

CHAPTER 10 – RECOMMENDED WATER SYSTEMS CIP

10.1 Introduction

Volume 1, Chapter 15 – CIP Program of the Water Resource Master Plan (WRMP) describes issues associated with Capital Improvement Projects (CIP) for GWA. Projects for the Water Treatment and Distributions Systems were identified based on facility visits, condition assessments, and hydraulic modeling and are presented in this chapter.

Some issues such as electrical power quality, corrosion, and technology (e.g., Supervisory Control and Data Acquisition) cross over water and wastewater services and are discussed in their respective chapters in Volume 1 of the WRMP.

Table 10-1 summarizes the proposed CIP program for the water system through 2025. Several projects are presented as recurring annually through 2025. 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 10-1 are the forms 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 projects have not been prioritized at this time.

Table 10-1 – Water Systems CIP

Project	Budget Year ^{1,2}							
	2007	2008	2009	2010	2011	2015	2020	2025
Water System								
Water Reservoir Internal/External Corrosion Assessment Program	\$125,000							
Water Reservoir Internal/External Corrosion Rehabilitation Program		\$500,000	\$500,000	\$500,000	\$500,000			
Ugum Water Treatment Plant Membrane Filtration		\$4,500,000						
Ugum Water Treatment Plant Reservoir Replacement			\$8,700,000					
Ugum Water Treatment Plant Raw Intake	\$550,000							
Water Distribution System Pipe Replacement ³		\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000	\$740,000
Mechanical/Electrical Equipment Replacement ³		\$925,000	\$925,000	\$925,000	\$925,000	\$925,000	\$925,000	\$925,000
Southern System Water Distribution System Improvements ⁴		\$900,000	\$900,000	\$900,000	\$900,000	\$900,000		
Central System Water Distribution System Improvements ⁴		\$600,000	\$600,000	\$600,000	\$600,000	\$600,000		
Northern System Water Distribution System Improvements ⁴		\$2,750,000	\$2,750,000	\$2,750,000	\$2,750,000	\$2,750,000		
Water Booster Pumping Station Improvements		\$700,000	\$500,000					
Water System Reservoirs		\$2,550,000	\$2,000,000	\$2,550,000	\$8,700,000	\$8,700,000		
Northern System Raw Water Transmission Lines ^{5,6}	\$4,500,000	\$6,300,000	\$15,700,000	\$7,000,000	\$11,500,000	\$11,000,000		
Electrical Upgrade - Water Wells	\$2,000,000							
Electrical Upgrade - Water Booster Stations (Pago Bay, etc)	\$650,000							
Electrical Upgrade - Water Booster Stations (Gayinero, etc)		\$350,000						
Electrical Upgrade - Other Water Booster Stations	\$250,000							
Annual Total	\$8,075,000	\$20,815,000	\$33,315,000	\$15,965,000	\$26,615,000	\$25,615,000	\$1,665,000	\$1,665,000

NOTES:

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

² Cost are 2007 Dollars

³ Costs are per year for the entire planning period

⁴ Costs are per year for the first 10 years of the planning period. Total = \$9.0 million for the Southern System; \$6.0 million for the Central System; and \$27.5 million for the Northern System

⁵ Costs do not include filtration to comply with GWUDI

⁶ Costs for Planning Year 2015 might be accelerated based on GWUDI designation

⁷ Cost does not include recurring CIP projects beyond 2011

CIP TOTAL ⁷ \$133,730,000

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Table 10-2 – Water Reservoir Internal/External Corrosion Assessment Program – 2007

PROJECT SUMMARY			
Project Name	Water Reservoir Internal/External Corrosion Assessment Program		
Project Type	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<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 _____
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Project Description (Attach Descriptive Figure as appropriate)	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 10-3 – Water Reservoir Internal/External Corrosion Rehabilitation Program – 2008-2011

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 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 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 _____
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Project Description (Attach Descriptive Figure as appropriate)	Based on the results of the corrosion assessment program for all steel water reservoirs program the rehabilitation of designated reservoirs over a 4 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 through FY 2011		
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 10-4 – 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"/> 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"/> 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"/> 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 _____		
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	\$4,500,000		
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	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 10-5 – Ugum Water Treatment Plant Reservoir Replacement

PROJECT SUMMARY			
Project Name	Ugum Water Treatment Plant Reservoir Replacement		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input checked="" 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"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input checked="" type="checkbox"/> System Redundancy	<input checked="" type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
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Project Description	<p>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 Public 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.</p>		
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 2006 Bond Issuance:		
GWA Project Manager			
Contractor, if any	Design: Construction:		
Project Schedule	Design Start: Design Completion: Construction Start: Construction Completion:		
Administrative Activities Underway			

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Table 10-6 – Ugum Water Treatment Plant Raw Water Storage

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; vertical-align: top;"> <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 checked="" type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input checked="" type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____
<input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input checked="" type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____		
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 System.		
Project Budget	\$550,000		
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 10-7 –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;"> <input 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 checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
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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.</p> <p>The basis for this reserve is 2,000 feet of pipe replaced per year.</p>		
Project Justification	Specific replacement areas are not identified at this time, but an allocation of resources is be reserved in the CIP for accounting purposes and to ensure funds are available.		
Project Budget	\$740,000 per year		
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			

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Table 10-8 – 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 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 checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____ </td> </tr> </table>	<input type="checkbox"/> Regulatory Compliance <input type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy	<input type="checkbox"/> System Capacity <input checked="" type="checkbox"/> OM&R <input type="checkbox"/> Other _____
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Project Description	Reserve for routine mechanical/electrical equipment replacement due to age, capacity, or failure. This reserve includes well pumps, booster pumps, valves, and emergency generators, and other items associated with the Northern, Central, and Southern Water Systems.		
Project Justification			
Project Budget	\$925,000 per year		
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 10-9 – Southern System Water Distribution System Improvements

PROJECT SUMMARY				
Project Name		Southern System Water Distribution System Improvements		
Project Type		<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 _____	
Project Description		The 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	Comment
1	Malojloj	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
2	Malojloj	Increase 6-inch waterline to 8 inches along Route 4 from end of existing 8-inch near Chotda St. to Malojloj Well St.	1200	Improve available fire flow in this area and further south
3	Inarajan	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 Abmam Dr. and connected back to the 12-inch main on Route 4.
4	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
5	Umatac	Increase 6-inch waterline to 8 inches from Route 4 south of Mata Ave towards the northeast to Chalan Joseph A. Cruz St.	700	Improve available fire flow in this area
6	Umatac	Increase 6-inch waterline to 8 inches (or larger) 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
7	Umatac	Increase 6-inch and 4-inch waterlines to 8 inches (or larger) along Route 4 and Route 2, from Jesus A. Quidachay St to Lasafua 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

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Vol 2 Chapter 10
Recommended Water Systems CIP

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

Project Justification	Improve fire flow and pressure in the respective areas.
Project Budget	\$9,000,000
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	

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Table 10-10 – Central System Water Distribution System Improvements

PROJECT SUMMARY				
Project Name	Central System Water Distribution System Improvements			
Project Type	<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 _____		
Project Description	<p>The hydraulic model for GWA's Central Water System identified deficiencies in pumping capacity and pipe size to provide adequate fire flow and pressure. The series of projects listed below identify the location, pipe diameter, length, and pumping needs to address these issues.</p>			
No.	Area	Description	Length	Comment
1	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
2	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 can be placed in this area with a ground elevation of about 382 feet.
3	Talofofo	Extend 12-inch line from intersection of Route 4A and San Miguel St. eastward along Jose P. Cruz St. to Chalan Kenton Laders	1600	Approximate length of 12-inch line could also be extended to proposed elevated storage tank that will improve both fire flows and pressures in the area
4	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 6 fps and improve fire flows
5	Agat	Connect dead-end 6-inch line along Route 2 above Agat #1 Reservoir to parallel 16-inch main or replace 6-inch line with a 8-inch (or larger) waterline as needed	2800	Improve substandard fire flow and pressure in this area

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Vol 2 Chapter 10
Recommended Water Systems CIP

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

Project Justification	Improve fire flow and pressure in the respective areas.
Project Budget	\$6,000,000
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	

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Table 10-11 – Northern System Water Distribution System Improvements

PROJECT SUMMARY				
Project Name		Northern System Water Distribution System Improvements		
Project Type		<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 _____	
Project Description		<p>The hydraulic model for GWA's Northern Water System identified deficiencies in pumping capacity and pipe size to provide adequate fire flow and pressure. The series of projects listed below identify the location, pipe diameter, and length to address these issues.</p>		
No.	Area	Description	Length	Comment
1	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
2	Santa Rosa*	Increase 6-inch waterline to 8 inches (or larger) to the east of Santa Rosa Reservoir (not including branched 6 inch lines).	3000	Improve available fire flow and pressure in this area
3	Santa Rosa	Increase 6-inch waterline on Tun Luis Tugong and Rosa to 8 inches (or larger).	2300	Improve available fire flow in this area
4	Yigo Elevated*	Extend 8-inch waterline along Chalan Arendo to Chalan Emsley.	4900	Improve available fire flow and pressure in this area
5	Mataguac Zone*	Increase 6-inch waterline to 8 inches along Chalan Maanao from Route 1 (Marine Drive) to Mataguac BPS to Chalan Aniles.	2300	Improve available fire flow, pressure and velocity in this area.
6	Mataguac Zone*	Increase 6-inch waterline to 8 inches along Evangelista from Route 1 (near Well Y-17).	600	Improve available fire flow, pressure and velocity in this area.
7	Mataguac Zone	Extend 6-inch waterline southward along Chalan Kaskahu until intersection with Chalan Okso. Install PRV where Mataguac and Yigo Zones meet.	1200	Improve available fire flow and pressure in this area.
8	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.
9	Yigo Zone *	Extend 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.

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Vol 2 Chapter 10
Recommended Water Systems CIP

Table 10-11 – Northern System Water Distribution System Improvements (continued)

No.	Area	Description	Length	Comment
10	Yigo Zone	Increase 6-inch waterlines along Aababang from Aapacha to Road K. (Adjacent to Route 1, north of Wells Y-5 & Y-6)	300	Improve available fire flow in this area.
11	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.
12	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 6 fps and improve fire flows
13	Yigo Zone *	Increase 8-inch waterline to 12 inches (or larger) on Marine Drive from Well Y-17 northward to Yigo Reservoir.	3800	Improve available fire flow and pressure in this area.
14	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.
15	Yigo Zone	Extend 6-inch waterline on Chalan San Juan to 8-inch line on Bouganvilla to complete loop (near top of Route 9).	300	Improve available fire flow in this area.
16	Yigo Zone	Install 6-inch waterline on Entrada to complete looping of 6-inch waterlines along Azud, Amarillio, and Apaca Streets. Connect end of 6-inch waterline along Chalan Santa Bernadita to 12-inch along Route 9.	500 and 400	Improve available fire flow in this area.
17	Yigo Zone	Install 6-inch connection between ends of Quezon and Magsaysay.	500	Improve available fire flow in this area.
18	Astumbo	Extend 6-inch waterline on Chiote between Kamute and Chalan A'Abang.	200	Improve available fire flow in this area.
19	Astumbo	Increase 6-inch waterline along Chalan Ibang to 12 inches from Y-Sengsong to S-13 and 8 inches to end. Increase 6-inch waterline along Chalan Pugue Matchena to 8 inches from Y-Sengsong to Chalan Pakpak. Increase 6-inch lines along S-13 and Chalan Pakpak between Chalan Ubas and Chalan Bongbong to 8 inches.	2200, 2200, and 800	Improve available fire flow to this area.
20	Astumbo *	Install an additional 16-inch waterline parallel to 12-inch waterline along Swamp and Y-Sengsong, connect to 24-inch along Route 3 and 16-inch waterline exiting Astumbo Reservoir.	9000	Improve velocities and available fire flow and pressure in this area.

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Table 10-11 – Northern System Water Distribution System Improvements (continued)

No.	Area	Description	Length	Comment
21	Kaiser *	Install an additional 12-inch (or larger) parallel line from Well D-10 (on Y-Sengsong) to Kaiser Reservoir. (Interconnect with parallel lines next to it)	5300	Improve available fire flow and pressure in this area.
22	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.
23	Kaiser	Connect 8-inch waterline left of Ilangilang to 24-inch line along Route 1. (Below Well H-1)	200	Improve available fire flow and pressure in this area.
24	Kaiser	Install 12-inch connection from Fatima to 6-inch waterline along Santa Monica.	800	Improve available fire flow and pressure in this area.
25	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.
26	Kaiser	Install 8-inch waterline along Sunrise St. from Route 1 to Route 16.	2200	Improve velocities, available fire flow and pressure in this area.
27	Kaiser	Install 12-inch waterline along St. John St. and Tun Pedro Cruz St. with connection to the 24-inch waterline on Route 1 and 14-inch waterline on Finegayan St. (labeled as A. Sanchez).	1000	Improve available fire flow in this area.
28	Tumon	Extend 6-inch waterline along Hospital to Pale San Vitores to complete loop.	300	Improve available fire flow in this area.
29	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.
30	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.
31	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.
32	Hyundai	Extend 12-inch waterline on South Sabana Barrigada from Carinoso to Route 16 (southwest of Hyundai Reservoir).	800	Improve velocities and available fire flow and pressure in this area.
33	Mangilao/Chaot	Extend 6-inch waterline south along Dimas St. to Carlos Lane. Extend 6-inch line south along Juan Muna St. to 8-inch along Corten Torres St. Extend 6-inch line from First St. off of Iglesias St. to East Rojas St. to complete loop (west of Mangilao Reservoir).	750, 300 and 100	Improve available fire flow and pressure in this area.

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Vol 2 Chapter 10
Recommended Water Systems CIP

Table 10-11 – Northern System Water Distribution System Improvements (continued)

No.	Area	Description	Length	Comment
34	Piti/Agana	Increase 4-inch and 8-inch waterline along Luna to 12 inches, which will connect the 12-inch line along Cadelaria to the 12-inch line along Route 7A.	1500	Improve available fire flow and pressure in this area.
35	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.	1100	Improve available fire flow in this area.
36	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.
37	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.
34	Mangilao/Chaot	Replace short section of 12-inch waterline on Highway 15 to 24 inches in the vicinity of M. Rivera St. (south of Well M-9)	300	Improve available fire flow and pressure in this area.
35	Piti/Agana *	Increase 4- and 8-inch waterline along Luna to 12 inches, which will connect the 12-inch line along Candelaria to the 12-inch line along Route 7A.	1500	Improve available fire flow and pressure in this area.
36	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.	1100	Improve available fire flow and pressure in this area.
37	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.
38	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.
Project Justification		Improve fire flow and pressure in the respective areas.		
Project Budget		\$27,500,000		
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				

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Table 10-12 – Water Booster Pumping Station Improvements

PROJECT SUMMARY					
Project Name	Water Booster Pumping Station Improvements				
Project Type	<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 _____		
Project Description	The 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	South	Agat	Provide BPS along Route 2 to boost pressure from Agat/Umatac Reservoir to Lasafua Reservoir		Capacity of Lasafua Reservoir is inadequate to supply its service area
2	Central	Talofofo	Provide BPS along Route 4A to boost pressure from Windward Hills #2 Reservoir to Talofofo	2 @ 400 gpm 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				
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					

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Table 10-13 – Water System Reservoirs

PROJECT SUMMARY					
Project Name		Water System Reservoirs			
Project Type		<input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> System Redundancy		<input checked="" type="checkbox"/> System Capacity <input type="checkbox"/> OM&R <input type="checkbox"/> Other _____	
Project Description		The 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	South	Agat	Provide 0.1 MG reservoir to replace existing Lasafua Reservoir	Overflow elevation should be set at 428 feet to match existing, or higher	Capacity of Lasafua Reservoir is inadequate to supply its service area
2	Central	Talofofo	Provide elevated tank in Talofofo	Capacity to be determined	Tank finish floor elevation should be set high enough to service homes in the 300 to 382-foot elevation
3	Northern	Mataguac	Provide 0.1 MG reservoir downstream from the Mataguac BPS	Overflow elevation to be determined	BPS currently discharges directly into the distribution system
4	Northern	Astumbo	Provide additional storage next to Astumbo #1 and #2	Overflow elevation to be set at 570 feet. Capacity to be determined	Fire protection storage inadequate in this area
5	Northern	Barrigada	Provide additional 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 \$2,550,000	2011 \$8,700,000	2009 \$2,000,000	2015 \$8,700,000
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					

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Table 10-14 – Northern System Raw Water Transmission Lines

PROJECT SUMMARY			
Project Name	Northern System Raw Water Transmission Lines		
Project Type	<input checked="" 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 _____	
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	A transmission line extending from Chaot Reservoir to Agana Heights Reservoir along Route 4.	A-series wells A-1, A-3, A-5, A-6, A-12, A-23, A-25, A-31, A-32.	This transmission line has been designed and is being prepared for bid. Though not included at this time, wells A-29 and A-30 should be connected to this transmission line in the future.
2	A branched transmission line from Swamp Road along Route 28 and Route 27a to Route 28, connecting to Kaiser Reservoir. Approximately 16,900 feet.	D-series (except D-14, D-22, D-23, and D-24), EX-05A, G-501, and Y-12.	Wells D-19, D-7, D-4, D-21, D-13, 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 for which the design is already complete.
3	A branched transmission line from the Well AG-01 on Route 9, extending along Route 3 to Route 28, and further extending to the Astumbo Reservoirs. A secondary branch would pick up several wells not on the main transmission line. Approximately 42,200 feet.	AG-01, AG-02, HGC-02, F-Series, D-22, D-23, D-24 and the EarthTech wells.	This is the third highest concentration of wells with fecal coliform hits, including wells F-13, F-2, F-10, and D-22. The existing 12-inch line along Route 9 between Well AG-1 and Yigo Reservoirs is isolated from the F-series wells by a valve.
4	A transmission line along Route 26 to near Route 1 and connecting to Barrigada Reservoirs. Approximately 18,800 feet.	EX-11 and M-Series, except M-12, M-14, M-17B, M-18, M-20A, and M-21.	Wells M-12, M-15, and M-18 need to be evaluated for inclusion in this transmission line or Item 2 above. Well NAS-1 also needs to be evaluated due to its isolation and distance from this transmission line.

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Vol 2 Chapter 10
Recommended Water Systems CIP

Table 10-14 – Northern System Raw Water Transmission Lines (continued)

No.	Description	Well Series	Comment
5	A branched transmission line extending from Ypaopao along Route 1 to Yigo Reservoirs. A branch would extend along Route 29 to connect wells Y-03, Y-7 (inactive), and Y-9. Approximately 30,800 feet.	Y-series wells except Y-12 and, possibly Y-15.	Well Y-15 is sufficiently distant from this proposed transmission line that it should be evaluated separately for inclusion or separate treatment.
6	A transmission line extending from Chaot Reservoir along Route 15 to Mangilao Reservoirs. Approximately 24,700 feet.	A-series wells not included in Item 1, except for A-29 and A-30.	Wells A-17 and A-19, might need to be included on a separate branch.
7	A transmission line to connect wells M-17A, M-20A and M-21 to Barrigada Heights Reservoir. Approximately 5,000 feet.	Wells M-17A, M-20A, and M-21.	--
Project Justification		To provide a means of separating transmission and distribution for effective treatment prior to disinfection.	
Project Budget		2007 \$4,500,000 (design is complete) 2008 \$6,300,000 2009 \$15,700,000 2010 \$7,000,000 2011 \$11,500,000 2015 \$9,100,000 2015 \$1,900,000	
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			

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Table 10-15 – Water Wells Electrical Upgrade

PROJECT SUMMARY			
Project Name	Water Wells Electrical Upgrade		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" 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"/> 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"/> 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 _____		
Project Description (Attach Descriptive Figure as appropriate)	<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			

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**Vol 2 Chapter 10
Recommended Water Systems CIP**

Table 10-16 – Electrical Upgrade – Pago Bay, Brigade and Windward Hills Water Booster Pump Stations

PROJECT SUMMARY			
Project Name	Electrical Upgrade – Pago Bay, Brigade, and Windward Hills Water Booster Pump Stations		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <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"/> 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"/> 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 _____		
Project Description (Attach Descriptive Figure as appropriate)	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			

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Table 10-17 – Electrical Upgrade – Gayinero, Santa Rosa, Santa Rita Springs and Truman Water Booster Stations

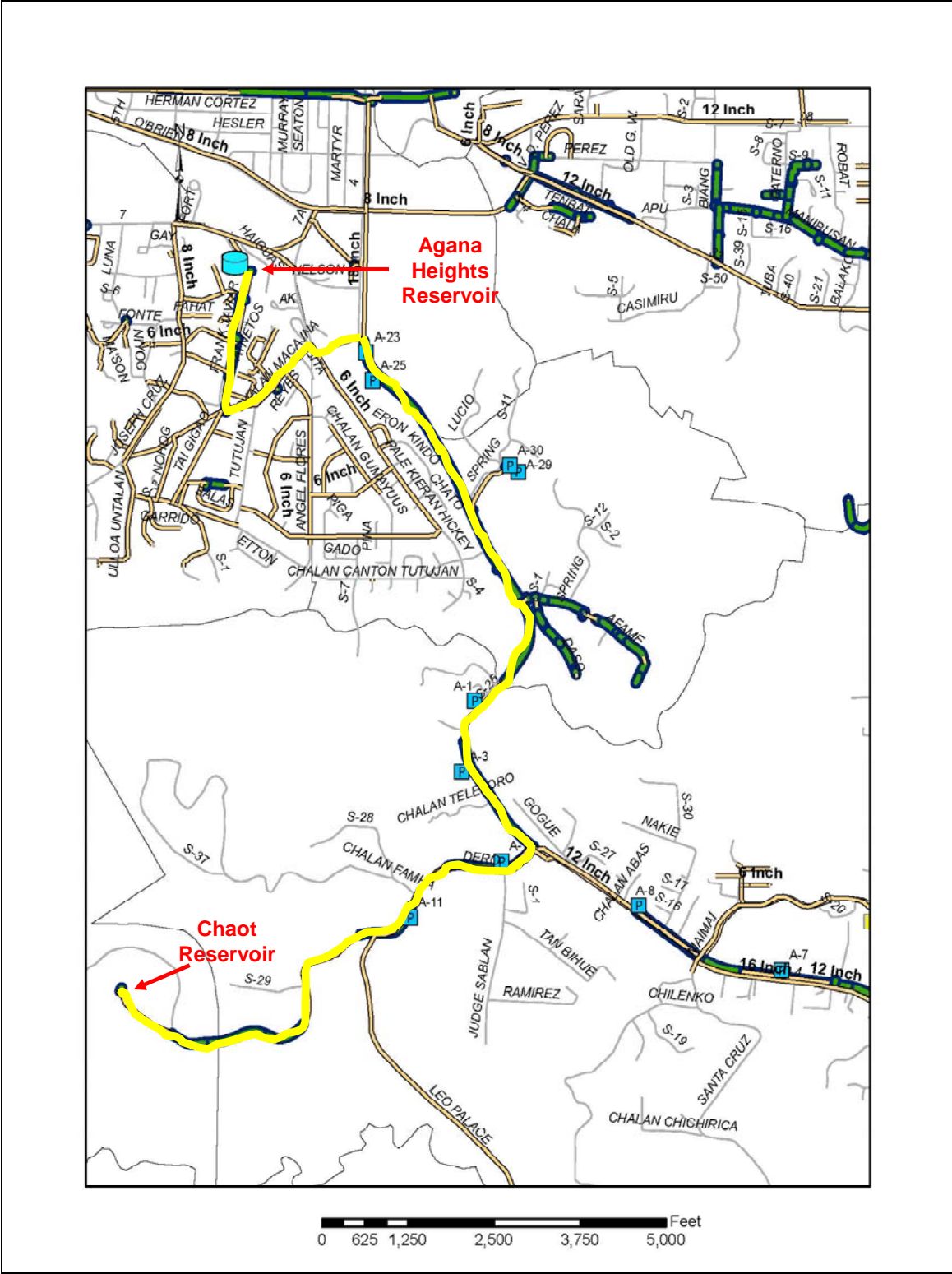
PROJECT SUMMARY			
Project Name	Electrical Upgrade – Gayinero, Santa Rosa, Santa Rita Springs, and Truman Water Booster Stations		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> 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"/> 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"/> 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 _____		
Project Description (Attach Descriptive Figure as appropriate)	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			

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Table 10-18 – Electrical Upgrade – Other Water Booster Stations

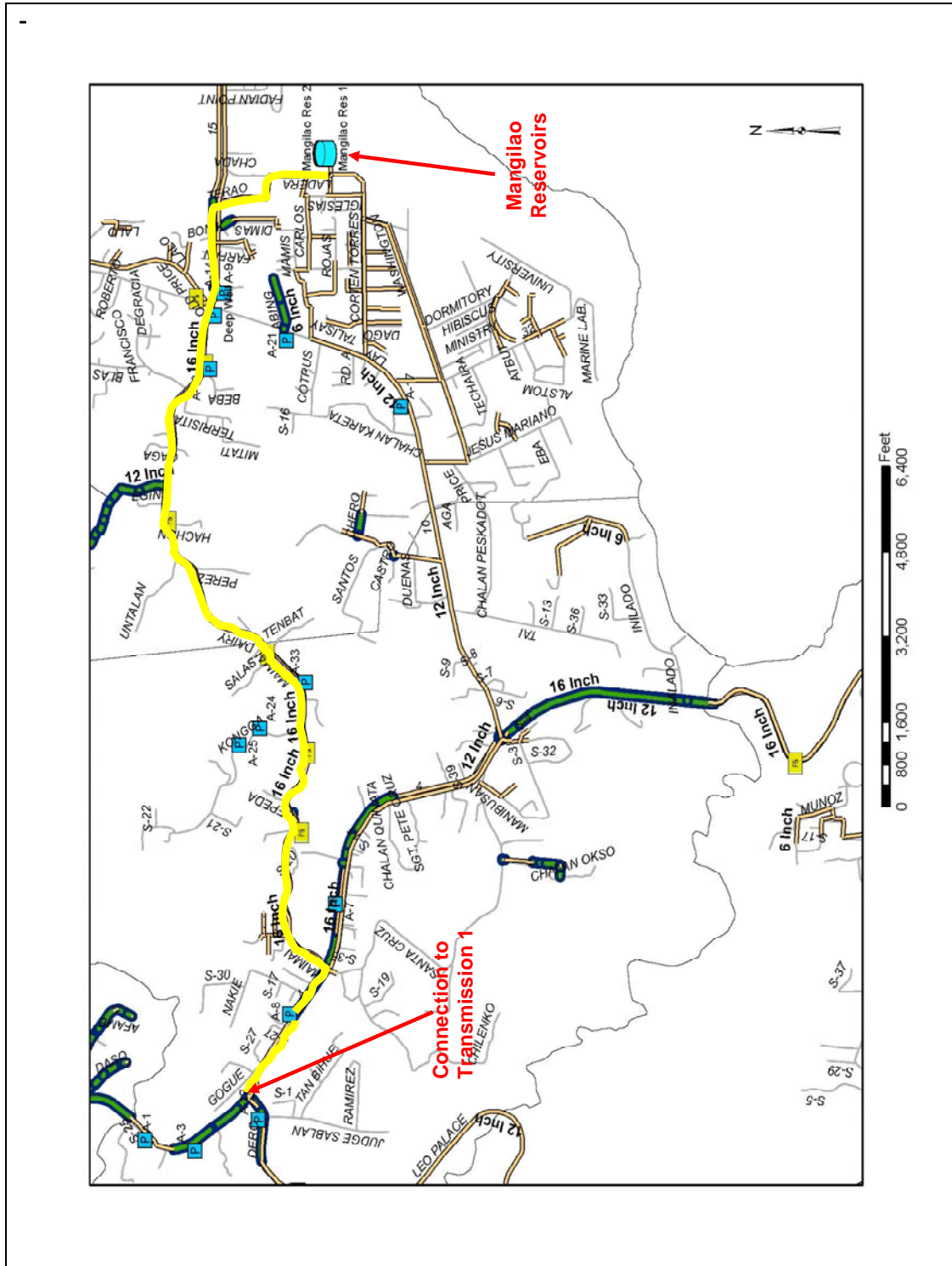
PROJECT SUMMARY			
Project Name	Electrical Upgrade – Other Water Booster Stations		
Project Type	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input type="checkbox"/> Regulatory Compliance <input checked="" type="checkbox"/> System Reliability <input type="checkbox"/> 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"/> 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"/> 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 _____		
Project Description (Attach Descriptive Figure as appropriate)	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			

Figure 10-1 - Planned Transmission Line 1



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Figure 10-6 - Proposed Transmission Line 6



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