CHAPTER 6. WATER RESOURCES

6.1 INTRODUCTION

Water resources as defined in this Environmental Impact Statement 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 5105, nearshore waters are defined as all coastal waters lying within a defined reef area, all coastal waters of a depth of less than 10 fathoms (60 feet [ft], 18.3 meters [m]), and all coastal waters greater than 10 fathoms up to 100 ft (30.5 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 implementing 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. The locations described in Volume 2 include the ROI for the utilities and roadway projects, and the chapters are presented in the same order as the resource areas contained in Volume 6.

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 implementing the alternatives within the ROI 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 into 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 percent (%) 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 (LEED) Silver certification for their facilities. LEED 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 (from laundry, dishwashing, and bathing) for irrigation.
- Rainwater Harvesting – Investigate harvesting, storage and distribution systems.

The quantity and quality of groundwater recharge is addressed in the existing Unified Facilities Criteria 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, LEED goals, and DoD policy based on recent executive orders and 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 1 acre (0.4 hectare) of land require a construction stormwater permit, which regulates stormwater quality and quantity to reduce pollutant impacts from contaminated runoff. The permit may require mitigation to meet required standards. 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. 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. Therefore, construction activities that result in disturbance of more than 1 acre (0.4 hectare) of land are considered to have an impact to surface water.

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 resources.

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 1 acre (0.4 hectare) of land require a construction stormwater permit 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). 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. 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 Volume 6, Chapter 12.

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 implementing the alternatives within the ROI 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 establish a baseline for the assessment, as described in the Volume 2, Chapter 4. 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. A Storm Water Implementation Plan describing detailed Stormwater Pollution Control measures for the Guam Road Network (GRN) is provided in Appendix G. DoD is committed to following guidance contained in this manual for all GRN projects, and in the Guam Transportation Stormwater Drainage Manual after it is evaluated and finalized.

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 (FIRMs) 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 applicable laws and regulations.
- Increasing risk associated with environmental hazards or human health.
- Decreasing existing and/or future beneficial use.
- Increasing risk of flooding.
- Depleting, recharging, or contaminating usable groundwater aquifer for municipal, private, or agricultural purposes.
- Locating increases in soil settlement or ground swelling that damages structures, utilities, or other facilities caused by inundation and/or changes in groundwater levels.
- Reducing impacts to wetlands available for human use or ecological services.
- Increasing long-term inundation, sedimentation, and/or damage to water resources.

If an activity is deemed as having an impact, the activity 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.
- Causing accidental or intentional contamination of groundwater.
- Ensuring that the capacity of water resources meets agricultural needs.
- Implementing stormwater management controls to prevent pollution during construction and subsequent operations.

- Preventing construction that could potentially cause runoff and could pollute the beaches and destroy marine life.
- Outlining the 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 Basic Alternative 1 (Preferred Alternative)

Basic Alternative 1 would utilize existing Guam Power Authority (GPA) power plants for base loads. The reconditioning of up to five Combustion Turbines (CTs) would be undertaken by the GPA on existing permitted facilities to provide required peaking and reserve power. Reconditioning would be made to existing permitted facilities at the Marbo, Yigo, Dededo (2 units), and Macheche CTs. These CTs are not currently being used up to their permit limits. Transmission and Distribution (T&D) system upgrades would be on existing above ground and underground transmission lines. This alternative supports Main Cantonment Alternatives 1 and 2. Main Cantonment Alternatives 3 and 8 would require additional upgrades to the T&D system.

Reconditioning GPA Facilities

The proposed T&D systems refurbishment would not directly impact surface water, groundwater, nearshore water, or wetlands because the new T&D systems would utilize existing utility corridors and not occur in sensitive water resources areas under Basic 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 United States (U.S.) Environmental Protection Agency (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 T&D Lines

Proposed upgrades to existing T&D lines associated with this alternative would include installing upgraded and new underground and overhead power lines. T&D lines proposed for the southern portions of Guam are primarily above ground, and would therefore require little soil disturbing activities. Land disturbing activities would trigger the requirement to seek coverage under the Construction General Permit (CGP). A site-specific SWPPP would be prepared and implemented in accordance with the CGP. The SWPPP would identify site-specific BMPs (Volume 2, Chapter 4, Table 4.2-1) that would be implemented as part of Basic Alternative 1 to reduce the potential for erosion, runoff, sedimentation, and subsequent water quality impacts.

Stormwater runoff in the northern portion of Guam infiltrates into the ground, with little to no surface water runoff. A review of GEPA's impaired waterbodies list (also known as the Clean Water Act [CWA] Section (§) 303(d) list) does not show any impaired surface waters in the areas where construction activities are proposed for the military relocation. Therefore, these construction activities are not anticipated to contribute to water quality impairments in this area, particularly given the implementation of SWPPP BMPs. Implementation of SWPPP BMPs would ensure that pollutants in stormwater runoff from construction areas are contained and treated on site. Stormwater runoff in the southern portion of

Guam can eventually flow to surface waters, and pollutants such as sediment can enter these surface waters. A review of GEPA's impaired waterbodies list shows impairments for sediment and bacteria in areas other than where construction activities are proposed for the military relocation. Therefore, these construction activities are not anticipated to contribute to water quality impairments in these areas, and the implementation of SWPPP BMPs would ensure that pollutants in stormwater runoff from construction areas are contained and treated on site.

A review was also conducted of GEPA's existing and proposed Total Maximum Daily Loads (TMDLs). A TMDL calculates the maximum amount of a pollutant that is allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. The TMDL allocates (or divides) the load between all of the sources of discharges to the waterbody. The sources to a waterbody include direct discharges such as outfalls from treatments plants, and indirect discharges such as stormwater runoff and septic tanks. GEPA has prepared TMDLs for waterbodies that are identified as impaired on the 303(d) list, which includes developing plans for each impaired waterbody to control discharges to it. GEPA has several TMDLs that have been approved by USEPA Region 9 for waters that are impaired for bacteria. The TMDLs identify the source of bacteria to likely be from sewage treatment discharges, septic tanks, and stormwater runoff. The proposed construction activities for the military relocation in the northern and southern portions of Guam are not expected to interfere with the implementation of promulgated or proposed TMDLs, or the attainment of water quality in waters where TMDLs are being pursued because construction activities are not associated with bacteria-producing pollutants.

A study to identify wetlands was conducted in various proposed project areas (Volume 9, Appendix G; Naval Facilities Engineering Command [NAVFAC] Pacific 2010) and the results are summarized in Volume 2, Chapter 4. No wetlands were identified in northern Guam in proposed project areas. Wetlands were identified adjacent to the proposed powerline corridor along Marine Corps Drive. However, the upgrades and new lines would be installed in existing upland corridors adjacent to the roadway and would not result in disturbance of wetlands.

Based on the above analysis, impacts to water resources from proposed power facility construction activities would be less than significant.

Summary of Basic Alternative 1 Impacts

Basic Alternative 1 would potentially affect water resources. However, through compliance with a CGP and implementation of a SWPPP and associated site-specific BMPs, effects to water resources would be minimized; therefore, there would be less than significant impacts to water resources.

Proposed Mitigation Measures

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

6.2.2.2 Summary of Impacts

Table 6.2-1 summarizes the potential impacts of Basic Alternative 1. A text summary is provided below.

Table 6.2-1. Summary of Potential Power Impacts

*Basic Alternative 1**
Construction Impacts (direct and indirect impacts are the same)
SW – LSI GW – LSI NW – LSI WL – NI
Operation Impacts (direct and indirect impacts are the same)
SW – NI GW – NI NW – NI WL – NI

Legend: GW=Groundwater; LSI = Less than significant impact; NI = No impact; NW = Nearshore Waters; SW= Surface Water/Stormwater; WL = Wetland.

Implementation of Basic Alternative 1 would have no impacts to water resources as there would be limited construction or change in operations under this alternative. The induced civilian population growth would have no impacts to water resources since there would be limited construction or change in operations. Stormwater would continue to be managed in accordance with laws, regulations, and plans which would reduce potential impacts to groundwater and nearshore waters. Because Basic Alternative 1 would involve land disturbing activities that trigger the requirements for CGP coverage, a Notice of Intent would be filed and a site-specific SWPPP would be prepared and implemented in accordance with the CGP. The SWPPP would identify site-specific BMPs (Volume 2, Chapter 4, Table 4.2.1) that would be implemented as part of the alternative to reduce the potential for erosion, runoff, sedimentation, and subsequent surface water quality impacts, which would also reduce potential for impacts to groundwater and nearshore water resources. Stormwater runoff from construction would not prevent the attainment of water quality standards in receiving waters or interfere with the implementation of TMDLs. No impacts to wetlands would occur.

6.2.3 Potable Water

This section focuses on the 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. Volume 6, Chapter 3 describes the potential impacts from the potable water alternatives that could impact groundwater resources.

6.2.3.1 Basic Alternative 1 (Preferred Alternative)

Basic Alternative 1 would provide additional water capacity of 11.3 MGd (42.8 MLd), which is anticipated to be met by an estimated 22 new wells at Andersen Air Force Base (AFB), rehabilitate existing wells, interconnect with the Guam Waterworks Authority (GWA) water system, and associated treatment, storage and distribution systems. Two new 2.5 MG (9.5 ML) water storage tanks would be constructed at ground level at NCTS Finegayan. Up to two new elevated 1 MG (3.8 ML) water storage tanks would be constructed at Finegayan within the Main Cantonment footprint.

New Water Supply Facilities and Distribution Lines

Construction

Under Basic Alternative 1, proposed well construction activities would result in the potential for a temporary increase in stormwater runoff, erosion, and sedimentation. Because construction would involve land disturbing activities that trigger the requirement for CGP coverage, a Notice of Intent would be filed

and a site-specific SWPPP would be prepared and implemented in accordance with the CGP. The SWPPP would identify site-specific BMPs (Volume 2, Chapter 4, Table 4.2-1) that would be reduce the potential for erosion, runoff, sedimentation, and subsequent surface water quality impacts, which would also reduce the potential for impacts to groundwater and nearshore water resources. No buildings/structures would be constructed in the 100-year flood zone; however, some stormwater detention basins could be constructed in the 100-year flood zone. In some of these areas, these open, grassed stormwater detention basins could also be utilized for additional uses, for example, as recreational fields.

Based on a preliminary review of Geographic Information System (GIS) data, the proposed water main construction footprint associated with Basic Alternative 1 would traverse areas adjacent to delineated and National Wetland Inventory (NWI)-indicated wetlands (Figure 6.2-1). A study to further evaluate these wetlands and other proposed project areas was conducted (Volume 9, Appendix G; NAVFAC Pacific 2010) and the results are summarized in Volume 2, Chapter 4. No wetlands were identified in northern Guam in proposed potable water project areas; wetlands were identified adjacent to the proposed potable water line corridor along Marine Corps Drive (Figure 6.2-1). The upgrades and new lines would be installed in existing upland corridors adjacent to the roadway and would not result in work in wetlands. Where waterlines cross rivers along Marine Corps Drive the lines would not be located underground and attached to bridges where necessary. Therefore, there would be no direct impacts to identified wetlands.

A SWPPP would be prepared and implemented and site-specific BMPs (Volume 2, Chapter 4, Table 4.2-1) would be implemented as part of the CGP during construction of the water main. These BMPs would reduce the potential for erosion, runoff, sedimentation, and subsequent indirect impacts to nearby wetland areas.

Stormwater runoff in the northern portion of Guam infiltrates into the ground, with little to no surface water runoff. A review of GEPA's impaired waterbodies list (also known as the CWA § 303(d) list) does not show any impaired surface waters in the areas where construction activities are proposed for the military relocation, including where wells and potable water distribution lines are proposed. Therefore, these construction activities are not anticipated to contribute to water quality impairments in this area, particularly given the implementation of SWPPP BMPs. Implementation of SWPPP BMPs would ensure that pollutants in stormwater runoff from construction areas are contained and treated on site. Stormwater runoff in the southern portion of Guam can eventually flow to surface waters, and pollutants such as sediment can enter these surface waters. A review of GEPA's impaired waterbodies list shows impairments for sediment and bacteria in areas other than where construction activities are proposed for the military relocation. Therefore, these construction activities are not anticipated to contribute to water quality impairments in these areas, and the implementation of SWPPP BMPs would ensure that pollutants in stormwater runoff from construction areas are contained and treated on site.

A review was also conducted of GEPA's existing and proposed TMDLs. GEPA has several TMDLs that have been approved by USEPA Region 9 for waters that are impaired for bacteria. The TMDLs identify the source of bacteria to likely be from sewage treatment discharges, septic tanks, and stormwater runoff. The proposed construction activities for the military relocation in the northern and southern portions of Guam are not expected to interfere with the implementation of promulgated or proposed TMDLs, or the attainment of water quality in waters where TMDLs are being pursued because construction activities are not associated with bacteria-producing pollutants.

Based on the above analysis, impacts to water resources from proposed potable water system construction activities associated with Basic Alternative 1 would be less than significant.

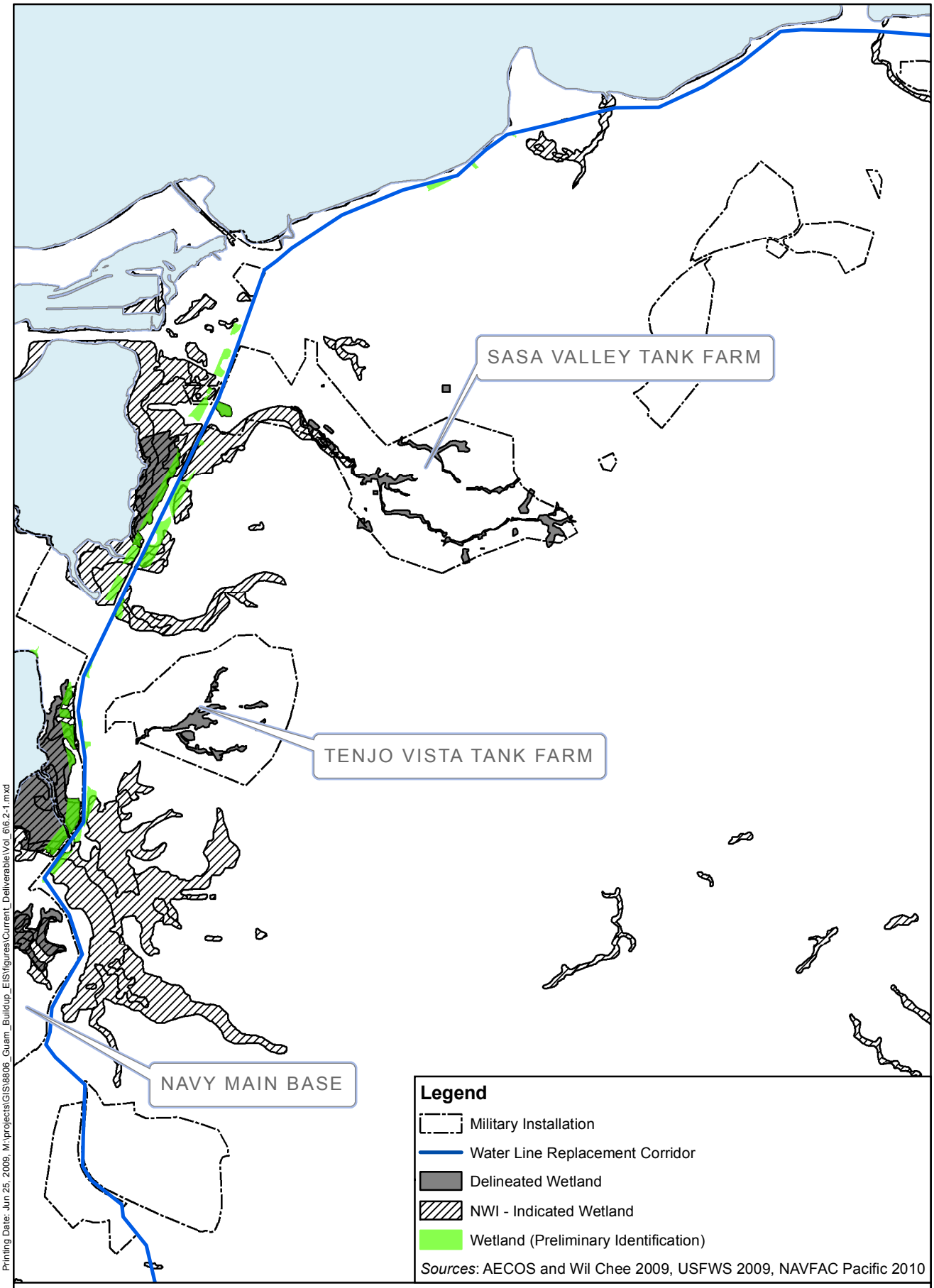

Figure 6.2-1
Location of Wetlands Adjacent to Proposed Waterline Replacement Corridor

Operation

The proposed new water wells that would draw from the Andersen and the Agafa-Gumas subbasins which are underdeveloped (as compared to the southern subbasins). The proposed resulting withdrawals associated with the new and existing wells under Basic Alternative 1 (including GWA and Andersen AFB planned expansions) would not exceed sustainable levels. The remaining three wells would be installed in the Finegayan subbasin. As with the other subbasins, 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 subbasins 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.

Since waterbody impairments and TMDLs relate to surface waters and not groundwater, an analysis of groundwater withdrawal as it relates to these potential effects is not applicable.

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 impact analysis relies on general aquifer-wide data. Increased groundwater withdrawals could potentially impact water levels in these caves by potentially decreasing the amount of fresh groundwater entering the cave system.

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 the 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, Chapter 4, Section 4.1.1.3) states that for every foot, the top of the groundwater table drops and the mid-point of the freshwater/saltwater transition zone becomes 40 ft shallower. Also, the average sea level itself imposes a constant boundary condition (as average for tidal fluctuations); the water table would remain slightly above the ocean level. Thus, due to the boundary imposed by the ocean and the dynamics of the freshwater lens, the change in water table elevation of 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 implementing 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 operations, to include the transportation, storage, and use of fuel on surface and groundwater resources. While alterations to the watershed can 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 Basic Alternative 1 would result in less than significant impacts to water resources.

Potential impacts to groundwater resources related to the withdrawal of water from the Northern Guam Lens Aquifer (NGLA) and protection of the NGLA from contamination related to stormwater runoff are discussed in Volume 6, Chapter 2, Section 2.2. Volume 6, Chapters 2 and 3 also discuss the shortfall of

water supply from off base indirect population demands for water, and DoD's proposed mitigation to provide excess water available from the DoD operated water system to meet the shortfall in the GWA operated water system, thereby eliminating the need for GWA to withdraw additional groundwater from the NGLA to meet near term peak demands. However, the DoD operated water system would withdraw additional water to provide it to the GWA operated system. Therefore, there would be less than significant impacts to groundwater resources from indirect population growth related to drinking water supplies.

New Water Storage Facilities

Construction

Under Basic Alternative 1, the construction of the new facilities would involve land disturbing activities that would trigger the requirement to seek coverage under the CGP. As part of the CGP requirement, a SWPPP would be prepared and implemented. The SWPPP would identify site-specific BMPs (Volume 2, Chapter 4, Table 4.2-1) that would be implemented as part of the alternative to reduce the potential for erosion, runoff, sedimentation, and subsequent water quality impacts, which would also reduce potential for impacts to groundwater and nearshore water resources. No buildings/structures would be constructed in the 100-year flood zone; however, some stormwater detention basins could be constructed in the 100-year flood zone. In some of these areas, these open, grassed stormwater detention basins could also be utilized for additional uses (e.g., recreational fields). No wetlands are located in the construction area.

The analysis of water body impairments and implementation of TMDLs related to the construction of new storage facilities is the same as those described above for construction activities of water supply facilities. Therefore, stormwater runoff from construction activities would not prevent the attainment of water quality standards or interfere with the implementation of TMDLs.

Based on the above analysis, impacts to water resources from proposed water storage tank construction would be less than significant.

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. The analysis of water body impairments and implementation of TMDLs related to the operation of these facilities is the same as those described for construction activities above. Therefore, stormwater runoff from operating facilities would not prevent the attainment of water quality standards or interfere with the implementation of TMDLs. While alterations to the watershed can 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 storage sites. Therefore, operations associated with Basic 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 construction in 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 anticipated impacts to the system would require approval from the U.S. Army Corps of Engineers (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 existing stormwater infrastructure or stormwater infrastructure improvements and stormwater flow paths would continue to mimic area topography; therefore, there would be no increase in flooding risk. No buildings/structures would be constructed in the 100-year flood zone; however, some stormwater detention basins could be constructed in the 100-year flood zone. In some of these areas, these open, grassed stormwater detention basins could also be utilized for additional uses, for example, as recreational fields.

Through the development and implementation of 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, Chapter 3, 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, Basic Alternative 1 would result in less than significant impacts to water resources.

Proposed Mitigation Measures

Impacts to cave and pool systems would be avoided if possible. If impacts are unavoidable, then potential impacts would be minimized to less than significant in accordance with measures developed through agency coordination.

6.2.3.2 Basic Alternative 2

Basic Alternative 2 would provide additional water capacity of 11.7 MGd (44.3 MLd), which is anticipated to be met by an estimated 20 new wells at Andersen Air Force Base (AFB) and 11 new wells at Air Force Base Barrigada, rehabilitate existing wells, interconnect with the Guam Waterworks Authority (GWA) water system, and associated treatment, storage and distribution systems. Two new 1.8 MG (6.8 ML) water storage tanks would be constructed at ground level at NCTS Finegayan and one 1 MG (3.8 ML) water storage tank would be construction at Air Force Base Barrigada. Up to two new elevated 1 MG (3.8 ML) water storage tanks would be constructed at Finegayan within the Main Cantonment footprint.

Under Basic Alternative 2, impacts to water resources would be similar to those described under Basic 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. The proposed water tank and water lines at Air Force Barrigada would avoid wetland areas identified at the facility (wetland locations are shown in Volume 2, Chapter 4). Refer to Section 6.2.3.1 for a discussion of potential impacts. Volume 6, Chapters 2 and 3 also discuss the shortfall of water supply from off base indirect population demands for water, and DoD's proposed mitigation to provide excess water from the DoD operated water system to the GWA operated water system to meet the shortfall,

thereby eliminating the need for GWA to withdraw additional groundwater from the NGLA to meet near term peak demands. However, the DoD operated water system would withdraw additional water to provide it to the GWA operated system. Therefore, there would be less than significant impacts to groundwater resources from indirect population growth related to drinking water supplies.

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. Monitoring groundwater extracted from the aquifer for groundwater chemistry and brine content would ensure protective measures could be taken in time to prevent harm to existing or beneficial use of groundwater as a drinking water source. Increases in stormwater would be managed by existing stormwater infrastructure or stormwater infrastructure improvements and stormwater flow paths would continue to follow area topography; therefore, there would be no increase in flooding risk. No buildings/structures would be constructed in the 100-year flood zone; however, some stormwater detention basins could be constructed in the 100-year flood zone. In some of these areas, these open, grassed stormwater detention basins could also be utilized for additional uses, for example, as recreational fields. Through the development and implementation of 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, Chapter 3, Table 3.1-1). Therefore, with the implementation of these measures, Basic Alternative 2 would result in less than significant impacts to water resources.

Proposed Mitigation Measures

Basic Alternative 2 would include the same 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.

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. However, a combination of BMPs (Volume 2, Chapter 4, Table 4.2-1), LID measures, and water monitoring programs would be implemented as a part of the proposed action to reduce the potential for erosion, runoff, sedimentation, and subsequent water quality impacts. Increases in stormwater would be managed by existing stormwater infrastructure or stormwater infrastructure improvements and stormwater flow paths would continue to follow area topography. Stormwater runoff from construction would not prevent the attainment of water quality standards in receiving waters or interfere with the implementation of TMDLs. While groundwater withdrawal rates would increase, implementation of sustainability practices would reduce the amount of groundwater needed, which would help minimize impacts to groundwater availability. The resulting total annual groundwater withdrawals would be less than the sustainable yield. Monitoring of groundwater chemistry and brine content of extracted groundwater would ensure protective measures could be taken in time to prevent harm to existing or beneficial use of groundwater as a drinking water source. 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, Chapter 3, Table 3.1-1), including Commander Navy Region (COMNAV) Marianas Instruction 3500.4, as well as the implementation of BMPs, LID, and monitoring.

Table 6.2-2. Summary of Potential Potable Water Impacts

*Basic Alternative 1**	*Basic Alternative 2*
Construction Impacts (direct and indirect are the same)	
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 – NI	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 – NI
Operation Impacts (direct and indirect are the same)	
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: GW=Groundwater; LSI = Less than significant impact; NI = No impact; NW = Nearshore Waters; SW= Surface Water/Stormwater; WL = Wetland; * Preferred Alternative.

6.2.4 Wastewater

As discussed in Volume 6, Chapter 3, existing off-base GWA wastewater system infrastructure is considered by USEPA Region 9 to be substandard. Problems with the wastewater system include inadequate treatment of sewage at treatment plants, frequent sewage spills, and overflows from collection piping and lift stations, poor quality of water discharged from treatment plants, inadequate wastewater connection service on Guam, and poor condition and reliability of the system. In its comments on the Draft Environmental Impact Statement, USEPA Region 9 stated that Guam's environmental and public health problems exceed those of most U.S. communities, with its population experiencing frequent sewage spills, exposures to waterborne disease, and illegal dumping that can result in public health problems associated with its wastewater collection and disposal systems. Over the last 7 years, the USEPA Region 9 has issued fines and enforcement orders to the GWA in an effort to address these problems and bring the wastewater system infrastructure into compliance with federal environmental laws and public health standards.

There have been some improvements to the wastewater system as a result of these enforcement actions, and at least one treatment plant, the Hagatna Wastewater Treatment Plant (WWTP), has undergone repairs and upgrades. Still, the wastewater system continues to suffer from decades of deferred maintenance and upgrades due to a lack of funding and limits on user fees paid by the customers they service. All of the 6-GWA treatment plants are routinely in non-compliance with their discharge permits, many due to the inoperability of a significant portion of the treatment processes at individual plants. The condition of the sewage collection system is largely unsurveyed and unknown. Piping is suspected to be undersized and damaged in much of the system, and pump stations undersized or failing. These issues lead to frequent sewage overflows into streets and neighborhoods, resulting in exposure to microbiological and other contaminants, leaching of sewage and contaminants into the groundwater aquifer used as a drinking water source, potentially resulting in illness. Lack of maintenance, corrosion, leakage, bypassed treatment processes, age, and vandalism all contribute to the substandard condition of the system.

Basic Alternative 1 (Alternative 1a supports Main Cantonment Alternatives 1 and 2; and Alternative 1b supports Main Cantonment Alternatives 3 and 8) combines upgrades to the existing primary treatment facilities and expansion to secondary treatment at the Northern District WWTP (NDWWTP). The difference between Alternatives 1a and 1b is a requirement for a new sewer line from Barrigada housing to NDWWTP for Alternative 1b.

6.2.4.1 Basic Alternative 1a (Preferred Alternative)

Construction

The proposed refurbishment of the NDWWTP to its original primary treatment design capacity, expansion of secondary treatment capacity, installation of 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 CGP and preparation of a SWPPP. A site-specific SWPPP would be prepared and implemented in accordance with the CGP. The SWPPP would identify site-specific BMPs (Volume 2, Chapter 4, Table 4.2-1) that would be implemented as part of the alternative to reduce the potential for erosion, runoff, sedimentation, and subsequent water quality impacts, which would also reduce potential for impacts to groundwater, nearshore water resources, and the marine environment.

Stormwater runoff in the northern portion of Guam infiltrates into the ground with little to no surface water runoff. A review of GEPA's impaired waterbodies list (also known as the CWA § 303(d) list) does not show any impaired surface waters in the areas where sewer collection systems are proposed nor in the area of the NDWWTP. There are water quality impairments in nearshore waters where the NDWWTP discharges, which are discussed in the Operation section that follows and in Volume 6, Chapter 16. Therefore, the construction activities are not anticipated to contribute to water quality impairments in this area, particularly given the implementation of SWPPP BMPs. Implementation of SWPPP BMPs would ensure that pollutants in stormwater runoff from construction areas are contained and treated on site. Stormwater runoff in the southern portion of Guam can eventually flow to surface waters and pollutants, such as sediment, can enter these surface waters. A review of GEPA's impaired waterbodies list shows impairments for sediment and bacteria in areas other than where construction activities are proposed for the military relocation. Therefore, the construction activities are not anticipated to contribute to water quality impairments in these areas, and the implementation of SWPPP BMPs would ensure that pollutants in stormwater runoff from construction areas are contained and treated on site.

A review was also conducted of GEPA's existing and proposed TMDLs. GEPA has several TMDLs that have been approved by USEPA Region 9 for waters that are impaired for bacteria. The TMDLs identify the source of bacteria to likely be from sewage treatment discharges, septic tanks, and stormwater runoff. The proposed construction activities for the military relocation in the northern and southern portions of Guam are not expected to interfere with the implementation of promulgated or proposed TMDLs, or the attainment of water quality in waters where TMDLs are being pursued because construction activities are not associated with bacteria-producing pollutants.

As summarized in Volume 2, Chapter 4, no wetlands were identified in northern Guam in proposed wastewater project areas.

Based on the above analysis, impacts to water resources from proposed wastewater facility construction activities would be less than significant.

Operation

As described in Volume 6, Chapters 2 and 3, the DoD proposes to use the existing GWA NDWWTP to treat and dispose of wastewater directly generated from new DoD facilities in northern Guam, and to use the Navy's Apra Harbor WWTP to treat sewage from additional visiting ships at Naval Base Guam. The GWA NDWWTP would handle most of the increased wastewater treatment demand from the DoD relocation. The Navy Apra Harbor WWTP would handle the increased wastewater treatment demand for all increases at Apra Harbor, such as the shipboard transient population. The GWA Hagatna WWTP and four southern Guam WWTPs would handle some of the increased wastewater treatment demand from the construction workforce and increased civilian population under proposed DoD relocation.

Direct Impacts

GWA NDWWTP. The Navy is conducting a study to evaluate potential impacts on water quality and the marine environment from the GWA NDWWTP wastewater discharge at its new ocean outfall (NAVFAC Pacific 2009). The study assessed 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 relocation on Guam. The study considered flows to the NDWWTP from the military relocation of 18 MG (68 ML) per day. Initial results indicate that upgrading the NDWWTP to secondary treatment would result in the plant effluent meeting all water quality standards, resulting in an improvement over current discharge water quality. Therefore, operation of GWA NDWWTP under Alternative 1a would result in a beneficial impact to nearshore water upon completion of improvements.

A review of GEPA's impaired waterbodies 303(d) list shows water body impairments for bacteria in numerous beaches in Guam, including Tanguisson Beach, which is located near the NDWWTP. Additionally, USEPA Region 9 approved a TMDL for Tanguisson Beach in December 2009. The TMDL for Tanguisson Beach includes a load allocation for bacteria (*Enterococci*) for the NDWWTP that would be imposed under a revised permit. The TMDL states, "The Guam Waterworks Authority (GWA) owns and operates two wastewater treatment facilities that affect these TMDL waters. GWA is currently under a Stipulated Order to address several problems that contribute to beach advisories. Included in the Order are renovations and upgrades to the WWTPs, as well as actions to correct problems associated with portions of the conveyance system. Permitted facilities identified in the table below (*sic* includes the NDWWTP) receive waste load allocations (WLAs)" (USEPA 2010:4). The TMDL states that point sources, including the NDWWTP, would be given a wasteload allocation of 104 colonies per 26 MG (100 ML) for *Enterococcus* species, which is equal to the Guam Water Quality ambient water quality

standard. The repairs and upgrades to the NDWWTP as outlined in the Stipulated Order are for primary treatment systems. The proposed action is for the repair and upgrade of the NDWWTP to 12 MG (45 ML) per day capacity, which is consistent with this TMDL. Additionally, the DoD proposes to provide further upgrades to the NDWWTP to secondary treatment in the event that these upgrades are imposed by USEPA Region 9 in the future.

The DoD conducted a study that predicted ambient concentrations of various pollutants from the NDWWTP outfall in the marine environment (NAVFAC Pacific 2009). The study concluded that even with upgrades and repairs to the NDWWTP primary systems, the discharge from the treatment plant would be just over the ambient water quality standard, with the water quality standards for *Enterococcus* species at 104 colonies per 26 MG (100 ML) and in ocean concentrations at the outfall diffuser at 110 colonies per 26 MG (100 ML). The study also concluded that with the installation of secondary treatment at the NDWWTP, the ocean concentrations at the outfall diffuser would meet ambient water quality standards, predicting these concentrations to be 78 colonies per 26 MG (100 ML). The proposed DoD primary upgrades to the NDWWTP would likely not support the attainment of the TMDL and ultimate attainment of bacteria standards for Tanguisson Beach, but secondary upgrades would support the achievement of the TMDL and attainment of water quality. Therefore, with DoD upgrades to secondary treatment, the proposed use of the NDWWTP would result in less than significant impacts to nearshore waters.

Apra Harbor Wastewater Treatment Plant. Volume 6, Chapter 3 describes DoD's proposal to use the existing Navy-owned Apra Harbor WWTP to treat sewage generated from new visiting ships to Naval Base Guam. The Apra Harbor WWTP is currently in non-compliance for aluminum, copper, and nickel in its discharge. However, the expected flows from the visiting ships are not expected to significantly increase or change the metals concentrations at the treatment plant. Volume 6, Chapter 3 describes the efforts underway to modify the permit to allow for a zone of initial dilution for this discharge. The Apra Harbor WWTP has been shown to have adequate current capacity, both physically and in its permit, to handle the estimated future wastewater demand. The plants current permit capacity allows for these additional flows and the resulting zone of initial dilution is expected to be issued to account for this full permitted flow. A review of the GEPA's impaired waterbodies 303(d) list does not show any impairment in nearshore waters in the area of the Apra Harbor WWTP. Therefore, operation of Apra Harbor WWTP under Basic Alternative 1a would result in less than significant impacts to nearshore waters.

Indirect Impacts

NDWWTP. As discussed in Volume 6, Chapters 2 and 3, the NDWWTP would receive some portion of the wastewater that would result from the indirect construction workforce and induced population growth from the military relocation. This indirect wastewater flow was estimated for the NDWWTP and incorporated into the plant capacity analysis that was conducted in Chapter 2 along with the direct wastewater flows expected from the DoD population. Indirect impacts related to this flow are considered along with the direct impacts in Chapter 3 as it relates to plant capacity and performance and in Chapter 16 as it relates to ocean water quality and marine life. For groundwater, surface water, and wetlands, these indirect impacts are not considered separately in this chapter, but are part of the analysis for the NDWWTP direct impacts in Section 6.2.4.1 above.

Hagatna Wastewater Treatment Plant and Collection System. As described in Volume 6, Chapters 2 and 3, Hagatna WWTP has been shown to have adequate capacity to handle the estimated increased demand from indirect wastewater generated by the military relocation associated temporary construction workforce and induced civilian growth in central Guam area. The Hagatna WWTP was recently

refurbished and plant performance has improved, with permit violations occurring less frequently. It is unclear whether the repairs and upgrades to the Hagatna WWTP would adequately treat the additional wastewater flows from the indirect populations. Therefore, the impacts to the Hagatna WWTP in terms of treatment and effluent quality are assumed to be significant. Impacts related to the discharge at the plant into the ocean outfall are addressed in Volume 6, Chapter 16.

The sewage collection system to the Hagatna WWTP experiences problems with inadequate capacity, leaks, line breaks and pump station outages, all resulting in sewage overflows onto the ground and into storm drains. The increased wastewater flow from the indirect populations would likely exacerbate the sewer overflow problems that currently exist in this collection system. There is an ongoing GWA development moratorium project that is planned that limits development in this portion of Guam due to the sewer system shortfalls, and includes the repair and replacement of the major portions of the collection system (Volume 6, see Chapter 3, Section 3.2.4).

If improvements are not made to the central sewer collection system under the moratorium project, then overflows would continue to occur and may become more frequent as increased flows from the indirect populations overwhelm the already inadequate system. Indirect impacts would likely cause further degradation to water resources with increased potential for sewage spills. Depending on the location of overflows, a sewage spill has the potential to impact surface water, groundwater (including the NGLA), nearshore water, and wetlands. Therefore, indirect impacts from construction workforce and induced population wastewater would result in significant impacts to water resources due to increased potential for sewage overflows in the collection system.

A review of GEPA's impaired waterbodies 303(d) list shows water body impairments for bacteria in numerous beaches in Guam, including beaches on Agana Bay, which is located near the Hagatna WWTP outfall. Additionally, USEPA Region 9 approved a TMDL for these beaches in December 2009. The TMDL includes a load allocation for bacteria (*Enterococci*) for the NDWWTP that would be imposed under a revised permit. Sewer line overflows are also identified in the TMDL as attributing to impairments, and are given a load allocation. The TMDL states, "The Guam Waterworks Authority (GWA) owns and operates two wastewater treatment facilities that affect these TMDL waters. GWA is currently under a Stipulated Order to address several problems that contribute to beach advisories. Included in the Order are renovations and upgrades to the WWTPs, as well as actions to correct problems associated with portions of the conveyance system. Permitted facilities identified in the table below (*sic* includes the Hagatna WWTP) receive waste load allocations (WLAs)" (USEPA 2010:4). GWA recently repaired and upgraded the Hagatna WWTP and compliance with permit limits for the plant has been improved. However, it is unclear whether these upgrades are sufficient to meet the TMDL wasteload allocations, or whether additional repairs are needed. Since it is uncertain whether existing treatment at the Hagatna WWTP is sufficient to meet the goals for GWA sewage treatment plants in the TMDL, this analysis assumes there is an existing negative impact on nearshore water quality from the existing Hagatna WWTP discharge, and additional flows to the plant resulting from the indirect construction workforce and induced population would further degrade water quality. Therefore, there would be a significant impact to nearshore water quality from the Hagatna WWTP and collection system from the indirect population increase on Guam resulting from the military relocation.

DoD acknowledges the existing sub-standard conditions of utility infrastructure systems on Guam and the desire by many for DoD to fund improvements to these systems and services. DoD also recognizes the constraints on GovGuam to be able to address these indirect impacts of the proposed military relocation. GovGuam has identified the need for $1.3 billion in funding to implement necessary water and

wastewater infrastructure improvements that must be accomplished in the first five years to accommodate the military relocation. The Council on Environmental Quality has facilitated interagency meetings with DoD and appropriate federal agencies to identify funding sources to meet this need. DoD is seeking from GoJ approximately $580 million for water and wastewater improvement projects pursuant to the terms of the Realignment Roadmap Agreement, described in Volume 1. The Economic Adjustment Committee (EAC) is evaluating overall Guam civilian hard (e.g., facilities) and soft (e.g., manpower, operations & management) infrastructure needs, including those associated with the proposed DoD military relocation. As part of this evaluation the EAC is specifically examining federal funding options for water and wastewater infrastructure improvements that may not be funded through GoJ financing.

Agat-Santa WWTP. The Agat-Santa WWTP is located in central Guam and is described in Volume 6, Chapter 3. This secondary treatment plant discharges to an ocean outfall and is currently out of compliance with its permit limits. Repairs to this plant are required under the 2003 Stipulated Order but have not been accomplished. Under the proposed DoD relocation, construction workers and civilian population growth would also result in indirect impacts to this plant due to increased wastewater flows. This increased demand on the Agat-Santa WWTP would only exacerbate current treatment and collection system problems and non-compliance. A review of GEPA's impaired waterbodies 303(d) list shows no water body impairments for bacteria in waters or beaches near the outfall of the Agat-Santa WWTP. Therefore, there would be a significant impact to nearshore water quality from the Agat-Santa WWTP from the indirect population increase on Guam resulting from the military relocation.

Other Wastewater Treatment Plants in Southern Guam. Under the proposed DoD relocation, construction workers and civilian population growth would also result in indirect impacts to four southern Guam WWTPs due to increased wastewater flows and increased demand. Volume 6, Chapters 2 and 3 describe the decrepit condition of these plants, and their significant noncompliance with their permit limits. These four plants are the Baza Gardens WWTP, the Umatac-Merizo WWTP, the Inarajan WWTP, and the Pago Socio WWTP, and are described in Volume 6, Chapter 3. Repairs to these plants are required under the 2003 Stipulated Order, but have not been accomplished. All of these plants are in significant non-compliance with their discharge permits. Under the proposed DoD relocation, construction workers and civilian population growth would also result in indirect impacts to these plants due to increased wastewater flows. The increased demand on the plants would only exacerbate problems at the already non-compliant plants. These plants discharge either to the ocean, small surface streams, or to the ground (and eventually the groundwater). Increasing flows to these plants could result in significant impacts to surface water quality, stormwater, groundwater, and marine water. Marine water impacts are discussed in Volume 6, Chapter 16. Volume 6, Chapter 3 discusses the GWA collection system and problems with line capacities and sewage overflows. These problems would likely result in significant impacts to water quality, stormwater, groundwater, and the marine environment from more frequent sewage overflows. A review of GEPA's impaired waterbodies 303(d) list shows water body impairments for bacteria in waters and areas near these plants, but there are no TMDLs currently proposed for them. Therefore, there would be a significant impact to water quality and potential impacts to groundwater from the indirect population increase on Guam resulting from the military relocation.

DoD acknowledges the existing sub-standard conditions of utility infrastructure systems on Guam and the desire by many for DoD to fund improvements to these systems and services. DoD also recognizes the constraints on GovGuam to be able to address these indirect impacts of the proposed military relocation. GovGuam has identified the need for $1.3 billion in funding to implement necessary water and wastewater infrastructure improvements that must be accomplished in the first five years to accommodate the military relocation. The Council on Environmental Quality has facilitated interagency meetings with

DoD and appropriate federal agencies to identify funding sources to meet this need. DoD is seeking from GoJ approximately $580 million for water and wastewater improvement projects pursuant to the terms of the Realignment Roadmap Agreement, described in Volume 1. The Economic Adjustment Committee (EAC) is evaluating overall Guam civilian hard (e.g., facilities) and soft (e.g., manpower, operations & management) infrastructure needs, including those associated with the proposed DoD military relocation. As part of this evaluation the EAC is specifically examining federal funding options for water and wastewater infrastructure improvements that may not be funded through GoJ financing.

Summary of Basic Alternative 1a Impacts

Under Basic Alternative 1a, there would be no work in or 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 and stormwater flow paths would continue to follow area topography. There would be no increase in flooding risk. No buildings/structures would be constructed in the 100-year flood zone; however, some stormwater detention basins could be constructed in the 100-year flood zone. In some of these areas, these open, grassed stormwater detention basins could also be utilized for additional uses (e.g., recreational fields). Through the development and implementation of the site-specific SWPPP 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, Chapter 3, Table 3.1-1).

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. However, increased potential for sewage spills would likely occur due to indirect impacts from construction workers and civilian population growth under DoD relocation that would result in increased wastewater flow to the NDWWTP, Hagatna WWTP, and other southern area WWTPs in already inadequate sewer collection systems and inadequate treatment plants in the south. Therefore, Basic Alternative 1a would result in less than significant direct impacts and significant indirect impacts to water resources until the sewer collection systems and southern area WWTPs can be upgraded to meet increased demands.

Proposed Mitigation Measures

Mitigation measures would be as described for Wastewater Basic Alternative 1a in Volume 6, Chapter 3, Section 3.2.4.1.

6.2.4.2 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 Basic Alternative 1a and would therefore have the same impacts for construction of these facilities. In addition to the 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 line and pump stations would be installed from Navy Barrigada to the existing GWA 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. No wetlands were identified in proposed wastewater project areas in northern Guam (see Volume 2, Chapter 4).

Construction would involve land disturbing activities that would trigger coverage under the NPDES stormwater CGP and preparation of a site-specific SWPPP. The SWPPP would identify site-specific BMPs (Volume 2, Chapter 4, Table 4.2-1) that would be implemented as part of the alternative to reduce the potential for erosion, runoff, sedimentation, and subsequent water quality impacts, which would also reduce potential for 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 new collection system from Barrigada would not impact water resources as the line would be buried. Under Basic Alternative 1b, the direct and indirect impacts the military relocation would have on the Hagatna WWTP and the central Guam sewage collection system and on the southern Guam WWTPs would be identical to those described under Basic Alternative 1a. Therefore, Basic Alternative 1b would result in less than significant direct impacts and significant indirect impacts to water resources until the sewer collection systems and southern treatment plants can be upgraded to meet increased demands.

Summary of Basic Alternative 1b Impacts

Under Basic Alternative 1b, there would be no work in or 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 and stormwater flow paths would continue to follow area topography. There would be no increase in flooding risk. No buildings/structures would be constructed in the 100-year flood zone; however, some stormwater detention basins would be constructed in the 100-year flood zone. In some of these areas, these open, grassed stormwater detention basins would also be utilized for additional uses, for example, as recreational fields. Through the development and implementation of a site-specific SWPPP and BMPs, and the implementation of 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, Chapter 3, Table 3.1-1).

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. However, increased potential for sewage spills would likely occur due to indirect impacts from construction workers and civilian population growth under DoD relocation that would result in increased wastewater flow to the NDWWTP, the Hagatna WWTP, and southern WWTPs in already inadequate sewer collection systems and overloaded and non-compliant WWTPs. All actions would be implemented in accordance with all applicable federal, GovGuam, and military orders, laws, and regulations (Volume 8, Chapter 3, Table 3.1-1). Therefore, Basic Alternative 1b would result in less than significant direct impacts and significant indirect impacts to water resources until the sewer collection systems and southern WWTPs can be upgraded to meet increased demand.

DoD acknowledges the existing sub-standard conditions of utility infrastructure systems on Guam and the desire by many for DoD to fund improvements to these systems and services. DoD also recognizes the constraints on GovGuam to be able to address these indirect impacts of the proposed military relocation. GovGuam has identified the need for $1.3 billion in funding to implement necessary water and

wastewater infrastructure improvements that must be accomplished in the first five years to accommodate the military relocation. The Council on Environmental Quality has facilitated interagency meetings with DoD and appropriate federal agencies to identify funding sources to meet this need. DoD is seeking from GoJ approximately $580 million for water and wastewater improvement projects pursuant to the terms of the Realignment Roadmap Agreement, described in Volume 1. The Economic Adjustment Committee (EAC) is evaluating overall Guam civilian hard (e.g., facilities) and soft (e.g., manpower, operations & management) infrastructure needs, including those associated with the proposed DoD military relocation. As part of this evaluation the EAC is specifically examining federal funding options for water and wastewater infrastructure improvements that may not be funded through GoJ financing.

Proposed Mitigation Measures

Proposed mitigation measures would be as described for Basic Alternative 1a.

6.2.4.3 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 (direct and indirect are the same)	
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 (direct with indirect in parenthesis)	
SW – NI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation. GW – LSI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation. NW – LSI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation. • increase in effluent discharge at NDWWTP but improved water quality WL – NI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation.	SW – NI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation. GW – LSI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation. NW – LSI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation. • increase in effluent discharge at NDWWTP but improved water quality. WL – NI (SI) • increased potential for sewage spill with increased demand on central sewer collection system under indirect impacts of DoD relocation.

Legend: DoD = Department of Defense; GW = Groundwater; LSI = Less than significant impact; NDWWTP = Northern District Wastewater Treatment Plant; NI = No impact; NW = Nearshore Waters; SI = Significant impact; SW = Surface Water/Stormwater; WL = Wetland. * Preferred Alternative.

Under implementation of Basic Alternative 1a or 1b, 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.

However, increased potential for sewage spills would likely occur due to indirect impacts from construction workers and civilian population growth under DoD relocation. This would result in increased wastewater flow to the NDWWTP, the Hagatna WWTP, and southern WWTPs in already inadequate sewer collection systems and overloaded and noncompliant southern WWTPs. The DoD cannot financially fix other current deficiencies in the GWA sewer collection system due to legal restraints, but would lead studies to identify where the impacts are and work with GWA to prioritize the improvement projects. Plus, the DoD is leading a federal inter-agency effort to identify other federal programs and funding sources that could benefit the people of Guam. Therefore, Basic Alternative 1a and 1b would result in less than significant direct impacts and significant indirect impacts to water resources until the sewer collection systems and southern WWTPs can be upgraded to meet increased demands.

6.2.5 Solid Waste

6.2.5.1 Basic Alternative 1 (Preferred Alternative)

The Preferred Alternative would be to continue to use the Navy landfill at Apra Harbor for municipal solid waste (MSW) until the new GovGuam Layon Landfill at Dandan is available for use. Disposal of other waste streams excluded from Layon Landfill would continue at the Navy landfill. Construction and demolition (C&D) debris would continue to be disposed at the Navy hardfill.

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 (GDPW 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, Inc. 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. 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.

Proposed Mitigation Measures

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

6.2.5.2 Summary of Impacts

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

Table 6.2-4. Summary of Potential Solid Waste Impacts

Preferred Alternative
Construction Impacts (direct and indirect are the same)
• No construction would occur.
Operation Impacts (direct and indirect are the same)
SW – NI GW – LSI • Contamination from leachate at existing Navy Sanitary Landfill is being determined. NW – NI WL – NI

Legend: GW = Groundwater; LSI = Less than significant impact; NI = No impact; NW = Nearshore Waters; SW = Surface Water/Stormwater; 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 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 rehabilitating existing pavement materials and placing an asphalt overlay or reconstructing 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; (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 erosion and siltation impacts 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. A Stormwater Implementation Plan describing detailed stormwater pollution control measures for the GRN is provided in Volume 9, Appendix G.

Waters of the U.S., which are wetlands and stream channels under the CWA jurisdiction, are discussed in a regulatory context in this chapter. Potential impacts to wetlands, stream channels, and other aquatic habitats 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 Clearing and Grading Permit to be obtained from the Guam Department of Public Works (GDPW). This permit requires development of an Environmental Protection Plan, which must incorporate compliance measures to protect marine and surface water resources, including the preparation of a Water Quality Monitoring Plan. An Erosion Control Plan is also 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 be 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, Chapter 3, Table 3.1-1), including Commander Navy Region (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 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. To ensure consistency with the Sole Source Aquifer Program and in accordance with Section 1424(e) of the Safe Drinking Water Act, project activities over the Northern Guam Sole Source Aquifer or the NGLA would be subject to review during design by GEPA in coordination with FHWA and USEPA Region 9. USEPA Region 9 also has a role coordinating with other federal agencies to review federal financial assistance projects that may impact the NGLA. 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 GDPW 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, replacement of five bridges along Route 1, and replacement of box culverts of three 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 metal discharge to 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 cause 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 are jurisdictional under the CWA (Waters of the U.S.). As shown in Table 6.2-5, construction activities associated with the five bridge replacements and three bridge box culvert replacements would temporarily affect a total area of 1.52 acres (0.62 hectares) of potential Waters of the U.S. 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 degradation of aquatic communities in the immediate area of the bridge/box culvert replacement. Indirect impacts may occur farther 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. 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/box culvert replacement projects would cause an unavoidable loss of 1.52 acres (0.62 hectares) 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/box culvert replacements. Improvement of hydraulic conveyance in bridge areas would reduce scour and stream redirection by channeling the water flow more efficiently through the bridge or culvert structure. Reducing stream bank scour would maintain the integrity of stream banks in the immediate area of the bridge and reduce sedimentation in downstream freshwater aquatic and marine habitats.

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

GRN Project #	*Bridge Name*	*Dimensions (ft)*		*Impact to Potential Waters of the U.S. (acres)*	
		Structure Width	*Stream Channel Width*	*Streams*	*Wetlands*
3	Agana Bridge #1	102.0	39.3	0.15	0
35	Atantano Bridge	80.6	42.7	0.14	0
	Aguada Bridge	95.3	41.3	0.15	0
	Asan Bridge # 1	100.0	77.3	0.28	0
	Asan Bridge # 2	96.5	72.1	0.26	0
	Fonte Bridge	100.0	76.5	0.28	0
	Laguas Bridge	80.8	41.2	0.13	0
	Sasa Bridge	82.3	40.3	0.13	0
Total Area				**1.52**	**0**

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'])].
Legend: ft = feet; GRN = Guam Road Network; U.S. = United States.

The FHWA has determined that U.S. Coast Guard bridge construction permits are not required for the bridge and culvert replacement projects pursuant to 23 U.S.C. 144(h) [Notwithstanding any other provision of law, the General Bridge Act of 1946 (33 U.S.C. 523-533) shall apply to bridges authorized to be replaced, in whole or in part, by this section, except that subsection (b) of section 502 of such Act of 1946 and section 9 of the Act of March 3, 1899 (30 Stat. 1151) shall not apply to any bridge constructed, reconstructed, rehabilitated, or replaced with assistance under this title, if such bridge is over waters (1) which are not used or susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce, and (2) which are (a) non tidal, or (b) if tidal, used only by recreational boating, fishing, and other small vessels less than 21 feet in length.]. Coordination letters between the FHWA (for the determination) and the U.S. Coast Guard (for its concurrence on the determination) are included in this EIS in Volume 9, Appendix C.

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, Chapter 3, 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 surface water.

If mitigation is required during the CWA Section 404 regulatory permitting process, FHWA would identify potential areas available for compensatory mitigation. These areas may include aquatic habitat enhancements at Camp Covington or other areas identified during the permitting process.

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 not result in adverse 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 not result in adverse impacts to water resources.

Proposed Mitigation Measures

Mitigation measures have not been identified for Alternative 1.

Year 2030 (Operation)

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 runoff in accordance with the source control and treatment BMPs outlined in the Stormwater Implementation Plan (Volume 9, Appendix G); 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 located.

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. As mentioned above, an Erosion Control Plan is required for a Clearing and Grading Permit by the GDPW when the area to be graded is more than 5,000 square feet (ft^2) (464 square meters [m^2]) 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 outlined in the Stormwater Implementation Plan (Volume 9, Appendix G) there would be 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, Chapter 3, 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 8, Chapter 3, Table 3.1-1. 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 (five) and box culvert (three) replacements at eight stream crossings. The bridge/box culvert 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 relocation. 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 and subsequent Section 404 permit process 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 of federal interest by USACE. A new feasibility study is currently underway. The bridge projects also include replacement of the Agueda Bridge, Atantano Bridge, Asan Bridge # 1, Asan Bridge # 2, 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/box culvert 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 2010). 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/box culvert replacement projects. These include replacement of five bridges and three bridge box culverts 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 or their box culverts 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 the 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 outlined in the Stormwater Implementation Plan (Volume 9, Appendix G) there would be 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, Chapter 3, 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 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. Surface water quality protection measures discussed above would also serve to protect groundwater resources.

In the southern part of the Central Region, groundwater resources are very limited; hence, water quality impacts would generally apply to surface water resources and would mainly involve the bridge projects along Route 1. Therefore, Alternative 1, Year 2030 groundwater impacts in the Central Region would be less than significant.

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 and is shown to be within the coastal flood zone in the FEMA FIRMs. The Routes 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 groundwater 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 groundwater 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.

Proposed 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 § 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.

Proposed Mitigation Measures

Proposed 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 the exception of a few projects that would not be built as part of the GRN improvements program and varying locations of a few MAPs.

Proposed Mitigation Measures

Proposed 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

the exception of a few projects that would not be built as part of the GRN improvements program and varying locations of a few MAPs.

Proposed Mitigation Measures

Proposed 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 would not be positioned on Guam; therefore, the no-action alternative would obviate the need to improve roads necessary for the military relocation. 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.

2010

Construction activities for the improvement projects to be completed by 2014 would commence in 2010 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 2010, 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. An Erosion Control Plan is required by the GDPW for a Clearing and Grading Permit when the area to be graded is more than 5,000 ft^2 (464 m^2) 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 Clearing and Grading Permit to be obtained from the GDPW. This permit requires development of an Environmental Protection Plan, which must incorporate compliance measures to protect marine and surface water resources, including the preparation of a Water Quality Monitoring Plan. An Erosion Control Plan is also required for clearing, grading, grubbing, embankment or filling, excavation, or other earth-moving operations. The Erosion Control 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 GDPW prior to discharging waste. Therefore, the no-action alternative, Year 2010, would result in less than significant impacts to surface water.

Groundwater

Under the no-action alternative, Year 2010, 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. The same surface water quality protection measures discussed above would also serve to protect groundwater resources. Therefore, the no-action alternative, Year 2010, would result in less than significant impacts to groundwater.

Nearshore Waters

Under the no-action alternative, alterations to the watershed have the potential to 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, Chapter 3, 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 2010, would result in less than significant impacts to nearshore waters.

2014

Potential impacts and proposed mitigation associated with the no-action alternative to water resources would be the same as those described for 2010 (refer to Section 6.2.6.4, Year 2010). 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 2010). 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 6.2-6 summarizes the potential impacts of each alternative. 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. ** Includes floodplains, wetlands, streams, temporary and permanent impoundments and other aquatic habitats.

Construction activities would consist of intersection improvements, bridge/box culvert 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/box culvert 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 particulates that accumulate on roadway surfaces (such pollutants originate from highway use and maintenance and from ambient atmospheric deposition) and due to erosion and siltation impacts 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 soil 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 Pollution Prevention Plans, Environmental Protection Plans, Erosion 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 construction BMPs (Volume 2, Chapter 4, Table 4.2-1) and permanent BMPs (Volume 9, Appendix G), there would be no increased risk from environmental hazards or to human health. Furthermore, all actions associated with each alternative would be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations (Volume 8, Chapter 3, Table 3.1-1), including COMNAV Marianas Instruction 3500.4.

6.2.6.7 Summary of Proposed Mitigation Measures

Table 6.2-7 summarizes the proposed mitigation measures for roadway project impacts to water resources.

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

Phase	*Mitigation Measure*
Construction	• Aquatic habitat enhancements at Camp Covington or other identified areas as required during the permit process.
Operation	• 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

6.3 LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE

Stream channels that are potentially jurisdictional under the CWA would be impacted by bridge/box culvert replacements; therefore, the five bridge and three box culvert replacement projects included in this Environmental Impact Statement would be subject to Section 404 permitting requirements. All of the action alternatives include the eight bridge/box culvert replacement projects; therefore, an analysis of the *least environmentally damaging practicable alternative* as defined in the CWA is not necessary.