

CHAPTER 9 – RECOMMENDED WATER SYSTEMS CIP

9.1 Introduction

The WRMP has identified about \$900 million in capital improvement projects needed to rehabilitate and upgrade its water and wastewater infrastructure to improve basic services and comply with regulatory requirements. Approximately 60% of that capital outlay (or \$550 million) is needed to address water system needs. The water system projects summarized in this chapter are based on facility visits, condition assessments, and engineering analyses described in Chapters 1 to 8 in this volume.

The recommended water CIP program elements are based on the best information available at the time of the WRMP development. The specific project recommendations were derived from planning level analyses including a conceptual water hydraulic model. This model will continue to be refined as GWA collects and incorporates better infrastructure and water usage information. Further infrastructure system assessments and modeling will be needed to finalize other CIP recommendations and the prioritization of those projects. Design studies will typically be needed to further refine design parameters before proceeding with construction.

It is important to note also that the WRMP represents a snapshot in time with respect to project needs and priorities. The WRMP provides a solid foundation and reasonable estimate of the magnitude of investment needed to substantially improve utility service and reliability and to attain regulatory compliance. GWA will need to continue to update the WRMP as more information becomes available and basic assumptions change. For instance, at the end of the WRMP development, new general information was provided about possible significant military expansion on Guam. This possibility is addressed in a cursory manner in Volume 1 - Chapter 17, but will need to be addressed in more detail as more information becomes available. In this specific example, not only could demands increase substantially and quickly, other strategies like integrating existing military and municipal systems into one utility may be deemed necessary, feasible and appropriate to have a more secure, robust sustainable water supply while providing environmental protection.

Volume 1, Chapter 15 – Capital Improvement Program (CIP) of the WRMP describes elements associated with the CIP projects for GWA. Some issues such as electrical power quality, corrosion and technology: e.g., Supervisory Control and Data Acquisition (SCADA) are common for the water and wastewater systems and are discussed in their respective chapters in Volume 1 of the WRMP.

Table 9-1 summarizes the proposed CIP projects for the water system through 2026, which were developed principally from analyses presented in Chapters 6 (Hydraulic Modeling), 7 (Condition Assessment), and 8 (Water System Facilities). Several projects are presented as recurring annually through 2026. These projects can be defined as sequential projects to replace/rehabilitate the water system assets over their useful life to mitigate catastrophic failure and financial impacts on GWA.

The tables that follow Table 9-1 are the forms that represent CIP projects that are either grouped due to their similarity (e.g., distribution line replacements for fire flow and pressure) or individual projects. The intent of these tables is to help GWA to manage individual CIP projects effectively going forward. Some the table fields are blank because information is not available until the project is closer to implementation. The CAPE tool described in Chapters 10 and 15 (briefly) of Volume 1 can be used to manage and display the information in the Project Summaries.

9.2 Project Ranking

The \$900 million value of capital improvements GWA is facing over the next 20 years must be prioritized for implementation to determine their impact on rates and other funding sources.

Ranking of the projects was accomplished by a 3-step process.

1. System-wide improvements that are similar in nature were ranked based on technical criteria. For example, sewer upgrades were ranked based on overflows and surcharges. Those upgrades that were designed to eliminate historical overflows were given a higher priority than those where the sewer simply surcharges. Similarly, the transmission line priorities were based on historical fecal coliform data in the wells.
2. Each project was assigned a project type based on the intended purpose of the project. Most projects were assigned multiple project types since they usually accomplish more than one purpose.
3. The planner who developed the project used professional judgment to evaluate the assignment of project types and to schedule projects over the 20-year planning window. The highest priority projects are scheduled earlier in the planning period.

The project types are discussed below:

- **Life and Safety (LS)** – Projects that can have a direct impact on reducing risks to LS of customers and employees. An example of a LS project is one that will meet minimum fire flow and pressure standards.
- **Regulatory Compliance (RC)** – Projects that are intended to ensure compliance with safe drinking water, water quality, and other regulations promulgated by EPA and GEPA. An example of a RC project is one that will help a wastewater treatment plant comply with its NPDES permit.
- **System Capacity (SC)** – Projects that are intended to increase capacity for existing or future flows, loads, and demand. An example of a SC project type is an upgrade of a sewer to prevent overflows or surcharging.
- **System Reliability (SR)** – Projects that are intended to increase the reliability of existing infrastructure and facilities. An example of a SR project type is the improvement to the Ugum WTP raw water intake to reduce the impact of siltation.
- **System Redundancy (SRED)** – Projects that are intended to provide redundant facilities or unit processes. An example of a SRED project type is the addition of a second finished water reservoir at the Ugum WTP.
- **Operation Maintenance and Rehabilitation (OM&R)** – Projects that are needed to operate, maintain, and rehabilitate existing facilities and infrastructure to extend their useful life. An example of an OM&R project type is development and implementation of a corrosion control program.

There are some exceptions to this ranking. Some projects are already funded and are under design or construction. Examples include the upgrade of the Ugum WTP to membrane filtration, and the Sinajana transmission line. No attempt was made to change the schedule of these types of projects.

Some projects with low rankings based on project type were included in the first five years because they are critical to asset maintenance or system operation. These include corrosion control and SCADA improvements.

Though the CIP identifies over 70 specific water and wastewater projects, placeholders for uncertainties are included in the CIP to ensure sufficient financial resources are available for unexpected needs and on-going capital improvements to system-wide issues such as distribution pipe replacement, mechanical/electrical replacement and wastewater collection system rehabilitation.

A second approach to project ranking was conducted after the draft WRMP was submitted for review. This approach consisted of a development of numerical points for each project type by means of a pairwise comparison. The pairwise comparison consisted of comparing the importance of each project type with each other project type. Points were assigned as follows:

- If project type A is much more important than project type B, five points were assigned to project type A.
- If project type A is more important than project type B, four points were assigned to project type A.
- If project type A is of equal importance to project type B, three points were assigned to project type A.
- If project type A is less important than project type B, two points were assigned to project type A.
- If project type A is much less important than project type B, one point was assigned to project type A.

For each comparison, the total number of points allocated between two project types is six. If project type A in the comparison gets five points, project type B automatically gets one point. Similarly, if project type A in the comparison gets three points, project type B automatically gets three points.

Four WRMP team members conducted the pairwise exercise independently. After the pairwise comparison was completed, the total number of points for each project type was tallied. The maximum number of points any project type could get is 25, and the minimum number is five. An average of the total points for each project type for all four team members was calculated. The ranking and average points of the project types are listed below:

1.	Life and Safety	21.8
2.	Regulatory Compliance	17.0
3.	System Reliability	16.3
4.	System Capacity	13.8
5.	System Redundancy	11.8
6.	Operation Maintenance and Rehabilitation	9.5

The points for each project type listed above were assigned to each of the CIP projects and their ranking was reviewed. The pairwise comparison matched closely with the initial ranking that was conducted. The pairwise comparison approach was not used for the final ranking; however, the point total was included for each project in the CIP project description summary listed in Volume 2,

Chapter 9 – Recommended Water Systems CIP, and Volume 3, Chapter 9 – Recommended Wastewater Systems CIP.

9.3 Conclusions

The primary feature of this section is the presentation of CIP project details using individual project summary sheets for proposed CIP tasks. Also a project prioritization process is explained using six categories as a means of developing ranking of projects. The six categories are:

- Life and Safety
- Regulatory Compliance
- System Reliability
- System Redundancy
- System Capacity
- Operation Maintenance and Rehabilitation Recommendations

A process known as “pairwise comparison” was used to provide a numerical ranking to assist in the prioritization of projects. This process is described in the initial section of this chapter.

9.4 Recommendations

The schedule for commencement and completion of projects was to some extent determined as a factor in the prioritization exercise. However, some tasks with relatively low ranking were given a near term completion date because they provide support for so many features of other projects, these were related to electrical and SCADA systems as an example.

9.5 CIP Impacts

Table 9-1 lists all Water System CIP projects in this chapter. They are also presented in Table 15-1 in Volume 1, Chapter 15 – Capital Improvement Program.

Table 9-1 – Water Systems CIP

Project	Project Types ³	Priority Ranking	Budget Year ^{1,2}																			Totals		
			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025		2026	
Water System																								
Water Reservoir Internal/External Corrosion Assessment Program	LS/SR/OMR	47.6	\$125,000																			\$125,000		
Water Reservoir Internal/External Corrosion Rehabilitation Program	LS/SR/OMR	47.6		\$500,000	\$500,000	\$500,000	\$500,000															\$2,000,000		
Ugum Water Treatment Plant Membrane Filtration	SC/OMR	23.3	\$8,500,000																			\$8,500,000		
Ugum Water Treatment Plant Reservoir Replacement	LS/SR/SRED	49.9			\$8,700,000																	\$8,700,000		
Ugum Water Treatment Plant Intake Modifications	SR	16.3	\$550,000																			\$550,000		
Water Distribution System Pipe Replacement	LS/SR/OMR	47.6	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$5,000,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$53,140,000		
Mechanical/Electrical Equipment Replacement	LS/SR/OMR	47.6		\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$930,000	\$17,670,000		
Southern System Water Distribution System 2005 Improvements	LS/SR	38.1		\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000							\$4,000,000	\$6,000,000	\$23,000,000	
Central System Water Distribution System 2005 Improvements	LS/SR	38.1		\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000								\$6,000,000		
Northern System Water Distribution System 2005 Improvements	LS/SR	38.1		\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000	\$2,600,000								\$26,000,000		
Pressure Zone Realignment/Development 2005 Improvements	LS/SR	38.1		\$2,700,000	\$2,700,000	\$2,700,000																\$8,100,000		
Water Booster Pump Station 2005 Improvements	LS/SR	38.1		\$700,000	\$500,000																	\$1,200,000		
Water System Reservoirs 2005 Improvements	LS/SR	38.1		\$2,600,000	\$2,600,000	\$2,600,000	\$8,700,000					\$8,700,000										\$25,200,000		
Northern System Raw Water Transmission Lines	LS/SR	38.1	\$4,500,000	\$4,300,000		\$18,000,000		\$19,000,000	\$20,000,000	\$20,000,000		\$19,000,000		\$15,000,000		\$4,000,000						\$123,800,000		
Water System Supply Wells 2025 Improvements	SC	13.8																			\$5,000,000	\$5,000,000		
Southern System Water Distribution System 2025 Improvements	LS/SR	38.1																			\$4,000,000	\$6,000,000	\$10,000,000	
Northern System Water Distribution System 2025 Improvements	LS/SR	38.1											\$5,700,000	\$5,700,000	\$5,700,000	\$5,700,000	\$5,700,000	\$5,700,000	\$5,700,000	\$5,700,000	\$5,700,000	\$57,000,000		
Water Booster Pump Station 2025 Improvements	LS/SR	38.1																			\$1,600,000	\$1,600,000		
Water System Reservoirs 2025 Improvements	LS/SR	38.1											\$3,000,000	\$4,300,000	\$3,000,000	\$8,700,000	\$8,700,000					\$27,700,000		
Northern System GWUDI Filtration Compliance ⁴	RC	17								\$14,500,000	\$14,500,000	\$14,500,000	\$14,500,000	\$14,500,000	\$14,500,000	\$14,500,000	\$14,500,000	\$14,500,000				\$145,000,000		
Year Total				\$18,675,000	\$21,230,000	\$25,430,000	\$34,230,000	\$19,630,000	\$29,430,000	\$44,930,000	\$44,930,000	\$24,930,000	\$48,370,000	\$26,370,000	\$39,870,000	\$26,170,000	\$28,870,000	\$30,570,000	\$30,570,000	\$7,370,000	\$20,370,000	\$8,970,000	\$19,370,000	\$550,285,000
Electrical/SCADA																								
Electrical Upgrade - Water Booster Stations (Pago Bay, etc)	LS/SR	38.1	\$650,000																			\$650,000		
Electrical Upgrade - Water Booster Stations (Gayinero, etc)	LS/SR	38.1		\$350,000																		\$350,000		
Electrical Upgrade - Water Booster Stations (Other WBPS)	LS/SR	38.1			\$250,000																	\$250,000		
Electrical Upgrade - Water Wells	LS/SR	38.1	\$2,000,000																			\$2,000,000		
Year Total				\$2,650,000	\$350,000	\$250,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$3,250,000	
Annual Total				\$21,325,000	\$21,580,000	\$25,680,000	\$34,230,000	\$19,630,000	\$29,430,000	\$44,930,000	\$44,930,000	\$24,930,000	\$48,370,000	\$26,370,000	\$39,870,000	\$26,170,000	\$28,870,000	\$30,570,000	\$30,570,000	\$7,370,000	\$20,370,000	\$8,970,000	\$19,370,000	\$553,535,000
							\$122,445,000					\$192,590,000					\$151,850,000					\$86,650,000		

¹ Cost based on (10% design, 5% Services during construction, 7% Construction Management, 50% Planning Level Adjustment)

² Costs are 2007 Dollars

³ Project Types: RC=Regulatory Compliance; SR=System Reliability; SRED=System Redundancy; SC=System Capacity; OMR=OM&R; LS=Life & Safety

⁴ Costs for design, planning, and construction of full treatment for GWUDI compliance; If filtration avoidance is allowed, total costs will be approximately \$5,000,000 after transmission lines are complete

Table 9-2 – Water Reservoir Internal/External Corrosion Assessment Program

PROJECT SUMMARY			
Project Name	Water Reservoir Internal/External Corrosion Assessment Program		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	47.6		
Project Description	Develop and implement a corrosion assessment program for all steel water reservoirs to determine extent of internal and external reservoir corrosion and necessary course of action to rehabilitate or replace the impact reservoirs.		
Project Justification	The failure of the Barrigada Water Reservoir #1 in June 2005 demonstrated the urgent need to internally inspect and carryout a full condition assessment of all steel reservoirs to determine the degree of corrosion damage and establish remedial action or reservoir replacement as appropriate.		
Project Budget	\$125,000		
Funding Source(s)	USEPA: FY 2007 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-3 – Water Reservoir Internal/External Corrosion Rehabilitation Program

PROJECT SUMMARY			
Project Name	Water Reservoir Internal/External Corrosion Rehabilitation Program		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	47.6		
Project Description	Based on the results of the corrosion assessment program for all steel water reservoirs, program the rehabilitation of designated reservoirs over a four-year period as a phased project.		
Project Justification	The failure of the Barrigada Water Reservoir #1 in June 2005 demonstrated the urgent need to internally inspect and carryout a full condition assessment of all steel reservoirs to determine the degree of corrosion damage and establish remedial action or reservoir replacement as appropriate.		
Project Budget	\$500,000/year FY 2008 through FY 2011. Total: \$2,000,000		
Funding Source(s)	USEPA: FY 2008–2011 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-4 – Ugum Water Treatment Plant Membrane Filtration

PROJECT SUMMARY			
Project Name	Ugum Water Treatment Plant Membrane Filtration		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input checked="" type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input checked="" type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	23.3		
Project Description	This project will replace the existing sand filters at the Ugum Water Treatment Plant with submerged membrane filters. The preliminary concept is to retrofit the existing sand filter cell structures with the submerged membrane filters. Two of the cells would be retrofit with 360 membranes each. This would provide a plant capacity ranging from 7 million gallons per day (mgd) when raw water turbidity is less than 50 NTUs to 3 mgd when the raw water turbidity is greater than 200 NTU.		
Project Justification	One of the existing dual media filters has earthquake damage and needs repair or replacement. The other filters need refurbishment.		
Project Budget	\$8,500,000		
Funding Source(s)	USEPA: FY 2005 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway	Submerged membrane filtration pilot work was performed from May through December 2005 on raw water from the Ugum River. This pilot work is part of a multi-step sealed bid process initiated by Guam Waterworks Authority.		

Table 9-5 – Ugum Water Treatment Plant Reservoir Replacement

PROJECT SUMMARY			
Project Name	Ugum Water Treatment Plant Reservoir Replacement		
Project Type	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input checked="" type="checkbox"/> System Redundancy </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input checked="" type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input checked="" type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	49.9		
Project Description	This project will provide a 2.0 million gallon finished water reservoir at the Ugum Water Treatment Plant. The existing reservoir shows significant damage to the cover as a result of a series of typhoons. The damage has contributed to corrosion which could result in premature failure. This reservoir is the sole source of finished water for most of the Southern Water System. Failure of this reservoir would result in a significant hardship on customers in the system. The new reservoir would allow the existing reservoir to be taken off-line and refurbished.		
Project Justification	The existing reservoir is damaged, but cannot be taken out-of-service for repair because there is no back-up.		
Project Budget	\$8,700,000		
Funding Source(s)	USEPA: FY 2005–2007 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-6 – Ugum Water Treatment Plant Intake Modifications

PROJECT SUMMARY			
Project Name	Ugum Water Treatment Plant Intake Modifications		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	16.3		
Project Description	This project would improve the intake structure for the Ugum Water Treatment Plant to minimize siltation and to provide more reliable raw water supply during low river flow conditions.		
Project Justification	The existing intake is susceptible to siltation and requires frequent maintenance. The Ugum WTP is the sole source of water (except two small wells) for supplying the Southern Water System.		
Project Budget	\$550,000		
Funding Source(s)	USEPA: FY 2007 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-7 –Water Distribution System Pipe Replacement

PROJECT SUMMARY			
Project Name	Water Distribution System Pipe Replacement		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none; vertical-align: top;"> <input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	47.6		
Project Description	<p>In addition to specific pipe replacement projects identified through hydraulic modeling, there is an ongoing need for pipe replacement to address leak, failure and age issues. This project meets that need.</p> <p>The basis for this reserve is about 13,500 linear feet of pipe replaced per year through 2015 and 2,000 feet of pipe replaced per year thereafter.</p>		
Project Justification	Specific replacement areas are not identified at this time, but an allocation of resources is reserved in the CIP for accounting purposes and to ensure funds are available.		
Project Budget	\$5 million per year through 2015 and \$740,000 per year thereafter. Total: \$53,140,000		
Funding Source(s)	USEPA: FY 2006–2025 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-8 – Mechanical/Electrical Equipment Replacement

PROJECT SUMMARY			
Project Name	Mechanical/Electrical Equipment Replacement		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	47.6		
Project Description	Reserve for routine mechanical/electrical equipment replacement due to age, capacity, or failure. This reserve includes well pumps, booster pumps, valves, emergency generators and other items associated with the Northern, Central and Southern Water Systems.		
Project Justification	Sufficient funds must be reserved to ensure water system mechanical and electrical equipment is replaced in a timely manner.		
Project Budget	\$930,000 per year Total: \$17,670,000		
Funding Source(s)	USEPA: FY 2007–2025 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-9 – Southern System Water Distribution System 2005 Improvements

PROJECT SUMMARY				
Project Name		Southern Water Distribution System 2005 CIP Fire Protection Improvements		
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1		
Project Description		The 2005 CIP hydraulic model for GWA's Southern Water System has identified deficiencies in water pipe sizes required to provide adequate fire flow. The series of projects listed below identify the location, pipe diameter and length to address this issue.		
No.	Area	Description	Length, ft	Comment
S1	Malojloj Elevated	Increase 6-inch waterline to 8 inches along Fangualoan St. from Malojloj Well St. to S-15 and on to connection to 12-inch waterline along Route 4.	4200	Improve available fire flow in this area
S2	Malojloj Elevated	Increase 6-inch waterline to 8 inches along Kalamasa and Barcinas	1900	Improve available fire flow in this area and further south
S3	Malojloj Elevated	Connect the 6-inch and 8-inch pipes with a new 8-inch pipe at the intersection of Malojloj Well and Route 4	50	Need to verify the location of these two pipes.
S4	Malojloj Elevated	Increase the 6-inch waterline parallel to Route 4 from Fangualoan to Ates to 8-inch.	550	Improve available fire flow in this area.
S5	Malojloj	Install 8-inch waterline from the end of the waterline on Quinene to Baza to Route 4 to complete loop. Install 8-inch waterline along Santiago, from Route 4 to Quinene.	700, 1400	Improve available fire flow in this area.
S6	Malojloj	Connect the 8-inch and 12-inch pipes with a new 8-inch pipe at the intersection of Acfalle and Route 4	50	Need to verify the location of these two pipes.
S7	Inarajan	Install 8-inch waterline to complete loop of 6-inch waterline at the ends of Chagamin St. and Y Peca Lane	500	Need to verify if connection between dead-end leg lines is feasible, or if the waterline along Chagamin St. should be extended to Ad'Man Dr. and connected back to the 12-inch main on Route 4.
S8	Inarajan	Increase 6-inch waterline to 8 inches along Route 4 at interconnection of parallel 8-inch and 12-inch lines about 1900 feet south of As Quede St.	200	Improve available fire flow in this area and further to the south and west

Table 9-9 – Southern System Water Distribution System 2005 Improvements (continued)

No.	Area	Description	Length, ft	Comment
S9	Merizo	Increase the 6-inch and 8-inch waterline along Chalan Joseph A Cruz from Route 4 south of Mata Ave to Merizo Reservoir to 8-inch and 12-inch.	1600, 3600	Improve available fire flow in this area.
S10	Umatac	Increase the 6-inch waterline along Road A from Jesus A. Quidachay to Road B to 8-inch.	550	Improve available fire flow in this area.
S11	Umatac	Increase 6-inch waterline to 12 inches along Route 4 from Bile St. to the transition from the 6-inch to 12-inch waterline about 1000 feet south of Jesus A. Quidachay St.	4500	Improve available fire flow in this area
S12	Umatac	Increase 6-inch and 4-inch waterlines to 8 inches along Route 4 and Route 2, from Jesus A. Quidachay St to Lasafua Reservoir and to Agat/Umatac Reservoir.	13,000	Need to verify if there are any segments of 12-inch line along this length of line. Improve available fire flow in this area
Total Length			32,800	
Project Justification		Improve fire flow and pressure in the respective areas.		
Project Budget		FY2008 – FY2017 \$13,000,000 (Assume \$1,300,000 per year for 10 years) FY2024 \$4,000,000 FY2026 \$6,000,000 Total: \$23,000,000.		
Funding Source(s)		USEPA: FY 2008–2017 Bond Issuance:		
GWA Project Manager				
Contractor, if any		Design: Construction:		
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway				

Table 9-10 – Central System Water Distribution System 2005 Improvements

PROJECT SUMMARY				
Project Name		Central Water Distribution System 2005 Improvements		
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1		
Project Description		The 2005 hydraulic model for GWA's Central Water System identified deficiencies in pumping capacity and pipe size to provide adequate fire flow and pressure, and reduce high velocities and friction losses. The series of projects listed below identify the location, pipe diameter, length, and pumping needs to address these issues.		
No.	Area	Description	Length, ft	Comment
C1	Talofofo	Install booster pump station near Windward Hills #2 Reservoir and increase 8-inch waterline to 12 inches along Route 4A southeastward to San Miguel St.	6000	Improve fire flow and pressures in Talofofo. There is a need to site a dedicated elevated storage tank in Talofofo to replace the previous one abandoned
C2	Talofofo	Increase 8-inch waterline to 12 inches along Route 4A from San Miguel St. southward to Manual P Mantanona Lane	3800	Evaluate if an elevated storage tank w/ overflow @ 500' can be placed in this area with a ground elevation of about 382 feet.
C3	Talofofo	Increase 6-inch waterline to 8 inches along Ernest P. Santos from Johnny S. Taitague. northward to Ralph Santos	2900	Improve substandard fire flow and pressure in this area
C4	Santa Rita	Increase 8-inch waterline to 12 inches along Route 17 from Chalan J. Kindo intersection and eastward along Route 17 to Sinifa Reservoir	3000	Reduce max-day velocities that exceed six fps and improve fire flows
C5	Agat	Install 8-inch waterline from the dead-end 6-inch line along S16 to the 10-inch line on Kalachucha.	400	Improve substandard fire flow and pressure in this area
C6	Agat	Increase 6-inch waterline to 12 inches along Umang from S-11 eastward to S-41.	1200	Improve substandard fire flow and pressure in this area
Total Length			17,300	

Table 9-10 – Central System Water Distribution System 2005 Improvements (continued)

Project Justification	Improve fire flow and pressure in the respective areas.
Project Budget	\$6,000,000 (Assume \$600,000 per year for 10 years.)
Funding Source(s)	USEPA: FY 2008–2017 Bond Issuance:
GWA Project Manager	
Contractor, if any	Design: Construction:
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:
Administrative Activities Underway	

Table 9-11 – Northern System Water Distribution System 2005 Improvements

PROJECT SUMMARY				
Project Name		Northern System Water Distribution System 2005 Improvements		
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1		
Project Description		The 2005 hydraulic model for GWA's Northern Water System identified deficiencies in pumping capacity and pipe size to provide adequate fire flow and pressure, and reduce high velocities and friction losses. The series of projects listed below identify the location, pipe diameter, and length to address these issues.		
No.	Area	Description	Length, ft	Comment
N1	Santa Rosa	Extend 6-inch waterline on north end of Tun Thomas Dongo to 12-inch line with an 8-inch waterline.	300	Improve available fire flow in this area
N2	Santa Rosa	Increase 6-inch waterline to 8 inches to the east of Santa Rosa Reservoir (not including branched 6 inch lines).	3000	Improve available fire flow in this area. Verify the ground elevation at this area.
N3	Santa Rosa	Increase 6-inch waterline on Tun Luis Tugong and Rosa to 8 inches.	2300	Improve available fire flow in this area
N4	Santa Rosa	Increase 8-inch waterline on Anao and S-1 to 12 inches (or larger).	2600	Improve available fire flow and pressure in this area
N5	Yigo Elevated	Increase 8-inch waterline to 12 inches along Chalan Arendo to Chalan Emsley.	4900	Improve available fire flow and pressure in this area
N6	Yigo Elevated	Connect dead end pipes along Chalan Emsley with a new 8-inch pipe	1600	Improve available fire flow and pressure in this area
N7	Yigo Elevated	Connect dead end pipes at the west end of the Yigo Elevated zone with a new 8-inch pipe	900	Improve available fire flow and pressure in this area
N8	Yigo Elevated	Increase 6-inch waterline at the south end of the Yigo Elevated zone to a new 8-inch pipe.	300	Improve available fire flow and pressure in this area
N9	Mataguac Zone	Increase 6-inch waterline to 8 inches along Chalan Maanao from Route 1 (Marine Drive) thru Mataguac BPS to Evangelista Road.	2300	Improve available fire flow, pressure and velocity in this area.
N10	Mataguac Zone	Increase 6-inch waterline to 8 inches along Envangelista from Route 1 (near Well Y-17).	600	Improve available fire flow, pressure and velocity in this area.

Table 9-11 – Northern System Water Distribution System 2005 Improvements (continued)

No.	Area	Description	Length, ft	Comment
N11	Mataguac Zone	Install 8-inch waterline along Chalan Sarana from Chalan Kaskahu to Chalan Okso. Install PRV where Mataguac and Yigo Zones meet.	800	Improve available fire flow and pressure in this area.
N12	Yigo Zone	Increase 6-inch waterline on Ton Jose to 8 inches. Install 8-inch waterline along Chalan Paharu, from Well Y-23 to Ton Jose.	1600 and 2800	Improve fire flow in this area.
N13	Yigo Zone	Increase 6-inch waterline to 8 inches along Chalan Langet, from Route 1 to Ree. Install 8-inch waterline on Ree from Chalan Langet to 12-inch line on Aga. (Near lower portion of Route 1, southwest of Well Y-10)	600 and 650	Improve available fire flow in this area.
N14	Yigo Zone	Install 8-inch waterline along Aababang from Apacha to Road K (adjacent to Route 1, north of Wells Y-5 & Y-6)	300	Improve available fire flow in this area.
N15	Yigo Zone	Increase 6-inch waterline to 8 inches along Milalak from Marine Drive westward (not including branch lines).	1800	Improve available fire flow in this area.
N16	Yigo Zone	Increase section of 8-inch waterline to 12 inches along Highway 15 between 12-inch lines at Road B. Wendy and Gayinero Dr.	3600	Reduce max-day velocities that exceed six fps and improve fire flows
N17	Yigo Zone	Increase 6-inch waterline along Chaguian Machananao to 12 inches from Route 9 southward (including only main waterline).	5300	Improve available fire flow in this area.
N18	Yigo Zone	Install 6-inch waterline on Entrada to complete looping of 6-inch waterlines along Azud, Amarillo and Apaca Streets. Connect end of 6-inch waterline along Chalan Santa Bernadita to 12-inch line along Route 9.	500 and 400	Improve available fire flow in this area.
N19	Yigo Zone	Install 8-inch connection between ends of Quezon and Magsaysay. Near Well F-09.	500	Improve available fire flow in this area.
N20	Astumbo	Install 8-inch waterline on Chiote between Kamute and Chalan A'Abang.	200	Improve available fire flow in this area.
N21	Astumbo	Increase 6-inch waterline along Chalan Ibang to 12-inch line. Increase 6-inch waterline on S-13 to 8 inches. Increase 6-inch waterline on Chalan Pakpak from S-13 to Chalan Bongbong to 8 inches. Increase 6-inch waterline on Chalan Puegue Matchena from Chanlan Balako to Chanlan Pakpak to 8-inch line.	2400 400 850 2300	Improve available fire flow and pressure in this area.
N22	Kaiser	Install an 8-inch waterline along Lada from Adora to connect to the 14-inch line along Ukudo (north of Well D-18)	800	Improve available fire flow and pressure in this area.

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Table 9-11 – Northern System Water Distribution System 2005 Improvements (continued)

No.	Area	Description	Length, ft	Comment
N23	Kaiser	Connect 8-inch waterline to 24-inch line along Route 1/Marine Drive, northeast of the intersection with Route 16. (Below Well H-1)	200	Improve available fire flow and pressure in this area.
N24	Kaiser	Install 8-inch connection from Fatima to 6-inch waterline along Santa Monica.	800	Improve available fire flow and pressure in this area.
N25	Kaiser	Install 14-inch connection along Ukudo from south of Lada to 12-inch line on Santa Monica.	800	Improve available fire flow and pressure in this area.
N26	Kaiser	Connect 8-inch waterline at the end of D.G. Benavente to the 10-inch to the west with a new 8-inch to complete loop.	100	Improve available fire flow and pressure in this area.
N27	Tumon	Extend 6-inch waterline along Hospital to Pale San Vitores to complete loop.	300	Improve available fire flow in this area.
N28	Tumon	Install 8-inch waterline from end of Father San Vitores Street to end of Father Duenas Drive to complete loop along these streets and Gov. Skinner St., Gov. Bradley St. and Father Ramon St.	1500	Improve available fire flow and pressure in this area.
N29	Hyundai	Increase 6-inch waterline along Bello Road to 8 inches from Chalan Villagomez to Duenas (north of Hyundai Reservoir).	1200	Improve available fire flow and pressure in this area.
N30	Hyundai	Install 12-inch connection along Corenso to connect North Sabana Barrigada to South Sabana Barrigada (west of Hyundai Reservoir).	1500	Improve available fire flow and pressure in this area. Verify the existing pipe size and connection location.
N31	Mangilao/ Chaot	Install an 8-inch waterline from end of Inilado to the 6-inch on Jesus Mariano to complete loop. Install an 8-inch waterline from end of Jesus Mariano to the 6-inch on Alstom to complete loop (southwest of Mangilao Reservoir).	2700, 950	Improve available fire flow and pressure in this area.
N32	Mangilao/ Chaot	Install an 8-inch waterline from end of Lalo to the 6-inch on Costat to complete loop. Install an 8-inch waterline from end of Bilmar to the 12-inch on Route 10 to complete loop (north of Mangilao Reservoir).	450, 1600	Improve available fire flow and pressure in this area.
N33	Mangilao/ Chaot	Extend the 8-inch waterline from end of Guzman to the 6-inch on Route 8 to complete loop. Install an 8-inch waterline from end of Lizama to the 6-inch on the east to complete loop (north of Mangilao Reservoir).	400, 550	Improve available fire flow and pressure in this area.
N34	Mangilao/ Chaot	Increase 6-inch waterline along Campus to 8 inches (southwest of Mangilao Reservoir).	1200	Improve available fire flow and pressure in this area.

Table 9-11 – Northern System Water Distribution System 2005 Improvements (continued)

No.	Area	Description	Length, ft	Comment
N35	Mangilao/ Chaot	Install 8-inch waterline south along Dimas St. to Carlos Lane. Install 8-inch line south along Juan Muna St. to 8-inch along Corten Torres St. Install 8-inch line from First St. off of Iglesias St. to East Rojas St. to complete loop. Install 8-inch line from Rita P. Muna to Dong (Southwest of Mangilao Reservoir).	750, 300 and 100	Improve available fire flow and pressure in this area.
N36	Piti/Agana	Increase 4-inch waterline along Luna to 8 inches, from Gutierrez to Route 7.	1500	Improve available fire flow and pressure in this area.
N37	Piti/Agana	Install 12-inch connection along Chalan Obispo from Route 7A south to Pale Kieran Hickey Dr. and connect up 8-inch along Haiguas Dr.	800, 1100	Improve available fire flow and pressure in this area.
N38	Piti/Agana	Connect the 6-inch waterline from end of San Ramon to Route 7A with a new 8-inch.	50	Improve available fire flow and pressure in this area.
N39	Pulantat	Extend 8-inch line on Arterio A. Cruz to 16-inch line on Route 4 (south of Pago Bay booster).	300	Improve available fire flow in this area.
N40	Pulantat	Install 8-inch main along Pulantat Road from connection with 12-inch main at Chalan Teleforo intersection to 6-inch line at S-37 intersections to complete loop.	2600	Improve available fire flow in this area.
N41	Pulantat	Increase 6-inch waterline at the intersection between Pulantat and Tomas Quichocho to 12 inches.	100	Improve available fire flow and pressure in this area.
N42	Pulantat	Increase 6-inch waterline along As Aguero, As Taisipic and Munoz to eight inches.	3200	Improve available fire flow in this area.
N43	Pulantat	Connect the two parallel waterlines (12-inch & 16-inch) at the intersection of Route 4 and Sis. Mary Eucharita Dr. with a new 8-inch.	50	Improve available fire flow in this area.
Total Length			~69,700	
Project Justification		Improve fire flow and pressure in the respective areas.		
Project Budget		\$26,000,000 (Assume \$2,600,000 per year for 10 years.)		
Funding Source(s)		USEPA: FY 2008–2017 Bond Issuance:		
GWA Project Manager				
Contractor, if any		Design: Construction:		
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway				

Table 9-12 – Pressure Zone Realignment/Development 2005 Improvements

PROJECT SUMMARY					
Project Name		Pressure Zone Realignment/Development 2005 Improvements			
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points		38.1			
Project Description		The hydraulic modeling of the water system identified areas with inadequate service pressures and flows. Installations of PRV/PSV stations are required at strategic locations to facilitate the development of discrete pressure zones, and improve circulation of flow from a higher pressure zone to a lower pressure zone.			
No.	High Pressure Zone	Low Pressure Zone	Street	Waterline Diameter	Comment
1	Mataguac 740	Yigo 658	Install PRV along Chalan Sabana, west of the intersection with Chalan Kaskahu	6	Modeled as a proposed PRV
2	Yigo 658	Ysengsong 570	Install PRV along Route 1/Marine Drive, west of intersection with Wusstig (south of Well Y-10)	12	Modeled as a proposed PRV
3	Yigo 658	Ysengsong 570	Install PRV or closed valve along Route 3 south of Well F-11	12	Modeled as a proposed PRV
4	Yigo 658	Ysengsong 570	Install PRV or closed valve along Nanka south of Deep Well F-11	8	Modeled as a proposed PRV
5	Yigo 658	Ysengsong 570	Install PRV along Route 3 at intersection with Ysengsong	20	Modeled as an assumed check valve
6	Ysengsong 570	Kaiser 408	Install PRV along Lada, east of the intersection with Ukudo	8	Modeled as a proposed PRV
7	Ysengsong 570	Kaiser 408	Install PRV along Santa Monica, north of the intersection with Chalan Henry Kaiser	12	Modeled as a proposed PRV
8	Ysengsong 570	Kaiser 408	Install PRV or closed valve along Route 26/Y-Sengsong, north of the intersection with Route 1/ Marine Drive. (East of Well D-14)	12	Modeled as a proposed PRV
9	Barrigada 481	Kaiser 408	Install PRV or closed valve along Route 26, near intersection with Chalan Villagomez St.,	16	Modeled as a proposed PRV
10	Barrigada 481	Kaiser 408	Install PRV or closed valve along Lemon China near intersection with Chalan Villagomez St.,	12	Modeled as a proposed PRV

Table 9-12 – Pressure Zone Realignment/Development 2005 Improvements (continued)

No.	High Pressure Zone	Low Pressure Zone	Street	Waterline Diameter	Comment
11	Barrigada 481	Mangilao/ Chaot 381	Install PRV along Route 16, southwest of intersection with Sabana Barrigada and east of Well NAS-1.	16	Modeled as a proposed PRV
12	Kaiser 408	Piti/Tumon 236	Install PRV or closed valve along Pale San Vitores near intersection with Route 1/Marine Drive (north of Nissan Tank).	12	Modeled as a proposed PRV
13	Kaiser 408	Piti/Tumon 236	Install PRV along Route 1/Marine Drive near intersection with Adrian Sanchez Street	24	Modeled as a proposed PRV
14	Kaiser 408	Piti/Tumon 236	Install PRV along Adrian Sanchez St. near intersection with Route 1/Marine Drive.	14	Modeled as a proposed PRV
15	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV or closed valve along Route 8, west of the intersection with Biang.	8	Modeled as a proposed PRV
16	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV or closed valve along Chalan R.S. Sanchez, north of the intersection with Manibusan.	8	Modeled as a proposed PRV
17	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV or closed valve along Route 33, north of the intersection with Canada Toto Loop.	8	Modeled as a proposed PRV
18	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV or closed valve along Canada Toto Loop, north of the intersection with Chapel.	8	Modeled as a proposed PRV
19	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV or closed valve along Route 6, north of the intersection with Candelaria Road	6	Modeled as a proposed PRV
20	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV along Route 7, just west of intersection with Frank Javier	10	Modeled as a proposed PRV
21	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV along Frank Javier just southeast of Agana Heights Reservoir	10	Modeled as a proposed PRV
22	Mangilao/ Chaot 381	Piti/Tumon 236	Install PRV along Route 4 just north of Well A-23	12	Modeled as an assumed check valve
23	Manengon 434	Pulantat 420	Install PRV along Chalan Teleforo, southwest of Pulantat Reservoir	8	Modeled as an assumed check valve
24	Malojloj 410	Inarajan 297	Install PRV north of intersection of Route 4 and Tinaga	8	Modeled as a proposed PRV
25	Malojloj 410	Inarajan 297	Install PRV at intersection of Route 4 and Tun Enemyco & Regina	8	Modeled as a proposed PRV

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Table 9-12 – Pressure Zone Realignment/Development 2005 Improvements (continued)

No.	High Pressure Zone	Low Pressure Zone	Street	Waterline Diameter	Comment
26	Malojloj 410	Pigua 334	Install PRV at intersection of Route 4 and Espinosa Ave. along Route 4, west of both waterlines on Espinosa Ave.	8	Modeled as an assumed check valve
Project Justification		Pressure zone changes needed to improve flow circulation and discrete pressure zones.			
Project Budget		\$8,100,000 (Assume \$2,700,000 per year for 3 years.)			
Funding Source(s)		USEPA: FY 2006 Bond Issuance:			
GWA Project Manager					
Contractor, if any		Design: Construction:			
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:			
Administrative Activities Underway					

Table 9-13 – Water Booster Pump Station 2005 Improvements

PROJECT SUMMARY					
Project Name		Water Booster Pump Station 2005 Improvements			
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy		<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1			
Project Description		The 2005 hydraulic model for GWA's three water systems identified deficiencies in water booster pumping capacity to provide adequate supply to areas in two systems. The projects listed below are intended to address these limitations.			
No.	System	Area	Description	Pump Requirements	Comment
B1	South	Agat	Provide BPS along Route 2 to boost pressure from Agat/Umatac Reservoir to Agat Elevated Tank	250 gpm at 125-foot TDH	Capacity of Lasafua Reservoir is inadequate to supply its service area.
B2	Central	Talofofa	Provide BPS along Route 4A to boost pressure from Windward Hills #2 Reservoir to Talofofa.	400 gpm at 100-foot TDH	New 12-inch transmission line required as well.
Project Justification		Provide additional booster capacity to ensure adequate supply to affected areas.			
Project Budget		\$1,200,000 (Assume \$700,000 in one year and \$500,000 in another.)			
Funding Source(s)		USEPA: FY 2008 Bond Issuance:			
GWA Project Manager					
Contractor, if any		Design: Construction:			
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:			
Administrative Activities Underway					

Table 9-14 – Water System Reservoirs 2005 Improvements

PROJECT SUMMARY					
Project Name		Water System Reservoirs 2005 Improvements			
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy		<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1			
Project Description		The 2005 hydraulic model for GWA's three water systems identified deficiencies in reservoir capacity. The projects listed below are intended to address these deficiencies.			
No.	System	Area	Description	Pump Requirements	Comment
R1	South	Agat	Provide 0.1 MG elevated tank to replace existing Lasafua Reservoir.	Overflow elevation should be set at 500 feet.	Capacity of Lasafua Reservoir is inadequate to supply its service area.
R2	Central	Talofofo	Provide 0.1 MG elevated tank.	Overflow elevation should be set at 510 feet.	Tank elevation needs to be set high enough to service homes in the 300 to 382-foot elevation.
R3	Northern	Mataguac	Provide 0.1 MG elevated tank downstream from the Mataguac BPS.	Overflow elevation should be set at 728 feet.	BPS currently discharges directly into the distribution system.
R4	Northern	Barrigada	Provide additional 2.0 MG storage near to Barrigada #3.	Overflow elevation to be set at 481 feet to match Barrigada #3.	Evaluate cost effectiveness of using only a partially full Barrigada #2 (due to overflow elevation at 497.8 feet) compared to constructing a new tank.
Project Justification		To provide adequate capacity and pressure for fire and customer supply.			
Project Budget		2008 \$2,600,000 2011 \$8,700,000 2009 \$2,600,000 2010 \$2,600,000			
Funding Source(s)		USEPA: FY 2008–2011 Bond Issuance:			
GWA Project Manager					
Contractor, if any		Design: Construction:			
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:			
Administrative Activities Underway					

Table 9-15 – Northern System Raw Water Transmission Lines

PROJECT SUMMARY			
Project Name	Northern System Raw Water Transmission Lines		
Project Type	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points	38.1		
Project Description	<p>GWA currently operates a combined transmission/distribution system, which requires treatment (chlorination) at most of the individual wells. To provide more reliable and fewer points of treatment, transmission lines separate from distribution are needed. The projects below are intended to address this need. This need will be even more pressing if the Northern System is declared groundwater under the direct influence of surface water (GWUDI), and filtration avoidance criteria cannot be met.</p> <p>The transmission lines will contain well water to a reservoir(s) where chlorination facilities will be located. If filtration is required, membrane filters can be located at the respective reservoirs.</p>		
No.	Description	Well Series	Comment
1	Zone 236 Transmission Line: serving the Agana Heights Reservoir along Route 4 and Route 7. (Figure 8-4) Approx. 7,400'	A-23, A-25, A-31, and A-32.	This transmission line is part of the Sinajana Transmission Line project that has been designed and is being prepared for bid.
2	Zone 381 Transmission Line: serving the Chaot Reservoir along Route 4 and Dero Dr. (Figure 8-4) Approx. 16,450'	A-01, A-03, A-05, A-06, A-12, A-29, and A-30.	This transmission line is part of the Sinajana Transmission Line project that has been designed and is being prepared for bid. Although not included at this time, Wells A-29 and A-30 should be connected to this transmission line in the future. The two wells are assumed to be connected for the "lengths" identified to the left. Also, the designed pipe diameters need to be revised to those recommended herein, since future demands and CIP improvements will require more conveyance capacity.
3	Zone 408 Transmission Line: serving the Kaiser Reservoir along Santa Monica Ave., Route 1, and Route 28. (Figure 8-3) Approx. 47,200'	D-01 thru D-07, D-09 thru D-11, D-14 thru D-18, EX-05, GHURA-501, H-01, M-12, M-14, M-18, and Y-12	Wells D-7, D-4, and D-17, have a history of fecal coliform hits, though only D-4 showed their presence from 2003 through 2005. This is the second highest concentration of wells with fecal coliform hits, following the A-series. Also, Wells H-01, M-14, and M-18 are a considerable distance from the Kaiser Reservoir and should be evaluated in the future for their feasibility as part of this transmission main.
4	Zone 570 Transmission Line: serving the Ysengsong Reservoirs along Route 3, Swamp Rd., Route 28, and Chalan Isang. (Figure 8-3) Approx. 51,500'	D-08, D-12, D-13, D-19 thru D-22, D-24 thru D-28, F-05, F-06, F-09, F-12, F-13, F-15 thru F-20	D-13, D-19, D-21, D-22, and F-13 have a history of fecal coliform hits.

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Table 9-15 – Northern System Raw Water Transmission Lines (continued)

No.	Description	Well Series	Comment
5	Zone 658 Transmission Line: serving the Yigo Reservoirs along Route 3, Route 9, and Route 1. (Figure 8-3) Approx. 108,400'	AG-01, AG-02A, F-01 thru F-04, F-07, F-08, F-10, F-11, HGC-2, Y-01 thru Y-07, Y-09, Y-10, Y-14, and Y-16 thru Y-23	F-02 and F-10 have a history of fecal coliform hits. The Yigo Pressure Zone is the largest zone that will require the highest amount of pipeline capital improvement expenditure.
6	Zone 381 Transmission Line: serving the Mangilao Reservoirs along Route 15, Route 10, and Chapel Rd. (Figure 8-4) Approx. 51,550'	A-02, A-04, A-07, A-08, A-09, A-10, A-13, A-14, A-15, A-17, A-18, A-19, A-21, A-26, and A-28	Although Wells A-15, A-19, and A-26 are included in this transmission line, they are located a considerable distance from the Mangilao Reservoirs. They should be evaluated in the future for their feasibility as part of this transmission line.
7	Zone 481 Transmission Line: serving the Barrigada Reservoirs along Route 26, S-3, and Lemon China Rd. (Figure 8-4) Approx. 28,800'	EX-11, M-01 thru M-09, M-15, M-21, and M-23	M-21 is located a considerable distance from the Barrigada Reservoirs. It should be evaluated in the future for its feasibility as part of this transmission line.
8	Zone 670 Transmission Line: serving the Hyundai Reservoir along Juan C. Fejeran Rd. (Figure 8-4) Approx. 5,600'	M-17A, M-20A, and M-17B	--
9	Zone 724 Transmission Line: serving the Santa Rosa Reservoir along Route 15. (Figure 8-3) Approx. 6,000'	Y-15	--
Project Justification		To provide a means of separating transmission and distribution for effective treatment prior to disinfection.	
Project Budget		#1 & #2	2007 & 2008 \$8,800,000 (total)
		#3	2010 \$18,000,000
		#4	2012 \$19,000,000
		#5	2013 & 2014 \$40,000,000 (total)
		#6	2016 \$19,000,000
		#7	2018 \$15,000,000
		#8 & #9	2020 \$4,000,000 (total)
		Total:	~ \$124,000,000
		USEPA: FY 2005–2020 Bond Issuance:	
GWA Project Manager			
Contractor, if any		Design: Construction:	
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:	
Administrative Activities Underway			

Table 9-16 – Water System Supply Wells 2025 Improvements

PROJECT SUMMARY				
Project Name		Water System Supply Wells 2025 Improvements		
Project Type		<input type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input checked="" type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		13.8		
Project Description		The 2025 hydraulic model for GWA's three water systems identified deficiencies in groundwater supply wells. The projects listed below are intended to address these deficiencies.		
No.	System	Area	Description	Comment
1	North	Yigo	Provide new groundwater wells totaling 1900 gpm. Install 290 gpm on the west portion along Route 3. Install 1200 gpm on the north portion along Route 9. Install 410 gpm on the east portion along Route 1.	New supply is necessary to prevent the storage reservoirs from draining during max day demand.
2	North	Astumbo	Provide new groundwater wells totaling 1800 gpm. Install 600 gpm on the north portion along Chalan Lumasu. Install 1200 gpm near the existing Astumbo Reservoirs along Ysengsong Rd.	New supply is necessary to prevent the storage reservoirs from draining during max day demand
3	North	Chaot	Provide new groundwater wells totaling 1050 gpm along Route 4.	New supply is necessary to prevent the storage reservoirs from draining during max day demand
Project Justification		To provide adequate supply to meet increased water demand by 2025.		
Project Budget		2024 \$5,000,000		
Funding Source(s)		USEPA: FY 2025 Bond Issuance:		
GWA Project Manager				
Contractor, if any		Design: Construction:		
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway				

Table 9-17 – Southern System Water Distribution System 2025 Improvements

PROJECT SUMMARY				
Project Name		Southern Water Distribution System 2025 CIP Fire Protection Improvements		
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1		
Project Description		The 2025 hydraulic model for GWA's Southern Water System has identified deficiencies in water pipe sizes required to provide adequate fire flow. The series of projects listed below identify the location, pipe diameter, and length to address this issue.		
No.	Area	Description	Length, ft	Comment
1	Malojloj	Increase Malojloj Reservoir 12-inch inlet/outlet pipe to 24-inch and continue down Route 4 to Malojloj Well St.	3250	Improve available fire flow in this area
2	Malojloj	Increase 12-inch waterline along Route 4 from Malojloj Well St. to Tinaga St. to 16-inch	7450	Improve available fire flow in this area and further south
3	Malojloj	Increase 8-inch waterline along Route 4 from Tinaga St. to Tun Enemyco & Regina St. to 12-inch	17,000	Improve available fire flow in this area and further south
Total Length			27,700	
Project Justification		Improve fire flow and pressure in the respective areas.		
Project Budget		2024 – \$4,000,000 2026 – \$6,000,000 Total: \$10,000,000		
Funding Source(s)		USEPA: FY 2020-2025 Bond Issuance:		
GWA Project Manager				
Contractor, if any		Design: Construction:		
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway				

Table 9-18 – Northern System Water Distribution System 2025 Improvements

PROJECT SUMMARY				
Project Name		Northern System Water Distribution System 2025 Improvements		
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1		
Project Description		The 2025 hydraulic model for GWA's Northern Water System identified deficiencies in pumping capacity and pipe size to provide adequate fire flow and pressure, and reduce high velocities and friction losses. The series of projects listed below identify the location, pipe diameter, and length to address these issues.		
No.	Area	Description	Length, ft	Comment
1	Mangilao/Chaot	Increase Chaot Reservoir 12-inch inlet/outlet pipe to 24-inch down Dero Rd. to Route 4, then north up Route 4 to Chalan Canton Tutujan, and west to Senator Gibson Ct.	13,500	Reduce velocity and improve pressure in this area.
2	Kaiser	Install 24-inch distribution transmission main from Kaiser Reservoir and west along Route 1 to Chalan Liguán.	7480	Increase conveyance capacity and Improve pressure in this area
3	Kaiser	Install 16-inch transmission line from Kaiser Reservoir to Barrigada Reservoirs via Route 1 and Route 26 as part of a booster line to fill proposed Yigo CIP Reservoir.	8900	Supply for proposed Yigo Reservoir on Route 15.
4	Barrigada	Install 12-inch transmission line from Barrigada Reservoirs to Route 26 as part of a booster line to fill proposed Yigo CIP Reservoir.	1100	Supply for proposed Yigo Reservoir on Route 15.
5	Barrigada	Install 16-inch transmission line from Chalan Villagomez, southward on Route 26, and northeast on Route 15 as part of a booster line to fill proposed Yigo CIP Reservoir.	20,600	Supply for proposed Yigo Reservoir on Route 15.
6	Yigo Zone	Increase existing 12-inch distribution main to 16-inch on Route 15, northward from Route 26 to the proposed Yigo CIP Reservoir.	12,600	Increase conveyance capacity and improve pressure in the Adacao Rd. area
7	Yigo Zone	Install 24-inch outlet pipe for proposed Yigo CIP Reservoir and connect to distribution main on Route 15	700	Increase supply and conveyance capacity and improve pressure in Adacao Rd. area
8	Yigo Zone	Increase existing 8-inch distribution main to 12-inch on Adacao Rd. and Route 26	4800	Increase conveyance capacity and improve pressure in the Adacao Rd. area

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Table 9-18 – Northern Water Distribution System 2025 Improvements (continued)

No.	Area	Description	Length, ft	Comment
9	Yigo Zone	Increase existing 2-inch distribution main to 8 inches, joining Wusstig Rd. and Chalan Islas Marianas	3400	Improve loop capacity to increase pressure and lower velocity in this area
10	Yigo Zone	Install parallel 16-inch distribution main on Wusstig Rd., from Route 1 to proposed Yigo CIP Reservoir.	10,600	Increase supply and improve pressure in this area
11	Yigo Zone	Install 12-inch distribution main that connects existing parallel mains on Route 1 at Chalan La Chanch	100	Improve loop capacity and conveyance in this area
12	Yigo Zone	Install 16-inch parallel main from Yigo Reservoirs, along Route 1, and west through Route 9 to Chalan Santa Bernadita	12,500	Part of the proposed pressure zone boundary adjustment that transfers some of the existing area served by the 658 pressure zone into the higher 724 pressure zone.
13	Yigo Zone	Install 16-inch outlet pipe from proposed Yigo CIP Reservoir to proposed 2005 CIP main on road S-11.	1600	Part of the proposed pressure zone boundary adjustment that transfers some of the existing area served by the 570 pressure zone into the higher 658 pressure zone.
14	Astumbo	Increase inlet/outlet pipe for existing Astumbo Reservoirs to 24-inch.	6100	Increase conveyance capacity, reduce velocity, and improve pressures in this area.
15	Astumbo	Install 24-inch outlet pipe for proposed Astumbo CIP Reservoir, westward from Chalan Koda to Chalan Ibang	6400	Increase supply in this area.
16	Astumbo	Increase existing 12-inch distribution main on Ysengsong Rd. to 24 inches, northward from Chalan Lahe to Chalan Koda	7200	Increase conveyance capacity and improve pressure in this area.
17	Astumbo	Increase existing 12-inch distribution main on Ysengsong Rd. to 24 inches, from Chalan Ibang to Chalan Hachon	2050	Increase conveyance capacity and improve pressure in this area.
18	Astumbo	Increase existing 12-inch distribution main on Ysengsong Rd. to 16 inches, from Chalan Hachon to Route 3.	2900	Increase conveyance capacity and improve pressure in this area.
19	Astumbo	Increase existing distribution mains to 10 inches for area bordered by Ysengsong Rd. to the north, Kamute and Chalan A'Abang to the south, Chalan Hachon to the east, and Chalan Fago and Nika to the west	31,000	Increase conveyance capacity and improve pressure in this area.
Total Length			~ 154,000	

Table 9-18 – Northern Water Distribution System 2025 Improvements (continued)

Project Justification	Improve fire flow and pressure in the respective areas.
Project Budget	\$57,000,000 (Assume \$5,700,000 per year for 10 years.)
Funding Source(s)	USEPA: FY 2015–2025 Bond Issuance:
GWA Project Manager	
Contractor, if any	Design: Construction:
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:
Administrative Activities Underway	

Table 9-19 – Water Booster Pump Station 2025 Improvements

PROJECT SUMMARY					
Project Name		Water Booster Pump Station 2025 Improvements			
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy		<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1			
Project Description		The 2025 hydraulic model for GWA's three water systems identified deficiencies in water booster pumping capacity to provide adequate supply to areas of the respective system. The projects listed below are intended to address these limitations.			
No.	System	Area	Description	Pump Requirements	Comment
1	North	Kaiser	Provide BPS at Kaiser Reservoir to boost water to proposed Yigo CIP Reservoir on Route 15	1800 gpm at 330-foot TDH	Yigo transmission mains are inadequate to fill proposed CIP reservoir, and Kaiser Reservoir has sufficient capacity.
2	North	Barrigada	Provide BPS at Barrigada Reservoirs to boost water to proposed Yigo CIP Reservoir on Route 15	1800 gpm at 300-foot TDH	Yigo transmission mains are inadequate to fill proposed CIP reservoir, and Barrigada Reservoirs have sufficient capacity.
Project Justification		Provide additional booster capacity to ensure adequate supply to affected areas.			
Project Budget		\$1,600,000			
Funding Source(s)		USEPA: FY 2025 Bond Issuance:			
GWA Project Manager					
Contractor, if any		Design: Construction:			
Project Schedule		Design Start: Design Completion: Construction Start: Construction Completion:			
Administrative Activities Underway					

Table 9-20 – Water System Reservoirs 2025 Improvements

PROJECT SUMMARY					
Project Name		Water System Reservoirs 2025 Improvements			
Project Type		<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy		<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Pairwise Points		38.1			
Project Description		The 2025 hydraulic model for GWA's three water systems identified deficiencies in reservoir capacity. The projects listed below are intended to address these deficiencies.			
No.	System	Area	Description	Tank Requirements	Comment
1	Northern	Yigo	Provide 0.2 MG elevated tank near Flores Cadena and Chalan Koda.	Overflow elevation should be set at 658 feet.	Existing Yigo Reservoirs are too far from this area to provide sufficient pressure or supply.
2	Northern	Yigo	Provide 0.3 MG elevated tank up Wusstig Rd. near Chalan Sabana Pale.	Overflow elevation should be set at 658 feet.	Existing Yigo Reservoirs are too far from this area to provide sufficient pressure or supply.
3	Northern	Yigo	Provide 0.2 MG elevated tank along Route 15 northeast of Route 26.	Overflow elevation should be set at 658 feet.	Existing Yigo Reservoirs are too far from this area to provide sufficient pressure or supply.
4	Northern	Astumbo	Provide additional 2.0 MG storage near Flores Cadena and Chalan Koda.	Overflow elevation to be set at 570 feet.	Existing Astumbo Reservoirs do not have sufficient capacity, especially after incorporating the 2005 recommended pressure zone boundary changes to serve former Kaiser area.
5	Northern	Chaot	Provide additional 2.0 MG storage at existing Chaot Reservoir site.	Overflow elevation to be set at 381 feet.	Existing Chaot Reservoir lacks sufficient capacity, and existing Mangilao Reservoirs are too far to provide adequate supply and pressure in this area.

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Table 9-20 – Water System Reservoirs 2025 Improvements (continued)

Project Justification	To provide adequate capacity and pressure for fire and customer supply.												
Project Budget	<table> <tr> <td>2018</td> <td>\$3,000,000</td> <td>2021</td> <td>\$8,700,000</td> </tr> <tr> <td>2019</td> <td>\$4,300,000</td> <td>2022</td> <td>\$8,700,000</td> </tr> <tr> <td>2020</td> <td>\$3,000,000</td> <td></td> <td></td> </tr> </table>	2018	\$3,000,000	2021	\$8,700,000	2019	\$4,300,000	2022	\$8,700,000	2020	\$3,000,000		
2018	\$3,000,000	2021	\$8,700,000										
2019	\$4,300,000	2022	\$8,700,000										
2020	\$3,000,000												
Funding Source(s)	USEPA: FY 2016–2020 Bond Issuance:												
GWA Project Manager													
Contractor, if any	Design: Construction:												
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:												
Administrative Activities Underway													

Table 9-21 – Northern System GWUDI Filtration Compliance

PROJECT SUMMARY			
Project Name	Northern System GWUDI Filtration Compliance		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input type="checkbox"/> Life and Safety <input checked="" type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input type="checkbox"/> Life and Safety <input checked="" type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input type="checkbox"/> Life and Safety <input checked="" type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	17		
Project Description	This project would provide membrane filtration for all Northern Lens groundwater assuming all aquifers have been designated GWUDI of surface water. Note the assumption that all groundwater will be designated is a worst case scenario.		
Project Justification	Assume membrane filtration is needed to comply with Surface Water Treatment Rule regulations.		
Project Budget	\$145,000,000 (Assumed to be \$14,500,000 per year for 10 years beginning in 2013.)		
Funding Source(s)	USEPA: FY 2006 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-22 – Electrical Upgrade –Water Booster Stations (Pago Bay, etc.)

PROJECT SUMMARY			
Project Name	Electrical Upgrade – Water Booster Pump Stations (Pago Bay, Brigade, Windward Hills)		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	38.1		
Project Description	This project is for the electrical upgrade at the Pago Bay, Brigade, and Windward Hills Water Booster Stations by replacing the existing motors with premium efficiency motors, improve the system grounding, install transient voltage surge suppression equipment (TVSS), replace the motor control center, replace instrumentation controls, and add power factor correction. This project includes a detailed engineering assessment and preparation of design engineering plans.		
Project Justification	The original distribution board and motor controls have reached their useful life, have signs of corrosion, and are missing parts. Improvements in motor efficiency and control devices reduce energy consumption costs. The voltage and transient surge suppressions reduce voltage surges within the facility while power factor correction help improve voltage stability.		
Project Budget	\$650,000		
Funding Source(s)	USEPA: FY 2007 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-23 – Electrical Upgrade –Water Booster Stations (Gayinero, etc.)

PROJECT SUMMARY			
Project Name	Electrical Upgrade –Water Booster Pump Stations (Gayinero, Santa Rosa, Santa Rita Springs and Truman)		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	38.1		
Project Description	This project is for the electrical upgrade at the Water Booster Stations by replacing the existing motors with premium efficiency motors, improve the system grounding, installation of transient voltage surge suppression equipment (TVSS), replace the motor control center and main distribution board, replace the instrumentation controls, and add power factor correction, where applicable. Included is a detailed engineering assessment and preparation of design engineering plans and specifications.		
Project Justification	The original distribution board and motor controls reach their useful life, have signs of corrosion, and missing parts. Improvements in motor efficiency reduce energy costs. The application of transient surge suppressions and power factor capacitors reduce voltage surges and improve stability.		
Project Budget	\$350,000		
Funding Source(s)	USEPA: FY 2008 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-24 – Electrical Upgrade –Water Booster Stations (Other WBPS)

PROJECT SUMMARY			
Project Name	Electrical Upgrade – Other Water Booster Pump Stations		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	38.1		
Project Description	This project is for the electrical upgrade at the other Water Booster Stations such as Yigo Elevated Tank, Pale Kieran, etc. Project scope includes: replacing the existing motors with premium efficiency motors, improve system grounding, install transient voltage surge suppression equipment (TVSS), replace the motor control center and main distribution board, replace instrumentation controls, and add power factor correction, where applicable.		
Project Justification	Several stations have their original distribution board and motor controls reach their useful life, have signs of corrosion, and missing parts. Improvements in motor efficiency reduce energy costs. The voltage and transient surge suppressions and power factor correction also reduce voltage surges and improve voltage stability.		
Project Budget	\$250,000		
Funding Source(s)	USEPA: FY 2009 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

Table 9-25 – Electrical Upgrade - Water Wells

PROJECT SUMMARY			
Project Name	Electrical Upgrade - Water Wells		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; border: none;"> <input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input checked="" type="checkbox"/> Life and Safety <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
Pairwise Points	38.1		
Project Description	<p>This project is to upgrade the electrical system at each of the water wells as recommended in the Electrical Assessment of the GWA WRMP Report. The initial step is to develop a standard electrical checklist and guideline. Next is to conduct an assessment of the electrical system at each station with the goal to change the transformer secondary connection and surge suppression, replace the service conductors, correct the voltage unbalance, prevent water conductor entry, replace the meter socket, install transient voltage surge suppression, install electronic motor protection, install electronic motor starter, install power factor correction equipment, integrate voltage unbalance relays in the auto transfer switch control system, interlock the chlorination controls with the well controls, interlock with well flush controls, and documentation.</p>		
Project Justification	<p>This project is to improve the electrical reliability at each of the water pumping stations by implementing the recommendations of the GWA WRMP. Those priority stations that are critical to operations and high maintenance are to be completed first.</p>		
Project Budget	\$2,000,000		
Funding Source(s)	USEPA: FY 2007 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			