversion or restriction of surface water flow would occur.

Implementation of Basic Alternative 1 would be in compliance with all federal, GovGuam, and military orders, laws, and regulations, and would include the implementation of BMPs and facility-specific LID measures to be identified and developed as part of project design. These actions would minimize potential water quality impacts from facility operation, to include the transportation, storage, and use of fuel on surface and groundwater resources. While alterations to the watershed have the potential result in indirect impacts that could alter nearshore water quality, these potential effects would be minimized by complying with all applicable orders, laws and regulations. No wetland areas would be affected by operations, as no delineated wetland areas are located near the proposed water treatment and storage sites. Therefore, operations associated with Alternative 1 would result in less than significant impacts to water resources.

Summary of Basic Alternative 1 Impacts

Under Basic Alternative 1, there would be no reduction in the amount of wetlands on Guam, and there would be no reduction in the availability or accessibility of water resources. However, increased groundwater withdrawals could potentially impact water levels in caves located along the northern shoreline of Guam by potentially decreasing the amount of fresh groundwater entering the cave system. The cave and pool systems may be considered jurisdictional waters of the U.S.; thus, any potential impacts to the system would be discussed and potentially permitted by the USACE. Implementation of sustainability practices would reduce the amount of groundwater needed, that would help minimize impacts to groundwater availability. Increases in stormwater would be managed by stormwater infrastructure and stormwater flow paths would continue to mimic area topography, and no construction would occur in a flood zone; therefore, there would be no increase in flooding risk. Through the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) and LID measures, and facility-specific plans and procedures, there would no increased risk from environmental hazards or to human health. All actions would be implemented in accordance with all applicable federal, GovGuam, and military orders, laws, and regulations (Volume 8 Table 3.1-1). A detailed description of resource protection measures potentially required by regulatory mandates is in Volume 7, Section 3.1. A more detailed explanation of potential regulatory permitting requirements is also available in Volume 8 (Table 3.1-1). Therefore, with the implementation of these measures, Alternative 1 would result in less than significant impacts to water resources.

Potential Mitigation Measures

No mitigation measures related to water resources have been identified for Basic Alternative 1.

6.2.3.2 Basic Alternative 2

Basic Alternative 2 would consist of installation of up to 20 new potable water supply wells at 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.

Under Basic Alternative 2, impacts to water resources would be similar to those described under Alternative 1, as dispersing the groundwater wells would not change the overall pumping rates nor exceed sustainable yields for the subbasins, and no wetlands are located in the identified groundwater well areas. Please refer to Section 6.2.3.1 for a discussion of potential impacts.

Summary of Basic Alternative 2 Impacts

Under Basic Alternative 2, there would be no reduction in the amount of wetlands on Guam, and there would be no reduction in the availability or accessibility of water resources. Implementation of sustainability practices would reduce the amount of groundwater needed, that would help minimize impacts to groundwater availability, as would the development of brackish water. The monitoring of groundwater chemistry and brine discharge would ensure no harm to existing or beneficial use. Increases in stormwater would be managed by stormwater infrastructure and stormwater flow paths would continue to mimic area topography, and no construction would occur in a flood zone; therefore, there would be no increase in flooding risk. Through the development and implementation of site-specific BMPs (Volume 2, Chapter 4 Table 4.2.1) and LID measures, and facility-specific plans and procedures, there would no increased risk from environmental hazards or to human health. All actions would be implemented in accordance with all applicable federal, GovGuam, and military orders, laws, and regulations (Volume 8, Table 3.1-1). Therefore, with the implementation of these measures, Alternative 2 would result in less than significant impacts to water resources.

Potential Mitigation Measures

Basic Alternative 2 would include the same potential mitigation measures described under Basic Alternative 1. Please refer to Section 6.2.3.1.

6.2.3.3 Summary of Impacts

Table 6.2-2 summarizes the potential impacts of each basic alternative. A text summary is provided below.

Table 6.2-2. Summary of Potential Potable Water Impacts

*Basic Alternative 1**	*Basic Alternative 2*
Construction Impacts	
SW: LSI • temporary increase in stormwater runoff, erosion, and sedimentation GW: LSI • increased potential for local groundwater contamination; localized increase in sea water intrusion; NW: LSI • minor increase in runoff volume and pollutant loading potential WL: LSI • Indirect, temporary impacts to wetland areas	SW: LSI • temporary increase in stormwater runoff, erosion, and sedimentation GW: LSI • increased potential for local groundwater contamination; localized increase in sea water intrusion NW: LSI • minor increase in runoff volume and pollutant loading potential WL: LSI • Indirect, temporary impacts to wetland areas
Operation Impacts	
SW: LSI • minor increase in stormwater discharge intensities and volume; potential decrease in cave and pool water levels GW: LSI • increased potential for local groundwater contamination NW: LSI • minor increase in runoff volume and pollutant loading potential WL: NI	SW: LSI • minor increase in stormwater discharge intensities and volume; potential decrease in cave and pool water levels GW: LSI • increased potential for local groundwater contamination NW: LSI • minor increase in runoff volume and pollutant loading potential WL: NI

Legend: SI-M = Significant Impact Mitigable to Less Than Significant, LSI = Less Than Significant Impact, SW= Surface Water/Stormwater, GW=Groundwater, NW = Nearshore Waters, WL = Wetland.
* Preferred Alternative.

Construction and operational activities would have the potential to cause erosion and sedimentation that could degrade surface water quality. In addition, the action alternatives would increase the potential for leaks and spills from contaminants. These potential impacts would be reduced through the combination of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1), LID measures, and monitoring programs. Increases in stormwater would be managed by stormwater infrastructure and stormwater flow paths would continue to mimic area topography. While groundwater withdrawal rates would increase, implementation of sustainability practices would reduce the amount of groundwater needed, that would help minimize impacts to groundwater availability. The resulting total annual groundwater withdrawals would be less than the sustainable yield and monitoring of groundwater chemistry and brine discharge would ensure no harm to existing or beneficial use. With the implementation of potential mitigation measures (i.e., mitigation measures to be determined during the USACE permitting process for potential impacts to the cave/pool system), potential impacts to jurisdictional waters of the U.S. would be less than significant. The alternatives would be implemented in compliance with all federal, local, and military orders, laws, and regulations (Volume 8 Table 3.1-1), including Commander Navy Region Marianas Instruction 3500.4, as well as the implementation of BMPs, LID, and monitoring.

6.2.4 Wastewater

6.2.4.1 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.

Basic Alternative 1a

Construction

The proposed upgrade of the NDWWTP, expansion to secondary treatment, and installation of a sewer line would result in the potential for a temporary increase in stormwater runoff, erosion, and sedimentation. Construction would involve land disturbing activities that would trigger coverage under the NPDES stormwater construction general permit and preparation of a SWPPP. Therefore, this alternative would result in impacts on water resources. However, these impacts would be minimized during construction as a comprehensive stormwater management program will be implemented for the military buildup. The construction stormwater program would include preparation and implementation of a Regional SWPPP for the military buildup and a site-specific SWPPP for each construction project. Standard construction BMPs (Volume 2 Chapter 4 Table 4.2.1), as well as site-specific BMPs, would be identified and implemented to reduce the potential for erosion, runoff, sedimentation, and associated surface water quality impacts, which would also reduce potential impacts to groundwater, nearshore water resources, and the marine environment. Therefore, construction activities associated with Alternative 1a would result in less than significant impacts to water resources.

Operation

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 Draft Guam Northern District Outfall Assessment, October 2009*). The study is assessing the potential 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. The study was still in draft form at the time of this DEIS publication, but will be finalized before publication of the FEIS. Initial results indicate the upgrade of the NDWWTP to secondary treatment would allow the plant to meet all water quality standards.

Summary of Basic Alternative 1a Impacts

Under Basic Alternative 1a, there would be no reduction in the amount of wetlands on Guam, and there would be no reduction in the availability or accessibility of water resources. There would be no permanent increase in stormwater; stormwater flow paths would continue to follow area topography, and no construction would occur in a flood zone. There would be no increase in flooding risk.

Upon completion of the proposed upgrade to the NDWWTP's primary system and expansion to secondary treatment, the effluent discharge would meet discharge requirements in receiving waters and improve the water quality. Through the development and implementation of a Regional SWPPP, site-specific BMPs and the implementation the LID measures, and facility-specific plans and procedures, there would no increased risk from environmental hazards or to human health. All actions would be implemented in accordance with all applicable federal, GovGuam, and military orders, laws, and regulations (Volume 8 Table 3.1-1). Therefore, Alternative 1a would result in a beneficial impact to water

resources upon completion of improvements.

Potential Mitigation Measures

No mitigation measures related to water resources are needed for Basic Alternative 1a.

Basic Alternative 1b

Under Basic Alternative 1b, the proposed upgrade of the NDWWTP, expansion to secondary treatment, and installation of a sewer line would be the same as described under Alternative 1b and would therefore have the same impacts for construction of these facilities. In addition to a sewer line proposed in Basic Alternative 1a, Basic Alternative 1b would include a new sewer line and pump stations to convey wastewater generated from Barrigada housing to the NDWWTP.

Construction

Under Basic Alternative 1b, new sewer lines and pump stations would be installed from Navy Barrigada to the existing NDWWTP collection system. The pipelines would follow along previously disturbed areas within the existing right of way, so there would be no direct impacts on wetlands or surface water features along the route. In addition, this area is part of an additional investigation to verify presence/absence of wetlands using remotely sensed data verified by ground truthing. Results of the investigation will be incorporated into the FEIS.

Construction would involve land disturbing activities that would trigger coverage under the NPDES stormwater construction general permit and preparation of a SWPPP. Therefore, this e alternative would result in impacts on water resources. However, these impacts would be minimized during construction as a comprehensive stormwater management program will be implemented for the military buildup. The construction stormwater program would include preparation and implementation of a Regional SWPPP for the military buildup and a site-specific SWPPP for each construction project. Standard construction BMPs (Volume 2 Chapter 4 Table 4.2.1), as well as site-specific BMPs, would be identified and implemented to reduce the potential for erosion, runoff, sedimentation, and associated surface water quality impacts, which would also reduce potential impacts to groundwater, nearshore water resources, and the marine environment. Therefore, construction activities associated with Basic Alternative 1b would result in less than significant impacts to water resources.

Operation

Operation of the collection system would not impact water resources as the line would be buried. Therefore, operations associated with Basic Alternative 1b would result in less than significant impacts to water resources.

Summary of Basic Alternative 1b Impacts

Under Basic Alternative 1b, there would be no reduction in the amount of wetlands on Guam, and there would be no reduction in the availability or accessibility of water resources. There would be no permanent increase in stormwater; stormwater flow paths would continue to follow area topography, and no construction would occur in a flood zone. There would be no increase in flooding risk.

Upon completion of proposed upgrade to the NDWWTP's primary system and expansion to secondary treatment, the effluent discharge would meet discharge requirements in receiving waters and improve the water quality. Through the development and implementation of a Regional SWPPP, site-specific BMPs and the implementation the LID measures, and facility-specific plans and procedures, there would be no increased risk from environmental hazards or to human health. All actions would be implemented in

accordance with all applicable federal, GovGuam, and military orders, laws, and regulations (Volume 8, Table 3.1-1). Therefore, Basic Alternative 1b would result in a beneficial impact to water resources upon completion of improvements.

Potential Mitigation Measures

No mitigation measures related to water resources are needed for Basic Alternative 1b.

6.2.4.2 Summary of Impacts

Table 6.2-3 summarizes the potential impacts of each interim alternative. A text summary is provided below.

Table 6.2-3. Summary of Potential Wastewater Impacts

*Basic Alternative 1a**	*Basic Alternative 1b*
Construction Impacts	
SW: LSI • temporary increase in stormwater runoff, erosion, and sedimentation GW: LSI • increased potential for local groundwater contamination NW: LSI • localized increase in turbidity WL: NI	SW: LSI • temporary increase in stormwater runoff, erosion, and sedimentation GW: LSI • increased potential for local groundwater contamination NW: LSI • localized increase in turbidity WL: NI
Operation Impacts	
SW: NI GW: NI NW: BI • minor increase in effluent discharge but improved water quality WL: NI	SW: NI GW: NI NW: BI • minor increase in effluent discharge but improved water quality. WL: NI

Legend: LSI = Less Than Significant Impact, NI = No Impact, BI = Beneficial Impact, SW = Surface Water/Stormwater, GW = Groundwater, NW = Nearshore Waters, WL = Wetland. * Preferred Alternative

Implementation of Basic Alternative 1a or 1b would have no significant impacts to water resources as there would be limited construction or change in operations under these alternatives. Stormwater would continue to be managed in accordance with laws, regulations, and plans that would reduce potential impacts to groundwater and nearshore waters. No impacts to wetlands would occur. Upon completion of the improvements to the NDWWTP's primary treatment system and expansion to secondary treatment, discharge effluent would meet water quality standards (NPDES permit limits) and therefore would result in beneficial impacts on nearshore water quality.

6.2.5 Solid Waste

6.2.5.1 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.

The proposed Layon Landfill and its impacts to water resources were evaluated in the *Final Supplemental Environmental Impact Statement for the Siting of a Municipal Solid Waste Facility, Guam* (Guam DPW 2005). The Layon Landfill has been designed to accommodate solid waste from all current and future DoD sources, as well as civilian and commercial sources. GEPA approved the *Final Integrated*

Hydrogeologic Assessment for the Layon Municipal Sanitary Landfill Site (AMEC Geomatrix Consultants 2008) that established that the proposed landfill would not be located over an important source of groundwater because of potential low yield and marginal groundwater quality. The following analysis focuses on the potential impacts to water resources as a result of the continued use of the Navy Sanitary Landfill at Apra Harbor.

There would be no construction associated with the Preferred Alternative and therefore no impacts to surface water, groundwater, nearshore waters, or wetlands would occur due to construction.

Because the existing Navy Sanitary Landfill is unlined, there is a potential for leachate to adversely affect the underlying groundwater. Studies are currently under way to assess whether or not the underlying groundwater has been affected by leachate. Based on the conclusions of these studies, further action may be required. Continued use of the Navy Sanitary Landfill under the Preferred Alternative would further contribute to the potential contamination of the underlying groundwater. However, 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 groundwater drinking quality or quantities. Surface waters, nearshore waters, and wetlands would not be affected by continued use of the Navy Sanitary Landfill. Therefore, less than significant impacts to water resources would occur under the Preferred Alternative.

Potential Mitigation Measures

No mitigation measures related to water resources are needed for the Preferred Alternative.

6.2.5.2 Summary of Impacts

Table 6.2-4 summarizes the potential impact of the Preferred Alternative. A text summary is provided below.

Table 6.2-4. Summary of Potential Solid Waste Impacts

Preferred Alternative
Construction Impacts
• No construction would occur.
Operation Impacts
SW: NI GW: LSI • Contamination from leachate at existing Navy Sanitary Landfill is being determined. NW: NI WL: NI

Legend: LSI = Less Than Significant Impact, NI = No Impact, SW = Surface Water/Stormwater, GW = Groundwater, NW = Nearshore Waters, WL = Wetland

Implementation of the Preferred Alternative has the potential to contribute to continued contamination of the underlying groundwater. However, 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 groundwater drinking quality or quantities. Surface waters, nearshore waters, and wetlands would not be affected by continued use of the Navy Sanitary Landfill. Therefore, less than significant impacts to water resources would occur under the Preferred Alternative.

6.2.6 Off Base Roadways

The major components of the proposed Guam Road Network (GRN) projects include intersection

improvement, bridge replacement, pavement strengthening, road widening, roadway relocation, and construction of a new road, all of which impact water resources to various degrees. Intersection improvement projects include relocation of existing military access points (MAPs) and various levels of roadway intersection improvements throughout the island. These types of projects generally involve some pavement widening and subsequent increase in impervious surfaces. Pavement strengthening projects and roadway rehabilitation projects would involve rehabilitation of existing pavement materials and placement of an asphalt overlay or reconstruction of the pavement with new materials. Although such projects generally do not increase impervious surfaces, they may require retrofit of the existing drainage systems to convey stormwater to roadway BMPs. Roadway widening projects include clearing and grubbing, site grading, and widening of pavement and subsequent increase in impervious surfaces along the roadway. With respect to water resources, all of these proposed improvements would generally have (1) little to no impact on floodplains, unless the improvements encroach on an existing floodplain; (2) minor impact on runoff and drainage, possibly requiring relocation or adjustments of drainage catch basins and increasing roadway runoff due to the addition of impervious surfaces; (3) little to no impact to coastal resources because the projects do not involve work in the coastal bays or estuaries and most are located away from the coastline; (4) no impact to National Wild and Scenic Rivers because no rivers in the vicinity of the projects have been designated as such; and (5) potential impact to water quality due to the addition of impervious surfaces that would likely contain sediment, nutrients, hydrocarbons, metals, bacteria, and other particulates that accumulate on roadway surfaces (such pollutants originate from highway use and maintenance and from ambient atmospheric deposition), and due to impacts to erosion and siltation in the drainage area during construction when heavy storms or high wind events occur. These potential impacts are analyzed for each alternative. Also discussed are the impacts attributable to bridge and roadway relocation projects.

Wetlands and waters of the U.S. are discussed in a regulatory context in this chapter. Potential impacts to wetlands and waters of the U.S. are discussed in an ecological context (i.e., potential impacts to special status species, vegetation and marine communities) within the biological resource chapters (Chapter 12 for terrestrial and freshwater aquatic communities and species and Chapter 13 for marine environments).

6.2.6.1 Alternative 1

Year 2014 (Peak Construction and Peak Population)

North

Surface Water/Stormwater. Construction for the North Region projects for this alternative include pavement strengthening along Routes 1, 3, and 9; pavement widening along Routes 3, 9, and 28; construction of a new road; and intersection improvements including MAPs along Routes 3, 9 and 15. With construction of this type, the potential for accidental spills of sediment, fuel, and other toxic materials may occur at any time during the construction period. Water quality impacts from spills could be short or long-term depending on the type of material, size of the spill, and seasonal timing.

To address these potential impacts, roadway-specific BMPs would be included in the planning, design, and construction for all proposed projects. To start construction, regulations set forth by GEPA require a grading permit and a stockpiling permit to be obtained from the Guam DPW. The permits require development of an Erosion and Sediment Control Plan required for clearing, grading, grubbing, embankment or filling, excavation, or other earth-moving operations. This plan would also describe construction site BMPs to be used during construction to minimize the impacts of construction and construction-related activities on the watershed. These include, but are not limited to, temporary soil stabilization, temporary sediment control, scheduling, waste management, materials handling, and other

non-stormwater BMPs. During construction, work within or adjacent to floodplains would be equipped with appropriate stormwater control BMPs to prevent spills from occurring within the waterways, debris from entering the waterway, and erosion from occurring within the streambed. Water would be diverted away from any construction activities using appropriate water diversion BMPs.

Through the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) there would no increased risk from environmental hazards or to human health. Furthermore, all actions associated with Alternative 1 would be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations (Volume 8 Table 3.1-1), including COMNAV Marianas Instruction 3500.4. Therefore, construction activities associated with Alternative 1, Year 2014 in the North Region would result in less than significant impacts to surface water.

Groundwater. As described in the Volume 2, Chapter 4, the infiltration characteristics are high in the North Region; therefore, any surface water quality impact could also impact groundwater quality if poor quality surface water percolates directly to the groundwater. Thus, the same surface water quality protection measures discussed above would also serve to protect groundwater resources. In addition, in the event groundwater dewatering is proposed or anticipated during construction, and an alternative method of disposal (e.g., discharge to sanitary sewer, retention on site) is not feasible, then the Contractor would coordinate with the Guam DPW prior to discharging waste. Therefore, construction activities associated with Alternative 1, Year 2014 in the North Region would result in less than significant impacts to groundwater.

Nearshore Waters. Potential impacts from roadway construction activities would be lessened through the implementation of the surface water BMPs and adherence to all applicable orders, laws, and regulations relating to water quality. No direct impacts to coastal resources would occur. Therefore, construction activities associated with Alternative 1, Year 2014 in the North Region would result in less than significant impacts to nearshore waters.

Central

Proposed construction projects located in the Central Region have been evaluated for two areas that have two very different hydrologic regimes. One is the northern section of the Central Region (characterized as a broad sloping limestone plateau) and the other is the southern section of the Central Region (characterized as a mountainous region composed of eroded volcanic formations and steep narrow streambeds that outlet directly into the bays). Proposed construction in the northern section includes pavement strengthening along Routes 1, 8, 8A, 10, 15, 16, 25, 26, and 27, and Chalan Lujuna; pavement widening along Routes 8, 8A, 16, 26, and 28, and Alageta-Lily; intersection improvements (including MAPs) along Routes 1, 8A, 15, and 16; and roadway relocation along Route 15. Proposed construction in the southern section of the Central Region includes pavement strengthening along Route 1 and replacement of five bridges along Route 1. Construction of the type proposed in the north section of the Central Region is the same as those described for the North Region.

Surface Water/Stormwater. In addition to the potential impacts and associated water quality protection measures discussed for Alternative 1, North (Section 6.2.6.1), construction of the type proposed in the south section of the Central Region has the potential to: 1) damage existing riverbeds and embankments for work occurring within waterways if appropriate construction BMPs, such as soil stabilization, sediment control, and surface water diversion away from the construction site, are not in place prior to commencement of construction activities; and 2) cause an increase in suspended sediment, hydrocarbons, oil and grease, and heavy metals in the surface water bodies if appropriate stormwater and non-stormwater BMPs are not in place prior to work occurring within or adjacent to the rivers where the

bridge replacements are to occur.

Proposed dewatering activities associated with structure placement could also introduce contaminants into the surface waters if inappropriate sampling and disposal methods for potentially contaminated groundwater are not conducted during construction. The bridge replacement projects could impact erosion and sedimentation within the streams if the improvements result in increased flow velocities or incorporate inadequate erosion control practices for short-term (construction) operations and for long-term operations within and/or adjacent to the stream channels. Hydraulic modeling would therefore be required to assess the potential impacts and provide adequate data for the design of flood and erosion control facilities. The bridge replacements are proposed to span crossings along Route 1 over the Agana River, Atantano River, Laguas River, Sasa River, and Fonte Rivers. These rivers are considered perennial (flowing water for all or most of the year) and have a direct nexus with waters considered navigable under the CWA. Therefore, the channels of these rivers bounded by observed ordinary high water marks along each channel's stream bank should be considered jurisdictional under the CWA (waters of the U.S.). As shown in Table 6.2-5, construction activities associated with the five bridge replacements would temporarily remove a total area of approximately 1 acre. Temporary direct impacts associated with construction activities include the potential for increased erosion associated with grading into the subsoil within and outside the stream channel, vegetation removal, and potential impacts to aquatic communities in the immediate area of the bridge replacement. Indirect impacts may occur further downstream outside of the immediate construction area and be prolonged in time. These indirect effects may include degradation of stream channel aquatic habitats and marine habitats supporting coral communities and fisheries. FHWA and GEPA have mandated standard operating procedures and BMPs specific to sediment control that accounts for storm water runoff and other Guam-specific criteria for pollution prevention during construction and operation of the proposed roads. With respect to hydraulic conveyance, the bridge replacement projects could impact erosion and sedimentation within the streams if the improvements result in increased flow velocities or incorporate inadequate erosion control practices for short-term (construction) operations and for long-term operations within and/or adjacent to the stream channels. Hydraulic modeling would therefore be required to assess the potential impacts and provide adequate data for the design of flood and erosion control facilities. Improved hydraulic conveyance under the new bridges would benefit downstream channel segments, wetland areas and open water habitats by decreasing scour along the stream bank near the bridge replacements and decreasing sediment inputs into downstream freshwater and marine habitats. In summary, the bridge replacement projects would cause an unavoidable loss of approximately 1 acre of waters of the U.S. However, the impacts would be minimized through: 1) use of construction and source control BMPs cooperatively developed by the FHWA and GEPA and 2) improved hydraulic conveyance under the proposed bridge replacements.

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

GRN Project #	*Bridge Name*	*Dimensions (ft)*		*Impact to Potential Waters of the U.S.*	
		Structure Width	*Stream Channel Width*	*Square Ft*	*Acres*
3	Agana Bridge	87.0	39.3	5,777.1	0.13
35	Atantano Bridge	80.6	42.7	5,286.6	0.12
	Fonte Bridge	100.0	76.5	11,920.0	0.27
	Laguas Bridge	80.8	41.2	5,801.0	0.13
	Sasa Bridge	82.3	40.3	6,062.0	0.14
Total Area				**34,846.6**	**0.80**

Notes: Stream channel widths were calculated by averaging the width of four cross-stream lines between observed ordinary high water marks (OHWM) for each bridge. Two upstream lines and two downstream lines were measured for each bridge.
The estimated area of direct impacts to potential waters of the U.S. was calculated by the following equation: (Stream channel width) x (Structure width) + (Assumed area of upstream channel modifications [30']) + (Assumed area of downstream channel modifications [30']).

Through the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) there would no increased risk from environmental hazards or to human health. Furthermore, all actions associated with Alternative 1 would be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations (Volume 8 Table 3.1-1), including COMNAV Marianas Instruction 3500.4. Therefore, construction activities associated with Alternative 1, Year 2014 in the Central Region would result in less than significant impacts to groundwater.

Groundwater. Potential construction impacts to groundwater resources resulting from implementation of Alternative 1, Year 2014 in the Central Region would be similar to the potential impacts discussed under Alternative 1, Year 2014 for the North Region (refer to Section 6.2.6.1). Therefore, construction activities associated with Alternative 1, Year 2014 in the Central Region would result in less than significant impacts to groundwater.

Nearshore Waters. Potential construction impacts to nearshore waters resulting from implementation of Alternative 1, Year 2014 in the Central Region would be similar to the potential impacts discussed under Alternative 1, Year 2014 for the North Region (refer to Section 6.2.6.1). Therefore, construction activities associated with Alternative 1, Year 2014 in the Central Region would result in less than significant impacts to nearshore waters.

Apra Harbor

Proposed construction projects within the Apra Harbor Region include pavement strengthening along Routes 1 and 2A, roadway rehabilitation along Route 11, and intersection improvements along Route 1. Route 11 is the main entry to Apra Harbor which is shown to be within the coastal flood zone in the FEMA FIRMs. The Route 1/11 interchange is located within the floodplain of the Masso River. Construction of this type has the potential to cause an increase in suspended sediment, hydrocarbons, oil and grease, and heavy metals in the surface water bodies for work occurring within or adjacent to the Masso River and the adjacent Piti Canal.

Potential construction impacts to water resources in Apra Harbor are similar to those described for Alternative 1, Year 2014, North Region (refer to Section 6.2.6.1). Therefore, construction activities associated with Alternative 1, Year 2014 in Apra Harbor would result in less than significant impacts to water resources.

South

Proposed construction projects within the South Region include improvements along Route 5 (pavement strengthening only), Route 2 (intersection improvement) and Route 12 (relocation of MAPs).

Potential construction impacts to water resources in the South Region are similar to those described for Alternative 1, North Region (refer to Section 6.2.6.1). Therefore, construction activities associated with Alternative 1, Year 2014 in the South Region would result in less than significant impacts to water resources.

Potential Mitigation Measures

No potential mitigation measures have been identified for Alternative 1.

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North

The North Region projects for this alternative include pavement strengthening and intersection improvements for MAPs. Resulting long-term impacts on water resources within this area are itemized below.

Surface Water/Stormwater. Under Alternative 1, potential impacts to runoff and drainage flows could occur due to increased impervious surfaces and could require modifications to existing drainage systems. These impacts would be minimized through management of stormwater and erosion in accordance with the applicable SWPPP and associated BMPs (Volume 7 Chapter 2 Table 6.2-6); therefore, these impacts are less than significant. In this area, the roadway drainage generally flows off the pavement via sheet flow minimizing the need for underground storm drain and catch basin networks. This may require adjustments of adjacent swales or construction of new surface flow systems to enable proper drainage flow offsite. No impacts to floodplains are anticipated because no flood hazard zones have been designated where the proposed improvements are to take place.

Diversion of drainage from one watershed to another would be avoided. Roadway-specific BMPs would be included in the planning, design, and construction for all proposed 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 m) or a proposed cut or fill is greater than 5.0 ft (1.5 m) in height. This stormwater plan would describe the impacts and proposed mitigation related to runoff and drainage.

Through the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) there would no increased risk from environmental hazards or to human health. Furthermore, all actions associated with Alternative 1 would be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations (Volume 8 Table 3.1-1), including COMNAV Marianas Instruction 3500.4. Therefore, Alternative 1, Year 2030 in the North Region would result in less than significant impacts to surface waters.

Groundwater. Under Alternative 1, potential impacts to groundwater quality could occur due to the addition of impervious surfaces that would likely contain sediment, nutrients, hydrocarbons, metals, bacteria, and other particulates that accumulate on roadway surfaces (such pollutants originate from routine roadway use and maintenance and from ambient atmospheric deposition). Because the infiltration characteristics are high, any surface water quality impact could also impact groundwater quality. Groundwater is the primary drinking water supply for the island; therefore, water quality protection would be important. Thus, the same surface water quality protection measures discussed above would

also serve to protect groundwater resources. Therefore, Alternative 1, Year 2030 in the North Region would result in less than significant impacts to groundwater.

Nearshore Waters. While alterations to the watershed have the potential result in indirect impacts that could alter the nearshore water quality, these potential effects would be minimized by complying with all applicable orders, laws and regulations presented in Volume 7 Section 3.1. In addition, the aforementioned surface water resource protection measures would minimize potential indirect impacts to nearshore waters. No direct impacts to coastal resources would occur. Therefore, Alternative 1, Year 2030 in the North Region would result in less than significant impacts to nearshore waters.

Central

Descriptions of affected water resources for the Central Region have been split into the northern and southern part and are described in detail in Volume 2. Roadway projects located in the northern part of the Central Region include pavement strengthening; pavement widening; intersection improvements, including MAPs; and roadway relocation.

Surface Water/Stormwater. Proposed GRN projects in the southern part of the Central Region include pavement strengthening and bridge replacement at five stream crossings. The bridge replacement projects would be undertaken to correct structural deficiencies, increase load capacity, and provide compliance with seismic requirements of the bridges. Studies have shown that the Agana Bridge #1 would not be able to support the proposed loadings for the military buildup. Due to the age and condition of this structure, replacement is required. The new structure would be lengthened to adequately accommodate the flood flow of the river. The width of the new structure would accommodate wider lanes and a median, with sidewalks and barriers on each side.

Hydraulic modeling and flood control improvements associated with the Agana River Bridge Replacement Project would be coordinated through the USACE Flood Control Study for the Hagatna (Agana) River. Flood control was originally studied by USACE in 1977 and was found to be feasible. Since then, conditions have changed, requiring reinvestigation by USACE. A new feasibility study is currently underway. The bridge projects also include replacement of the Atantano Bridge, Laguas Bridge, Sasa Bridge, and Fonte Bridge. These bridges would be replaced due to structural deficiencies, but they would have hydraulic conveyance capacity similar to those under existing conditions. Bridge replacement efforts would also include improvements to the underlying channel as necessary to enable adequate hydraulic conveyance capacity while maintaining or improving potential erosive characteristics of the channel embankments. Improvements to the channels would involve such items as debris removal; placement of erosion control, such as riprap, gabions, vegetated surfaces (with or without erosion control blankets depending on shear forces in the channel),or concrete channel lining on the upstream and/or downstream sides of the bridges and above piers where necessary; and wing wall replacement where necessary.

Under Alternative 1, potential impacts to floodplains located in the northern part of the Central Region would be minimal because very few designated flood hazard areas are shown to exist on the FEMA FIRMs (FIRMs 2009). Only two floodplain areas are shown to be within any of the improvements in the North Central Area, and these are both located on Route 1. These include the Harmon Sink and the Tamuning Drainageway. Route 1 road improvements in these areas are limited to pavement strengthening, that should have no impact to the floodplains. Impacts to floodplains in the southern part of the Central Region are also limited to Route 1. Numerous culverts and bridges along Route 1 cross narrow streams that outlet into the bays and to Apra Harbor. Encroachments into the floodplains and floodways of some of these streams would occur for the bridge replacement projects. These include

replacement of five bridges located along Route 1. All of these bridge improvement projects would involve work within or adjacent to 100-year floodplains. Work occurring within the Agana and Fonte Rivers would be within a FEMA-designated floodway. Bridge lengthening, pier replacement, pier widening, channel lining, and/or bridge replacement activities could impact the upstream floodplain by increasing depths of flow for the 100-year storm event. Location hydraulic studies for each bridge site would require hydraulic modeling to demonstrate the pre- and post-project hydraulic conditions of the floodplain to assess and mitigate the impacts. In general, these bridges would be replaced due to structural deficiencies, but they would have hydraulic conveyance capacity similar to those under existing conditions with the possible exception of the Agana Bridge # 1, that may be designed with additional capacity in accordance with recommendations set forth by USACE as specified in their ongoing Hagatna River Flood Control Study.

Potential impacts to runoff and drainage in the northern part of the Central Region could occur due to roadway widening, intersection improvements, and relocation of Route 15, all of which would increase impervious surfaces and could require modifications to existing drainage systems, including swales, storm drains, catch basins, and connecting stormwater treatment BMPs such as detention basins or biofiltration systems. In this area, the roadway drainage on the east side of the island generally flows off the pavement via sheet flow, minimizing the need for underground storm drain and catch basin networks. This may require adjustments of adjacent swales or construction of new surface flow systems to enable proper drainage flow offsite. Roadway drainage on the west side of the island generally flows to a curb and gutter system and to a catch basin/ storm drain conveyance system. Route 1 is curbed and flows southerly in a storm drain system to the Tamuning Drainageway or to the Harmon Sink. Work along Route 1 may require adjustments to catch basins and incorporation of BMPs at the Tamuning Drainageway outlet. In other areas, runoff flows directly to sinks that allow the untreated runoff to percolate to the groundwater system below, that could impact groundwater quality if the percolation rates are too high. In the south central area, impacts to runoff and drainage would occur along Route 1. The roadway is generally curbed, and runoff flows to storm drain networks that outlet directly to the adjacent waterways. All bridge improvement projects could impact runoff and drainage if the bridge improvements/replacements increase flow depths or velocities within the stream channels. This could result in flow conveyance capacity reductions of the connecting drainage systems or increased erosion potential within the channel. Hydraulic modeling would therefore be required to assess the potential impacts and provide adequate data for the design of flood and erosion control facilities. Improved hydraulic conveyance under the new bridges would benefit downstream channel segments, wetland areas and open water habitats by decreasing scour along the stream bank near the bridge replacements and decreasing sediment inputs into downstream freshwater and marine habitats.

Through the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) there would no increased risk from environmental hazards or to human health. Furthermore, all actions associated with Alternative 1 would be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations (Volume 8 Table 3.1-1), including COMNAV Marianas Instruction 3500.4. Therefore Alternative 1, Year 2030 in the Central Region would result in less than significant impacts to surface water.

Groundwater. In the northern part of the Central Region, potential impacts to groundwater quality could occur due to the addition of impervious surfaces that would likely contain sediment, nutrients, hydrocarbons, metals, bacteria, and other particulates that accumulate on roadway surfaces (such pollutants originate from routine roadway use and maintenance and from ambient atmospheric deposition). Increases in suspended sediment, hydrocarbons, oil and grease, and heavy metals during

construction could also impact surface and groundwater quality. Because the infiltration characteristics are so high, any surface water quality impact could also impact groundwater quality. Groundwater is the primary drinking water supply for the island; therefore, water quality protection would be important. In the southern part of the Central Region, impacts to water quality would generally involve surface water resources (groundwater resources are very limited in this area) and would mainly involve the bridge projects along Route 1. Impacts could occur if the bridge improvements/replacements increase flow velocities within the stream channels that could result in increased erosion potential within the channel and subsequent increase in suspended sediment downstream. Therefore, Alternative 1, Year 2030 in the Central Region would result in less than significant impacts to groundwater.

Nearshore Waters. Potential construction impacts to nearshore waters resulting from implementation of Alternative 1, Year 2030 in the Central Region would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the North Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in the Central Region would result in less than significant impacts to nearshore waters.

Apra Harbor

The proposed GRN projects within the Apra Harbor Region include pavement strengthening, roadway rehabilitation along Route 11, and intersection improvements. Route 11 is the main entry to Apra Harbor, that is shown to be within the coastal flood zone in the FEMA FIRMs. The Route 1/11 interchange is located within the floodplain of the Masso River. Proposed improvements could have the following impacts to water resources:

Surface Water/Stormwater. Potential impacts to surface water resources resulting from implementation of Alternative 1, Year 2030 in Apra Harbor would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the North Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in Apra Harbor would result in less than significant impacts to surface water.

Groundwater. Potential impacts to surface water resources resulting from implementation of Alternative 1, Year 2030 in Apra Harbor would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the North Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in Apra Harbor would result in less than significant impacts to groundwater.

Nearshore Waters. Potential impacts to nearshore waters resulting from implementation of Alternative 1, Year 2030 in Apra Harbor would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the North Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in Apra Harbor would result in less than significant impacts to nearshore waters.

South

The proposed GRN projects within the South Region include improvements along Route 5 (pavement strengthening only) and Route 12 (relocation of MAPs). These routes are located within the upper reaches of the Atantano River and Namo River watersheds along the southwest portion of the island. The Atantano River flows westerly into the Inner Apra Harbor, while the Namo River flows westerly to Agat Bay. Proposed improvements could have the following impacts to water resources:

Surface Water/Stormwater. Potential impacts to surface water resources resulting from implementation of Alternative 1, Year 2030 in the South Region would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the South Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in the South Region would result in less than significant impacts to surface

water.

Groundwater. Potential impacts to surface water resources resulting from implementation of Alternative 1, Year 2030 in the South Region would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the North Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in the South Region would result in less than significant impacts to groundwater.

Nearshore Waters. Potential impacts to nearshore waters resulting from implementation of Alternative 1, Year 2030 in the South Region would be similar to the potential impacts discussed under Alternative 1, Year 2030 for the North Region (refer to Section 6.2.6.1, Year 2030). Therefore, Alternative 1, Year 2030 in the South Region would result in less than significant impacts to nearshore waters.

Potential Mitigation Measures

Most floodplain impacts are associated with the bridge rehabilitation/ improvement projects located along Route 1. A Floodplain Evaluation is required under the National Flood Insurance Program (23 *Code of Federal Regulations* 650, Subpart A Section 650). Measures to mitigate floodplain impacts could include:

- Channel widening, channel lining, channel recontouring
- Pier placement/reconfiguration
- Utility line relocation where utilities cause obstructions to flow
- Debris removal, incorporation of debris noses upstream of piers and wingwalls
- Steepening of embankments using lining such as gabions

6.2.6.2 Alternative 2 (Preferred Alternative)

Peak construction and permanent impacts on water resources under Alternative 2 would be similar to those described under Alternative 1 because the same projects are proposed under this alternative with the exception of varying locations of the MAPs along Route 3.

Potential Mitigation Measures

Potential mitigation measures for Alternative 2 would be the same as those proposed for Alternative 1.

6.2.6.3 Alternative 3

Peak construction and permanent impacts on water resources under Alternative 3 would be similar to those described under Alternative 1 because the same projects are proposed under this alternative, with a few projects that would not be built as part of the GRN improvements program and varying locations of a few MAPs.

Potential Mitigation Measures

Potential mitigation measures for Alternative 3 would be the same as those proposed for Alternative 1.

6.2.6.4 Alternative 8

Peak construction and permanent impacts on water resources under Alternative 8 would be similar to those described under Alternative 1 because the same projects are proposed under this alternative, with a few projects that would not be built as part of the GRN improvements program and varying locations of a few MAPs.

Potential Mitigation Measures

Potential mitigation measures for Alternative 8 would be the same as those proposed for Alternative 1.

6.2.6.5 No-Action Alternative

Under the no-action alternative, Marine Corps units would remain in Japan and would not relocate to Guam, the visiting aircraft carrier would berth at Kilo Wharf, and an Army Ballistic Missile Defense Task Force (BMDTF) would not be positioned on Guam; therefore, the no-action alternative would obviate the need to improve roads necessary for the military buildup. Road improvements associated with the natural growth of Guam's population would continue and include several projects previously identified. These include projects to be constructed by the years 2014 and 2030. Projects to be in place by 2014 include pavement widening along Routes 10A and 27, and Tiyan Parkway, and intersection improvement projects along Routes 1 and 7. All of these projects are located within the Central Region. Projects to be in place by 2030 include pavement widening along Routes 2, 7A, 25, and 26 and intersection improvements located along Routes 1, 4, and 16. All of these projects are located within the Central Region, with the exception of the Route 2 widening, that is located in the South Region.

2009

Construction activities for the improvement projects to be constructed by 2014 would commence in 2009 and would be typical of public works maintenance projects. Because the no-action alternative would involve significantly fewer projects to be constructed during the year 2014, construction impacts on water resources under this alternative would be less than with the action alternatives. Typical impacts to water resources from the proposed roadway improvements to be constructed in Year 2014 are described below.

Surface Water/Stormwater

Under the no-action alternative, Year 2009, there would be an increase in impervious surfaces and potential changes to drainage systems that include swales, storm drains, catch basins, and connecting stormwater treatment BMPs, such as detention basins. Increases in onsite drainage velocities and/or flow due to increased impervious area would be mitigated through the use of detention facilities, energy-dissipating devices at outlets, channel lining, use of grass swales or hydroseeded embankments where potential erosion could occur, incorporation of headwalls or flared end outlets, and use of appropriate stormwater treatment BMPs that would remove pollutants from the drainage system. Roadway-specific BMPs would be included in the planning, design, and construction for all proposed 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 m) or a proposed cut or fill is greater than 5.0 ft (1.5 m) in height. This stormwater plan would describe the impacts and proposed mitigation related to runoff and drainage. No impacts to floodplains are anticipated because no flood hazard zones have been designated where the proposed improvements are to take place.

Prior to starting construction, regulations set forth by GEPA require a grading permit and a stockpiling permit to be obtained from the Guam DPW. The permits require development of an Erosion and Sediment Control Plan required for clearing, grading, grubbing, embankment or filling, excavation, or other earth-moving operations. This plan would describe construction site BMPs to be used during construction to minimize the impacts of construction and construction-related activities on the watershed. These include, but are not limited to, temporary soil stabilization, temporary sediment control, scheduling, waste management, materials handling, and other non-stormwater BMPs. In the event groundwater dewatering is proposed or anticipated during construction, and an alternative method of disposal (e.g., discharge to sanitary sewer, retention on site) is not feasible, then the Contractor would coordinate with the Guam DPW prior to discharging waste. Therefore, the no-action alternative, Year 2009, would result in less than significant impacts to surface water.

Groundwater

Under the no-action alternative, Year 2009, potential impacts to groundwater quality could occur due to the addition of impervious surfaces that would likely contain sediment, nutrients, hydrocarbons, metals, bacteria, and other particulates that accumulate on roadway surfaces (such pollutants originate from routine roadway use and maintenance and from ambient atmospheric deposition). Because the infiltration characteristics are high, any surface water quality impact could also impact groundwater quality. Groundwater is the primary drinking water supply for the island; therefore, water quality protection would be important. Thus, the same surface water quality protection measures discussed above would also serve to protect groundwater resources. Therefore, the no-action alternative, Year 2009, would result in less than significant impacts to groundwater.

Nearshore Waters

Under the no-action alternative, alterations to the watershed have the potential result in indirect impacts that could alter the nearshore water quality; however, these potential effects would be minimized by complying with all applicable orders, laws and regulations presented in Volume 7, Section 3.1. In addition, the aforementioned surface water resource protection measures would minimize potential indirect impacts to nearshore waters. No direct impacts to coastal resources would occur. Therefore, the no-action alternative, Year 2009, would result in less than significant impacts to nearshore waters.

2014

Potential impacts and required mitigation associated with the no-action alternative to water resources would be the same as those described for 2009 (refer to Section 6.2.6.4, Year 2009). Therefore, the no-action alternative, Year 2014, would result in less than significant impacts to water resources.

2030

Potential impacts and required mitigation associated with the no-action alternative to water resources would be the same as those described for 2009 (refer to Section 6.2.6.4, Year 2009). Therefore, the no-action alternative, Year 2030, would result in less than significant impacts to water resources.

6.2.6.6 Summary of Impacts

Table 6.2-7 summarizes the potential impacts of each interim alternative. An analysis of long-term alternatives was not prepared because the alternatives are not ready for project-specific analysis. A text summary is provided below.

Table 6.2-6. Summary of Potential Roadway Project Impacts

Potentially Impacted Resource	*Alternative 1*	*Alternative 2**	*Alternative 3*	*Alternative 8*
Floodplains	LSI	LSI	LSI	LSI
Runoff and Drainage	LSI	LSI	LSI	LSI
Coastal Resources	NI	NI	NI	NI
Surface Water Quality	LSI	LSI	LSI	LSI
Groundwater Quality	LSI	LSI	LSI	LSI

Legend: LSI = Less Than Significant Impact, NI = No Impact. * Preferred Alternative

Construction activities would consist of intersection improvements, bridge replacements, pavement strengthening, road relocation, road widening and construction of a new road. With respect to water

resources, all these types of improvements would generally have: (1) potential impact on floodplains where the bridge replacement projects are proposed; (2) minor impact on runoff and drainage for all projects, possibly requiring relocation or adjustments of drainage catch basins and increasing roadway runoff due to the addition of impervious surfaces; (3) little to no direct impact to coastal resources because the projects do not involve work in the coastal bays or estuaries and most are located away from the coastline; (4) potential impact to surface water quality due to the addition of impervious surfaces that would likely contain sediment, nutrients, hydrocarbons, metals, bacteria, and other particulates that accumulate on roadway surfaces (such pollutants originate from highway use and maintenance and from ambient atmospheric deposition) and due to impacts to erosion and siltation in the drainage area during construction when heavy storms or high wind events occur; and (5) potential impact to groundwater quality in the north area of the island because infiltration characteristics are high in this area causing the potential for groundwater to be under the influence of surface water impacts.

Each of the action alternatives would include physical changes that would be considered potentially significant impacts on water resources. Roadways, bridges, drainage systems, stormwater pollution control systems, erosion control systems, and flood control systems would be designed in accordance with specific water resource considerations to prevent impacts to surface and groundwater resources, floodplains, coastal resources, and the overall runoff and drainage systems. Storm Water Management Plans, Erosion and Sediment Control Plans, and Location Hydraulic Studies for Flood Plains would be required prior to construction. All of these documents would be used to develop and implement proper measures to prevent water resource impacts.

Through the development and implementation of site-specific BMPs (Volume 2 Chapter 4 Table 4.2.1) there would no increased risk from environmental hazards or to human health. Furthermore, all actions associated with Alternative 1 would be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations (Volume 8, Table 3.1-1,), including COMNAV Marianas Instruction 3500.4.

6.3 LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE

Since none of the alternatives involve potential impacts to wetlands as defined in Section 404(b)(1) of the Clean Water Act (CWA), no analysis relative to Section 404 is necessary to identify the *least environmentally damaging alternative* as defined in the CWA.

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