CHAPTER 3.
UTILITIES

3.1 AFFECTED ENVIRONMENT

This section includes information related to existing electrical utilities, potable water supplies, wastewater systems, solid waste, and roadways on Guam that could be directly or indirectly affected by the proposed military buildup. The region of influence (ROI) for this resource includes the Department of Defense (DoD) lands and lands that support public utilities servicing DoD that would be directly affected by the proposed military buildup. It also includes the public utilities that may be indirectly affected by the projected increase in the construction workforce and other induced growth.

3.1.1 Power

The ROI for power includes the generation units and transmission and distribution (T&D) system supporting the existing island-wide power system (IWPS). DoD, Guam Power Authority (GPA), and independent power producers (IPPs) also operate backup diesel generators dedicated to mission critical and emergency functions, but these generators are reserved for those functions; therefore, they are not considered in this analysis.

The existing IWPS consists of generation units owned by GPA, generation contracted to GPA, and DoD-owned generation units whose output is available to GPA based on a customer service agreement between GPA and the DoD. The list of generation units is included in the GPA generation status report that is prepared daily and submitted to the Navy's Utility Group. The names of power-generating facilities and an example of the information presented in the generation status report are provided in Table 3.1-1, with an additional column showing the type of unit. At the time of the below report, GPA had an installed capacity of 553.4 megawatts (MW). GPA's generation units available for use had a capacity of 429.8 MW. Figure 3.1-1 shows the power facility locations on Guam. GPA's demand forecast has indicated that the reserve capacity (or excess capacity to ensure reliability) would be exceeded in 2017, based on GPA's load projections for the IWPS without the DoD proposed buildup (GPA 2008).

Table 3.1-1. Example of the Information Presented in the Guam Power Authority Generation Status Report

Plant	*Rated Capacity*	*Actual Capacity*	*Capacity Used*	*Unit Type*
GPA Steam				
Cabras #1	66	66	52	Base load
Cabras #2	66	66	47	Base load
Cabras #3	40	39	37	Base load
Cabras #4	40	39	37	Base load
Tanguisson #1	26.5	26.5	15	Base load
Tanguisson #2	26.5	26.5	15	Base load
Enron IPP Piti #8	44	0	0	Base load
Enron IPP Piti #9	44	44	42	Base load
GPA Steam Total	**353.0**	**307.0**	**245.0**	
GPA Diesels				
Manengon	10	8.8	0	Peaking
Dededo CT #1	23	21	0	Peaking
Dededo CT #2	23	0	0	Peaking
Dededo	10	5	0	Peaking
Macheche	22	20	0	Peaking
Temes (Piti)	40	40	0	Peaking
Yigo CT	22	0	0	Peaking
Talafofo	10	4	0	Peaking
Mount Tenjo	26.4	24	0	Peaking
Marbo CT	16	0	0	Peaking
GPA Diesel Total	**202.4**	**122.8**	**0**	
GPA Total	**555.4**	**429.8**	**245.0**	
DoD Diesels				
NCTS Finegayan	7.5	7.5	0	Backup, dedicated
Radio Barrigada	4	4	0	Backup, dedicated
Orote	19.8	19.8	0	Backup
Naval Hospital	2	2	0	Backup, dedicated
DoD Total	**33.3**	**33.3**	**0**	
System Total	**588.7**	**463.1**		
Peak Load Total			245	

Legend: CT = combustion turbine; GPA = Guam Power Authority; NCTS = Naval Computer and Telecommunications Station.
Notes: All units in megawatts.

A summary of Navy service outages for all DoD facilities currently on Guam from October 2005 to July 2006 indicates the following:

- During this period, 214 outages occurred.
- GPA system failures accounted for 39 of those outages; of these 39, 10 were generation outages and 29 were T&D system outages.
- The internal distribution system for DoD facilities accounts for 175 of the outages.

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Figure 3.1-1
Power Facility Locations, Guam

Miles 0 2 4
0 3 6 Kilometers
N W E S

This summary covers a relatively short period and is not intended to provide a comprehensive evaluation of IWPS performance or to detail outages down to specific circuits or devices. The summary does show that nearly 85% of the outages in the 9-month period were external to the GPA system. A more detailed evaluation of the outage data would identify specific system components (lines, breakers, switchgear, transformers, or similar components) that represent a larger portion of the outages and would reveal the upgrades that would have the greatest effect on system performance. The age of the generation units within the IWPS varies from less than 10 years to more than 30 years old.

Table 3.1-2 summarizes the base-load generation units that provide most of the energy consumed on Guam and their "thermal efficiency." Thermal efficiency is sometimes called "energy efficiency"; when expressed as a percentage, the thermal efficiency must be between 0% and 100%. Thermal efficiencies are typically less than 50% because of inefficiencies in converting energy sources into electric power, such as friction and heat loss.

Table 3.1-2. Guam Power Authority Base-Load Generation Units

Power Plant	*Generation (MWh)*	*% of Total*	*Thermal Efficiency (%)*
Cabras #1	156,953	16	34.35
Cabras #2	138,191	15	34.13
Cabras #3	131,124	14	42.18
Cabras #4	137,732	14	40.84
Tanguisson #1	47,140	5	26.46
Tanguisson #2	39,123	4	25.29
Enron IPP Piti #8	160,932	17	42.91
Enron IPP Piti #9	144,994	15	42.78
Total	**956,189**	**100**	

Legend: IPP = independent power producers; MWh = megawatt-hours.

The existing power generation units and T&D systems within the north, central, Naval Base Guam, and south regions of Guam are described in Sections 3.1.1.1 through 3.1.1.3.

According to Fitch Ratings, GPA has shown an ongoing process of improvement. Recent bond rating upgrade shows the impact of that commitment. Fitch Ratings affirms the rating on Guam Power Authority's (GPA) $375 million of outstanding electric system revenue bonds at 'BB+'. The Rating Outlook remains Positive. The rating is supported by a continuation of the solid track record of GPA's governance structure, a more stable financial profile, and improving system reliability and operating performance. The Positive Outlook reflects the improved relationship with the public utilities commission's (PUC) approval of a base rate increase and other charges, and the PUC's willingness to respond to the fuel cost volatility in 2008 and provide GPA with a third fuel cost recovery via the Levelized Energy Adjustment Clause.

Fitch believes that a rating upgrade is dependent on continued improvements in debt service coverage for full obligations (including the capitalized lease), increases in liquidity to a level sufficient to protect against volatile fuel prices and adverse economic impacts, and natural disasters (typhoons and earthquakes). Additionally, the rating and Outlook reflect the continued progress on the pay down of government past account receivables. Other Rating considerations include:

- Absence of competition
- Key load center transmission lines being placed underground, providing protection from outages due to typhoons

- Ongoing exposure to natural disasters
- Tourism-based economy (mitigated by current military presence and future expansion)
- Dependence on oil for generation and the need for the PUC to approve timely recovery of fuel costs thought the LEAC.

GPA, the only retail provider of energy on the Island of Guam, serves 45,751 customer accounts and a population of approximately 175,000. Fitch's rating definitions and the terms of use of such ratings are available on the agency's public site, www.fitchratings.com. Published ratings, criteria and methodologies are available from this site, at all times.

GPA's 2010 budget was approved in August 2009 during a meeting of the Consolidated Commission on Utilities. Commissioners approved the Authority's FY10 Budget with an anticipated $386 million estimated revenues ($139M non-fuel and $247M in fuel revenues). Despite lower projected electricity sales due primarily to the economic slowdown on the island, the Authority's budget reflects a more conservative forecast that maintains key funding for projects aimed at improving service.

3.1.1.1 North

Andersen Air Force Base (AFB)

The T&D system at Andersen AFB is currently operating near capacity and would need to be expanded to meet increases in future DoD loads. The T&D system is primarily underground with some overhead power lines. The Navy would continue to install new lines underground to provide enhanced resistance to damage from typhoons.

No power generation is available at Andersen AFB.

Finegayan

The Finegayan area currently has limited development and is a potential site for major facilities associated with the DoD buildup. DoD has a facility on standby to generate 7.5 MW for a communication facility at the Naval Computer and Telecommunications Station (NCTS). The IWPS does not have access to this power generation unit because the unit is fully dedicated to mission-critical functions at NCTS. This NCTS generator facility is permitted as a standby generation unit and as a unit to meet special power requirements.

The GPA Macheche combustion turbine (CT) is located on non-DoD land and is currently permitted for 4,280 hours per year of operation. It has a rated capacity of 22 MW and actual capacity of 20 MW. It was constructed in 1993.

3.1.1.2 Central

Andersen South

GPA facilities at Marbo and Yigo provide generation capacity in the Andersen South area. Neither of these units is presently used for any substantial source of generation, and neither has been used for approximately 2 years. These units would need some level of rehabilitation to operate reliably as intermediate generation (generation that is not used continuously but is used for more than peak loads). These units are listed as having system capacity but are not operating at this time. Marbo is rated at 16-MW capacity and Yigo at 22-MW capacity. Marbo is permitted to operate 2,640 hours per year and Yigo for 4,280 hours per year. The construction date for Marbo is unknown and Yigo was constructed in 1993.

Barrigada

The Dededo generation facilities and Radio Barrigada facility are in the central area of Guam but physically separated. Radio Barrigada is a DoD asset and not available to the GPA system because its use is dedicated to a specific mission. At the time the Power Generation Technical Study was done, the Dededo facilities, except Dededo CT #2 as shown in Table 3.1-1, are available to provide generation capacity as needed by the generation system. The Dededo generation facility comprises two CTs and four diesel units. Each Dededo CT has a rated capacity of 23 MW and the diesel generators have 10 MW rated capacity (four 2.5-MW units). Dededo CT #1 was constructed in 1992, CT #2 in 1994, and the diesel units in 1972. Dededo CT #2 was recently reconditioned by GPA and is now available to generate power.

Piti/Nimitz Hill

The Cabras and Piti generation units provide the majority of energy produced by the IWPS. These facilities have been upgraded and are some of the most reliable facilities for efficiently generating power for the system. The Cabras and Piti units are used primarily as base load generation units except when out of service for maintenance or failures. The majority of the fuel storage for the IWPS is also located in the harbor area because of its proximity to generation units and the supply ship unloading facilities. These units are permitted as base load generation units and can operate continuously, year round. Table 3.1-3 shows their ratings and status.

Table 3.1-3. Cabras and Piti Generation Units

GPA Steam	*Rated Capacity*	*Actual Capacity*	*Year Constructed*
Cabras #1	66	66	1974
Cabras #2	66	66	1975
Cabras #3	40	39	1996
Cabras #4	40	39	1996
Enron #8 (Piti)	44	44	1999
Enron #9 (Piti)	44	44	1999

Note: All units megawatts.

Manengon is a diesel unit located in the hills toward the eastern side of Guam. It is permitted for only 4,640 hours per year. It is rated at 10 MW capacity with an actual capacity of 8.8 MW.

Naval Base Guam

The Orote Power Plant is a DoD asset. The Orote facility is operational and can connect to the IWPS and generate power to the system. The facility has not generated substantial power to the IWPS for many years and is not currently suitable to provide extended operation support to the IWPS. The site would need additional system upgrades to provide the necessary reliability to the system and consideration for expanded fuel storage and would need modification to the existing air permit for the site. The Orote facility is not permitted for extended operation and must notify the Guam Environmental Protection Agency (GEPA) before scheduled operation. These permit restrictions would need to be changed to allow more flexibility and more hours of operation should the Orote facility be used to provide substantial generation capacity to the IWPS. The Orote Power Plant has a rated and actual capacity of 19.8 MW. The date of construction is unknown.

The Naval Hospital facility is dedicated to support the hospital and would not provide capacity or supply to the IWPS.

3.1.1.3 South

At the Naval Munitions Site, generation capacity at Talafofo and Mount Tenjo is a GPA asset and can provide power generation support to the IWPS. These units are permitted for up to 50% operation (4,640 hours per year). Talafofo has a rated capacity of 10 MW and an actual capacity of 4 MW. The Mount Tenjo facility has a rated capacity of 26.4 MW and an actual capacity of 24 MW. Both units were constructed in 1993.

3.1.2 Potable Water

The ROI for potable water includes the Andersen AFB and Navy water systems, which would be directly affected by the proposed military buildup, and the Guam Waterworks Authority (GWA) water system, which could be indirectly affected by increased water demands associated with the construction workforce and induced population growth. Locations of the components of the primary water system that are associated with each of these water systems (i.e., active and planned water supplies, storage facilities, and water distribution lines) are presented in Figure 3.1-2 and Figure 3.1-3. The three water systems are described in detail in Section 3.1.2.1.

3.1.2.1 Water Systems

Andersen AFB Water System

Andersen AFB gets its water from Andersen Northwest Field and Andersen South. It includes an off base water supply; disinfection, storage, and transmission system; and an on base water distribution system. The off base water supply and transmission system includes nine water production wells, two booster pump stations, three storage tanks, chlorination facilities, one fluoridation facility, and approximately 80,000 feet (ft) (24,400 meters [m]) of water lines. The existing on base water distribution system includes a pump station, three storage tanks, and approximately 700,000 ft (213,350 m) of water lines.

Water is currently supplied to Andersen AFB from seven of the nine off base water production wells; the remaining two wells are inactive. An additional five wells were constructed on the Andersen Northwest Field. Water supplied from the off base production wells is stored, disinfected, fluoridated, and then pumped to the main base. The off base production wells draw water from the Northern Guam Lens Aquifer (NGLA).

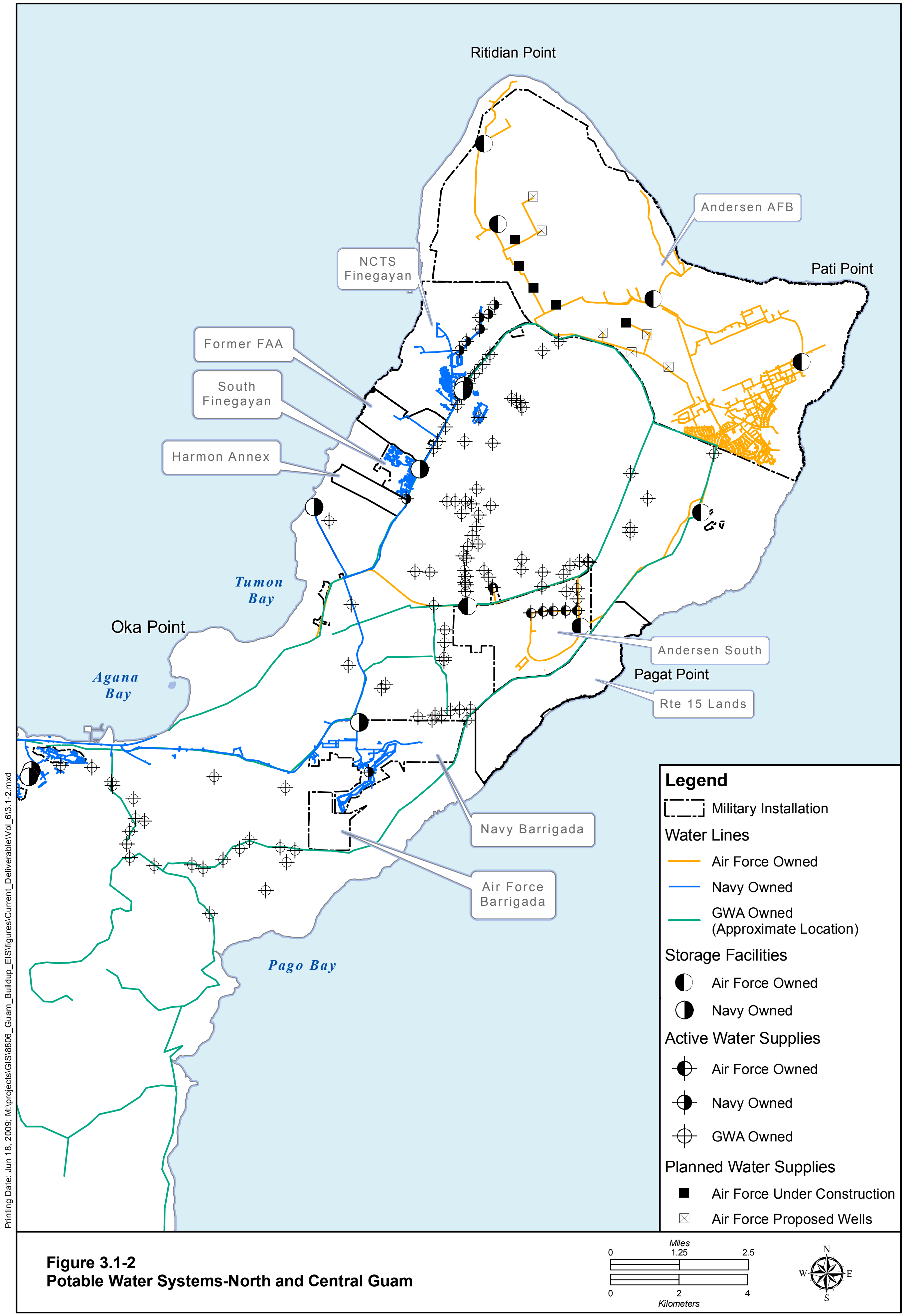

Figure 3.1-2
Potable Water Systems-North and Central Guam

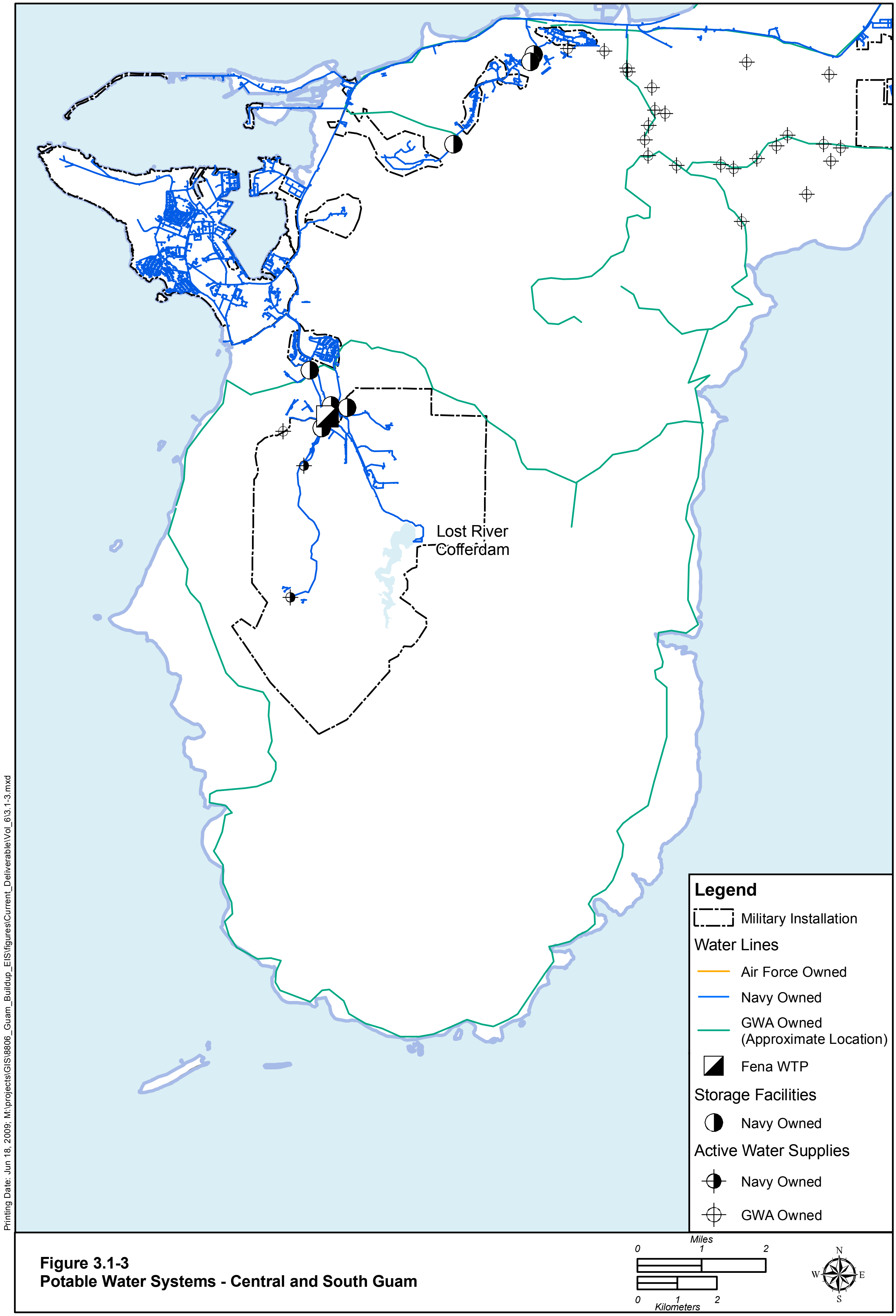

Figure 3.1-3
Potable Water Systems - Central and South Guam

Navy Water System

The Navy water system services NCTS Finegayan, South Finegayan, Navy Barrigada, Nimitz Hill, the Naval Hospital, the Naval Munitions Site, and the Naval Base Guam. The existing Navy water system is an island-wide system extending from the Navy Reservoir in southern Guam to NCTS Finegayan near the northern tip of Guam. Water for the system is supplied primarily from the Fena Water Treatment Plant (WTP). Water is distributed from the treatment plant to storage tanks designed to serve different service zones and transfer water to other DoD lands across Guam. Most of the transmission lines from the storage tanks to the distribution systems are 24-inch (in) (61-centimeter [cm]) pipelines. The Navy system is interconnected to supply water to GWA and for emergency service capability. Under a 1991 memorandum of understanding with the Government of Guam (GovGuam), the Navy system provides up to 4 million gallons per day (MGd) (15 million liters per day [mld]) to the GWA water system. Transmission lines connecting the Navy water system and the Andersen AFB system also exist, but they are presently out of service.

Primary water supply sources for the Navy's island-wide water system are located in the southern region of Guam and include Almagosa Springs, Bona Springs, and the Fena Reservoir surface water impoundment. Water from the above three sources are treated at the Fena WTP and are distributed through a network of storage tanks, transmission lines, and booster pump stations. Groundwater wells are the primary source of potable water at Finegayan and Navy Barrigada. A brief description of the water supply sources in each of the Navy service areas is provided below.

- At NCTS Finegayan and South Finegayan, water is supplied primarily by on-site groundwater wells. If necessary, water can also be supplied by interconnections with the GWA system or the Navy's island-wide system.
- At Navy Barrigada, water is supplied primarily by groundwater wells. As a backup, the water storage system is connected to the Navy's island-wide system.
- At the Naval Hospital, water can be provided from either the Navy island-wide water system or from on-site groundwater wells. Currently, two wells are operational.
- At the Naval Base Guam and other Navy areas south of the Piti Power Plant, potable water is supplied entirely by the Fena WTP.

GWA Water System

The baseline condition of the GWA water system is described in GWA's *Water Resources Master Plan* (WRMP). The overall condition of the water system's equipment is identified as poor in the WRMP with substantial corrosion in all infrastructure. The water system has a 50% Unaccounted for Water (UFW) rate compared to an acceptable rate of 15% or less. Problems with the GWA infrastructure result from the effects of natural disasters, poor maintenance, and vandalism. According to the WRMP, the water system infrastructure does not meet the basic flow and pressure requirements for all customers. The water system did not consistently comply with regulatory requirements. The unreliable drinking-water delivery system resulted in frequent bacterial contamination from sewage spills, causing "boil water" notices to be sent to residents. Maintenance to improve the system has been conducted since the water system was assessed in 2005. GWA plans improvements to the distribution system principally to improve the continuity of the water supply. Improvements include a corrosion control program, pipe and equipment replacement, distribution system improvements, improvements to the GWA Northern Public Water System's raw-water transmission line, and filtration compliance for groundwater under the direct influence of surface water.

The GWA water system consists of three public water systems known as the Northern, Central, and Southern Public Water Systems, serving the respective areas of Guam with some overlaps.

The GWA Northern Public Water System is the largest system serving all public areas in the north and central parts of the island south of Andersen AFB and serves an approximate population of 146,050. This system consists of 119 groundwater wells, 14 storage facilities (11 in use), and 10 booster pump stations (nine in use). The GWA Northern Public Water System is important to the Marine Corps relocation because of its proximity to the relocation areas and because the system is supplied primarily by the same aquifer that serves the DoD systems.

The GWA Central Public Water System consists of one spring, eight storage facilities (five in use), and nine booster stations (six in use). The main source of water for this system is the Navy water system; water is purchased through 54 metered interconnections, of which 15 are reported to be inactive. Water from the Northern Public Water System can also be fed via water mains to the Central Public Water System.

- The GWA Southern Public Water System supplies the southern and southeastern parts of Guam. It consists of two groundwater wells, four springs, 14 storage facilities, 16 booster stations (14 in use), and the Guam Water Treatment Plant.

Financially, during the 1997 to 2002 time frame, GWA demonstrated losses of nearly $80 million (Deloitte Touche Tohmatsu 2003) partly because of bad debt write-offs and the lack of rate increases. In 2001, a $9 million judgment was made against GWA for failure to pay for water delivery from the Navy. Also at this time, GWA carried $12 million debt to GPA and $3.5 million to a private vendor (Reuters 2009).

The United States Department of Justice (DOJ) filed a civil suit against GWA and GovGuam in December 2002 for failure to comply with the Safe Drinking Water Act and the Clean Water Act (CWA). The Stipulated Order for Preliminary Relief for Civil Case No. 02-0035 (SO) was negotiated in June 2003. The SO requires GWA to improve water and wastewater conditions so that it would comply with all applicable regulations, including the National Primary Dinking Water Regulations and Maximum Contaminant Levels for microbiological contaminants, and to provide reliable water services to the public on Guam. The SO requires the following steps:

- Ensure United States (U.S.) Environmental Protection Agency (USEPA) oversight of plans and other submittals relating to the SO.
- Reorganize staff and hire qualified personnel as general manager, financial officers, engineers, etc.
- Develop a WRMP.
- Develop a plan to ensure that optimal chlorine levels are maintained at chlorination points and throughout the distribution system.
- Ensure that there are adequate chlorine supplies on Guam.
- Implement a project to upgrade the groundwater chlorination system.
- Develop and implement a potable-water leak detection and response program.
- Develop and implement a water meter improvement program.
- Develop an inventory of operation and maintenance parts and ensure that the parts are available.
- Develop and implement an emergency response plan.
- Develop and implement a preventive maintenance program.
- Comply with specific financial and reporting requirements.

As described in the 2003 independent audit of GWA finances, compliance with the SO was estimated at $225 million. GWA intended to meet this obligation initially by borrowing approximately $160 million. Between 2003-2005, GWA sold bonds, settled litigation related to the authority's debt, and received rate relief. Improvements have reduced labor and operating costs by more than 20% (Reuters 2009).

As part of compliance with the SO, GWA submitted the Guam WRMP in 2007. The GWA WRMP lists the following goals:

- Institute sound asset management and capital planning.
- Develop foundation for sound management, operations and maintenance, and financial planning.
- Engage the customer and achieve the appropriate level of service.
- Achieve long-term resource sustainability.
- Establish a road map for full regulatory compliance.

The plan includes descriptions of the components of the water system, the water budget, a water-lost control program, a water conservation program, development of and results from hydraulic modeling of the water system, an assessment of facility conditions, and a comprehensive capital improvements program (CIP) for the water system.

The WRMP states that substantial improvements to the distribution system are of primary concern. The improvements were developed to improve service levels; satisfy storage, flow, and pressure requirements to meet fire protection criteria; and reduce the high level of water loss from the system. The full cost of the CIP for water through 2025 is estimated at $550 million. GWA developed the following projects to support the needed improvements:

- Conversion of the Ugum WTP to a 4.0-MGd (15.1-mld) membrane filtration facility
- Modification of the Ugum WTP intake at the diversion in the Ugum River
- Transmission line construction
- Supervisory Control and Data Acquisition (SCADA) improvements
- Corrosion control program
- Raw-water storage land acquisition and storage tank construction at Ugum WTP

Progress has been made in implementing the WRMP projects. Many major capital projects have been completed. Some of the projects have been delayed and fines have totaled approximately $250,000. GWA has invested more than $80 million in capital improvements since 2003 (Reuters 2009). As documented in the *Quarterly Stipulated Order Compliance Progress Report No. 20*, some of the important improvements to the GWA water system are as follows:

- Implementation of a leak detection plan—GWA has a crew dedicated to leak detection. In Fiscal Year 2007 alone, more than 11,000 leaks were repaired.
- Residual disinfection—Implementation of an Interim Disinfection Residual Level Monitoring Program is in progress with biweekly sampling at 93 selected locations, daily sampling at disinfected wells, and twice-daily sampling at high-risk wells.
- Chlorine supply—GWA has contracted with a vendor to always have an adequate supply of chlorine on the island.
- Water meter improvement program—GWA has replaced more than 97% of the industrial meters and 68% of the residential meters.
- Emergency response plan—The plan has been prepared and partially integrated into the Guam Emergency Response Plan.

- Preventative maintenance program—A plan has been prepared. GWA has implemented a computerized maintenance management system.
- Transmission line projects—The Sinajana Transmission Line project is under way.

The progress made by GWA in providing a reliable water system has been recognized by USEPA. As stated in the *EPA Progress Report 2006: Pacific Southwest Region* (USEPA 2006):

> Last year, however, improvements to the island's drinking water and wastewater treatment systems, along with EPA oversight of the Guam Waterworks Authority (GWA), resulted in the safest drinking water Guam has experienced in decades. The GWA improved its management by hiring a new chief engineer on loan from EPA, and increasing the number of certified operators at its wastewater treatment plant. Better generators, pumps, and motors were installed; the disinfection system was improved.

In preparation for the military buildup and to complete the remaining capital improvements, GWA has prepared a 5-year CIP for fiscal years 2009 to 2013. GWA estimates that the cost for expanding the system to accommodate the induced population would total $200 million for 16 wells plus storage facilities and transmission lines. The GWA program has not been presented to DoD in detail. However, discussions have been initiated between GWA and DoD to begin working through the details to coordinate GWA support for the proposed buildup. One example is a proposal for co-management by GWA and DoD of the NGLA. It is not clear whether the CIP would be adequate to meet the needs of the induced and construction worker populations. The CIP would be financed through surplus system revenues, grants, and loans (Deloitte Touche Tohmatsu 2008, Reuters 2009). Substantial rate increase relief is anticipated.

3.1.2.2 DoD Water Storage Facilities

The capacity of the existing DoD storage facilities is listed in Table 3.1-4. The storage capacity by area is shown in Table 3.1-5.

Table 3.1-4. Department of Defense Water Storage Facilities

Tank	*Capacity (Gallons)*	*Capacity (MGd)*	*Owner*	*Location*	*Type*
Water Storage Tank	150,000	0.15	Andersen AFB	Andersen AFB, Northwest Field	At-grade, steel
Water Storage Tank	150,000	0.15	Andersen AFB	Andersen AFB, Northwest Field	Steel
Storage Tank No. 2	250,000	0.25	Andersen AFB	Andersen South	Partially buried concrete
Storage Tank No. 4	480,000	0.48	Andersen AFB	Andersen South	Partially buried concrete
Santa Rosa Storage Tank	2,000,000	2.00	Andersen AFB	Andersen South	Buried concrete
Facility 19008	250,000	0.25	Andersen AFB	Andersen AFB	Ground level concrete
NCTS South, Finegayan South	250,000	0.25	Navy	South Finegayan	Elevated
NCTS Elevated	250,000	0.25	Navy	North Finegayan	Elevated
NCTS Ground (inoperative in 2005)	200,000	0.20	Navy	North Finegayan	Ground
Barrigada	3,000,000	3.00	Navy	NCTMS Barrigada	Reinforced concrete covered by earth
Naval Hospital	1,000,000	1.00	Navy	Naval Hospital	Reinforced concrete covered by earth
Nimitz Hill	1,000,000	1.00	Navy	Nimitz Hill	Reinforced concrete covered by earth
Adelup	3,000,000	3.00	Navy	Naval Hospital/ Nimitz Hill	Reinforced concrete covered by earth
Maanot	500,000	0.50	Navy	Apra Harbor/ Naval Munitions	Reinforced concrete at grade
Tupo	5,000,000	5.00	Navy	Apra Harbor/ Naval Munitions	Reinforced concrete covered by earth
Naval Magazine	700,000	0.70	Navy	Apra Harbor/ Naval Munitions	Reinforced concrete covered by earth
Apra Heights Tank	5,000,000	5.00	Navy	Apra Harbor/ Naval Munitions	Reinforced concrete covered by earth

Legend: AFB = Air Force Base; MGd = million gallons per day; NCTS = Naval Computer and Telecommunications Station;
Source: NAVFAC Pacific 2008b.

Table 3.1-5. Department of Defense Water Storage Capacity by Area

Area	*Total Existing Capacity (MG)*
South Finegayan	0.25
North Finegayan	0.25
Andersen Northwest Field	0.30
Andersen Main Base	0.25
Andersen South	2.73
Apra Harbor/Naval Munitions	11.2
Barrigada	3.00
Navy Hospital/Nimitz Hill	5.00
Total	**23**

Legend: MG = million gallons.
Source: NAVFAC Pacific 2008b.

3.1.3 Wastewater

The ROI for wastewater includes wastewater systems on Guam that would be directly or indirectly affected by the proposed military buildup. Wastewater flows from DoD lands are presently treated by the GWA Northern District Wastewater Treatment Plant (NDWWTP), the GWA Hagatna Wastewater Treatment Plant (WWTP), and the Navy Apra Harbor WWTP. The NDWWTP would be handling most of the increased wastewater treatment demand from the DoD buildup. The Navy Apra Harbor WWTP would handle the increased wastewater treatment demand from the ship based transient DoD personnel. The NDWWTP and Hagatna WWTP are also anticipated to treat most of the increased wastewater flows that would be generated by the temporary construction workforce and the increased civilian population. Descriptions of all three wastewater systems are provided in Section 3.1.3.

GWAs wastewater infrastructure (treatment plants, collection piping, and pump stations) has slowly deteriorated over the years. This, coupled with natural disasters such as typhoons and flooding, has resulted in frequent sewage spills at pump stations and collection piping, collapse of collection piping, and failure of treatment plant equipment. Lack of GWA resources, particularly restrictions on fees that can be collected from the public for sewer services, have severely limited GWA's ability to adequately maintain and update their wastewater treatment system. As a result, GWA has experienced frequent violations of its NPDES permit conditions, including inability to adequately treat wastewater and exceedances of the allowed pollutant levels in plant discharges.

On April 4, 1997, USEPA Region 9 issued a tentative decision to deny the reissuance of the Clean Water Act Section 301(h) secondary treatment variance to GWA for the NDWWTP and the Hagatna WWTP because, in USEPA Region 9's view, GWA failed to provide sufficient information that both plants meet 301(h) secondary treatment variance criteria. Central to this tentative denial was USEPA's assessment that the Hagatna WWTP and Northern District WWTP had failed to meet minimum standards for primary treatment, including adequate removal of pollutants, violations of pollutant discharge permit limits, and inability to demonstrate that plant discharges are not impacting water quality or the environment.

GWA provided additional information to USEPA Region 9 in an attempt to address the inadequacies cited in the USEPA Region 9 tentative secondary treatment variance denial. However, lack of maintenance on GWAs aging plants due to resource shortfalls continued to limit GWA's progress in improving their wastewater treatment program and bringing the plants into permit compliance.

In December 2002 the U.S. Department of Justice filed a civil lawsuit against GWA and the Government of Guam (GovGuam) for failure to comply with the Clean Water Act (CWA) and its NPDES permits. As noted in Section 3.1.2, this civil lawsuit also sued GWA for failure to comply with the Safe Drinking

Water Act for issues associated with their potable water system. As a result of the lawsuit, a Stipulated Order for Preliminary Relief was issued that requires GWA to improve the conditions of their water and wastewater systems (Civil Case No. 02-0035). For wastewater, the Stipulated Order required GWA to comply with their NPDES permits, and required that GWA establish a comprehensive program to provide safe and reliable wastewater services to the public. The SO established definitive milestones for improving the GWA's management and organizational structure, operations, financial administration, facility construction and rehabilitation, and staff training. The SO requirements also included detailed wastewater construction and rehabilitation projects in central and northern Guam, including:

- Construction of a new ocean outfall at the Hagatna WWTP by January 1, 2008.
- Construction of a new ocean outfall at the Northern District WWTP by January 1, 2009.
- Implementation of corrective actions to restore primary treatment to the original design operational capacity at the Hagatna WWTP and the Northern District WWTP by March 2, 2007.
- Implementation of corrective actions to restore operational capacity at the Agana Main Sewage Pump Station by March 2, 2007.
- Implementation of corrective actions to stop overflows of raw sewage from the Agana Main Sewage Pump Station, including development of an implementation schedule.
- Assessment of the Chat Wastewater Pump Station and sewer collection and conveyance system, including development of an implementation schedule.

In 2003, an independent audit of GWA finances was conducted which estimated the cost for GWA to comply with the SO at $225 million. GWA intended to meet this obligation initially by borrowing approximately $160 million. Between 2003 and 2005, GWA sold bonds, settled litigation related to the authority's debt, and received rate relief. Improvements have reduced labor and operating costs by over 20 percent (Reuters, 2009).

As part of compliance with the SO, GWA developed the Guam Water Resources Master Plan (WRMP) in 2007. The Water Resources Master Plan lists the following goals:

- Institute sound asset management and capital planning
- Develop a foundation for sound management, operations, and maintenance and financial planning
- Engage the customer and achieve the appropriate level of service
- Achieve long-term resource sustainability
- Establish a road map for full regulatory compliance

The plan includes descriptions of the components of the wastewater treatment facilities, wastewater collection system, an estimation of current and future wastewater flows, wastewater collection system hydraulic modeling development and results, sewer hook-up program for un-sewered properties (e.g.: septic tanks), a facility conditions assessment, and a comprehensive wastewater system capital improvements plan (CIP). The Water Resources Master Plan did not consider future wastewater flow increases that could result from the military buildup on Guam; however, the flow estimates for the NDWWTP were overestimated by roughly double due to faulty flow measuring devices.

The primary objectives of the CIP are to improve the operations of the system and to meet the requirements of SO. The total capital needs through 2025 are substantial at an estimated $900 million in 2007 dollars. The full cost of the CIP for wastewater identified by the Water Resources Master Plan is estimated at $335 million. The GWA developed the following projects to support the needed improvements in central and northern Guam:

- Improve the Hagatna WWTP by adding an additional primary clarifier for redundancy, new solids screens, improved grit removal, and an effluent pump station.
- Construct a new primary clarifier for future flows and system reliability at the Northern District WWTP.
- Repair existing sludge handling facilities and construct a new sludge digester and new sludge dewatering facilities for centralized sludge treatment and system reliability at the Northern District WWTP.
- Upgrade sewer capacities at the Hagatna WWTP and the Northern District WWTP.
- Provide sewer hook-ups for the Hagatna WWTP and the Northern District WWTP un-sewered properties (e.g.: septic tanks). This has been identified as a high priority effort because septic systems have the potential to impact Guam's sole source aquifer used for drinking water (the Northern Guam Lens Aquifer).
- Implement a wastewater collection system recurring inspection program.
- Implement a wastewater collection system replacement and rehabilitation program.
- Install System Control and Data Acquisition (SCADA) improvements; these are systems that collect data at the treatment plants and at pump stations, and transmit this data to a central control facility.

Progress has been made to implement the projects called for in the Water Resources Master Plan . Many major capital projects have been completed. However, some of the projects have been delayed, resulting in fines of approximately $250,000. GWA has invested over $80 million in capital improvements since 2003 (Reuters 2009). As documented in the Quarterly SO Compliance Progress Report No. 20, some of the significant improvements to the GWA wastewater system include:

- Sewer Hook-up Revolving Fund – this program provides financial assistance to low-income owners of septic systems that are slated for hookup to the GWA sewer collection system, GWA developed a program, and the fund is now available for public use.
- Hagatna WWTP Ocean Outfall – The outfall was put into service on January 23, 2009.
- Northern District WWTP Ocean Outfall – The outfall was put into service on December 15, 2008.
- Assessment of the Chat Wastewater Pump Station and Sewer Collection and Conveyance System – GWA submitted an Engineering Assessment, and constructed a new pump station and new sewer lines that are currently in service.
- Agana Main Sewage Pump Station Renovation – GWA completed repairs and the pump station was put back on line and worked as the headworks for the Hagatna WWTP.
- Hagatna WWTP Renovation – GWA completed refurbishment of the plant and put it into full service on March 29, 2007.
- Northern District WWTP Renovation – GWA has completed portions of the treatment plant refurbishment.

In 2007, GWA established a private/public partnership with Veolia LLC to operate GWA's Hagatna WWTP and Northern District WWTP. In 2008, citing an overburdened wastewater system, GWA imposed a development moratorium for areas in central Guam, and issued a request for proposals in order to use a private partner for upgrading the wastewater collection system in central Guam. The project was estimated to cost from $30 million to $40 million, and expected to bid in September 2009 and complete in two years. It would increase the capacity of central Guam sewer collection system and help improve treatment efficiency at the Hagatna WWTP.

NPDES Discharge Monitoring Reports (DMR) for the Hagnata WWTP and the Northern District WWTP from January to June, 2009 indicate that despite progress made by GWA to bring their facilities into compliance, the plants continue to violate their permit conditions. Discharges from the Hagatna WWTP and the NDWWTP do not consistently meet the minimum primary treatment standards for removal of organic matter and suspended solids. Both plants also experience routine violations of their effluent discharge pollutant limits, including exceedances of their maximum flow (6 MGd), and exceedances of their suspended solids and biological oxygen demand limits.

Between the years 1998 and 2001, GWA revised their permit renewal application and submitted additional information to USEPA Region 9 to request a continuance of their 301(h) secondary treatment variance. These submittals included information related to the installation of new extended ocean outfalls for the Hagnata WWTP and the Northern District WWTP. The new outfalls were put into service in December 2008, and the Hagatna WWTP was refurbished to restore its original designed capacity in 2007.

In January 2009, USEPA Region 9, upon review of this new information from GWA, again issued a tentative decision to deny the 301 (h) secondary treatment variance, followed by a final decision to deny the variance September 30, 2009, USEPA Region 9. This final variance denial decision by USEPA Region effectively requires GWA to install full secondary treatment at both the Hagnata WWTP and the Northern District WWTP. In its final decision, USEPA Region 9 stated that they denied the variance because the treatment plants did not meet several Clean Water Act 301(h) criteria, including the following:

- The discharge does not meet the mandatory minimum standard of primary treatment.
- GWA has not demonstrated that the discharge would attain or maintain water quality to allow recreational activities in and on the water.
- GWA has not demonstrated that the discharge would attain or maintain water quality to allow protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.
- The applicant's monitoring data are insufficient to demonstrate compliance with Guam's water quality standards.
- The applicant has not developed a program to control toxic pollutants from nonindustrial sources.

USEPA Region 9 has indicated that they will issue an Administrative Order that outlines specific requirements to bring the NDWWTP to secondary treatment standards as well as interim provisions to refurbish the plant to meet the mandatory minimum standards for primary treatment. The interim provisions will include monitoring requirements to develop a basis of design for the needed secondary treatment. GWA anticipates major system refurbishment (e.g. primary clarification, grit chamber, chlorine contact tank, drying beds, etc.) that is currently underway at the NDWWTP would improve the plant performance to meet its existing compliance requirements at current flows. GWA has also suggested that completion of the on-going development moratorium project that limits development and new sewer connection, and mitigation of septage discharge at the Hagatna WWTP, would improve plant performance and lead to permit compliance.

The recent 301(h) secondary treatment variance denial decision by USEPA was issued at the same time this DEIS/OEIS was in final preparation for release to the public. However, the alternatives presented in this DEIS/OEIS have been changed to reflect the need for secondary treatment at the NDWWTP to address the projected flows to the plant during the period of the Guam military buildup (2010 to 2019).

DoD is engaged in ongoing consultation with GWA, USEPA Region 9, and GEPA concerning wastewater requirements from the Guam military buildup. The purpose of this consultation is to achieve a common understanding of the requirements for treatment plant upgrades that address not only the military buildup on Guam, but also those associated with the recent 301(h) secondary treatment variance denial. All parties are committed to working collaboratively to develop solutions that meet everyone's needs . While these discussions may ultimately lead to specific timeframes for treatment plant upgrades, they are not expected to result in significantly different facilities than those represented in the wastewater alternatives in this EIS/OEIS.

In preparation for the military buildup and to complete the remaining planned water and wastewater capital improvements, GWA has prepared a new five year CIP for fiscal years 2009 to 2013. GWA estimates the cost for expanding its system to accommodate the military buildup induced population to cost a total of $200 Million, including $66 Million for wastewater infrastructure improvements. The CIP will be financed through surplus system revenues, grants and loans (Reuters 2009; Deloitte Touche Tohmatsu 2008). USEPA Region 9 is working with GWA and GEPA to identify grant money to assist in funding the immediate need for primary treatment plant upgrades.

The wastewater flows presented in Section 2.3.3 include expected wastewater flows that are part of normal civilian population growth during the period of time of the military buildup - years 2010 to 2019. After 2019, normal civilian population growth on Guam would continue, thereby generating additional wastewater flows from the population in the out years. As part of DoD's ongoing consultation with GWA, GEPA and USEPA Region 9, GWA has indicated that if DoD selects an alternative in this EIS/OEIS that involves using the NDWWTP, long-range wastewater flows at the NDWWTP beyond the military buildup (e.g.: beyond the year 2019) would quickly exceed the 12 MGd design capacity of the plant. GWA projects a future capacity need at the NDWWTP of 18 MGd. As mentioned previously in Section 2.3.2, USEPA Region 9 recently issued a decision to deny GWA's secondary treatment 301(h) variance, effectively requiring GWA to upgrade its NDWWTP and Hagatna WWTP to secondary treatment. Therefore, the treatment plant upgrades needed to meet this new requirement should be planned to ultimately provide an 18 MGd plant capacity at the NDWWTP.

The analysis of wastewater presented in this EIS/OEIS centers on the impacts related to the proposed action that are the responsibility of the DoD to assess; namely the military buildup on Guam during the years 2010 to 2019. Thus, the EIS presents a detailed analysis of potential environmental impacts as they relate to the military buildup and total projected wastewater flow of 12 MGd that could be treated at the NDWWTP during this timeframe. This EIS/OEIS also includes an analysis of potential environmental impacts that may be associated with upgrades to the NDWWTP to an 18 MGd capacity, but only as they relate to expected changes in water quality that could result from increased pollutant loads in the plant discharge from a larger 18 MGd plant. See Chapter 3 Section 3.2.4.2 for this analysis. Nevertheless, treatment plant upgrades to expand the NDWWTP to a 18 MGd capacity would not result in different treatment processes than those represented in the wastewater alternatives in this EIS/OEIS, but would simply be sized larger. It is expected that GWA will need to conduct additional engineering analysis to properly size the NDWWTP to accommodate the projected future 18 MGd plant capacity.

3.1.3.1 Northern District Wastewater Treatment Plant

The NDWWTP is owned by GWA and operated by Veolia under contract with GWA. The treatment plant treats wastewater flows from civilian populations and DoD installations that are located in northern Guam. Andersen AFB, NCTS Finegayan, and South Finegayan contribute wastewater flows to the NDWWTP.

The wastewater collection system maintained by Andersen AFB consists of a network of gravity sewers, four major pump stations, and force mains located on the south side of the airfield. Two small sewage pump stations collect wastewater generated from facilities located on the north side of the airfield and convey the wastewater via force main to the gravity collection system on the south side of the airfield. The system also collects wastewater generated by the industrial and residential areas on the base. The average daily wastewater flow generated by Andersen AFB in 2008 is approximately 0.36 MGd (1.36 mld). Wastewater generated by Andersen AFB is discharged off base into the GWA sewage collection system at a sewer manhole located near the Andersen AFB main gate. The wastewater is then conveyed to the NDWWTP for treatment.

The wastewater collection system at NCTS Finegayan is primarily gravity sewer system consisting of two main trunk lines. The wastewater is conveyed to the NDWWTP via a GWA wastewater collection system. At South Finegayan, the wastewater collection system is a gravity sewer system connected to the GWA wastewater collection system. The wastewater is conveyed to the NDWWTP. The current average wastewater flow generated by NCTS Finegayan is approximately 0.17 MGd (0.64 mld).

Facilities and infrastructure at Andersen South have been abandoned and are not being maintained. The original sewers in the area flowed to a sewer pumping station located along the northern edge of the site. Sewage from the pump station discharged to a GWA sewer collection system and was subsequently conveyed to the NDWWTP for treatment. Neither the sewer lines nor the sewer pumping station are in operating condition and Andersen South contributes no wastewater flows to the NDWWTP.

The NDWWTP is a primary treatment plant designed for an average daily flow of 12.0 MGd (45.4 mld) and a peak capacity of 27 MGd (102 mld). Communication with GWA has indicated that the current average daily flow to the NDWWTP from civilian and military sources is approximately 5.7 MGd (22 mld) (GWA 2008a).

The NDWWTP discharges treated effluent through a newly constructed 34-in (86-cm) outfall into the Philippine Sea approximately 2,100 ft (640 m) offshore at a depth of approximately 150 ft (45 m) near Tanguisson Point. Section 301(h) of the CWA allows the USEPA administrator to waive secondary treatment requirements for publicly owned treatment works that discharge into marine waters under a modified National Pollutant Discharge Elimination System (NPDES) permit. The NDWWTP had received a 301(h) modified permit (NPDES Permit No. GU0020141) that expired on June 30, 1991. This permit authorized the NDWWTP to discharge a maximum daily flow of 6 MGd (23 mld). Because GWA failed to provide sufficient information for USEPA to conclude that the GWA permit renewal application met the 301(h) criteria, USEPA issued a tentative decision on April 4, 1997, denying the reissuance of a 301(h) variance to GWA. GWA revised the permit renewal applications by installing a new extended outfall and planned CIP for restoring the treatment capacity of the plant. The new outfall was put into service in December 2008. Based on plant operation performance and data provided by GWA on the actual discharged wastewater qualities, USEPA denied GWA’s application for a renewed variance from full secondary treatment in September 30, 2009, and concluded that the CWA 301(h) criteria have not been met at the NDWWTP.

3.1.3.2 Hagatna Wastewater Treatment Plant

The Hagatna WWTP is owned and operated by GWA. The treatment plant treats wastewater flows from civilian populations and DoD lands that are located in central Guam. Navy and Air Force Barrigada, the Naval Hospital, and DoD lands located in the Nimitz Hill area contribute wastewater flows to the Hagatna WWTP.

The existing Navy Barrigada sewer system consists of approximately 13,000 ft (3,962 m) of gravity sewer lines ranging from 6 to 8 in (15 to 20 cm) in diameter. The existing Naval Hospital sewer system consists of approximately 14,800 ft (4,511 m) of gravity sewer lines ranging from 6 to 10 in (15 to 25 cm) in diameter. The Nimitz Hill sewer system consists of gravity sewer lines ranging from 6 to 15 in (15 to 38 cm) in diameter. There is one lift station for the Naval Hospital sewer system and one lift station for the Nimitz Hill sewer system. Sanitary sewer systems servicing Barrigada, the Naval Hospital, and Nimitz Hill are connected to GWA interceptor sewers. Wastewater generated at these DoD lands is conveyed to GWA's Hagatna WWTP for treatment. The current average wastewater flow generated by Navy Barrigada is approximately 0.34 MGd (1.28 mld).

The Hagatna WWTP is a primary treatment facility designed to treat an average daily flow of 12.0 MGd (45.4 mld) and a peak flow of 21 MGd (79 mld). Communication with GWA has indicated that the current average daily flow to the Hagatna WWTP from civilian and military sources is approximately 4.4 MGd (16.6 mld) (GWA 2008b). Treated effluent is discharged from the WWTP through a newly constructed 42-in (107-cm) outfall into Agana Bay approximately 2,178 ft (664 m) offshore at a depth of approximately 275 ft (84 m) under a USEPA-administrated permit (NPDES Permit No. GU0020087) that expired on June 30, 1991. The permit contained a 301(h) variance allowing for less than secondary treatment and authorized the Hagatna WWTP to discharge a maximum daily flow of 12 MGd (45.4 mld). GWA failed to provide sufficient information for USEPA to conclude that the GWA permit renewal applications for both plants met the 301(h) criteria. As a result, USEPA issued a tentative decision on April 4, 1997, denying the reissuance of a 301(h) variance to GWA. GWA revised the permit renewal applications by installing a new extended outfall for each of these two plants. The new outfall for the Hagatna WWTP was put into service in December 2008 and the Hagatna WWTP was refurbished to restore its original designed capacity in 2007. Based on plant operation performance and data provided by GWA on the actual discharged wastewater qualities, USEPA denied GWA's application for a renewed variance from full secondary treatment on September 30, 2009, and concluded that the CWA 301(h) criteria have not been met at the Hagatna WWTP.

3.1.3.3 Apra Harbor WWTP

The Apra Harbor wastewater collection and treatment system is Navy owned and operated. It services Naval facilities at the Naval Base Guam, Apra Heights, and Naval Munitions Site. The Apra Harbor wastewater system also collects and treats discharged sludge flow from the Navy's Fena WTP. The existing wastewater collection system includes nine major sewer trunk or subtrunk lines consisting of about 35 miles (56 kilometers) of sewer lines ranging from 6 in to 36 in (15 to 91 cm) in diameter, and 24 sewer pumping/lift stations.

Wastewater is conveyed to the Apra Harbor WWTP for treatment. The Apra Harbor WWTP is a secondary treatment facility designed to treat an average daily flow of 4.3 MGd (16 mld) and a peak flow of 9 MGd (34 mld). The treatment plant currently receives an average daily flow of approximately 2.9 MGd (11 mld). Treated effluent is discharged through an ocean outfall into Tipalao Bay under NPDES Permit No. GU0110019. This permit authorizes the Apra Harbor WWTP to discharge an average monthly flow of 4.3 MGd (16.3 mld). The Navy-owned outfall also discharges effluent from the GWA Agat-Santa Rita WWTP (NPDES Permit No. GU0020222). A military construction project to rehabilitate/upgrade the existing Apra Harbor WWTP is currently under way.

3.1.4 Solid Waste

The ROI for solid waste includes solid waste facilities on Guam that would be directly or indirectly affected by the proposed military buildup. Solid waste from DoD lands is presently disposed of at the Navy Sanitary Landfill or the Air Force landfill at Andersen AFB. Solid waste from non-DoD sources is disposed of at GovGuam facilities. Descriptions of the existing Navy, Air Force, and GovGuam solid waste facilities are provided in the following sections.

3.1.4.1 Navy Sanitary Landfill

The Navy owns and operates one landfill facility on Guam. The Navy Sanitary Landfill is located in the southeastern portion of the Apra Harbor Navy Base. The landfill is bounded to the northeast, east, and south by wetlands; to the northwest by Perimeter Road; and to the west by Shoreline Drive (Figure 3.1-4). A natural vegetative barrier blocks views of the landfill from the nearby Navy Exchange and Commissary.

The landfill has been in use since 1965 and is currently operated by the Base Operations Support contractor, DZSP-21, under the terms of the administratively extended Solid Waste Management Permit, No. 95-1009, dated December 26, 1995. The Navy has applied for a permit renewal from GEPA.

The Navy Sanitary Landfill filling operations do not appear to have followed any particular final filling plan. However, a grading plan was developed in 1996 and proposed a maximum elevation of 48 ft mean sea level (msl) for the landfill.

The Navy Sanitary Landfill serves all DoD lands and their tenants, including the following:

- Apra Harbor Navy Base
- Naval Munitions Site
- Nimitz Hill
- Naval Hospital
- NCTS Barrigada
- South Finegayan
- NCTS Finegayan

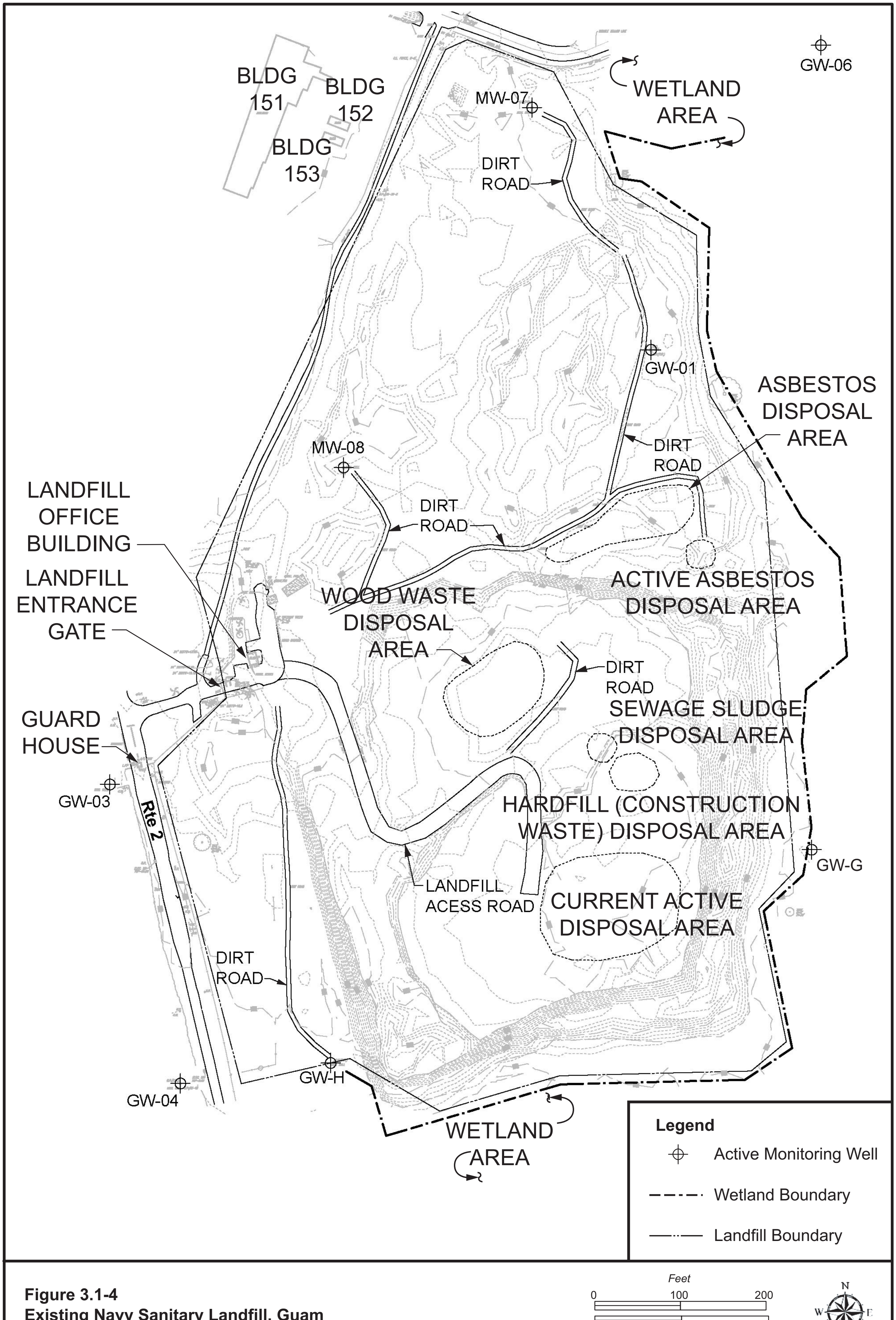

Figure 3.1-4
Existing Navy Sanitary Landfill, Guam

The landfill also receives waste from Navy ships berthed in Apra Harbor. Naval activities on Guam generate approximately 21 tons (19 metric tons) of solid waste daily that is placed at the landfill. The Navy Sanitary Landfill currently accepts waste from housing, commercial, and industrial activities; hardfill from on-base construction projects; sterilized waste from ships; asbestos waste; and wastewater treatment sludge that has passed the paint filter test.

The Navy landfill is unlined and occupies an area of approximately 60 acres (ac) (24 hectare [ha]). An active waste placement area is in the southeast corner of the landfill site. Other designated and segregated areas of the landfill site include areas for asbestos, hardfill (e.g., concrete), wood waste, and sewage sludge. Soils and backfill are used for daily cover. Concrete debris is often used for berming and landfill road maintenance.

Foreign refuse from ships is collected in special containers strategically located along the ship's berthing. Containers are picked up and transported to a specifically designed facility using steam for the decontamination and sterilization of ship waste. After the sterilization process, a compactor truck transports the waste to the Navy landfill for disposal.

Asbestos-containing material is accepted at the landfill on a case-by-case basis. The landfill is notified at least 24 hours before the receipt of incoming asbestos waste. After receiving approval for disposal, certified asbestos contractors arrive with the asbestos waste prebagged and sealed in compliance with GEPA and Navy regulations. A landfill operator inspects the seals of the asbestos bags for their integrity and accompanies the asbestos contractor to the designated area for disposing asbestos. The contractor places the waste and covers it with at least 6 in (15 cm) of soil cover. The landfill operator is required to observe the process and ensure that the landfill remains in compliance with its permit. Sludge from Navy's WWTP is accepted at the Navy Sanitary Landfill if the sludge passes a paint-filter test, demonstrating that the sludge meets landfill requirements of no free liquid.

Solid waste prohibited from being disposed of in the landfill includes the following:

- Hazardous waste
- Liquids
- Oily wastes, oil-based paints, and petroleum products
- Metal and appliances
- Whole or partially whole vehicles, vehicle parts, and tires
- Batteries
- Wet sewage sludge
- Flammables

Collection truck operators visually inspect waste loads in each container for prohibited wastes. If prohibited wastes are found, the load would not be collected until the material has been removed for proper disposal.

An office located at the landfill entrance is the only on-site structure. There are no scales for weighing incoming loads of solid waste. Collected solid waste volumes are estimated by the refuse collection truck driver or landfill personnel at the Navy landfill control office. Wastes deposited at the landfill via other vehicles and haulers, such as ship waste, WWTP sludge, and construction/demolition waste, are estimated by the landfill personnel. Waste disposal to the landfills is tracked through daily trip tickets, daily disposal logs, weekly metric reports, and semiannual and annual reports submitted to GEPA and Naval Facilities Engineering Command, Marianas (NAVFAC Marianas).

Groundwater at the landfill facilities is monitored at two upgradient wells, two downgradient wells, and four wells located within the landfill boundary. Groundwater is currently monitored on a quarterly basis. Landfill gas (methane) is also monitored on a quarterly basis. Groundwater and gas monitoring data are reported to GEPA in semiannual solid waste reports. The groundwater monitoring is conducted on a quarterly basis. Using the current monitoring program, statistically significant concentrations of chlordane and five volatile organic compounds have been detected in the downgradient wells in recent years, but these levels are below any drinking water maximum contamination levels.

The base operator support contractor maintains a litter control fence along the edge of the landfill operations area and along the operations area access road to prevent the escape of windblown litter.

Recycling Facilities

The Navy does not have an official recycling program. However, small-scale localized recycling is being implemented, such as cardboard recycling at the Exchange and Commissary.

NAVFAC Marianas has initiated an effort to "partner" with Andersen AFB in its recycling efforts. By collecting and transferring recyclable waste from Navy facilities to the Andersen AFB recycling center, the Navy hopes to reduce the flow of waste into the Navy landfill and increase the profitability of the Air Force's investment into its recycling equipment by adding volume of recyclable waste. However, the current volume of recyclable waste generated by the Navy is likely well below the amount needed to construct and operate a dedicated Navy recycling center that is capable of supporting itself in terms of cost.

3.1.4.2 Air Force Solid Waste Facilities

Landfill Facilities

The Air Force owns and operates a single landfill on Guam, located at Andersen AFB near Route 1 and the entrance road to Andersen AFB. The current landfill is a vertical expansion constructed over an unlined landfill area and began operation in late 1998. The landfill expansion has a design capacity of 172,000 cubic yards (CY) (131,503 cubic meters [m^3]) and had an expected life of 10 years. The current landfill footprint occupies an area of approximately 79 ac (32 ha). A base operator support contractor operates and maintains the facility under a current Resource Conservation and Recovery Act (RCRA) Subtitle D permit.

The landfill is also constructed over a sole-source aquifer. Federal law prevents new landfills or landfill expansions to be constructed over sole-source aquifers. However, the Andersen AFB landfill was exempted from this siting restriction.

The landfill expansion is constructed with a double liner system that provides an added measure of protection should one of the liners fail. This site is also equipped with fire hydrants at the corners of the property and a base landfill wash rack.

The landfill is made up of two major sections: a solid waste disposal area and a hardfill disposal area. Waste delivered to the landfill facility is first identified and segregated. Waste consisting of cardboard, paper, glass, plastic, scrap metal, and aluminum is taken to Andersen AFB's Arc Light Recycling Center (discussed below). Typical municipal waste such as food waste and other types of biodegradable trash is placed in the solid waste disposal area and then compacted and covered with roughly 6 in (15 cm) of soil daily. Wood (e.g., crates) and green waste are segregated into separate piles and shredded by a large wood chipper. The resulting wood chips are provided to local residents and base operators for mulching and landscaping purposes. Construction debris like concrete, asphalt, and rock are piled together and processed through a rock crusher. The crushed debris is then mixed with dirt and used as daily cover for the landfill. Construction and demolition debris that cannot be crushed is disposed of in the hardfill section of the landfill.

For several years, the Air Force and Navy have structured their long-term solid waste collection and disposal plans based on the expectation that GovGuam would open a new, fully compliant Subtitle D landfill by September 2007 per the terms of a federal consent decree. At this time, the Air Force and possibly the Navy would become GovGuam customers, using the GovGuam landfill and other solid waste management facilities.

Because GovGuam had not established a new landfill by September 2007, the Air Force was left with few options to meet its solid waste disposal needs in the near future. The Air Force landfill reached its original design capacity in September 2007. The Air Force recently constructed a 2-ac (0.81-ha) expansion to meet its disposal needs through 2009. Because the GovGuam landfill would not become available until July 2011, the Air Force would need to further expand the existing landfill or pursue diversional and/or operational measures to maximize landfill life.

Recycling Facilities

Andersen AFB has taken the lead in recycling efforts on Guam. Beginning in 1997, the base constructed the Arc Light Recycling Center (Facility 2408) to support its voluntary recycling program. This center is operated by a private contractor and currently receives and processes cardboard, wastepaper, aluminum cans, glass, and plastic bottles. The glass is ground to fill sandbags and provide backfill at construction sites. The other items are separated, stacked, and compressed into large bales that are sold off-island a few times a year through a broker. In addition, palm fronds and other green waste are ground at the base landfill, producing mulch that is available to installation residents through a "Self-Help Store."

The operating cost of the recycling center is approximately $300,000 annually, far greater than the $30,000 in revenues that the center generates through sales of recyclable materials. However, the recycling program saves the Air Force an estimated $1.7 million in costs each year by diverting 45% to 52% of the base's trash (i.e., 8,650 tons [7,847 metric tons]) from being disposed of at the Andersen AFB landfill, thus prolonging the life of this landfill.

A list of recycling equipment that the base owns and operates is provided in Table 3.1-6.

Table 3.1-6. Recycling Equipment at Andersen AFB

Equipment	*Model/Make*	*Quantity*
Baler	Model EX602 Horizontal	2
Weight scale	Series 9711-326	1
Recycling trailer, 17 feet × 8 feet (6-foot B/L wheels), with pintel hook attachment		1
Andela glass pulverizer	Model GP-07	1
Toter containers, 96 gallons (for family housing units)		1,500
Dumpsters, 8 cubic yards (for industrial/commercial facilities)		40
Source: Air Force Solicitation 2007		

Andersen AFB has an educational program that influences installation activities and informs residents about the importance of waste recycling, the base's voluntary recycling program, and Air Force facilities and services available to allow them to participate in recycling efforts at the base.

3.1.4.3 GovGuam Solid Waste Facilities

The current solid waste management system on Guam consists of the disposal site Ordot Dump and three waste transfer stations (Dededo, Ayat, and Malojloj). The GovGuam hardfill in Malojloj is no longer operational. These facilities and other permitted private hardfills (Northern Hardfill and Eddie Cruz Hardfill) serve the entire civilian community of Guam. Trash collection is provided by Guam Department of Public Works (DPW) and several private trash haulers.

Currently, the Ordot Dump is the only facility available on Guam for the disposal of municipal, commercial, and industrial waste. The first use of the site as a dump is not documented. However, the site was used for waste disposal by the Japanese during their occupation of Guam in the early 1940s (World War II). After the liberation of Guam, the Navy continued to use the site as a disposal area. Ownership of the Ordot Dump was transferred from the Navy to GovGuam in 1950 under the Organic Act. The Guam DPW is primarily responsible for the collection of solid waste on Guam and operation of the Ordot Dump.

The Ordot Dump receives approximately 526 tons (477 metric tons) of waste/day or 191,990 tons (174,089 metric tons) per year. The dump has grown to full capacity, covering an estimated 54 ac (22 ha) to date. The dump is unlined and improperly designed, operated, maintained, and monitored to safely accept industrial and municipal waste. The dump does not incorporate any of the features of a modern landfill, such as soil cover; a liner system to prevent the infiltration of leachate to surface and groundwater; a leachate collection and treatment system; groundwater monitoring wells; a stormwater diversion, collection, and management system; gas monitoring and venting systems; and erosion and sedimentation control.

The Ordot Dump was created in a natural flowing ravine before regulatory standards for siting a landfill were established. Although the dump has been filled in the ravine, the general slope of the area remains southward approximately 500 ft (152 m) to the Lonfit River. Leachate emanates from the dump and flows to the river, a violation of the federal CWA. In February 2004, USEPA, DOJ, and GovGuam entered into a consent decree to resolve issues related to this unauthorized discharge of pollutants to the Lonfit River.

The consent decree outlines specific tasks and time requirements that the GovGuam has agreed to complete to correct the violation. These tasks included the closure of the Ordot Dump by October 2007 and the siting, design, and construction of a new municipal solid waste landfill facility that is fully compliant with federal RCRA Subtitle D but that has not yet been completed. The opening of the new landfill, which began construction on February 25, 2009, would coincide with the mandated regulated closure of Ordot Dump.

The Ordot Dump is still in operation; however, it is at full capacity and it is unknown how much longer it can continue to receive waste. Following its eventual closure, the Consent Decree mandates a 30-year postclosure maintenance plan that would include monitoring of the gas, stormwater, leachate, cover system, and monitoring wells.

The new landfill site (Layon Landfill) selected by GovGuam is located near the village of Inarajan. The selection of this site was based on landfill siting criteria set forth in RCRA Subtitle D, the Guam Solid Waste Disposal Rules and Regulations (Guam Code Annotated [GCA] Title 22, Division 4, Chapter 23), and other guidelines. These criteria are used to evaluate the potential site impacts of the landfill on surface and groundwater quality, wetlands, floodplains, nearby communities, traffic, air quality, biological resources, archaeological and historic resources, land use, airport safety, aesthetics, noise levels, property values, and utilities. The proposed landfill site is approximately 317 ac (128 ha), with a landfill footprint of 127.4 ac (52 ha), and with a design capacity of 15.8 million CY (12.1 million m^3) that would provide at least 30 years of service life (HDR|Hawaii Pacific Engineers 2008).

Girshman, Brickner, and Bratton, Inc. (GBB), the receivership firm managing GovGuam's solid waste program, recently awarded a construction contract for the initial phase of the landfill and construction that began on February 25, 2009. The current phase consists of constructing the landfill operations road and performing mass grading for landfill Cells 1 and 2. Invitations to bid on the construction of the Layon Municipal Sanitary Landfill Entrance Area Facilities and Cells 1 and 2 were released on August 17, 2009. Cells 1 and 2 are approximately 11.0 ac (4.5 ha) each, with planned waste filling depths of approximately 100 ft (30 m). The Layon Landfill is currently projected to be ready for acceptance of solid waste by July 2011. The landfill would be designed and operated in compliance with the federal RCRA Subtitle D Municipal Solid Waste Landfill Facility regulations and Guam's solid waste disposal regulations (GCA Title 22, Division 4, Chapter 23). These regulations serve to minimize and mitigate any potential adverse affects on human health and the environment created by the landfill.

Integrated Solid Waste Program

In 1983, GEPA adopted a solid waste management plan for Guam and regulations for solid waste collection and disposal. In 2000, GovGuam began the process of upgrading and modernizing its solid waste facilities with the adoption of the *Integrated Solid Waste Management Plan for the Island of Guam* (ISWMP) through Public Law 25-175 (December 12, 2000). In addition, the Guam legislature enacted more than 40 laws related to solid waste management and disposal from October 1983 to September 2006. Unfortunately, these legislative attempts have largely failed to improve the effectiveness and efficiencies of Guam's solid waste management program. The program has been plagued by funding inefficiencies; poor permit, tipping, and user fee collection rates; poor waste collection records; delays in meeting mandated and planned performance criteria (such as privatization of waste collection and disposal activities); and a consent decree requiring the closure of the Ordot Dump and the construction of a new landfill. To address these efficiencies and the consent decree, GEPA prepared a draft update to the ISWMP in September 2006 (GEPA 2006). The plan has not yet been adopted by the Guam legislature. The goal of the updated plan is to develop a truly "integrated" solid waste management system that provides waste management through diversion, recycling, composting, and processing. The integration would also consolidate all current solid waste management efforts on Guam (civilian and military) into one system to the extent possible. GovGuam has been consulting with the military for several years regarding the potential consolidation of their individual solid waste programs or components of these programs (e.g., recycling facilities).

The 2006 ISWMP identifies the objectives, performance criteria, and key elements of the integrated solid waste management system going forward. The plan addresses and provides recommendations for the following:

- The closure of the Ordot Dump
- The transfer of DPW's solid waste duties to a newly formed public utility corporation (to be known as the Guam Solid Waste Authority) under the oversight of the Consolidated Commission on Utilities
- The privatization of all solid waste operations
- A waste source and characterization study
- Source reductions, recycling, composting, resource recovery, and waste reduction
- The development of a new landfill and regulated landfill disposal
- The development of solid waste transfer stations around the island for accepting, segregating, and consolidating waste streams for recycling or landfill disposal
- Program funding requirements and potential funding sources (including the collection of permit and user/tipping fees)

- Special handling requirements and facilities for construction/demolition waste, household hazardous wastes, bulky metallic waste and white goods (e.g., washers, refrigerators), and green waste
- A public education program

The plan update revises Guam's solid waste load projections to the year 2037 (which approximates the conservative lifespan of the new landfill) and includes waste generated from future military buildup.

The goals and key components of this plan would not be realized without future legislation that makes the plan's recommendations mandatory and provides the funding mechanisms needed to implement the plan. To date, this legislation has not been forthcoming. In mid-December 2007 the federal courts appointed federal receivership of Guam's solid waste management program to ensure the prompt closure of Ordot Dump, the construction of a new compliant landfill, and implementation of the 2006 ISWMP.

3.1.5 Roadway Projects

Because of potential impacts on public and military utilities and infrastructure from associated roadway improvements, the existing infrastructure located within the Guam Road Network (GRN) are described. Public utilities in the GRN study area include electricity, water and wastewater facilities, telecommunications, fuel pipelines, and solid waste disposal. In addition, separate military-operated water and wastewater systems are either originating or terminating in the Apra Harbor and Andersen AFB areas, where roadway improvements are also considered.

3.1.5.1 North

Table 3.1-7 indicates the presence of each particular utility along the major roadway routes within the study area in the north region. The major roadway routes within northern Guam include Routes 1, 3, 9, 15, and 28.

Table 3.1-7. Existing Utilities within Guam Road Network Routes

Region	*Route*	*GPA Power*	*Navy Power*	*Power Plant*	*GPA Fuel*	*Telephone*	*Cable TV*	*Fiber Optic*	*GWA Sanitary Sewer*	*Navy Sanitary Sewer*	*Wastewater Treatment Plant*	*GWA Water*	*Navy Water*
North	1	X		X		OH	OH	X				X	
	3	X	X			OH and UG	OH	X	X	X		X	X
	9	X				OH	OH and UG	X		X		X	
	15	X				OH	OH	X				X	
	28					OH			X			X	
Central	1	X	X	X	X	OH and UG	OH and UG	X	X	X	X	X	X
	7	X				OH			X			X	
	8	X				OH and UG	OH and UG	X	X			X	X
	8A	X				OH and UG	OH		X	X		X	
	10	X				OH and UG	OH	X	X			X	
	15	X				OH and UG	OH		X			X	
	16	X			X	OH and UG	OH	X	X			X	X
	25*												
	26*												
	27	X		X		OH and UG	OH	X	X			X	X
Apra Harbor	1	X	X	X		OH and UG	OH and UG	X		X			X
	2A	X	X			OH and UG	OH						X
	11	X	X	X			OH and UG	X	X	X		X	X
South	2	X				OH and UG			X			X	
	5	X	X	X		OH and UG	OH		X	X		X	X
	12	X				OH			X			X	

Legend: GPA = Guam Power Authority; GWA = Guam Waterworks Authority; OH = overhead; UG = underground.
Note: * Utility data not currently available for Routes 25 and 26.

Power

GPA and IPPs generate power for the north region's study area. In addition, Navy-produced power is transmitted through northern Guam to Andersen AFB. GPA provides full electric utility services generated from power plants to individual users. Power is generated through the combustion of crude oil. Power generation in northern Guam comprises a GPA power plant located in Yigo and a joint power plant operated by GPA and Pruvient Energy Guam, Inc., located in Tanguisson.

Transmission of GPA and Navy power throughout northern Guam is through overhead power transmission lines. In northern Guam, 34.5-kilovolt (kV) overhead power lines are present along Routes 1, 3, 9, and 15. Overhead conductors with wooden cross arms on concrete poles are used at most locations, although a few wooden poles are still in use. The predominant service voltage is supplied through pole-mounted transformers that are provided with lightning surge arresters to protect downstream equipment.

Potable Water

GWA and the Navy operate and maintain water source facilities in the north region's study area. GWA's Northern Public Water System serves the population in northern Guam through an extensive network of wells. GWA's water distribution system is a collection of legacy pipe systems built principally by the Navy and then turned over to GovGuam to operate for the civilian population. GWA's water system combines transmission and distribution pipes into a common network, with isolation and pressure-reducing valves used to ensure that water reaches customers throughout northern Guam. The main water transmission and distribution pipe network in northern Guam is aligned along the existing major road network, either directly under the roads or adjacent to the roads in the existing roadway right-of-way (ROW). Parallel lines run the length of most of Routes 1, 3, 9, 15, and 28 to serve the most populated areas in the northern system.

The existing Navy water system is an island-wide system extending from the Navy Reservoir in southern Guam to NCTS Finegayan near the northern tip of Guam. Water for the system is supplied primarily from the Fena WTP. Water is distributed from the treatment plant through a network of reservoirs, transmission mains, and booster pump stations. Water is also supplied to Naval facilities from on-site groundwater wells.

In northern Guam, the Navy services NCTS Finegayan and South Finegayan primarily by on-site groundwater wells. If necessary, water can also be supplied by interconnections with the Navy water system along Route 3.

Wastewater

GWA provides wastewater services for the population in the north region, Andersen AFB, NCTS Finegayan, and South Finegayan. The system is made up of gravity sewer pipes and force mains, sewage pump stations, siphons, a WWTP, and an ocean outfall. Similar to the water transmission and distribution network, the wastewater network is aligned along the existing road network, either directly under the roads or adjacent to the roads in the existing roadway ROW. The Northern District WWTP is a Class III, primary treatment plant. This plant is located on the northwestern coast of Guam and provides wastewater treatment for northern Guam.

In addition to areas served by the GWA collection systems, approximately 41% of the island residents live in the areas of the north region that are not served by collection systems. High concentrations of properties in northern Guam use septic systems to collect and dispose of wastewater in areas that are not sewered.

Solid Waste

GBB has assumed all of the responsibilities, functions, duties, powers, and authority of the Solid Waste Management Division (SWMD) of the Guam DPW. The SWMD provides collection of residential solid waste materials in the north region's study area. The SWMD also manages disposal of residential and commercial solid waste.

The Air Force owns and operates a landfill at Andersen AFB in the north region. The landfill is located near Route 1 and the entrance to Andersen AFB. The landfill handles disposal of solid waste and hardfill. The Air Force also constructed the Arc Light Recycling Center near the main entrance. The recycling center is run by a private contractor and handles mixed recyclables for residents located on and off the base.

Telecommunications

The two main providers of telecommunication services (i.e., telephone, television, and fiber optics) for Guam are GTA Teleguam and MCV Broadband. Most of the transmission of telephone and television lines throughout northern Guam is through overhead transmission lines. Portions of the telephone and television lines and all of the fiber optic lines are buried underground. Main transmission and distribution lines are aligned along all of the existing major roadways in northern Guam.

3.1.5.2 Central

Table 3.1-7 indicates the presence of each particular utility along the major roadway routes within the central region. The major roadway routes within central Guam are Routes 1, 8, 8A, 10, 15, 16, 25, 26, and 27, and the Chalan Lujuna roadway.

Power

GPA and IPPs generate power for the central region. In addition, the Navy transmits power through the central region for DoD facilities on the island. GPA provides full electric utility services generated from power plants to individual users. Power is generated through the combustion of crude oil. Three power plants are in the northern portion of central Guam: GPA power plants in Macheche and Dededo and a joint power plant operated by GPA and supplied by Shell Guam, Inc., located in Marbo. A GPA power plant at Manengon Hills is located in the southern portion of the central region.

Transmission of GPA and Navy power throughout central Guam is through overhead power transmission lines. Both 34.5-kV and 115-kV overhead power lines are present throughout many of the major roads in central Guam. The transmission network in the central region runs along Routes 1, 8, 10, 15, 16, 26, and 27, and the Chalan Lujuna roadway. Overhead conductors with wooden cross arms on concrete poles are used at most locations, although a few wooden poles are still in use. The predominant service voltage is supplied through pole-mounted transformers that are provided with lightning surge arresters to protect downstream equipment.

Fuel lines for GPA, the Navy, the Air Force, and Shell are located along Route 16 between the Tiyan Guam Airport and the Tanguisson Power Plant in central Guam.

Water

The GWA and the Navy operate and maintain water source facilities in the central region. The Navy system is interconnected to supply water to GWA and for emergency service capability. The Central Public Water System serves the east side of central Guam through the U.S. Navy Fena WTP. The west side of central Guam is served through an extensive network of wells. GWA's water distribution system is a collection of legacy pipe systems built principally by the Navy and then turned over to GovGuam to operate for the civilian population. The GWA water system combines transmission and distribution pipes into a common network, with isolation and pressure-reducing valves used to ensure that water reaches customers throughout central Guam. The main water transmission and distribution pipe network in central Guam is aligned along the existing major road network, either directly under the roads or adjacent to the roads in the existing roadway ROW.

The existing Navy water system is an island-wide system extending from the Navy Reservoir in southern Guam to NCTS Finegayan near the northern tip of Guam. Water for the system is supplied primarily from the Fena WTP. Water is distributed from the treatment plant through a network of reservoirs, transmission mains, and booster pump stations. Water is also supplied to Naval facilities from on-site groundwater wells.

In central Guam, the Navy services Navy Barrigada and the Naval Hospital primarily by on-site groundwater wells. As a backup, water can also be supplied by interconnections with the Navy water system along Routes 1, 8, and 16.

Wastewater

GWA provides wastewater services for the population of central Guam. The system is made up of gravity sewer pipes and force mains, sewage pump stations, siphons, WWTPs, and ocean outfalls. Similar to the water transmission and distribution network, the wastewater network is aligned along the existing road network, either directly under the roads or adjacent to the roads in the existing roadway ROW. The Hagatna WWTP is a Class III, primary treatment plant located adjacent to Agana Bay in central Guam. One other WWTP is in central Guam (Pago Socio WWTP); however, it is not located adjacent to the GRN.

In addition to areas served by the GWA collection systems, approximately 41% of the island residents live in areas not served by collection systems. High concentrations of properties in central Guam use septic systems for wastewater collection and disposal in areas that are not sewered.

Solid Waste

GBB has assumed all of the responsibilities, functions, duties, powers, and authority of the SWMD of the Guam DPW. The SWMD provides collection of residential solid waste materials in central Guam. The SWMD also manages disposal of residential and commercial solid waste. In central Guam, the SWMD operates the Ordot Dump and a transfer facility at Dededo. The Ordot Dump is scheduled to close in mid-2011. Residents within the central region can recycle, for free, cardboard and glass at the Dededo Transfer Station and Ordot Dump.

Telecommunications

The two main providers of telecommunication services (i.e., telephone, television, and fiber optics) for central Guam are GTA Teleguam and MCV Broadband. Most of the transmission of telephone and television lines throughout central Guam is through overhead transmission lines. Portions of the telephone and television lines and all of the fiber optic lines are buried underground. The main transmission and distribution network is aligned along nearly all of the existing major roadways within central Guam.

3.1.5.3 Apra Harbor

Table 3.1-7 indicates the presence of each particular utility along the major roadway routes within the

Apra Harbor region. The major roadway routes within the Apra Harbor region include Routes 1, 2A, and 11.

Power

GPA and many IPPs generate power for the Apra Harbor region. In addition, the Navy produces power for DoD facilities. GPA provides full electric utility services generated from power plants to individual users. Power is generated through the combustion of crude oil. One GPA power plant is located in Cabras and three IPP power plants are located at Temes, Mec, and Orote Point.

Transmission of GPA and Navy power throughout the Apra Harbor region is through overhead power transmission lines. The Apra Harbor region contains overhead 34.5-kV lines along Route 1. Overhead conductors with wooden cross arms on concrete poles are used at most locations, although a few wooden poles still are in use. The predominant service voltage is supplied through pole-mounted transformers that are provided with lightning surge arresters to protect downstream equipment.

Water

GWA and the Navy operate and maintain water source facilities in the Apra Harbor region. The Navy system is interconnected to supply water to GWA and for emergency service capability. The Central Public Water System serves the Apra Harbor region through the U.S. Navy Fena WTP. The GWA water distribution system is a collection of legacy pipe systems built principally by the Navy and then turned over to GovGuam to operate for the civilian population. GWA's water system combines transmission and distribution pipes into a common network, with isolation and pressure-reducing valves used to ensure that water reaches customers throughout the Apra Harbor region. The main water transmission and distribution pipe network in the Apra Harbor region is aligned along Routes 1 and 11, either directly under the roads or adjacent to the roads in the existing roadway ROW.

The existing Navy water system is an island-wide system extending from the Navy Reservoir in southern Guam to NCTS Finegayan near the northern tip of Guam. Water for the system is supplied primarily from the Fena WTP. Water is distributed from the treatment plant through a network of reservoirs, transmission mains, and booster pump stations. Water is also supplied to Naval facilities from on-site groundwater wells.

In the Apra Harbor region, the Navy water system services the Naval Base Guam through the Fena WTP. Transmission lines for the Navy water system run along Routes 1, 2A, and 11.

Wastewater

GWA and the Navy provide wastewater services for the Apra Harbor region's population. The system is made up of gravity sewer pipes and force mains, sewage pump stations, siphons, a WWTP, and an ocean outfall. Similar to the water transmission and distribution network, the wastewater network is aligned along the existing road network, either directly under the roads or adjacent to the roads in the existing roadway ROW. The Navy operates a wastewater treatment plant located in the Apra Harbor region.

Solid Waste

GBB has assumed all of the responsibilities, functions, duties, powers, and authority of the SWMD of the Guam DPW. The SWMD provides collection of residential solid waste materials in the Apra Harbor region's study area. The SWMD also manages disposal of residential and commercial solid waste.

The Navy-owned and operated landfill is located at the southeastern area of Naval Base Guam. The landfill currently accepts all solid waste and hardfill generated by all DoD lands on Guam. The Navy landfill also accepts solid waste from Navy ships, as well as asbestos and wastewater treatment sludge. The Navy does not currently have an official recycling program.

Telecommunications

The two main providers of telecommunication services (i.e., telephone, television, and fiber optics) for the Apra Harbor region's study area are GTA Teleguam and MCV Broadband. Most of the transmission of telephone and television lines throughout the Apra Harbor region's study area is through overhead transmission lines. Portions of the telephone and television lines and all of the fiber optic lines are buried underground. The main transmission and distribution network is aligned along the existing major roadways within the Apra Harbor region's study area.

3.1.5.4 South

Table 3.1-7 indicates the presence of each particular utility along the major roadway routes within southern Guam. The major roadway routes in southern Guam include Routes 2, 5, and 12.

Power

GPA generates power for the south region. GPA provides full electric utility services generated from power plants to individual users. Power is generated through the combustion of crude oil. A power plant is located in Tenjo within southern Guam.

Transmission of GPA power throughout the study area in southern Guam is through overhead power transmission lines. Along Routes 2A and 2 in the southwest portion of the island are 34.5-kV overhead lines. Along Route 5, 34.5-kV overhead lines also cross southern Guam. Overhead conductors with wooden cross arms on concrete poles are used at most locations, although a few wooden poles are still in use. The predominant service voltage is supplied through pole-mounted transformers that are provided with lightning surge arresters to protect downstream equipment.

Water

GWA and the Navy operate and maintain water source facilities in southern Guam. The Navy system is interconnected to supply water to GWA and for emergency service capability. Southern Guam is served by the U.S. Navy Fena WTP. GWA's water distribution system is a collection of legacy pipe systems built principally by the Navy and then turned over to GovGuam to operate for the civilian population. GWA's water system combines transmission and distribution pipes into a common network, with isolation and pressure-reducing valves used to ensure that water reaches customers throughout southern Guam. The main water transmission and distribution pipe network in southern Guam is aligned along the major roadways, either directly under the roads or adjacent to the roads in the existing roadway ROW.

The existing Navy water system is an island-wide system extending from the Navy Reservoir in southern Guam to NCTS Finegayan near the northern tip of Guam. Primary water supply sources for the Navy's island-wide water system are located in the southern region of Guam and include Almagosa Springs, Bona Springs, and the Fena Reservoir surface water impoundment. Water for the system is primarily supplied from the Fena WTP. Water is distributed from the treatment plant through a network of reservoirs, transmission mains, and booster pump stations. Water is also supplied to Naval facilities from on-site groundwater wells.

In southern Guam, the Navy's water system services the Navy Munitions Site through the Fena WTP. Transmission lines for the Navy water system run along Route 5.

Wastewater

GWA provides wastewater services for the population of southern Guam. The system is made up of gravity sewer pipes and force mains, sewage pump stations, siphons, WWTPs, and ocean outfalls. Similar to the water transmission and distribution network, the wastewater network is aligned along the existing road network, either directly under the roads or adjacent to the roads in the existing roadway ROW. The Agat-Santa Rita WWTP, a Class II treatment plant, is located on the west coast of Guam. The Agat-Santa Rita WWTP serves the area bounded to the north by the intersection of Routes 2 and 2A, to about the midpoint of Route 12 to the east, and to Taelayag Beach on the south (near where Route 2 heads inland to the east as opposed to directly on the coast). Three other WWTPs (i.e., Baza Gardens WWTP, Inarajan WWTP, and Umatac-Merizo WWTP) are in southern Guam; however, they do not serve areas adjacent to the GRN.

Solid Waste

GBB has assumed all of the responsibilities, functions, duties, powers, and authority of the SWMD of the Guam DPW. The SWMD provides collection of residential solid waste materials in southern Guam. The SWMD also manages disposal of residential and commercial solid waste. Within southern Guam, the SWMD operates the Agat Transfer Station, where residents can recycle, for free, cardboard and glass.

Telecommunications

The two main providers of telecommunication services (i.e., telephone, television, and fiber optics) for the south region's study area are GTA Teleguam and MCV Broadband. Most of the transmission of telephone and television lines throughout southern Guam is through overhead transmission lines. Portions of the telephone and television lines, as well as all of the fiber optic lines are buried underground. The main transmission and distribution network is aligned along nearly all of the existing major roadways within southern Guam.

3.2 Environmental Consequences

3.2.1 Approach to Analysis

3.2.1.1 Methodology

The impact analysis for utilities compares the existing capacity and demand on a utility to the projected capacity and demand. This is done for each of the utility alternatives. Military and civilian populations on Guam are projected to increase as a result of the proposed military buildup. Projected population changes are used to forecast future demand for a utility, based on average per capita usage. Changes in facility usage or new facility construction may also contribute to the total projected demand. Demand projections are then compared to the planned capacity under each utility alternative.

For roadway projects, potential impacts on public and military utilities and infrastructure that would result from construction and operation of the associated roadway improvements for each of the proposed project alternatives are analyzed separately. It is important to note that the utility information gathered to date was acquired using geographic information systems; therefore, it inherently contains a fairly high level of approximation regarding horizontal location. Furthermore, no information is currently available regarding the vertical depth of buried utilities. Another factor considered in the analysis of impacts on utilities is the methods of construction. It has been safely ascertained through historical reference and observation that many of the existing underground utilities were constructed rather hastily and did not adhere to generally accepted construction standards; therefore, an analysis of utility impacts must include that any particular utility within the area of a construction project involving digging and/or grading activities has been identified as needing to be relocated.

3.2.1.2 Determination of Significance

A determination of significant adverse effect is made when the projected increase in demand for a utility would exceed the planned capacity for that utility such that the utility provider would not be able to service additional demands while maintaining the same level of service for existing customers.

Potential adverse effects of demand exceeding capacity include brownouts/blackouts for power, low water pressure or rotating water shutoffs for potable water, discharge of inadequately treated wastewater or sewer backups, and solid waste accumulation at various collection points if a landfill is unable to accept additional waste.

Utility impacts caused by the proposed roadway improvements are assessed following the Federal Highway Administration's *Guidance for Preparing and Processing Environmental and Section 4(f) Documents (T 6640 8A)* (Federal Highway Administration 1987). Utility impacts would involve project effects that are assessed within this document under the category of construction impacts.

3.2.1.3 Issues Identified during Public Scoping Process

The public scoping process identified concerns, both from the public and regulatory stakeholders, about impacts from the proposed military buildup to public utilities on Guam and received comments for DoD to partner with GovGuam to improve utilities and infrastructure for all residents.

With regard to power, respondents requested that the military evaluate options for developing alternative energy sources, such as wind generation, waste-to-energy, solar power, and ocean thermal energy conversion. Respondents requested that the environmental impact statement/overseas environmental impact statement (EIS/OEIS) address impacts of the proposed military buildup on the civilian power supply and plans for the military to partner with local utility providers to increase the capacity of public power facilities.

With regard to potable water, respondents requested that the EIS/OEIS evaluate the impact that the military buildup would have on the existing potable water supply and the sustainable yield of the NGLA. Respondents requested that alternative sources of potable water, such as surface water, groundwater, recycled water, and desalination, be considered to meet the projected increase in potable water demand.

Wastewater concerns were primarily focused on assessing impacts on sewer lines, pump stations, and sewage outfalls. Respondents expressed a desire for the military to fund improvements to GWA wastewater facilities that accept military wastewater flows as a way of mitigating impacts on these facilities and bringing them into regulatory compliance.

With regard to solid waste, respondents requested that the EIS/OEIS assess impacts of the military buildup on landfill capacity and operations, including potential impacts on the planned GovGuam landfill and impacts associated with the temporary construction workforce. Respondents requested that the EIS/OEIS consider opportunities for the military to partner with the local government to share solid waste facilities.

3.2.2 Power

Projected interim power demands from the proposed military buildup are summarized in Table 3.2-1, which reflects existing Guam civilian and DoD power demands, projected increases in Guam civilian demands caused by natural population growth, projected DoD increases associated with the military buildup, increases associated with the imported construction workforce, and civilian increases that could result from induced growth.

Table 3.2-1. Projected Power Demand and Supply

GPA Power System	*Demand (MW)*									
	Interim Period without 25% Growth Factor					*Long-Term without 25% Growth Factor*				
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Islandwide, including anticipated growth (existing DoD and GPA baseline projected growth included)										
Existing Guam	281	287	294	299	303	306	309	312	315	318
Guam Induced Civilian Increase (induced growth caused by military increase)	4.93	12.25	19.99	23.44	29.24	22.08	11.23	7.75	7.75	7.88
Construction Worker Increase	1.18	2.99	5.19	6.51	6.70	4.43	1.38	0.00	0.00	0.00
DoD Increase (less 39.8 MW load from transient aircraft carriers)	1.83	2.18	5.04	11.35	17.99	33.31	35.29	35.29	35.29	36.26
Total Demand	**288.94**	**304.42**	**324.21**	**340.29**	**356.93**	**365.82**	**356.90**	**355.03**	**358.03**	**362.14**
Total Available Supply	**490.00**	**490.00**	**550.00**	**550.00**	**550.00**	**630.00**	**630.00**	**630.00**	**630.00**	**630.00**
Future Supply Accounting for 1.52 Reliability Factor	322.37	322.37	361.84	361.84	361.84					
Future Supply Accounting for 1.52 Reliability Factor						414.47	414.47	414.47	414.47	414.47
Supply – Demand (net excess or shortfall without transient loads)	33.43	17.95	37.63	21.55	4.91	48.66	57.58	59.44	56.44	52.33
Transient Load Highest requirement with CVN group)						39.82	39.82	39.82	39.82	39.82
Supply – Demand (net excess or shortfall with transient loads)	**33.43**	**17.95**	**37.63**	**21.55**	**4.91**	**8.84**	**17.76**	**19.62**	**16.62**	**12.51**

Source: NAVFAC Pacific 2008d. Guam Power Authority Integrated Resource Planning (IRP 2008) for existing Guam growth projections.

The projections account for all on-base DoD power demands that would be generated by active duty personnel and their dependents, the on-base civilian workforce, and industrial demands from on-base facilities. Power demands from projected civilian induced growth caused by the military buildup are included. To meet the increased power demand as the military buildup progresses, the work associated with the interim alternatives would begin in 2010 and the additional power would be available by 2012 and available in time to service the projected demand. Table 3.2-1 summarizes the power situation.

The power demands of the construction workforce while working on base are considered by all interim alternatives. The additional power capacity would be available to the IWPS at that time. GPA would need to upgrade local power systems to accommodate housing for the construction workforce.

A socioeconomic analysis of the proposed military buildup has estimated that civilian growth induced by the military buildup could increase the island-wide population on Guam by up to 40,000 in the peak year of 2014. Preliminary evaluation of the affects of this population increase on the electrical system shows a power demand of approximately 0.74 kilowatt per person. This amount represents two-thirds of the current average electrical demand per person on Guam of 1.1 kw. Per person power consumption was obtained from CIA world factbooks using 2006 data (9,682.897 kw-hours per person / 365 days per year / 24 hours per day = 1.1 kw per person), the most recent available data from this source (Nationmaster.com 2006).

The predicted population growth on Guam induced by the DoD buildup varies from 6,651 people in 2010 to 39,481 people in 2014 (peak impact) and down to 10,639 in 2019. These changes correspondingly increase demands on the electrical system by 4.93 MW (2010 initial) to 29.24 MW (2014 peak) to 7.88 MW (2019 long-term). The expected growth rate on Guam was obtained from GPA data for baseline growth of power demand and shows a projected demand increase of 37 MW between 2010 and 2019 (10 years in the future).

3.2.2.1 Interim Alternative 1 (Preferred Alternative)

Description

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

Potential Mitigation Measures

Adequate power supply during the interim period is based on ensuring that the DoD requirements for power are presented to the utility provider, GPA in sufficient time to allow GPA to plan for the increased loads. DoD has had initial discussion with GPA to outline the potential loads to allow GPA to do the necessary due diligence to plan for these requirements.

The Public Utilities Commission requires that GPA maintain a generation reliability standard that their outages cannot exceed “1 day in 4.5 years”. To reliably meet this requirement, past GPA analysis has identified that a generation capacity in the installed system of approximately 1.52 times the system’s peak demand level is required to provide the necessary reserve margin. During the interim period the peak load for the IWPS is projected to reach 357 MW, applying the 1.52 reserve capacity, GPA would need a generation capacity of 543 MW to meet the PUC requirement. GPA has an installed generation capacity of 550 MW. To reach its installed capacity, GPA will need to recondition existing generation units and return them to full service capability. In addition to the efforts to recondition existing generation units, the following measures are being undertaken to mitigate the buildup’s interim and long term electrical demands on the island wide power system:

1. In support of the on-base development related to the Guam buildup, a comprehensive energy management plan is being developed for Guam. The plan has interest from several federal executive departments and will focus on reducing the energy footprint of DoD infrastructure, a “Nega Watt” approach and the development of renewable energy sources for Guam. Nega Watt and renewable energy efforts will be coordinated closely with GPA. The strategy is comprised of the following basic elements with a listing of some of the measures being taken with respect to existing and proposed facilities:

a. Conservation and demand reduction:
Existing Infrastructure Buildup Infrastructure
Facility Energy Audits Smart Metering on all buildings
Energy Conservation Programs Demand reduced through sustainability
Energy Conservation Investment User training and education
Program (ECIP) Smart base technology

b. Sustainable Design/Development Strategies
Existing Infrastructure Buildup Infrastructure
LEED projects being implemented All Facilities LEED Silver
Sustainable Program Officer
Sustainable Systems Integration
Modeling (SSIM)

c. Sustainable Infrastructure
Existing Infrastructure Buildup Infrastructure
Foot Print Reduction Low Impact Development
Adaptive Reuse of Facilities Integrated Site Design
Brown Field Development Passive Solar Orientation
Carbon Sequestration
Reuse of Construction and Demolition
Debris
Transportation Demand Management

d. Renewable Energy
Existing Infrastructure Buildup Infrastructure
Solar Hot Water System Conversions Solar Hot Water Systems
Integrated Solar Photovoltaic Systems Photovoltaic Compatible Facilities
Renewable Energy Studies

2. Unified Facilities Criteria (UFC) incorporate energy conservation standards and policy from various Executive Orders and public laws to provide guidance and goals for new and renovated DoD facilities. These conservation measures would result in a reduced increased demand for utilities. Many of these conservation standards and policy were initiated in compliance with the Energy Policy Act of 2005. The following provisions would be incorporated into the planning, design and construction of DoD facilities:
   a. New Bachelor Enlisted and Officer Quarters (BEQ and BOQ) would be designed and constructed in accordance with the Energy Policy Act of 2005.
   b. New buildings (except residential) would be designed to comply with **American Society of Heating, Refrigerating and Air Conditioning Engineers** (ASHRAE) Standard 90.1. Based on UFC guidance, the building design would also strive to achieve an energy consumption level that is 30% below ASHRAE Standard 90.1.
   c. New residential buildings would be designed to comply with the International Code Council (ICC) International Energy Conservation Code. Based on UFC guidance, the building design would also try to achieve an energy consumption level that is 30% below International Energy Conservation Code standards.

d. All new purchases of energy consuming products would be either ENERGY STAR-qualified or FEMP-recommended.

e. Relevant energy conservation measures to be considered include:

    i. Optimizing building orientation to reduce cooling loads or energy loads to cool the buildings
    ii. Building insulation optimization
    iii. Sealing building envelope for air tightness
    iv. "cool roof"
    v. Using motion detectors to reduce lighting and to setback cooling in unoccupied buildings
    vi. Natural Lighting

f. Energy compliance analysis and life cycle cost analysis:

    i. Systems modeling is being used to analyze usage of energy conservation measures and provide comparative life cycle costs. This process comprehensively examines energy, water, transportation, ecological resources, green building, social/cultural and economic factors. Within the parameters of energy, this modeling evaluates: building insulation, windows, infiltration, lighting, HVAC systems, delivery efficiency, water use, conventional water heating, solar thermal water heating, and building integrated Photovoltaics. This modeling approach follows a three step process:

        1. First it considers measures to make the building work more efficiently. This includes orientation, solar shading/high performance facades, and building envelope/air tightness considerations.
        2. Secondly, use of various levels of system efficiencies are considered, analyzing energy usage, capital and life cycle costs.
        3. Thirdly, it considers what potential renewable systems could be utilized for the specific location and facilities.

    To date, this analysis has been performed on two types of buildings: BEQ and duplex housing. The modeling analysis has thus far resulted in the following estimates of energy savings:

        - BEQ – 31% savings for $1.88/SF
        - Duplex House – 32% savings for $4.93/SF

DoD is committed to meet the required 30% energy savings and has identified approaches to reach this goal. The areas that would allow meeting that goal for the bachelor enlisted quarters (BEQ) are listed in Table 3.2-2.

Table 3.2-2. Approaches Associated With Achieving 30% Reduction in Facilities Demand

BEQ Energy Modeling Summary		
Package Summary	*Baseline*	*Efficiency Approach*
Windows	Code Minimum	High Efficiency
Infiltration	0.5 ACH	0.25 ACH
Lighting	100% Incandescent Fixtures	50% Incandescent/ 50% Compact Fluorescent
HVAC	Standard Efficiency Packaged Terminal AC	High Efficiency Packaged Terminal AC
DHW Use Reduction	USEPA 1992 Baseline	40% DHW Reduction
Environmental Benefit and Cost Indicators		
% Energy Use Improvement	N/A	31.20%
% CO2 Emissions Improvement	N/A	31.20%
Additional Capital Cost ($/SF)	N/A	$1.88/SF
Simple Payback Years	N/A	~2

Note: Baseline Defined as ASHRAE 90.1; DHW = domestic hot water; ACH = air flow change rate; HVAC= heating, ventilation and air conditioning; AC= air conditioning

f. The modeling has validated that it is possible to meet the 30% energy reduction at a minimal cost resulting in a lower energy footprint for the new facilities. DoD is committed to meeting the 30% reduction and will be looking to leverage additional savings where deemed appropriate and affordable on a facility by facility basis. Since the energy compliance behavior of the occupants, proper maintenance of systems, and other life cycle aspects will play a major role in the ability to sustain the full savings, the power demand requirements used for planning purposes provided to GPA were conservatively reduced by 10% instead of the 30% energy savings goal. This conservative approach will cover unknown contingencies and provide GPA with reasonable planning data to address the new demand requirements in a cost effective manner.

3. In addition to the efforts to minimize the energy footprint of the Guam buildup infrastructure, measures will be taken to mitigate the impact of the new development that would occur off-base as a result of the buildup. The improvements to GPA's IWPS' transmission and distribution capability to support the increased on-base demand for power will result in new power lines, thereby freeing up capacity on the existing infrastructure to address the anticipated off-base growth in demand for power. Reconditioning GPA's combustion turbines located in northern Guam will increase the reliability of the IWPS and provide reliable sources of power generation to support the existing and future off-base populations during emergencies. Efforts are continuing to work closely with GPA to ensure that the new requirements imposed on the IWPS do not degrade the overall reliability of the system to the detriment of all users. GPA is in the process of modeling the identified buildup power demands and will be working with DoD to identify system improvements that can be implemented to sustain system reliability and improve it where deemed

appropriate. DoD will help GPA develop strategies to obtain funding to implement the necessary improvements mentioned above.

4. Currently, DoD has 33 MW of power generation capability. 18.6 MW at the Orote Power Plant, 7.5 MW at the Finegayan Plant and the remainder in various locations as backup power for critical infrastructure. In addition to this existing capacity, it is expected that the new Marine Base at Finegayan will incorporate another 5+ MW of emergency generator capability to support its critical infrastructure. These assets can be utilized to reduce peak demand on the GPA system during days when GPA capacity might be insufficient for short time periods if requested by GPA. This may be a possibility during the interim period before the planned IWPS improvements can be implemented and at any future time in the event GPA has a system failure and needs the support.

If it appears that interim demand would exceed the generation capacity of the GPA system, DoD can work with GPA to adjust the construction tempo as a mitigation. This concept is discussed further in adaptive management, Volume 7 Interim Alternative 2

Description

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

Potential Mitigation Measures

The potential mitigation measures for power under Interim Alternative 2 would be similar to those described for Interim Alternative 1.

3.2.2.2 Interim Alternative 3

Description

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

Potential Mitigation Measures

The potential mitigation measures for power under Interim Alternative 3 would be similar to those described for Interim Alternative 1.

3.2.2.3 Long-Term Alternative 1

Long-Term Alternative 1 reconditions and modifies the existing GPA system to support part of the proposed load from the GPA grid. In addition, the GPA system would provide a new power generating facility at Cabras/Piti to support the remainder of the required loads and increase the base load capacity of the power system to meet increased base load needs. Oil, diesel, or liquified natural gas (LNG) would be used as fuel.

Long-term power alternative 1 involves T&D upgrades as well as ocean thermal energy conversion or geothermal as potential options for base load alternative energy. The T&D upgrades and the sustainable sources of energy that would lessen the reliance on fossil fuels are described in Section 2.1.5.3, in this volume.

Implementation of Long-Term Alternative 1 is expected to fully meet projected power demands for electrical capacities in 2015. A conceptual design for this alternative would be developed and analyzed in a subsequent tiered NEPA document before implementation. This conceptual design would more accurately determine the required capacity of the new power plant by taking into account any changes to the UFC criteria and any other changes that may occur. The currently proposed capacity of 80 MW may be adjusted. Close coordination with appropriate agencies would be undertaken during the tiered NEPA process. Air modeling for this alternative would be performed and any necessary air permits would be obtained at that time.

3.2.2.4 Long-Term Alternative 2

Long-Term Alternatives 2 recapitalizes and modifies the existing GPA system to support part of the proposed load from the GPA grid and provide a new generating facility at Potts Junction to support the remainder of the required loads. Oil, diesel, or liquified natural gas (LNG) would be used as fuel.

Long-term power alternative 2 involves T&D upgrades as well as ocean thermal energy conversion or geothermal as potential options for base load alternative energy. The T&D upgrades and the sustainable sources of energy that would lessen the reliance on fossil fuels are described in Section 2.1.5.3, in this volume.

Implementation of Long-Term Alternative 2 is expected to fully meet projected year 2015 power demands for electrical capacities. A conceptual design for this alternative would be developed and analyzed in a subsequent tiered NEPA document before implementation. This conceptual design would more accurately determine the required capacity of the new power plant by taking into account any changes to the UFC criteria and any other changes that may occur. The currently proposed capacity of 80 MW may be adjusted. Close coordination with appropriate agencies would be undertaken during the tiered NEPA process. Air modeling for this alternative would be performed and any necessary air permits would be obtained at that time.

3.2.2.5 Long-Term Alternative 3

Long-Term Alternative 3 would rely on GPA to determine the best approach to supply the required power to all their customers, including DoD. Implementation of Long-Term Alternative 3 is expected to fully meet projected year 2015 power demands for electrical capacities. A solution for this alternative would be developed and analyzed in a subsequent tiered NEPA document before implementation. Close coordination with the appropriate agencies would be undertaken during the tiered NEPA process, and air quality modeling for this alternative would be performed and any necessary air permits would be obtained at that time. Long-Term Alternative 3 would involve using existing GPA assets/generating stations and upgrading capacity to meet projected demand increases.

3.2.2.6 Summary of Impacts

The following is a summary of operational impacts on existing utilities that would be associated with increased power demands. Environmental impacts are not included in this section, but are detailed in the individual resource chapters of Volume 6. Analysis of long-term alternatives was not done because those alternatives are not yet ripe for project-specific analysis. Table 3.2-3 shows anticipated supply and demand in 2014 and 2016.

Table 3.2-3. Supply and Demand in 2014 and 2016

Alternatives	*Supply (2014)*	*Demand (2014)*	*Power Surplus (2014)*	*Supply (2016)*	*Demand (2016)*	*Power Surplus (2016)*
Interim Alternative 1	361.84	356.93	4.91	414.47	356.90	57.58
Interim Alternative 2	361.84	356.93	4.91	414.47	356.90	57.58
Interim Alternative 3	361.84	356.93	4.91	414.47	356.90	57.58

Implementation of any of the three interim alternatives would result in adequate power in all years, including the peak year of 2014. However, this scenario is dependent upon reconditioning the required generating units and upgrading the T&D systems in time to meet the increased demand. Should that not happen for some reason, the resulting impacts could be power outages by either brownouts or blackouts. Several potential mitigations are discussed above as a contingency should this scenario occur. See Volume 7 for a discussion on mitigation measures and adaptive management. Table 3.2-4 summarizes the potential impacts on the power utility for the interim alternatives based on successful reconditioning of existing generation units in time to meet the increased demand.

Table 3.2-4. Summary of Interim Alternative Impacts for Power

Potentially Affected Resource	*Interim Alternative 1**	*Interim Alternative 2*	*Interim Alternative 3*
Power	LSI	LSI	LSI

Legend: LSI = Less than significant impact. *Preferred Alternative

Since all power demands are met in the interim by implementation of a selected interim alternative and because the power system would be subject to greater demand but could be operated within existing permitted capacity, the impact of the proposed DoD buildup on the power utility for Interim Alternative 1 was determined to be less than significant. For Interim Alternative 2, all power demands are also met in the interim but air permits for one or more of the power generation facilities would require modifications. While this impact would be greater than Interim Alternative 1, it is still considered less than significant since all interim power needs would be met. Interim Alternative 3 would require upgrades to the Navy generating facility at Orote and modifying the permit for Orote and some of GPA's existing units. While the impact of Interim Alternative 3 is greater than Interim Alternative 1 and similar to Interim Alternative 2, it is still considered less than significant since all interim power needs would be met.

3.2.3 Potable Water

3.2.3.1 Basic Alternative 1 (Preferred Alternative)

<u>DoD Water System</u>

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

Implementing Alternative 1 would result in a total planned water supply of 27.1 MGd (103 mld) for the DoD water system at buildout (Table 3.2-55) accounting for water transferred to GWA of 3.3 MGd (12.5 mld) from Fena Reservoir. The Navy transfers up to 4 MGd (15 mld) to GWA according to off base demand. Due to GWA's planned expansion, it is projected that in 2019 GWA will require less than the maximum transfer amount specified in the MOU. Currently, the transfer amount to GWA is less than the maximum, averaging approximately 3.5 MGd (13.2 mld). This planned supply is expected to fully meet the projected future DoD maximum daily demand of 27.1 MGd (102.6 mld). The planned supply also meets the projected average daily demand at each military base.

Given the planned supply, the Navy system has adequate water for average daily demand but a shortfall for maximum daily demand of 1.3 MGd (4.9 mld). Presently, based on personal communications with Navy utility managers on Guam, there is no existing water shortage being experienced, except during severe drought periods. The 1.3 MGd shortfall for maximum daily demand is based on planning criteria, which provides guidance for future project programming. Implementation of long-term alternatives would fully resolve the projected shortfall. Alternatively, the shortfall can be addressed through transfer of excess water from northern Guam through the Navy island-wide system. Maintenance to restore the ability to transfer excess water from the Andersen AFB system to the Navy island-wide water system would be needed. If this shortfall occurs, it is possible that water outages or low pressure conditions would take place within the water system. Water outages or low water pressure can result in microbiological and other contaminants entering the distribution system, potentially resulting in illness. Water outages or low water pressure can also prevent effective fire fighting and degrade the basic sanitary needs of the population.

As discussed in Section 2.2.1.1, by using sustainability measures, the Marine Corps base could reduce its estimated maximum daily demand by 40% compared to Unified Facilities Criteria (UFC) guidance. Additionally, the existing bases are expected to comply with Executive Order 13423, which specifies a 16% reduction in water usage over the 2007 baseline by 2015. An estimate of the water demand on the military bases incorporating these adjustments is presented in Table 3.2-6. Table 3.2-6 presents the DoD water supply and demand estimates assuming reductions for compliance with the executive orders regarding water conservation and sustainability efforts for this project. Using an estimate of the revised demand, the planned water supply is sufficient overall and for each base to meet the average daily demand and maximum daily demand.

To meet the increased maximum water demand as the military buildup progresses, construction of planned water components would begin in 2010. Pilot test wells would be drilled to verify the production capacity of the wells, and DoD well development would be coordinated with GWA and would comply with GEPA permit requirements to optimize groundwater withdrawal from the NGLA. Pilot test well results and/or coordination of groundwater withdrawal with GWA could result in some adjustment to the proposed locations of wells.

Table 3.2-5. Potable Water Alternative 1 Proposed DoD Water Supply and Demand

Water Supply Source	*Marine Corps Finegayan*	*Andersen AFB*	*Navy*	*Total*
Cantonment Alternatives 1 & 2				
Current Surface Water Supply			11	11
Current Groundwater Supply		4.7	3.1	7.8
Development of New Water Supply Wells	11.1			11.1
Rehabilitation of Existing Navy Well			0.5	0.5
GWA Transfer Projected Need in 2019			-3.3	-3.3
Planned Supply Cantonment Alternatives 1 & 2	**11.1**	**4.7**	**11.3**	**27.1**
Maximum Daily Demand using UFC Guidance	**10.5**	**4.0**	**12.6**	**27.1**
Projected Excess (Supply – Demand)	0.6	0.7	-1.3	0

Source: NAVFAC Pacific 2008b. *All units are MGd.*

Table 3.2-6. DoD Water Supply and Demand Estimates Using Executive Order Compliance and Sustainability Factor

Water Supply Source	*Marine Corps Finegayan*	*Andersen AFB*	*Navy*	*Total*
Cantonment Alternatives 1 & 2				
Current Surface Water Supply			11	11
Current Groundwater Supply		4.7	3.1	7.8
Development of new water supply wells	6.9			6.9
Rehabilitation of existing Navy well			0.5	0.5
GWA Transfer Projected Need in 2019			-3.3	-3.3
Supply Cantonment Alternatives 1 & 2	**6.9**	**4.7**	**11.3**	**22.9**
Maximum Daily Demand Using Executive Order Compliance and Sustainability Principles	**6.3**	**2.8**	**10.1**	**19.2**
Projected Excess (Supply – Demand)	0.6	1.9	1.2	**3.7**

Source: NAVFAC Pacific 2008b. All units are MGd.

<u>GWA Water System</u>

The GWA water system is not a component of the Alternative 1 water supply. The Navy would continue to transfer up to 4 MGd (15 mld) to GWA under the current memorandum of understanding. As noted above, it is projected that the transfer amount in 2019 will be reduced to 3.3 MGd (12.5 mld) due to GWA planned water system expansion.

Projected initial water demands on the GWA water system are summarized in Table 3.2-7Summarized in Table 3.2-7Error**! Not a valid bookmark self-reference.**, the total civilian demand on the GWA water system (including demand associated with the construction workforce and induced civilian growth) is projected to reach 61.5 MGd (233 mld) in 2014. The GWA water system currently has the capacity to supply 48.4 MGd (183 mld) of potable water. Planned GWA expansions would increase that capacity to 55.4 MGd (210 mld). According to GWA's 2010-2014 capital improvement plan, GWA plans on installing 16 potable wells with a combined capacity of 7 MGd (26 mld). There are shortfalls during the buildup even with GWA's planned expansion. The existing shortfall of 2.3 MGd (8.7 mld) in 2010 increases to a maximum of 6.1 MGd (23 mld) in 2014. To address this shortfall, the DoD is willing to transfer excess water production capacity to GWA, if requested. Alternately, GWA could install more potable water wells or adaptive management practices can be implemented by DoD such as slowing the pace of construction. More information on adaptive management is provided in Volume 7.

Table 3.2-7, which summarizes the existing demand on the GWA water system (including projected increases in civilian demand related to natural population growth), projected increases associated with the imported construction workforce, and civilian increases in demand that would result from induced growth as a result of the military buildup. Demand projections are then compared to the planned GWA potable water supply to identify whether shortfalls would be expected during the construction phase.

Summarized in Table 3.2-7**Error! Not a valid bookmark self-reference.**, the total civilian demand on the GWA water system (including demand associated with the construction workforce and induced civilian growth) is projected to reach 61.5 MGd (233 mld) in 2014. The GWA water system currently has the capacity to supply 48.4 MGd (183 mld) of potable water. Planned GWA expansions would increase that capacity to 55.4 MGd (210 mld). According to GWA's 2010-2014 capital improvement plan, GWA plans on installing 16 potable wells with a combined capacity of 7 MGd (26 mld). There are shortfalls during the buildup even with GWA's planned expansion. The existing shortfall of 2.3 MGd (8.7 mld) in 2010 increases to a maximum of 6.1 MGd (23 mld) in 2014. To address this shortfall, the DoD is willing to transfer excess water production capacity to GWA, if requested. Alternately, GWA could install more potable water wells or adaptive management practices can be implemented by DoD such as slowing the pace of construction. More information on adaptive management is provided in Volume 7.

Table 3.2-7. Projected Water Supply and Demand on the GWA Water System

GWA Water System	*Year*									
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Potable Water Demand[a]										
Existing Guam Civilian[b]	48.9	49.3	49.8	50.2	50.6	51.1	51.5	51.9	52.3	52.7
Construction Workforce	0.6	1.5	2.7	3.3	3.4	2.3	0.7	0.0	0.0	0.0
Induced Civilian Increase	1.2	3.1	5.1	5.9	7.4	5.6	2.8	2.0	2.0	2.0
Total Projected Demand	50.7	54.0	57.5	59.5	61.5	58.9	55.0	53.9	54.3	54.7
Potable Water Supply										
Existing GWA Supply[c]	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
Projected Excess before Expansion (Supply-Demand)	-2.3	-5.6	-9.1	-11.1	-13.1	-10.5	-6.6	-5.5	-5.9	-6.3
GWA Planned Expansion[d]	0	0	7	7	7	7	7	7	7	7
Total Planned Supply	48.4	48.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4
Projected Excess after Expansion (Supply-Demand)	-2.3	-5.6	-2.1	-4.1	-6.1	-3.5	0.4	1.5	1.1	0.7

Notes: All units are MGd. This table does not include GWA's effort to detect and fix leaks, UFW.
[a] Demand is based on a 50% UFW rate and population estimates provided in Volume 6, Table 2.2-5
[b] Includes projected increases in civilian demand related to natural population growth.
[c] Includes 4 MGd transferred from Navy to GWA.
[d] GWA Draft Capital Improvement Plan 2010-2014
Source: GWA 2007.

If this shortfall occurs, water outages or low pressure conditions could take place in parts of the water system. Water outages or low water pressure can result in microbiological and other contaminants entering the distribution system potentially resulting in illness. Water outages or low water pressure can also potentially prevent effective fire fighting and degrade the basic sanitary needs of the population. Water rationing may be implemented. It is probable that the impacts would fall disproportionally on the low income and poor.

The baseline condition of the GWA water system is described in the GWA WRMP. The overall condition of the water system equipment is identified as poor with substantial corrosion in all infrastructure. The water system has a 50% UFW rate compared to an acceptable rate of 15% or less. Problems with the GWA infrastructure result from the effects of natural disasters, poor maintenance, and vandalism. According to the WRMP, the water system infrastructure does not meet the basic flow and pressure requirements for all customers. Maintenance to improve the system has been conducted since the water system assessment was made in 2005. GWA plans improvements to the distribution system principally to improve continuity of the water supply. Improvements include a corrosion program, pipe and equipment replacement, distribution system improvements, northern system raw water transmission line improvements, and filtration compliance for groundwater under the direct influence of surface water.

The projected water demand for the Guam civilian population throughout 2010-2019, not including the effects of the military buildup, exceeds the current GWA water system capacity. To meet the projected demand on the GWA water system, it is imperative that the GWA begin planned expansions by 2010. In preparation for the military buildup, and to complete the remaining capital improvements, GWA has prepared a 5-year CIP for fiscal years 2010-2014. The CIP would be financed through surplus system revenues, grants, and loans (Reuters 2009; Deloitte Touche Tohmatsu 2008). Significant rate relief is anticipated. It is assumed that water supply expansions would be funded through collection of user fees from GWA customers. This would include user fees to be paid by contractors funded by the DoD that would be providing housing for construction workers.

The GWA program has not been presented to DoD in detail; however, discussions have been initiated between GWA and DoD to begin working through the details to coordinate GWA support for the proposed buildup. One example of the coordination efforts is a proposal for co-management by GWA and DoD of the Northern Guam Lens Aquifer. Given the information provided in recent CIP, the proposed GWA expansion is not sufficient to meet the added demand resulting from the buildup.

As shown in Table 3.2-7, housing for the construction workers, which are expected to reach a maximum population of approximately 18,000 in 2014, is expected to create increased demand for water in northern Guam by up to 3.4 MGd (12.9 mld). GWA has indicated to DoD that it will require new sources of water to meet the expected demand related to the buildup. GWA does not have the resources or the time to correct their unaccounted for water problem, estimated to be approximately 50% in order to use this water for the new demand. As presented in the CIP, GWA sees new wells as their option to partially meet this new demand and they have prepared a plan that identifies numerous potential well sites. Although, GWA currently has plans to drill wells in the near future, much of this water will offset wells that are being shutdown or subjected to reduced pumping due to high chlorides. GWA has indicated that they do not possess the financial resources to drill new wells in time to meet the early demands expected as a result of the buildup. In the CIP, well construction is identified in 2012.

With the standup of the Joint Region Marianas, the Region is in the process of evaluating the overall capacity of the joint DoD water system on Guam. Although this evaluation is in its infancy, there may potentially be 3 MGD of water that could be transferred to assist GWA with its water needs in northern Guam while they drill wells and install the associated infrastructure. Navy surface water resources may also be available to GWA in addition to the current allotment of up to 4 MGd.

Discussions between DoD and GWA can facilitate an understanding of the total impact of the development on the community infrastructure, the NGLA, the NDWWTP and on the construction progress. Although control of where temporary housing for construction workers is located resides with construction contractors and Gov Guam through its planning process, DoD is interested in avoiding adverse impacts through effective planning. Contractors proposing workforce housing will be responsible for coordinating site approvals and permits with local Guam planning and zoning agencies, and with GWA. DoD can require minimum housing standards for worker housing through contract provisions and selection criteria, which should guide the contractors to select locations with adequate utility infrastructure.

Northern Guam Lens Aquifer

"Sustainable yield" is defined as the rate at which groundwater can be continuously withdrawn from an aquifer without impairing the quality or the quantity of the pumped water. The peak average well withdrawal from the NGLA is shown in Table 3.2-8. The estimated well production includes the average daily demand for the Marine Corps relocation, Andersen AFB, and Navy Hospital; and the average daily demand for GWA population in north and central Guam excluding the demand met by surface water resources (up to 4 MGd (15 mld) transferred from Fena Reservoir). Although the Main Cantonment is proposed to be located on the Finegayan subbasin, most of the groundwater supply would be taken from Agafa-Gumas and Andersen subbasins because the Finegayan subbasin is near capacity.

Table 3.2-8. Total Well Withdrawal and Yield Estimates Projected for 2014 (Peak Year)

Wells	*Total*
GWA Maximum Average Daily Demand on Groundwater Resources	56
Cantonment Alternatives 1 & 2	
DoD Estimated Average Daily Demand on Groundwater Resources based on UFC (Finegayan, Andersen AFB, and Navy Hospital)	7.5
Total Well Withdrawal (Using UFC)	63.5
DoD Estimated Average Daily Demand based on Sustainability	6.5
Total Well Withdrawal (Using Sustainability)	**62.4**

In order to compare the estimated available yield of the NGLA with the demand at full build, Table 3.2-8 presents the approximate DoD and civilian well withdrawal assuming average daily demand at the Marine Corps base and off base. Because sustainable yield defines the rate at which groundwater can be *continuously* withdrawn from an aquifer without impairing the quality or the quantity of the pumped water, it is more appropriate to consider the average daily demand instead of the maximum daily demand when assessing potential impacts on the aquifer. Total average well demand from the NGLA of 63.5 MGd (240 mld) is below the 1991 sustainable yield estimate of 80.5 MGd (305.7 mld) but exceeds the 1982 sustainable yield estimate of 57.5 MGd (217.7 mld). However, as discussed in Chapter 2, the 1991 estimate is considered a more accurate estimate of the sustainable yield.

A sensitivity analysis was performed to determine the effect of using the average DoD daily demand estimates and various GWA UFW loss rates on the available yield of the NGLA. Figure 3.2-1 graphically represents the effect of reducing GWA's UFW loss rate, with DoD and GWA wells producing enough water to meet the average daily demand. With adequate well water withdrawal to meet the DoD and GWA average daily demands, peak well withdrawal would occur in 2014, with well withdrawal rates ranging between 64 MGd (242 mld) and 50 MGd (189 mld), depending on the UFW loss rate assumed for GWA. Note that DoD plans to support an updated sustainable yield study to be completed by the USGS. Please refer to Volume 6 Chapter 2 for more information regarding this future study.

As shown in Figure 3.2-1, planned DoD well expansion would not exceed the estimated sustainable yield and would therefore have less than significant impact on the NGLA.

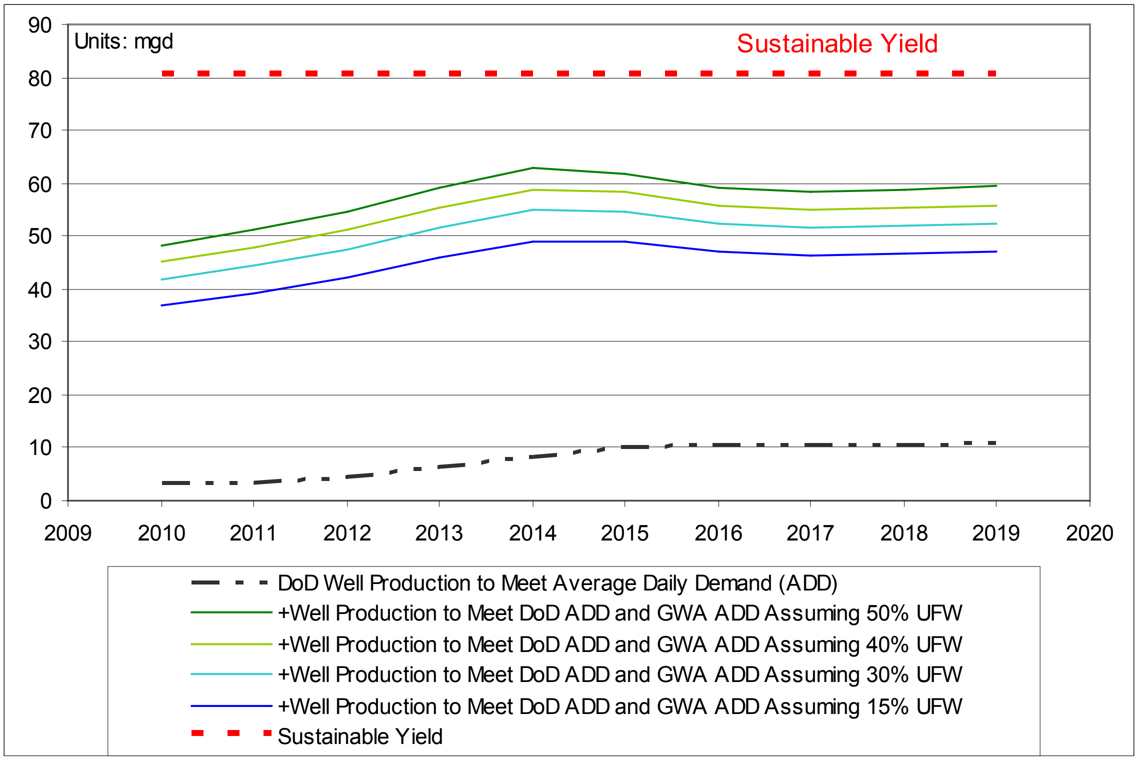

Figure 3.2-1. Well Withdrawal to Meet DoD Average Daily Demand and GWA Average Daily Demand (15-50% UFW for GWA)

Potential Mitigation Measures

Mitigation for Potential GWA Potable Water Shortfalls within DoD Control

If enough new planned GWA wells are not brought online by 2010, the proposed project has the potential to result in significant impacts on the Guam water supply. To mitigate those impacts, DoD could transfer excess water production capacity to GWA, if requested. Current assessments indicate the Andersen Air Force Base water system has well production capacity in excess of current and future Air Force requirements. Additionally, the wells at NCTS Finegayan can produce more than is presently needed by NCTS. However, some of the excess water well capacity at NCTS would be needed to support the on-base construction activities at Finegayan. Thus, in the northern DoD water system, there would be excess water production capacity that could be made available to GWA to meet their interim requirements. GWA would need to formally request this support through the Region's Utilities Department, who would determine water availability and appropriate rates reimbursement. The DoD expects that GWA or the developer requesting additional water would install the necessary piping to make the interconnections with DoD water systems.

The availability of excess DoD water production capacity to GWA water systems may be encumbered by the following:

- The lack of interconnections points between the former AAFB water system and the Navy island-wide system may increase the effective distance between the GWA water system requiring additional water and the DoD water resource
- Poor condition of certain DoD water mains that may require line segment replacement in order to interconnect

- Repair and maintenance of wells would periodically reduce DoD water supplies
- Droughts would reduce the capacity of DoD water production capacity
- Unforeseen increases in future DoD water demands that would reduce the excess water supply available to GWA

DoD would also undertake adaptive management, such as adjusting the construction tempo if off-base water demand from construction workforce housing and induced population growth outpace available supply and infrastructure. Adaptive management is discussed in more detail in Volume 7.

Mitigation for Potential GWA Potable Water Shortfalls outside DoD Control

Alternatively, GWA could implement improvements to reduce water losses associated with UFW. UFW is water that is not metered, such as the water lost through leaks or use without meters. GWA initiated a water loss control program in 2005 (GWA 2007). If the program were to reduce the UFW from the estimated 50% loss rate to approximately 40% by 2013, sufficient supply would be available within the GWA water system to meet the increased demand. This level of reduction is consistent with GWA's stated reduction goal of 20% for an aggressive but reasonable water loss program over a 5- to 10-year period (GWA 2007).

GWA would have the ability to assess a system development charge (SDC) to contractors and workforce housing developers that could be used to fund improvements to the water system. To address the timing gap between availability of SDC funds and construction of needed improvements to meet the anticipated demands, GWA may request an interconnection with the DoD water system, as discussed above, or seek other USGOV funding sources. These options would minimize impacts to existing rate payers.

Finally, if the GWA cannot meet the projected increase in demand resulting from induced civilian growth, GovGuam could implement measures to control the rate of induced growth through the building permit process and/or by restricting the number of water and sewer connection requests that are approved. Limitations on permits and water or sewer connections could delay completion of the DoD buildup.

GWA could also accelerate their leak detection program, which would reduce apparent water demand and eliminate the shortfall. Through the workforce housing permit approval process, GovGuam may charge development impact fees that could enhance financing options that could go toward acceleration of projects to improve the GWA water system.

Mitigation for Potential Impacts on NGLA

As a result of the ongoing discussions between GWA, CCU and DoD representatives, which culminated in a face-to-face meeting on October 7-8, 2009, it was generally agreed that a joint planning effort was needed for water resource development in the Northern Guam Lens Aquifer (NGLA) to ensure responsible development and preservation of the sole source aquifer. This could be done with an advisory panel composed of representatives from the various stake holders. Some of the proposed responsibilities of the advisory panel included:

- Co-management of the NGLA
- Measures to protect the NGLA
- Well placement
- Water exchange
- Rate structure
- Interconnections
- Well Head protection

- Support for workforce housing and DoD special purpose entity (SPE) housing

Additionally, as part of the adaptive management process, monitoring of groundwater quality during well development and use would be performed to ensure that increased pumping does not adversely affect the NGLA. Careful monitoring of the chloride concentrations in the subbasins and the capability to shift demand to wells farther from affected subbasins would reduce any potential negative impacts on groundwater. Additional details on mitigation are provided in Volume 7.

3.2.3.2 Basic Alternative 2

<u>DoD and GWA Water Systems</u>

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

<u>Northern Guam Lens Aquifer</u>

Total DoD and GWA well production estimates under Alternative 2 would be similar to those described for Alternative 1 (Section 3.2.3.1). However, relocation of water supply wells to Navy Barrigada would change well production estimates by aquifer subbasin. Well withdrawal within the Agana and Mangilao subbasins (Volume 6 Chapter 2 Figure 2.2-3) would increase by approximately 3.3 MGd (12.5 mld). The peak average well withdrawal from the NGLA is shown in Table 3.2-9. The estimated well withdrawal includes the average daily demand for the Marine Corps relocation, Andersen AFB, and Navy Hospital; and the average daily demand for GWA population in north and central Guam excluding the demand met by surface water resources (up to 4 MGd (15 mld) transferred from Fena Reservoir).

Table 3.2-9. Total Well Withdrawal and Yield Estimates Projected for 2014 (Peak Year)

Wells	*Total*
GWA Maximum Average Daily Demand on Groundwater Resources (2014)	56
Cantonment Alternatives 3 and 8	
DoD Additional Average Daily Demand on Groundwater Resources based on UFC (Finegayan, Andersen AFB, and Navy Hospital)	8.9
Total Well Withdrawal (Using UFC)	64.9
DoD Additional Average Daily Demand based on Sustainability Estimates	7.8
Total Well Withdrawal **(Using Sustainability)**	**63.8**

<u>Potential Mitigation Measures</u>

Potential mitigation measures would be as described for Alternative 1.

3.2.3.3 Long-Term Alternative 1

<u>Develop Lost River</u>

Development of the Lost River (Tolaeyuus River) is considered a long-term alternative to provide additional supply to the Navy water system during the dry season. It is estimated that the Lost River supply would yield 1.7 to 5.6 MGd (6.4 to 21 mld) during the dry season, based on the U.S. Geological Survey (USGS) data collected between 1998 and 2001. Supply from the Lost River would be limited by downstream habitat considerations. The U.S. Fish and Wildlife Service has identified a minimum conservation flow of 1 cubic foot per second (0.03 cubic meters per second). The existing cofferdam would be rehabilitated, the reservoir area dredged, and a pump station and discharge pipeline would be installed for distributing the supply to the existing Fena Reservoir pump station. The water would be delivered either to the Navy reservoir or the Fena WTP. The capacity of the WTP and Navy distribution system would not be expanded, because the added supply is needed to compensate for the drawdown on the Navy reservoir during the dry season. Additional study is required to define the conceptual design of this alternative.

No mitigation measures are considered at this time since this is a programmatic level long-term alternative.

3.2.3.4 Long-Term Alternative 2

Desalination

Desalination (removal of salt) of brackish water by reverse osmosis is a long-term alternative to meet projected DoD water demands in the event that the supply from freshwater wells is insufficient to meet DoD demand. Desalination of brackish water would replace the development of up to 31 new potable water supply wells at Andersen AFB and Barrigada.

No mitigation measures are considered at this time since this is a programmatic level long-term alternative.

3.2.3.5 Long-Term Alternative 3

Dredge Fena Reservoir

Sediment dredging of the Navy Reservoir is included as a long-term option. This option is retained as part of the ongoing maintenance of the reservoir and to provide additional supply to DoD in southern Guam by increasing the storage capacity of the reservoir up to the original design capacity. Additional assessment is required to address potential obstacles related to mobilizing a dredge over long distances to the project site, which is in a remote location, as well as logistical difficulties in managing dredged material on Guam.

No mitigation measures are considered at this time since this is a programmatic level long-term alternative.

3.2.3.6 Summary of Impacts

Table 3.2-10 summarizes the potential impacts of each basic alternative. An analysis of long-term alternatives was not developed because those alternatives are not ready for project specific analysis. A text summary is provided below.

Table 3.2-10. Summary of Potential Potable Water Impacts

Potentially Affected Resource	*Basic Alternative 1**	*Basic Alternative 2*
DoD Water System	LSI	LSI
GWA Water System	SI-M	SI-M
NGLA	LSI	LSI

Potentially Affected Resource	Basic Alternative 1*	Basic Alternative 2

Legend: SI-M = Significant impact mitigable to less than significant; LSI = less-than-significant impact. *Preferred Alternative

Implementation of Potable Water Basic Alternative 1 would result in a total planned water supply of 27.1 MGd (104 mld) for the DoD water system to serve the Marine Corps relocation. This planned supply is expected to fully meet the projected future DoD demand of 27.1 MGd (103 mld). Therefore, the proposed military buildup would have less-than-significant impact on the existing DoD water system.

There are projected shortfalls in the GWA system considering the existing supply and the planned well expansion defined in GWA's draft Capital Improvements Plan for 2010-2014. The increased demand of the construction workforce and induced civilian growth would occur fairly rapidly and is expected to challenge GWA to implement their expansion plans in a very short time. GWA continues to improve their system through maintenance efforts including an ongoing leak detection and repair program. GWA may request water supply from the DoD system. Current projections indicate that there will be water available in the DoD water system for transfer to GWA. If water supply is still inadequate, GovGuam could implement measures to control the rate of induced growth. Additionally, DoD can reduce the pace of contract awards. For this reason, the projected impact on the GWA water system is deemed significant but mitigable by GWA accelerating their system improvements adequately to meet the increased demand and/or the DoD transfer excess water production capacity to GWA in the interim to meet the increased demand, and reduction of the buildup pace through GovGuam permitting and slowing the rate of contractor award by DoD. Additionally, the projected GWA demands may be overstated since the UFW rate used in calculations is based on information in the 2007 GWA WRMP may have been significantly reduced through maintenance.

Planned DoD well expansion would increase groundwater withdrawal from the NGLA but would not exceed the estimated sustainable yield and would therefore have less than significant impact on the NGLA. If ground water monitoring data indicates the groundwater withdrawal by DoD would compromise the sustainable yield of the NGLA, the DoD would pursue other long-term alternatives or other mitigation measures, including adaptive management. These mitigation measures are discussed further in Volume 7.

The summary of impacts for Basic Alternative 2 are the same as described for Basic Alternative 1.

3.2.4 Wastewater

As explained in section 3.1.3, the GWA NDWWTP would handle most of the increased wastewater treatment demand from the DoD buildup. 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 Navy 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 GWA Hagatna WWTP would handle some of the increased wastewater treatment demand from the construction workforce and increased civilian population. Hagatna WWTP has been shown to have adequate capacity to handle this estimated increased demand. Thus, only the NDWWTP is analyzed for environmental consequences in this section.

As a result of the proposed military buildup, if Cantonment Alternative 1 or 2 is selected, the total year 2019 average daily flows to the NDWWTP from military and civilian sources are projected to increase to 11.5 MGd (43.7 mld). (Table 2.3-4). If Cantonment Alternative 3 or 8 is selected, the total year 2019 end state average daily flows to the NDWWTP from military and civilian sources are projected to increase to 11.5 MGd (43.7 mld). (Table 2.3-7). The year 2019 flow projections for these plants account for increased DoD wastewater flows to be generated by DoD active duty personnel and their dependents and by the on-base civilian workforce. The projected year 2019 wastewater flow also accounts for GWA forecasts for growth of the natural civilian population and induced growth of civilians caused by the military buildup in both northern Guam and central Guam.

Including these sources, the projected end state increase in wastewater flow in northern Guam as a result of the military buildup would not exceed the NDWWTP's design capacity of 12 MGd (45 mld). At the end state, however, the permit limit of 6.0 MGd (23.0 mld) would still be exceeded, and the plant would still need refurbishment to restore it to the original design capacity. A socioeconomic analysis of the proposed military buildup has estimated that induced civilian growth as a result of the military buildup could increase the island-wide population on Guam by up to approximately 40,000 in the peak year of 2014. Assuming this induced growth would be evenly distributed among the north, central, and Apra Harbor regions of Guam, the induced civilian demand for wastewater treatment in northern Guam is estimated to reach 1.6 MGd (6.0 mld) of water in both northern and central Guam. The construction workforce would generate up to an additional 1.5 MGd (5.7 mld) of wastewater flow to be treated at the NDWWTP in the peak year of 2014.

Thus, while the year 2019 wastewater treatment demand estimates would be within the physical capability of the NDWWTP design basis, the demand would peak in 2014 with the combined impacts of the Marine Corps relocation, construction workforce, and civilian growth and be in excess of that physical capacity at approximately 12.8 MGd average. In addition, the regulatory scenario requires attention regarding permit and secondary treatment issues.

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

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

<u>Basic Alternative 1a</u>

Projected wastewater flows to the NDWWTP are summarized in Table 3.2-11. Table 3.2-11 also summarizes existing Guam civilian and DoD flows, projected increases in flows from Guam civilians related to natural population growth, projected DoD increases associated with the military buildup, increases associated with the imported construction workforce, and civilian increases that could result from induced growth under Main Cantonment Alternatives 1 and 2 for northern Guam.

Table 3.2-11. Projected Wastewater Flows to the NDWWTP under Main Cantonment Alternatives 1 and 2

Source of Wastewater Flow	*Year*									
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Existing Guam Civilian	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20
Existing DoD	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Guam Civilian Increase	0.42	0.64	0.85	1.06	1.26	1.47	1.67	1.87	2.07	2.26
DoD Increase	0.24	0.48	0.53	0.57	2.71	2.95	2.99	3.03	3.07	3.12
Construction Workforce	0.26	0.66	1.14	1.43	1.47	0.97	0.30	0.00	0.00	0.00
Subtotal Direct DoD And Guam Civilian	**6.65**	**7.50**	**8.25**	**8.79**	**11.17**	**11.11**	**10.69**	**10.62**	**10.86**	**11.11**
Induced Civilian Increase	0.27	0.66	1.08	1.27	1.58	1.19	0.61	0.42	0.42	0.43
Total Flow – All Sources	**6.92**	**8.16**	**9.33**	**10.05**	**12.75**	**12.31**	**11.29**	**11.04**	**11.28**	**11.54**

Source of Wastewater Flow	*Year*									
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*

Note: All units are in million gallons per day.
Source: NAVFAC Pacific 2008c.

DoD wastewater flows include all on-base DoD wastewater flows that would be generated by active duty personnel and their dependents, the on-base civilian workforce, and industrial flows from on-base facilities. Increased wastewater flow from induced civilian growth resulting from the military buildup is included.

Wastewater flows to the NDWWTP from military and civilian sources are projected to increase to a peak of 12.8 MGd (48.3 mld) in 2014, which is somewhat more than the design capacity of 12 MGd (45 mld). Adding chemical coagulants or increasing the surface overflow rate (within the normal design range) of the clarifier would improve plant operations so that the primary clarifier would be able to treat the additional 0.8 MGd (2.8 mld) without adverse effects on the NDWWTP. However, the permit limit of 6 MGd (23 mld) would still be exceeded, and the plant would still need refurbishment and upgrades to restore it to the original design capacity.

Implementing Basic Alternative 1a would accomplish the required refurbishment of the NDWWTP to accept the projected increase in wastewater flows. DoD would coordinate with GWA to expedite the planned improvements and request for a NPDES permit modification to increase the effluent discharge limitation from 6.0 MGd (22.7 mld) to 12.0 MGd (45.4 mld), then comply with its modified NPDES permit requirements.

Under Basic Alternative 1, all military-generated wastewater, either from Andersen AFB or from the proposed Marine Corps relocation, would be conveyed to the NDWWTP for treatment. All flows from the current and proposed future military buildup at Andersen AFB would be conveyed through the existing GWA sewer to the NDWWTP, while wastewater flow generated from the proposed Marine Corps relocation at Finegayan would be conveyed via a new relief sewer line to the NDWWTP (as shown in Figure 2.3-2). The proposed modifications to the NDWWTP primary treatment system and collection system should be completed by 2013.

This alternative also provides secondary treatment at NDWWTP to comply with USEPA requirement to meet Guam Water Quality Standards. A trickling filter system is proposed as the secondary treatment process. The following new process components and upgrades would be required at the NDWWTP for this alternative:

- Four trickling filter
- Four secondary clarifiers
- Two additional anaerobic digesters (the same size as existing ones)
- One additional centrifuge solids-dewatering system and odor control

The new ocean outfall that was put into service in December 2008 at the NDWWTP would provide enough capacity to handle disposal of the increased long-term future flows.

These upgrades are same to support either Main Cantonment Alternatives 1 and 2 or Main Cantonment Alternatives 3 and 8. The proposed secondary treatment upgrades to the NDWWTP should be completed by 2016

Basic Alternative 1b

Basic Alternative 1b supports the proposed Main Cantonment Alternatives 3 and 8. This alternative includes upgrades to the NDWWTP to allow wastewater generated at Barrigada housing site to be conveyed to the GWA NDWWTP for treatment. Those upgrades to the NDWWTP would be identical to those described under Basic Alternative 1a, and will not be repeated here.

Under this alternative, a new sewer line and two pump stations would need to be installed to convey wastewater generated at Barrigada to the GWA NDWWTP for treatment. The primary-treatment facilities of the NDWWTP would be refurbished and upgraded to accept the additional DoD flows and military buildup–related flows in northern Guam. The estimated wastewater flows to the NDWWTP under Main Cantonment Alternatives 3 and 8 are shown in Table 3.2-11.

Table 3.2-12. Projected Wastewater Flows to the NDWWTP under Main Cantonment Alternatives 3 and 8

Source of Wastewater Flow	*Year*									
	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Existing Guam Civilian	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20
Existing DoD	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Guam Civilian Increase	0.42	0.64	0.85	1.06	1.26	1.47	1.67	1.87	2.07	2.26
DoD Increase	0.24	0.48	0.53	0.57	2.71	2.95	2.99	3.03	3.07	3.12
Construction Workforce	0.26	0.66	1.14	1.43	1.47	0.97	0.30	0.00	0.00	0.00
Subtotal Direct DoD and Guam Civilian	**6.65**	**7.50**	**8.25**	**8.79**	**11.17**	**11.11**	**10.69**	**10.62**	**10.86**	**11.11**
Induced Civilian Increase	0.27	0.66	1.08	1.27	1.58	1.19	0.61	0.42	0.42	0.43
Total Flow – All Sources	**6.92**	**8.16**	**9.33**	**10.05**	**12.75**	**12.31**	**11.29**	**11.04**	**11.28**	**11.54**

Note: All units are in million gallons per day.
Source: NAVFAC Pacific 2008c.

Under Alternative 1b, new sewer line would need to be installed to convey wastewater generated at Barrigada to the GWA NDWWTP for treatment. Figure 2.3-3 indicates the most likely routing of the proposed sewer lines. The proposed sewer lines and pump station should be completed by 2013.

Potential Mitigation Measures

Potential mitigation measures have been divided into two categories: those within DoD control and those outside of DoD control. The following potential mitigations cover the condition of demand exceeding the design capacity of the NDWWTP and assume that the near-term upgrades of the primary treatment system and permit issues would have been resolved.

Potential mitigations within DoD control:

1. The construction tempo could be reduced to reduce the peak construction workforce. This is discussed further in Volume 7 under adaptive management.
2. The execution of construction could be incentivized to reduce on-island construction workforce requirements by using off-island prefabrication techniques and/or sequencing labor intensive construction activities in such a way to reduce the peak construction workforce needs.

Potential mitigations outside of DoD control:

1. Adding chemical coagulants or increasing the surface overflow rate (within the normal design range) of the clarifier would improve plant operations so that the primary clarifier would be able to treat the additional 0.8 MGd (2.8 mld) without adverse effects on the NDWWTP. This should also be done with advance regulatory approval.
2. The collection system could be inspected and upgraded to minimize inflow and infiltration to reduce the demand.
3. The construction workforce housing could be located where a different WWTP would support the wastewater treatment needs. This could reduce the demand at NDWWTP by 1.47 MGd (mld). This one mitigation would reduce the peak flow to the NDWWTP to 11.3 MGd (mld), within the design capacity of the NDWWTP. GovGuam could manage this through their permitting process.
4. The Navy anticipates that special purpose entities will be formed to operate, manage, upgrade or develop utility plants and associated infrastructure such as collection or distribution systems. The precise manner in which these private business entities would operate is not known but the Navy anticipates they will receive financing from the Government of Japan under the agreement reached between the U.S. and Japan regarding relocation of Marines from Okinawa to Guam. The Navy will not exercise any authority or control over the SPEs but is committed to facilitate discussions between GOJ, the SPE and Guam to focus SPE efforts on addressing utility impacts associated with the short-term construction work force and long term population growth.

3.2.4.2 Long-Term Alternative 1

Long-term Alternative 1 consists of a phased implementation of refurbishment to the primary treatment system at the NDWWTP to address the interim wastewater treatment needs and the addition of a secondary wastewater treatment plant on DoD property with its own outfall as a long-term wastewater treatment solution. The proposed modifications to the primary treatment facilities at the NDWWTP would be the same as described in Basic Alternative 1 covered in Section 3.2.4.1 and is not repeated here. Projected interim wastewater flows to the NDWWTP are summarized in Tables 3.2-11 and 3.2-12. Tables 3.2-11 and 3.2-12 also summarizes existing Guam civilian and DoD flows, projected increases in flows from Guam civilians related to natural population growth, projected DoD increases associated with the military buildup, increases associated with the imported construction workforce, and civilian increases that could result from induced growth under Main Cantonment Alternatives 1, 2, 3, and 8.

The final phase consists of construction of a DoD only primary/secondary wastewater treatment facility at Finegayan on DoD land with its own outfall. The collection sewer would be changed to take wastewater from Finegayan directly to this new treatment plant. Should Main Cantonment Alternative 3 or 8 be chosen, the sewer modification would be expanded to extend the sewer from Barrigada to the existing GWA sewer that feeds NDWWTP all the way to this new DoD treatment plant. This final phase is a long-term alternative and will be addressed programmatically.

3.2.4.3 Summary of Impacts

Table 3.2-13 summarizes the potential impacts of the basic alternative, including the interim phase for long term alternative, shown below as impacts on NDWWTP treatment capacity and water quality. An analysis of long-term alternative was not developed because the alternative is not ready for project-specific analysis. A text summary is provided below.

Table 3.2-13. Summary of Potential Wastewater Impacts

Potentially Affected Resource	*Basic Alternative 1**
NDWWTP Treatment Capacity	SI-M
Water Quality (short/intermediate term)	LSI/BI

Legend: SI-M = Significant impact mitigable to less than significant, LSI = Less than significant impact, BI = Beneficial impact. * Preferred Alternative

Implementation of Basic Alternative 1, which is the Preferred Alternative, would accomplish the required refurbishment of the NDWWTP primary treatment system to accept the projected increase in wastewater flows such that there would be no impact on the NDWWTP ability to physically handle the increased interim wastewater flows. However, permit modifications would be required and interim increased wastewater flows would temporarily exceed the design capacity of the plant. Thus the impact to the NDWWTP from the proposed DoD buildup is deemed significant with potential mitigation of upgrades, permit modifications, and alterations of operations when the flow exceeds the design capacity.

During the time when NDWWTP would be operating only primary treatment, the ocean water quality might degrade some due to the increased flow, but that would be offset by the improved operation from the refurbishment. Thus near-term water quality is expected to be impacted in a less than significant manner. In the intermediate term, after the secondary treatment capability has been constructed and become operational, the impact to water quality would be beneficial due to the improved quality of the effluent. Impacts to water quality and the marine environment are expected to be the same as those described for Basic Alternative 1.

3.2.5 Solid Waste

3.2.5.1 Basic Alternative 1 (Preferred Alternative)

The Preferred Alternative for solid waste would be the continued use of Navy Landfill at Apra Harbor until Layon Landfill is opened, which is scheduled for July 2011. In July 2011, DoD would use GovGuam's Layon Landfill for disposal of municipal solid waste as set forth in the letter of intent (see Appendix C).

As described in Section 2.4.2, the Navy Sanitary Landfill has the potential for providing 10 years of capacity (until 2019) based on the computed demand in Table 2.4-2 (506,954 tons [459,900 metric tons]) and a capacity of 1,200,000 yd^3 (917,500 m^3) or 540,000 tons (490,000 metric tons), assuming a landfill height of 54 ft (16 m) above msl and minor operational improvements. Such operational improvements include reducing the daily cover to that which is required and using larger compaction equipment to achieve greater densities. Because the Navy Sanitary Landfill is unlined, leachate has the potential to affect the underlying groundwater. Studies are currently underway to assess whether or not the underlying groundwater has been affected by leachate. The conclusions of these studies show that further action may be required.

This alternative would also consist of using the planned new GovGuam landfill in Layon. The site selected for the Layon Landfill is approximately 317 ac (128 ha) in size, with a landfill footprint of 127.4 ac (52 ha). Based on studies of future solid waste disposal quantities in GEPA's ISWMP (GEPA 2006), GEPA and Guam DPW established a minimum design capacity of 14 million CY (11 million m^3) as an estimate of the volume required to manage Guam's municipal solid waste for a 30-year period. Based on detailed design documents completed since the ISWMP was completed, the Layon Landfill is estimated to have a capacity of 15.8 million yd^3 (12 million m^3) or 9.5 million tons (8.6 million metric tons), assuming an in-place density of 1,200 lbs/ yd^3 (TG Engineers 2009).

The landfill would be constructed in phases, with Cells 1 and 2 scheduled for construction at the same time, in July 2011. Cells 1 and 2 would cover approximately 11.1 ac (4.5 ha) and 11.3 ac (4.6 ha), respectively, with a combined waste capacity of 1.4 million yd^3 (1.1 million m^3) (GEPA 2009). Table 2.4-4 presents the projected solid waste generation rates from both the military buildup and the civilian Guam population by year. Solid waste rates are shown as two categories: DoD solid waste and Guam general population solid waste. These two categories were added together to determine total estimated solid waste in tons, which were then converted into cubic yards. In 2014, Cells 1 and 2 would have reached their capacity and would have provided approximately 4 years of useful life. The operations plan for the Layon Landfill (TG Engineers 2009) indicates that subsequent disposal cells would normally be constructed at intervals of 2-5 years. Therefore, the demand from the military buildup would not have a significant impact on the short-term capacity of the Layon Landfill.

Table 2.4-4 also provides an estimate of when the Layon Landfill would reach its ultimate capacity from solid waste generated by DoD and the Guam general population. Using a landfill airspace capacity of 15.8 million yd^3 (12.0 million m^3), the table indicates that the landfill would reach capacity in 2043, 32 years after opening. The estimated 32 years of capacity is greater than the 30 years used by Guam DPW and GEPA for planning and designing of the Layon Landfill; therefore, the military buildup would not have a significant impact on the long-term capacity of the landfill.

GovGuam completed the *Final Supplemental Environmental Impact Statement for the Siting of a Municipal Solid Waste Facility, Guam* (Guam DPW 2005) in July 2005. The report evaluated all aspects of siting a new landfill, including potential impacts on geology, groundwater, soils, air quality, noise, hydrology, water quality, wetlands, coastal zone management, vegetation, wildlife, aquatic ecology, land use, zoning, demographics, economics, recreation, sensitive receptors, utilities, road network, energy use and conservation measures, public health/safety, aesthetics, archaeological resources, and historical resources. Whenever impacts from the landfill development were identified, suitable mitigation measures were developed.

Currently two studies are being conducted regarding solid waste reduction. The first study is related to municipal solid waste recycling for long term DoD waste generation on Guam, including waste generated as part of the military buildup. The second study is related to construction and demolition debris associated with the construction phase of the military buildup. The construction and demolition debris study will estimate the quantity of material generated and what portion of the material could be potentially reused. Following completion of these studies, it is anticipated the recommendations presented in the respective study would result in a reduction in solid waste generation, thereby minimizing impacts related to solid waste disposal.

Potential Mitigation Measures

No mitigation measures are required.

3.2.5.2 Summary of Impacts

Table 3.2-14 summarizes the potential impact of the Preferred Alternative. A text summary is provided below.

Table 3.2-14. Summary of Potential Solid Waste Impacts

Potentially Affected Resource	*Preferred Alternative*
Solid Waste Disposal Capacity	LSI

Legend: LSI = Less-than-significant impact

The proposed action would result in increased solid waste generation. Implementation of the preferred solid waste alternative would provide sufficient disposal capacity for this increase. However, this would reduce the projected life of the Layon Landfill. Because this reduction would be minimal this draft EIS/OEIS concludes that impacts on solid waste disposal capacity would be less than significant.

3.2.6 Roadway Projects

3.2.6.1 Alternative 1

North

Roadway widening, pavement strengthening, and intersection improvement activities in the north region's study area would require utilities to be relocated along Routes 1, 3, 9, 15, and 28, as shown in Table 3.2-15. Utility relocation would include GPA and Navy utility system components for power, telephone, cable television, fiber optic, and GWA and Navy sanitary sewer and water.

Central

In the central region's study area, roadway widening, roadway realignment, pavement strengthening, intersection improvement, or bridge replacement projects would require utilities to be relocated along Routes 1, 7, 8, 8A, 10, 15, 16, 25, 26, and 27, as shown in Table 3.2-15. Utility relocation would include GPA and Navy utility system components for power, GPA fuel, telephone, cable television, fiber optic, and GWA and Navy sanitary sewer and water.

Apra Harbor

As shown in Table 3.2-15, utilities in the Apra Harbor region's study area would require relocation because of pavement strengthening and intersection improvement activities along Routes 1, 2A, and 11. Utility relocation would include GPA and Navy utility system components for power, telephone, cable television, fiber optic, and GWA and Navy sanitary sewer and water.

South

In the south region's study area, utility relocation would be required as a result of pavement strengthening and intersection improvement activities along Routes 2, 5, and 12, as shown in Table 3.2-15. Utility relocation would include GPA and Navy utility system components for power, telephone, cable television, and GWA and Navy sanitary sewer and water.

Table 3.2-15. Utility Relocation within Guam Road Network Routes

Region	*Route*	*Power*	*Navy Power*	*GPA Fuel*	*Telephone*	*Cable TV*	*Fiber Optic*	*GWA Sanitary Sewer*	*Navy Sanitary Sewer*	*GWA Water*	*Navy Water*
North	1	X			OH	OH	X		X	X	
	3	X	X		OH and UG	OH	X	X	X	X	X
	9	X			OH	OH and UG	X	X		X	
	15	X			OH	OH	X			X	
	28				OH			X		X	
Central	1	X	X	X	OH and UG	OH and UG	X	X	X	X	X
	7	X			OH			X		X	
	8	X			OH and UG	OH and UG	X	X		X	X
	8A	X			OH and UG	OH		X	X	X	
	10	X			OH and UG	OH	X	X		X	
	15	X			OH and UG	OH		X		X	
	16	X		X	OH and UG	OH and UG	X	X		X	X
	25*										
	26*										
	27	X			OH and UG	OH	X	X		X	X
Apra Harbor	1	X	X		OH and UG	OH and UG	X		X		X
	2A	X	X		OH and UG	OH and UG					X
	11	X	X			OH and UG	X	X	X	X	X
South	2	X			OH and UG			X		X	
	5	X	X		OH and UG	OH		X	X	X	X
	12	X			OH			X		X	

Legend: OH = overhead; UG = underground.
Note: * Utility data not currently available for Routes 25 and 26.
Source: Parsons Transportation Group

Potential Mitigation Measures

Planning and continued coordination with utility providers during the preliminary engineering and final design and the construction stages of the project would be necessary to minimize or eliminate interruption in utility service to customers. The Joint Region Marianas would coordinate with the affected service provider in each instance to ensure that work is conducted in accordance with the appropriate requirements and criteria. In addition, coordination efforts would lay out utility reroutes, identify potential conflicts, ensure that construction of the proposed project minimizes disruption to utility operations, and formulate strategies for overcoming problems that may arise. If interruptions of utility service are required, they would be restricted in duration and geographic extent. Careful scheduling of these disruptions and advance notification to occupants of the adjacent properties that would be affected by temporary service interruptions would help to avoid any critical service periods. Where feasible, utility relocations would be undertaken in advance of roadway construction activities.

3.2.6.2 Alternative 2 (Preferred Alternative)

North

Utility relocation would be similar to that described for Alternative 1.

Central

Utility relocation would be similar to that described for Alternative 1.

Apra Harbor

Utility relocation would be similar to that described for Alternative 1.

South

Utility relocation would be similar to that described for Alternative 1.

Potential Mitigation Measures

Potential mitigation measures would similar to those described for Alternative 1.

3.2.6.3 Alternative 3

North

Utility relocation would be similar to that described for Alternative 1.

Central

Utility relocation would be similar to that described for Alternative 1.

Apra Harbor

Utility relocation would be similar to that described for Alternative 1.

South

Utility relocation would be similar to that described for Alternative 1.

Potential Mitigation Measures

Potential mitigation measures would similar to those described for Alternative 1.

3.2.6.4 Alternative 8

North

Utility relocation would be similar to that described for Alternative 1.

Central

Utility relocation would be similar to that described for Alternative 1.

Apra Harbor

Utility relocation would be similar to that described for Alternative 1.

South

Utility relocation would be similar to that described for Alternative 1.

Potential Mitigation Measures

Potential mitigation measures would be similar to those described for Alternative 1.

3.2.6.5 Summary of Impacts

Table 3.2-16 summarizes the potential impacts of anticipated utility relocations under each action alternative. The types of improvements proposed under the project alternatives would not create new demand for water supplies, stormwater or wastewater transport or treatment, or solid waste disposal capacity or facilities. The potential for impact is limited to physical disruption of existing utilities, the need for relocation of utilities before construction of new transportation facilities, or unanticipated interruptions in utility services.

Table 3.2-16. Summary of Potential Roadway Projects Impacts

Potentially Affected Resource	*Alternative 1*	*Alternative 2**	*Alternative 3*	*Alternative 8*
Utility Relocations Required before Construction	LSI	LSI	LSI	LSI

*Legend: LSI = less-than-significant impact. * Preferred Alternative*

Potential mitigation measures include coordination with utility providers to minimize or eliminate interruption in utility service to customers. If interruptions of utility service are required, they would be restricted in duration and geographic extent. Careful scheduling of these disruptions and advance notification to occupants of the adjacent properties that would be affected by temporary service interruptions would help to avoid any critical service periods. When feasible, utility relocations would be undertaken in advance of roadway construction activities.

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