WASTEWATER UTILITY PLAN

American Samoa Power Authority

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Common Acronyms and Abbreviations

AC	Asbestos Cement Pipe
ACFM	Actual Cubic Feet Per Minute
ACH	Air Changes per Hour
ACOE	Army Corps of Engineers
ADF	Average Daily Flow
ADWF	Average Dry Weather Flow
ALK	Alkalinity
AOTR	Actual Oxygen Transfer Rate
ASEPA	American Samoa Environmental Protection Agency
ASPA	American Samoa Power Authority
ASR	Alkali-Silica Reaction
AWWF	Average Wet Weather Flow
BNR	Biological Nutrient Removal
BOD	5-Day Biochemical Oxygen Demand
CBOD	5-Day Carbonaceous Biochemical Oxygen Demand
CCTV	Closed Circuit Television
Cd	Cadmium
CEC	Cation Exchange Capacity
cf (CF)	Cubic Feet
CFR	U.S. Code of Federal Regulations
cfs	Cubic Feet Per Second
cfu	Colony Forming Units
CIP	Capital Improvement Plan
CMOM	Capacity, Management, Operations, and Maintenance
CMU	Concrete Masonry Units
COD	Chemical Oxygen Demand
CUP	Conditional Use Permit
CWA	Clean Water Act
d/D	Depth over Diameter
DBP	Disinfection By-Products
DIP	Ductile Iron Pipe
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
DP	Dissolved Phosphorus
DWF	Dry Weather Flow
E. coli	Escherichia Coliform Bacteria
EBPR	Enhanced Biological Phosphorus Removal
EID	Environmental Information Document
EOPC	Engineer’s Opinion of Probable Cost

ERU (or EDU)	Equivalent Residential Unit (or Equivalent Dwelling Unit)
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
fpm	Feet Per Minute
fps	Feet Per Second
ft	Feet
gal	Gallon(s)
GAO	Glycogen Accumulating Organism
gfd	Gallons Per Square Foot Per Day
gpcd	Gallons Per Capita Day
gpd	Gallons Per Day
gph	Gallons Per Hour
gpm	Gallons Per Minute
HDPE	High Density Polyethylene
HGL	Hydraulic Grade Line
hp	Horsepower
HRT	Hydraulic Residence Time
HVAC	Heating/Ventilation/Air Conditioning
I/I	Inflow and Infiltration
IPaC	Information for Planning and Consultation
kW	Kilowatt
kwh	Kilowatt-Hour
lb/day	Pounds Per Day
LS	Lump Sum
MBR	Membrane Bioreactor
MCC	Motor Control Center
MCL	Maximum Contaminant Level
MF	Microfiltration
MFEM	Membrane Filtration Equipment Manufacturer
µg/L	Microgram Per Liter (Parts Per Billion – ppb)
MG	Million Gallons
mg/l	Milligram Per Liter (Parts Per Million – ppm)
MGD	Million Gallons Per Day
MH	Manhole
mL	Milliliter
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MM	Maximum Month
MMF	Maximum Month Flow
MOS	Membrane Operating System

MPN	Most Probable Number
ND	Non-Detectable
ng/L	Nanogram Per Liter (Parts Per Trillion -- ppt)
NGVD	North American Vertical Datum
NH_3-N	Ammonia Expressed as Nitrogen
NO_3-N	Nitrate Expressed as Nitrogen
NO_3-N & NO_2-N	Sum of Nitrate and Nitrite Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
O_2	Oxygen
OR	Overflow Rate
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
P	Phosphorus
Pb	Lead
PDF	Peak Daily Flow
PER	Preliminary Engineering Report
PF	Peaking Factor
pg/L	Picogram Per Liter (Parts Per Quadrillion or ppq)
pH	Potential of hydrogen (acidity or basicity)
pph/sf	Pounds Per Hour Per Square Foot
PHF	Peak Hourly Flow
PLC	Programmable Logic Controller
POTW	Publicly Owned Treatment Work
ppb	Parts Per Billion (µg/L)
ppd	Pounds Per Day
pph/sf	Pounds Per Hour Per Square Foot
ppm	Parts Per Million (mg/L)
ppq	Parts Per Quadrillion (pg/L)
ppt	Parts Per Trillion (ng/L)
PQL	Practical Quantitation Limit
psia / psig	Pounds Per Square Inch (Absolute / Gauge)
PVC	Polyvinyl Chloride
RAS	Return Activated Sludge
RO	Reverse Osmosis
SA	Surface Area
SBC	Submerged Biological Contactor
SBR	Sequencing Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SCFM	Standard Cubic Feet Per Minute

SECAP	System Evaluation and Capacity Assurance Plan
sf (SF)	Square Feet
SMP	Solids Management Plan
SRP	Soluble Reactive Phosphorus (PO_4-P)
SSO	Sanitary Sewer Overflow
SSO_2	Stainless Steel
STEPOR	Septic Tank Effluent Pumping Overflow Rate
STFS	Secondary Treatment Feasibility Study
SVI	Sludge Volume Index
TAN	Total Ammonia Nitrogen
TDH	Total Dynamic Head
TIN	Total Inorganic Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TMP	Transmembrane Pressure
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
TS	Total Solids
TSS	Total Suspended Solids
UF	Ultrafiltration
USDA RD	United States Department of Agriculture Rural Development
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	Ultraviolet
VCO	Voluntary Consent Order
VFA	Volatile Fatty Acid
VFC (or VFD)	Variable Frequency Controller (or Drive)
VOC	Volatile Organic Compounds
VS	Volatile Solids
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
WLA	Waste Load Allocation
WQS	Water Quality Standards
WRCC	Western Regional Climate Center
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant
WWUP	Wastewater Utility Plan
Zn	Zinc

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EXECUTIVE SUMMARY

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Executive Summary

American Samoa Power Authority (ASPA) contracted with J-U-B Engineers, Inc. (J-U-B) to prepare an updated Wastewater Utility Plan (WWUP) for the wastewater systems and infrastructure under the ownership and control of ASPA. The updated plan will help ASPA to identify needed improvements to the wastewater systems and to develop plans for routine maintenance of the wastewater systems to improve their longevity. The WWUP is comprised of nine chapters, each of which is summarized in the following sections.

ES.1 Chapter 1 – Introduction

ES.1.1 Background

This WWUP aims to improve ASPA’s wastewater system longevity, optimize ASPA’s maintenance practices, and ensure that ASPA meets its sustainability and resiliency objectives for wastewater management. The plan builds upon ASPA's 2003 Utilities Master Plan and serves as a foundational document for future wastewater infrastructure projects and provides critical planning information for the Secondary Treatment Feasibility Study.

ASPA operates three sanitary sewer collection systems across two islands: Tafuna, Utulei, and Aunu’u. These systems, serving approximately 28,000 residents, include wastewater treatment plants (WWTPs) at Tafuna and Utulei, while the Aunu'u system discharges directly to the ocean. The Manu’a Islands do not have any sanitary sewer collection systems, only cesspools and septic tank systems. **Figure 1-2** in **Chapter 1** shows the existing wastewater systems. The WWUP evaluates existing conditions, outlines necessary upgrades, and provides a roadmap for future improvements.

ES.1.2 Planning Approach & Sustainability and Resiliency Goals

The planning approach for this WWUP was largely informed by the U.S. Environmental Protection Agency’s (USEPA) "Planning for Sustainability" guidelines, focusing on four core elements: setting goals, developing objectives and strategies, performing alternatives analyses, and developing a financial strategy. ASPA’s sustainability and resiliency goals include, but are not limited to, reducing sanitary sewer overflows, improving infrastructure inspections and condition assessments, protecting public health, complying with environmental regulations, and etc.

ES.1.3 Wastewater Utility Plan

Key components of the WWUP include evaluations of ASPA’s existing management, WWTPs, and collection systems. The plan also identifies potential wastewater system improvements, which are prioritized based on the risk of failure and the consequence of failure of wastewater infrastructure. The recommended system improvements comprise the Capital Improvement Plan (CIP), which outlines the phased implementation of the recommended system improvements.

The WWUP serves not only as a strategic tool for ASPA but also ensures that ASPA can address both current and future wastewater needs in American Samoa, with an emphasis on sustainability, regulatory compliance, and resilience against environmental challenges.

ES.2 Chapter 2 – Existing Environment

Chapter 2 provides a comprehensive overview of the environmental conditions, infrastructure, and socioeconomics of American Samoa for ASPA's Wastewater Utility Plan. The study boundary for the plan includes the Eastern and Western Districts of American Samoa, focusing on the islands of Tutuila and Aunu'u. Tutuila has a backbone of shield volcanoes and a highly irregular coastline, with most of the population residing along the southern coast. Aunu'u is a smaller island with less than one square mile of surface area. See **Figure ES - 1** for the Study Area Boundary.

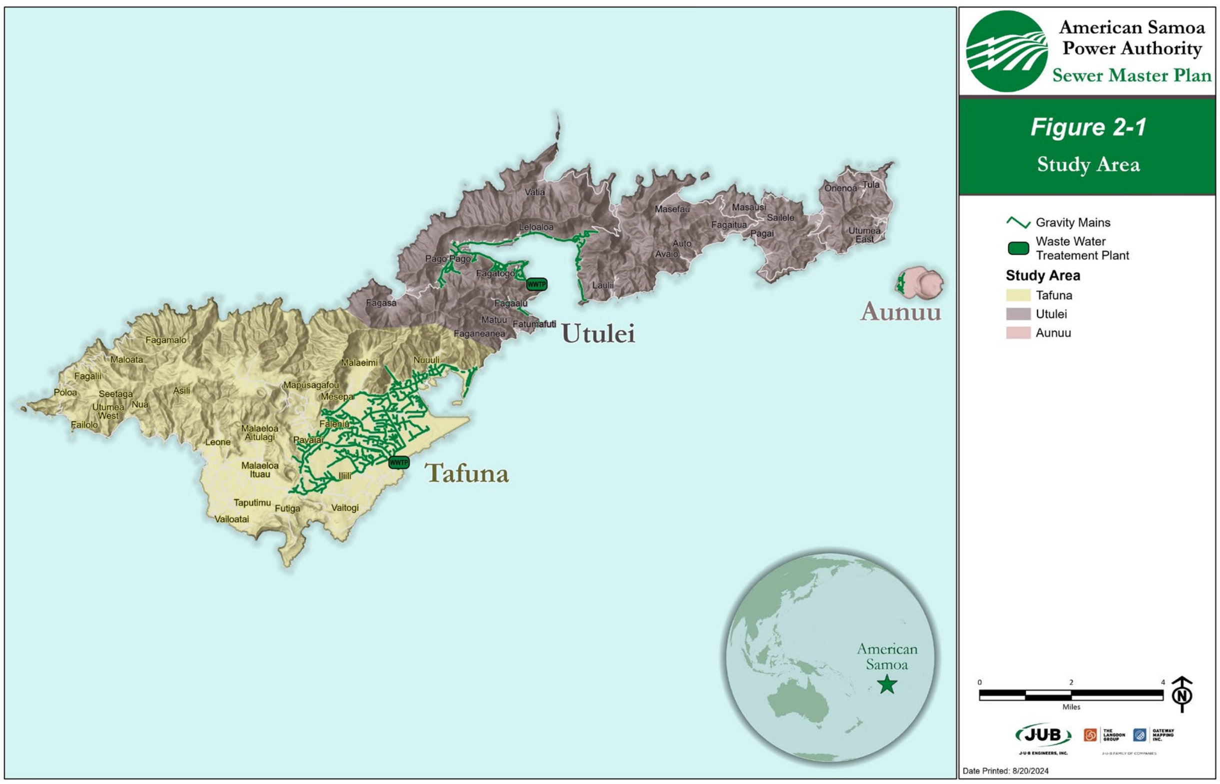

Figure ES - 1: Study Boundary

ES.2.1 Climate

American Samoa experiences a tropical climate with warm, humid, and rainy weather year-round. The average annual temperature is 82°F, with little seasonal variation. Rainfall varies significantly, with drier areas receiving around 125 inches annually and wetter, mountainous regions receiving up to 300 inches. The rainy season lasts from November to April.

ES.2.2 Water Resources

Surface water is scarce due to the small size of watersheds and minimal land area for reservoirs. Groundwater is the primary source of drinking water, with 58 wells on Tutuila and Aunu'u. High precipitation results in high groundwater recharge, but water quality is often poor, requiring significant treatment. ASPA operates microfiltration and reverse osmosis facilities to improve water quality.

ES.2.3 Wildlife Habitat

The islands' topography includes mountainous interiors and low-lying coastal areas. Vegetation is predominantly coastal lowland and montane forest. Five endangered species have the potential to inhabit the area. Additionally, American Samoa is a designated whale and turtle sanctuary and local and federal regulations provide additional protections for marine life under the Marine Mammal Protection Act and the National Marine Sanctuary of American Samona, among others. See **Table 2-1** and **Section 2.1.4**. for additional details.

ES.2.4 Cultural Resources and Human Environment

Samoan culture places a high value on family (aiga) and land management by chiefs (matai). Land is considered sacred and cannot be subdivided. The constitution protects Samoans against land alienation. The islands have significant cultural and historic sites, including the National Park of American Samoa and several National Historic Landmarks. See **Table 2-2** in **Section 2.1.6** for a list of protected sites on Tutuila.

ES.2.5 Socioeconomics

The population of American Samoa is predominantly indigenous Samoans. The median household income is low, with a high percentage of the population living below the poverty level. Most residents speak the Samoan language. The demographics of the Western and Eastern Districts are similar, with a total population of approximately 49,710. See **Table 2-3** in **Section 2.1.8** for more details of the demographics of the Western and Eastern Districts.

ES.2.6 Infrastructure

ASPA provides electricity, water, wastewater, and solid waste services to over 43,000 residents. The wastewater infrastructure is summarized in **Figure ES - 2**. The Tafuna collection system serves an estimated population of 19,854 and the Utulei collection system serves an estimated population of 7,675. The wastewater infrastructure faces challenges such as aging systems, high inflow and infiltration, and high operational costs. Drinking water quality issues are prevalent, with high levels of chlorides and coliform bacteria detected in some areas. ASPA is working to address these drinking water quality issues through new treatment facilities and infrastructure improvements.

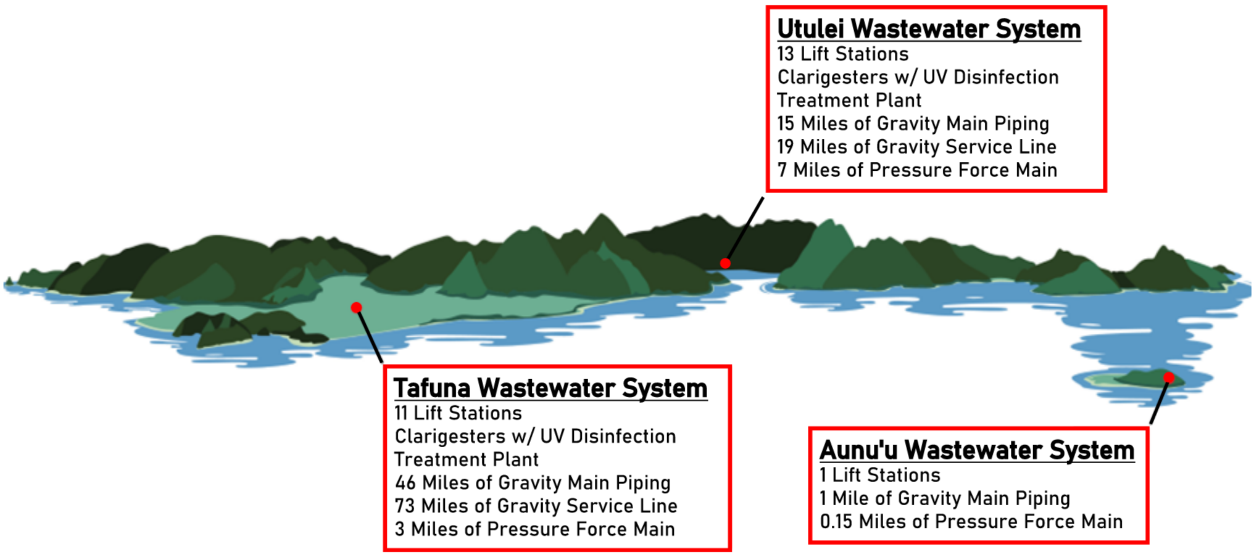

Figure ES - 2: Summary of ASPA's Wastewater Infrastructure

ES.2.7 Unique Challenges

American Samoa's remote location and limited conveniences impact infrastructure development and recruitment of technical staff. The islands are located thousands of miles from Australia, Hawaii, and the mainland United States, leading to logistical challenges and higher costs for materials and supplies. Climate change and rising sea levels pose additional risks to water resources, with increased rainfall and island subsidence expected to exacerbate these issues.

ES.2.8 Corrosive Environment

The tropical and coastal climate leads to high corrosion rates, affecting infrastructure maintenance and increasing costs. High humidity, rainwater, and airborne salinity contribute to rapid corrosion of metals, requiring frequent maintenance and replacement of parts. High chloride levels in groundwater and wastewater further accelerate corrosion.

ES.2.9 Conclusion

This chapter highlights the existing environmental conditions, infrastructure challenges, and socio-economic factors affecting American Samoa. The information provided serves as a foundation for developing strategies to improve the wastewater utility system and address the unique challenges faced by the territory.

ES.3 Chapter 3 – Flows and Loads

Chapter 3 provides an in-depth analysis of the wastewater treatment plants (WWTPs) in Tafuna and Utulei, focusing on their current and projected future flows and loads over a 20-year planning period. The report highlights the importance of understanding influent wastewater characteristics for effective infrastructure planning and compliance with environmental regulations.

ES.3.1 Tafuna WWTP

ES.3.1.1 General Information

The flow in the Tafuna WWTP is measured using 14-inch and 18-inch electromagnetic flow meters located upstream of the UV disinfection unit. Wastewater flow is manually recorded daily, and composite samples for BOD_5 and TSS are tested weekly. These composite samples are essential in providing a comprehensive understanding of the wastewater characteristics, as the BOD_5 and TSS levels are crucial indicators of organic pollution and suspended solids in the influent.

ES.3.1.2 Existing Flows and Loading

The average daily flow (ADF), maximum monthly flow (MMF), BOD_5 loadings, and TSS loadings were calculated based on the observed data for flow, BOD_5, and TSS reported in the Tafuna WWTP's daily monitoring report (DMR) from October 2018 to September 2023. The peak day flow was statistically extrapolated from the same DMR dataset, and the peak hourly flow was calculated based on the thirteen months of instantaneous flow recorded by the UV system from June 2019 to September 2021. The total ammonia, nitrogen, and phosphorus were calculated based on the monthly influent nutrient concentration data provided by ASPA spanning December 2011 through March 2018. **Table ES - 1** summarizes the existing flow and loading at various conditions.

The BOD_5 and TSS influent concentrations should be somewhat similar, but the TSS is about half of the BOD_5. Additionally, while the nitrogen concentration is closer to typical medium and high strength wastewater, the BOD_5 concentration is more similar to typical low and medium strength wastewater. Since the samples were collected towards the end of the long grit channel, some organic solids may have settled before the sampling point. This could explain the relatively low strength of the BOD_5 and TSS and the higher strength of nutrients since nutrients are usually soluble. Any contamination during sample collection, handling, and testing could also result in erroneous results. Despite the inconsistencies in the dataset as compared with the typical literature values, existing baseline conditions were established from the observed data provided by ASPA as described in the previous paragraph.

ES.3.1.3 Existing and Future Population

Population projections are essential for capacity planning and infrastructure development. By anticipating the future wastewater load, the WWTP can implement necessary upgrades and expansions to accommodate the increased demand. The wastewater collection system for the Tafuna WWTP spans eight villages in the western region of the island. The population of the Tafuna region has remained relatively unchanged in the last couple of decades. However, not all areas currently have sewer service. The estimated sewered population contributing to sewer flow to the Tafuna WWTP was estimated to be 19,854. The population served by the existing sewer collection system is assumed to remain unchanged in the future. Plans of expansion of the sewer system to new regions increases the future sewer population to 30,172, which includes the existing population, 3,175 new people from the Upper Pavaiai Region, and 7,143 new people from the Leone-Vaitogi Region.

ES.3.1.4 Future Flow and Loading

Additional future flows are anticipated for the Tafuna WWTP resulting from the addition of the hospital in the tech park and the expansion of the collection system in the Upper Pavaivai and Leone-Vaitogi Regions. The future ADF was calculated by adding the estimated additional flow from the new sources to the existing ADF coming into the plant. The average loadings per capita per day of the BOD_5, TSS, and nutrients in the influent wastewater from the new sources are anticipated to be the same as the current loading per capita per day. The current flow and loading peaking factors, maximum month, peak day, and peak hour, were multiplied with the average day flow and loading to calculate the future flow and loading, respectively, at these conditions. **Table ES - 1** summarizes the future flow and loading at various conditions.

Table ES - 1 Tafuna WWTP – Existing and Future Flow and Loads Summary

Parameter	Existing Conditions (2024)	Projected Future Conditions (2044)
Estimated Population (sewered)	19,854	30,172
Flow		
Average Day (MGD)	1.42	2.18
Maximum Month (MGD)	1.70	2.62
Peak Day (MGD)	3.50	5.34
Peak Hour (MGD)	5.50	8.40
BOD_5		
Average Day (ppd)	1,907	2,899
Maximum Month (ppd)	3,039	4,638
Peak Day (ppd)	4,864	7,392
TSS		
Average Day (ppd)	910	1,381
Maximum Month (ppd)	1,553	2,362
Peak Day (ppd)	2,177	3,315
Ammonia (TAN)		
Average Day (ppd)	471	715
Maximum Month (ppd)	751	1,145
Peak Day (ppd)	N/A	N/A
TN		
Average Day (ppd)	610	930
Maximum Month (ppd)	939	1430
Peak Day (ppd)	N/A	N/A
TP		
Average Day (ppd)	80	122
Maximum Month (ppd)	171	260
Peak Day (ppd)	N/A	N/A

ES.3.2 Utulei WWTP

ES.3.2.1 General Information

The flow at the Utulei WWTP is measured using 24-inch electromagnetic flow meters upstream of the UV disinfection. Similar to the Tafuna WWTP, wastewater flow is manually recorded daily and composite samples for BOD_5 and TSS are tested weekly. These composite samples are essential in providing a comprehensive understanding of the wastewater characteristics, as the BOD_5 and TSS levels are crucial indicators of organic pollution and suspended solids in the influent.

ES.3.2.2 Existing Flows and Loading

The average daily flow (ADF), maximum monthly flow, BOD_5 loadings, and TSS loadings were calculated based on the observed data for flow, BOD_5, and TSS reported in the Utulei WWTP's daily monitoring report (DMR) from October 2018 to September 2023. The peak day flow was statistically extrapolated from the same DMR dataset, and the peak hourly flow was calculated based on the five months of instantaneous flow recorded by the UV system from January 2019 to August 2021. The total ammonia, nitrogen, and phosphorus were calculated based on the biweekly influent nutrient concentrations provided by ASPA spanning September 2021 through September 2022. **Table ES - 2** summarizes the existing flow and loading at various conditions.

The influent BOD_5 and TSS concentration of the Utulei WWTP are significantly below the typical concentrations reported for low-strength wastewater. The low concentration of solids in wastewater suggests that the influent wastewater is very diluted as a result of I/I. Similar to the Tafuna WWTP, the influent TSS is lower than the influent BOD_5 for Utulei, which is unusual. Despite the inconsistencies in the dataset with the typical literature values, existing baseline conditions were established from the observed data provided by ASPA as described in the previous paragraph.

ES.3.2.3 Population and Future Projections

Population projections are essential for capacity planning and infrastructure development. By anticipating the future wastewater load, the WWTP can implement necessary upgrades and expansions to accommodate the increased demand. The wastewater collection system for the Utulei WWTP spans nine villages in the island's eastern region. The population of the Utulei region has decreased slightly in the last couple of decades but is expected to remain relatively unchanged for the analysis in this report. However, not all areas currently have sewer service. The estimated sewered population contributing to sewer flow to the Utulei WWTP was estimated to be 7,675. The population served by the existing sewer collection system is assumed to remain unchanged in the future. Plans to expand the sewer system to new regions will increase the future sewer population to 8,305, which includes the existing sewered population, 317 new people from the Matuu Region, 93 new people from the Faganeanea Region, and 220 new people from Pago Pago Village.

ES.3.2.4 Flow and Loading Summary

Additional future flows are anticipated for the Utulei WWTP resulting from the expansion of the collection system in the Matuu, Faganeanea, and Pago Pago Regions. Future flows and loading were estimated using the same methodology as at the Tafuna WWTP and are summarized in **Table ES - 2.**

Table ES - 2: Utulei WWTP – Existing and Future Flow and Loads Summary

Parameter	Existing Conditions	Projected Future Conditions (2044)
Estimated Population (sewered)	7,675	8,305
Flow		
Average Day (MGD)	2.04	2.21
Maximum Month (MGD)	2.70	2.94
Peak Day (MGD)	5.10	5.52
Peak Hour (MGD)	5.20	5.63
BOD_5		
Average Day (ppd)	1,533	1,658
Maximum Month (ppd)	2,345	2,554
Peak Day (ppd)	3,741	4,063
TSS		
Average Day (ppd)	995	1,077
Maximum Month (ppd)	1,370	1,486
Peak Day (ppd)	2,075	2,250
TAN		
Average Day (ppd)	240	260
Maximum Month (ppd)	455	493
Peak Day (ppd)	563	610
TN		
Average Day (ppd)	241	260
Maximum Month (ppd)	458	486
Peak Day (ppd)	567	611
TP		
Average Day (ppd)	31	34
Maximum Month (ppd)	79	85
Peak Day (ppd)	84	91

ES.4 Chapter 4 – Permit Conditions

ES.4.1 Overview

Chapter 4 provides a detailed overview of the regulatory background, current permit conditions, and anticipated future requirements for the WWTP operated by the American Samoa Power Authority (ASPA). The chapter emphasizes the importance of maintaining compliance with the EPA and the ASEPA to ensure environmental responsibility and public health protection.

ES.4.2 Regulatory Background

ASPA operates two main WWTPs: Tafuna and Utulei. The Tafuna WWTP discharges disinfected effluent into Vai Cove in the South Pacific Ocean under NPDES Permit No. AS 0020010, while the Utulei WWTP discharges into the Outer Pago Pago Harbor under NPDES Permit No. AS 0020001. Both facilities currently operate under a 301(h) waiver, which allows primary treatment standards for TSS and BOD, granted by the US EPA in 1999. The draft permit for the Tafuna WWTP tentatively denies the 301(h) waiver and requires a secondary level of treatment of BOD and TSS along with nutrient removal. However, a final decision on a new NPDES permit and 301(h) waiver has not been made.

ES.4.3 Tafuna WWTP Permit Conditions

The current NPDES Permit for the Tafuna WWTP was issued on September 30, 1999, and became effective on November 2, 1999. Although this permit expired at midnight on November 1, 2004, the EPA administratively extended the permit, and it remains in effect until a new permit is issued. The current permit has effluent discharge limits on BOD concentration, BOD loading, BOD removal, TSS concentration, TSS loading, TSS removal, settable solids, and pH. Monitoring is required for flow, oil and grease, and whole effluent toxicity (WET). The current permit is included in **Appendix B-1** and summarized in detail in **Section 4.2.1** of **Chapter 4**. The treatment capacity of the existing process is evaluated based on the effluent discharge limits of the current permit in **Chapter 6** of this report.

A draft permit for the Tafuna plant is in development by the EPA and is not publicly available yet. ASPA provided a draft copy to J-U-B Engineers to understand their future treatment needs, which is included in **Appendix B-2** and summarized in **Section 4.2.2** of **Chapter 4**. The parameters and limits in the draft NPDES permit are the basis of the planning objective for the effluent water quality of Tafuna's WWTP in the Secondary Treatment Feasibility Study (J-U-B Engineers, 2025). The future permit for the Tafuna WWTP, currently a draft, tentatively denies the 301(h) waiver and requires secondary treatment for BOD and TSS along with nutrient removal. The key changes between the current and draft permit are summarized below:

1. The required average monthly BOD and TSS percentage removal increases from 30% to 85%. Similarly, the limit for effluent concentration and daily loading of BOD and TSS are more stringent in the draft permit and decrease by approximately 30% and 40%, respectively, from the current permit limits. Moreover, the composite sample for BOD and TSS needs to be collected over a 24-hour period instead of the previous requirement of an 8-hour period.
2. There is no settleable solids discharge limit for the draft permit.

3. The discharge limits for the following parameters were added as follows.
    a. Oil and grease
    b. Total Nitrogen
    c. Ammonia Impact Ratio
    d. Total Phosphorus
    e. Herbicides and pesticides which includes 2,3,7,8-TCDD, bis(2-ethylhexyl) Phthalate, and 4,4'-DDT
    f. Enterococci
    g. Chronic Toxicity with *Strongylocentrotus purpuratus* or *Dendraster excentricus*
4. The following additional parameters need to be monitored:
    a. Temperature
    b. Total Ammonia
    c. Priority Pollutant Scan
5. There was no compliance period noted for any of the above-mentioned parameters.

ES.4.4 Utulei WWTP Permit Conditions

The current NPDES Permit for the Utulei WWTP was issued on November 18, 2019, and became effective on January 1, 2020. The current permit expired on December 31, 2024. The current permit has effluent discharge limits on BOD concentration, BOD loading, BOD removal, TSS concentration, TSS loading, TSS removal, pH, oil and grease, settable solids, total nitrogen, ammonia impact ratio, total phosphorus, enterococci, and chronic toxicity. Monitoring is required for flow, oil and grease, and whole effluent toxicity (WET). The current permit is included in **Appendix B-3** and summarized in detail in **Section 4.3.1** of **Chapter 4**. The treatment capacity of the existing process is evaluated based on the effluent discharge limits of the current permit in **Chapter 6** of this report.

There is no draft of a future permit for the Utulei WWTP. ASPA submitted a renewal application on June 7th, 2024, and requested a 301(h) waiver. Since there is no other basis or clarity on the future permit limits of the Utulei WWTP, they are anticipated to be the same as the draft permit limits of the Tafuna WWTP and are summarized in **Section 4.3.2** of **Chapter 4**.

ES.5 Chapter 5 – Existing Management Evaluation

ES.5.1 ASPA Organization

ASPA has five primary divisions: the Power Generation Division, the Transmission and Distribution Division, the Water Division, the Wastewater Division, and the Solid Waste Division. The Wastewater Division is responsible for managing the collection and treatment of wastewater throughout American Samoa and is under the direction of ASPA's Executive Director, with a Wastewater Manager who oversees three key areas: construction, operations, and engineering.

The Wastewater Construction Division handles the development and construction of new wastewater infrastructure, such as gravity mains, manholes, and septic systems. The Operations Department focuses on the ongoing maintenance and repair of the wastewater systems, including pipes, manholes, lift stations, force mains, and WWTPs. The Engineering Department manages data and infrastructure information, which aids in monitoring system performance and identifying needed improvements.

ES.5.2 Operation, Maintenance, and Construction Activities

ASPA performs a range of regular operational and maintenance activities to ensure the reliability and proper functionality of its wastewater systems. These activities include routine tasks such as routine flushing of collection system pipes, daily inspections of lift stations, monitoring of oil and grease traps, and ongoing repairs and replacement of infrastructure.

ASPA established a Wastewater Construction Division in 2020. The Construction Division regularly designs, constructs, and installs wastewater gravity mains, manholes, and service connections. Additionally, the Construction Division installs septic systems and inspects service connections and septic systems installed by others.

As ASPA staff performs operation and maintenance procedures, safety of the staff is a high priority. ASPA has both a confined space program and a lockout program that promote the safety of staff. Strict observance of the confined space and lockout programs allows ASPA staff to perform operation and maintenance procedures in a safe environment and reduces the potential for injury or harm.

ES.5.3 Evaluation of Standards

ASPA utilizes the Ten States Standards for the design, review, and approval of wastewater collection and treatment facilities. The Wastewater Construction Division performs in-house quality control tests on collection system gravity mains, manholes, and service laterals to ensure that the infrastructure meets the required performance standards. ASPA would like to continue to develop and approve design and construction standards and specifications, as well as procedures and standards for inspections, to utilize within its Construction Division.

ES.5.4 Improvements to ASPA's Wastewater Division

ASPA is a member of the Pacific Water and Wastewater Association (PWWA) and provides data and benchmarking updates to PWWA on an annual basis. Some ASPA employees have the opportunity to attend PWWA annual conferences, however, attendance is limited due to high travel and accommodation costs. To improve knowledge and skill development among its staff, it is recommended that ASPA increase opportunities for training, collaboration, and networking. Organizations such as the Water Environment Federation (WEF) and USEPA can provide valuable resources and professional development for ASPA staff. Additionally, ASPA can expand its apprenticeship program to include wastewater operator certification to strengthen the capacity of its Wastewater Division.

ES.5.5 Improvements to Operation, Maintenance, and Construction

Historically, ASPA has repaired and/or replaced wastewater system infrastructure when it has failed, or when a condition assessment indicates that it is approaching failure. To improve the long-term sustainability of its systems, ASPA should implement a more proactive maintenance strategy. A proactive maintenance strategy could involve regular inspections, such as closed-circuit television (CCTV) monitoring of collection pipes, to identify and address potential problems before they lead to system failures.

ASPA also uses a combination of asset management tools, such as software, spreadsheets, and GIS data. It is recommended that ASPA further develop its GIS data and acquire updated asset management software to better track infrastructure conditions, schedule maintenance, and monitor the performance of its wastewater systems.

ES.5.6 Improvements to Standards

ASPA currently utilizes the Ten States Standards, but to ensure consistent quality and efficiency in wastewater infrastructure projects, ASPA should expand its design and construction standards. To further develop its design and construction standards and specifications, as well as procedures and standards for inspections, ASPA could utilize its in-house engineering staff, or contract with an engineering consulting firm. ASPA could also adopt additional standards from organizations such as the American Public Works Association (APWA).

ES.6 Chapter 6 – Existing WWTP Evaluation

ES.6.1 Evaluation

Chapter 6 provides a comprehensive overview of the current state of the existing WWTP facilities, including the treatment process, hydraulic profile, site plan, and equipment, notes the observed deficiencies in each WWTP, and evaluates their overall performance, condition, and capacity. As the primary wastewater treatment facilities on Tutuila Island, their efficient operation is essential for maintaining environmental and public health standards. This detailed evaluation encompasses various aspects of the wastewater treatment process, including the design, operational challenges, and potential improvements required to sustain and enhance the effectiveness of these plants.

ES.6.2 Tafuna WWTP

ES.6.2.1 Facility Overview

The Tafuna WWTP serves the western villages of Tutuila Island and is strategically located near the Pago Pago International Airport. Initially constructed in 1977 and expanded during the 1990s, the plant has undergone several upgrades aimed at enhancing its capacity and improving the quality of the effluent it processes.

The major process units in the treatment plant are listed below:

- Headworks: Influent Pump Station, Screens, Washpress, and Grit removal
- Primary Treatment: Clarigester
- Disinfection: UV Disinfection
- Effluent Flow Measurement
- Outfall/ Effluent Disposal

- Solids processing and disposal: digestion (Clarigester), dewatering with a screw press and/or sludge drying beds, and landfilling

ES.6.2.2 Existing Process Units

The headworks of the Tafuna WWTP play a crucial role in the initial stages of wastewater treatment. They consist of grit channels, automatic screens, and an influent pump station. Notable upgrades include the addition of Huber Technologies' automatic bar screens in 2017, which have significantly streamlined the screening process. However, despite these improvements, certain deficiencies persist. Corroded metal surfaces, non-functional ultrasonic sensors, and the need for manual operations highlight areas requiring further attention and improvement.

The primary treatment of wastewater at the Tafuna WWTP is achieved using clarigesters, which have been partially rehabilitated over the years to enhance their effectiveness. Nevertheless, these clarigesters exhibit signs of wear and are prone to frequent blockages, necessitating ongoing maintenance and the replacement of parts. Effluent flow measurement is conducted using McCrometer electromagnetic flow meters. However, the condition of this area is compromised by corroded piping. Ultraviolet (UV) disinfection is employed for pathogen inactivation, an essential step in ensuring that the effluent meets health standards before discharge. Unfortunately, the UV disinfection system suffers from heavy corrosion and lacks redundancy, which complicates maintenance and operational reliability.

The effluent from the Tafuna WWTP is discharged into Vai Cove through a pipeline equipped with a diffuser manifold at the end. However, observations have revealed that the actual dilution factor achieved is lower than expected due to uneven flow distribution through the diffusers. This discrepancy necessitates reevaluating the outfall system to ensure that it functions optimally and meets environmental discharge standards.

The dewatering of sludge at the Tafuna WWTP is currently carried out with drying beds. The dried solids are subsequently disposed of in a nearby landfill. The dewatering process, however, is hindered by the region's humid climate, which affects the efficiency of drying beds. The introduction of a screw press is anticipated to improve operations by providing a more efficient means of dewatering. However, the connection between the digesters and the screw press is done with temporary piping to only one digester, indicating a need for additions to the system to make it more robust and to optimize the sludge management process. The management of solids is a critical component of wastewater treatment, and the Tafuna WWTP has made strides in improving its dewatering process. The challenges posed by the humid climate, however, underscore the need for innovative solutions to enhance the efficiency of sludge management. The ongoing efforts to integrate the screw press into the dewatering process are a positive step towards achieving this goal.

The support facilities at the Tafuna WWTP, including the operations building, generator, and utility water system, are in varying states of disrepair. Frequent power outages and inadequate backup power systems highlight the need for significant upgrades to ensure uninterrupted operations. Furthermore, the plant lacks a Supervisory Control and Data Acquisitions (SCADA) system, which is essential for real-time monitoring and control of the wastewater treatment processes. The implementation of a SCADA system would enhance the efficiency and reliability of plant operations by providing comprehensive data and automated control capabilities. The support infrastructure at the Tafuna WWTP is integral to the overall functionality and resilience of the facility. Addressing the deficiencies in the support facilities is crucial for ensuring that the plant can operate efficiently and effectively, even in the face of unexpected challenges such as power outages. The introduction of a SCADA system, in particular, would revolutionize the plant's operational capabilities by enabling real-time monitoring and automated control of key processes.

ES.6.2.3 Overall Performance and Assessment

The overall performance of the plant in meeting the effluent discharge limits based on the current permit is analyzed. Effluent quality has generally satisfied the permit limits, with the exception of four exceedance instances (7% of the reported data) of average monthly BOD_5 concentrations and one instance of reduced BOD_5 % removal (2% of the reported data) in the last five years from October 2018 to September 2023. It is recommended that ASPA closely monitor the concentration of BOD in the effluent. Addition of chemical coagulants may assist in BOD settling if the concentrations of BOD continue to exceed the effluent concentration for multiple instances in the future. The graphs of pollutants of concerns listed in the current NPDES permit are included in **Section 6.1.9** of **Chapter 6**.

The capacities of major elements within each process are shown in **Figure ES - 3** for existing conditions and **Figure ES - 4**. for future conditions. All equipment has adequate capacity under current conditions. The grit channels, the influent pumps, and the pumps at the plant drain lift station exceed the 85% firm capacity limit under current flows (black dashed line in the figures below). Hence, these units should be prioritized for future upgrades. The incoming future flow is anticipated to exceed the firm capacity of the grit channel and influent pump station in the next 20 years. Although the influent wet well, UV disinfection system, and screw press have sufficient capacity for future flows; the incoming flow capacities of these units are above the 85% firm capacity mark, as shown in the figure below. ASPA should observe the capacities of these processes in the coming years and reevaluate the need for expansion in the next facility plan.

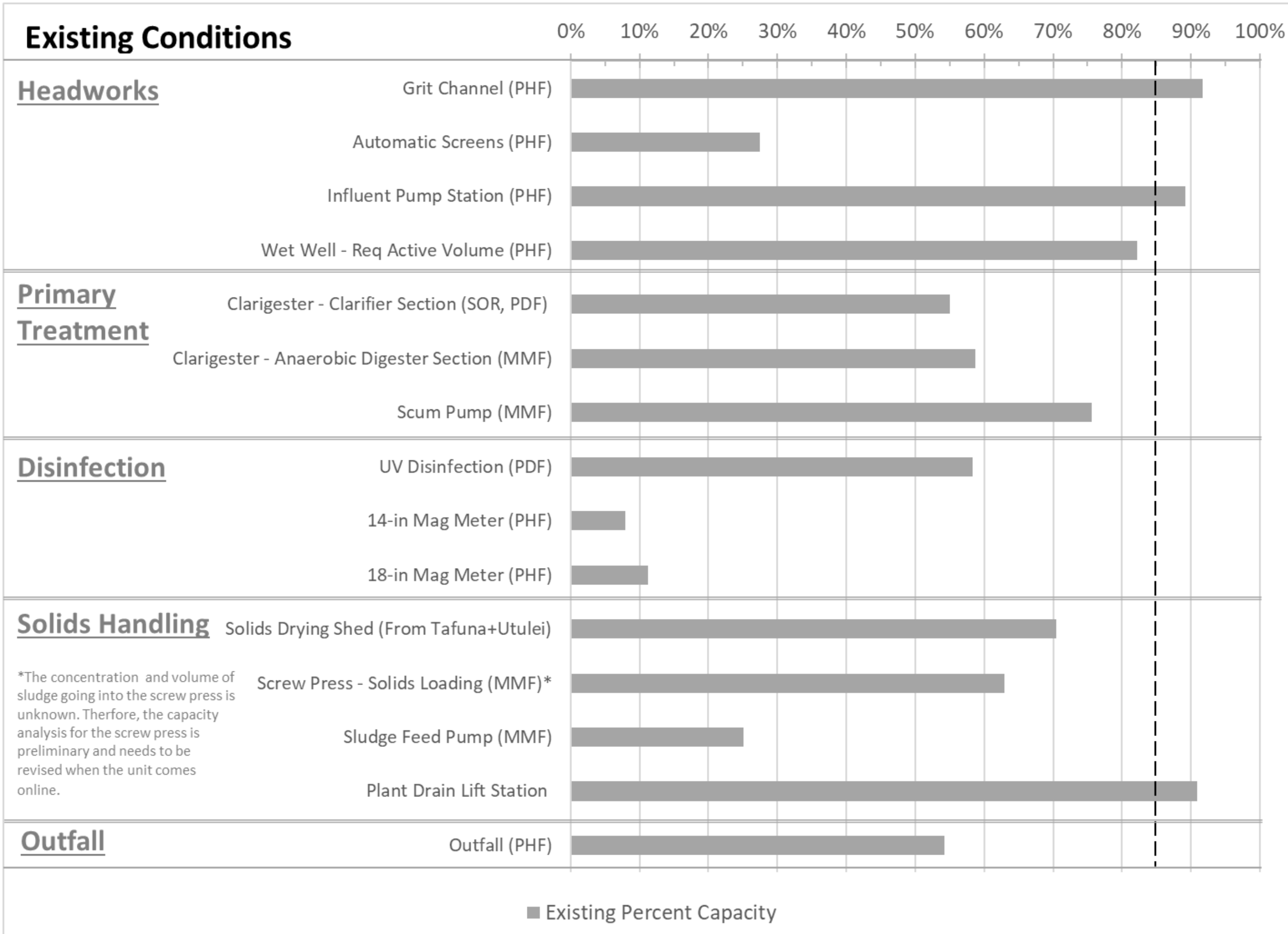

Figure ES - 3: **Tafuna WWTP – Capacity at Existing Condition**

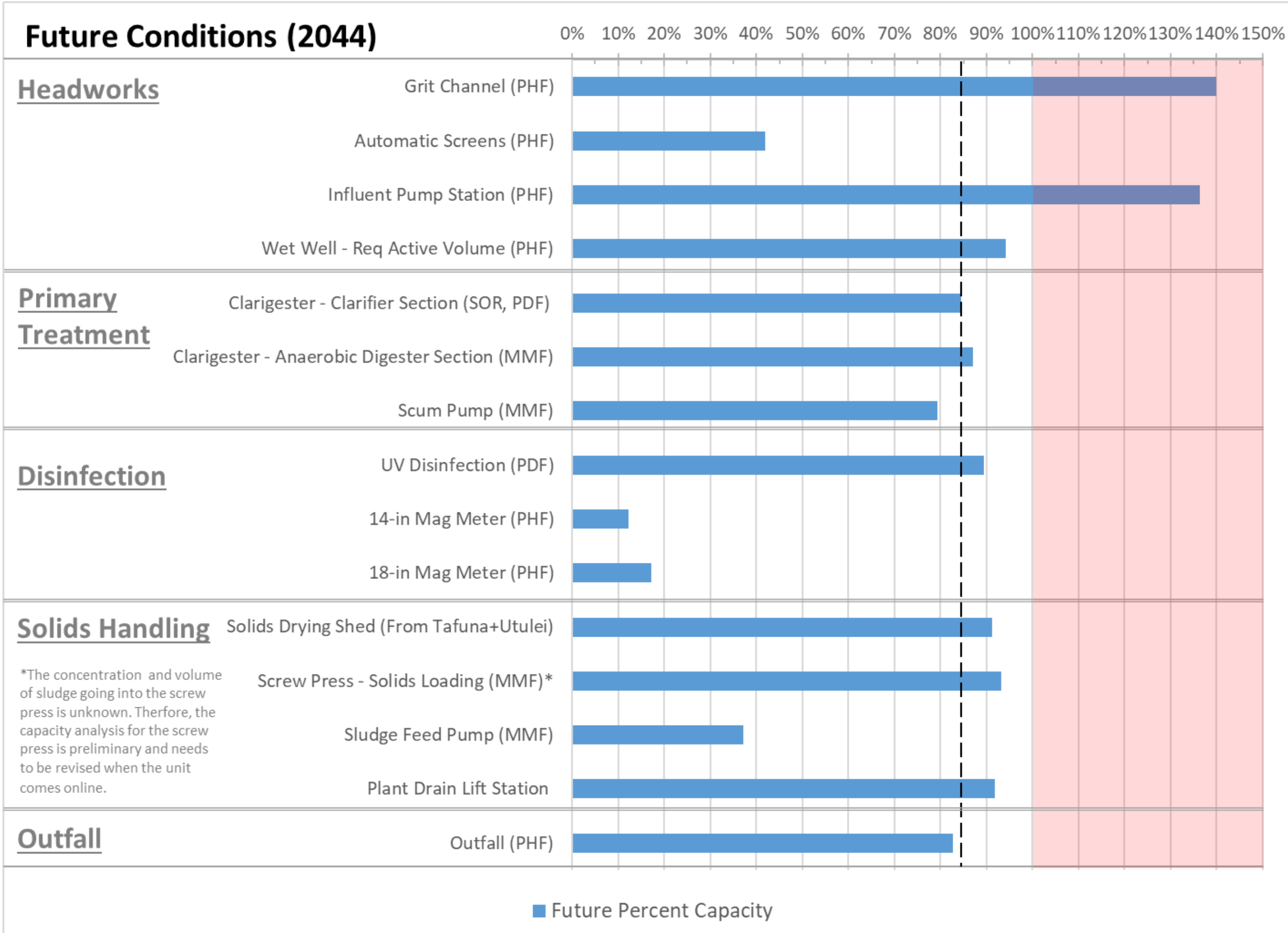

Figure ES - 4: **Tafuna WWTP – Capacity at Future Condition**

ES.6.3 Utulei WWTP

ES.6.3.1 Facility Overview

The Utulei WWTP serves the eastern villages of Tutuila Island and is located near the picturesque Pago Pago Harbor. Similar to the Tafuna WWTP, the Utulei facility was constructed in 1977 and expanded during the 1990s to accommodate the growing wastewater treatment needs of the region. The major process units in the treatment plant are:

- Headworks: Influent Pump Station and Manual Grit Removal
- Primary Treatment: Clarigester
- Disinfection: UV Disinfection
- Effluent Flow Measurement
- Outfall/ Effluent Disposal

ES.6.3.2 Existing Process Units

The headworks of the Utulei WWTP includes manual screening and grit removal, which pose significant operational challenges and safety hazards for plant personnel. The influent pump station, equipped with Flygt pumps, requires regular maintenance to ensure reliable operation. However, the lack of automated systems for grit removal exacerbates the operational difficulties faced by the facility. Primary treatment is provided by four clarigesters, which have undergone partial retrofits over the years. Despite these efforts, the clarigesters continue to face issues such as frequent blockages and dilapidated support structures, necessitating ongoing maintenance and upgrades.

The effectiveness of the primary treatment process at the Utulei WWTP is crucial for ensuring that the effluent meets required standards before further treatment and discharge. The clarigesters, despite undergoing partial retrofits, continue to present challenges that impact the overall efficiency of the treatment process. Addressing these issues through targeted maintenance and upgrades is essential for optimizing the plant's performance.

Effluent flow measurement at the Utulei WWTP is conducted using a single McCrometer magmeter. However, the absence of an influent flow meter compromises the accuracy of flow data, highlighting the need for additional metering systems to ensure precise monitoring. UV disinfection is employed for effluent treatment, but the system is energy-intensive and lacks redundancy, making it vulnerable to operational disruptions.

The support facilities at the Utulei WWTP, including the operations building and utility water system, are in poor condition and require significant repairs and upgrades. The plant operates without a SCADA system, relying on manual sampling and monitoring, which is labor-intensive and inefficient. The implementation of a SCADA system would greatly enhance the facility's operational efficiency by providing automated monitoring and control capabilities. Additionally, the backup generator, while functional, requires manual operation during power outages, underscoring the need for a more reliable and automated backup power system.

ES.6.3.4 Overall Performance and Assessment

The overall performance of the plant in meeting the effluent discharge limits based on the current permit is analyzed. The current effluent discharge limits for the Utulei WWTP are more stringent compared to the Tafuna WWTP. Few instances of exceedance were observed in the last five years from October 2018 to September 2023, which includes: two exceedance instances (8% of the reported data) of average monthly concentration of total phosphorus, five exceedance instances (12.8% of the reported data) and four exceedance instances (10.3% of the reported data) of the average monthly and maximum daily oil & grease respectively, and seven exceedance instances (16% of the reported data) and four exceedance instances (9% of the reported data) of average monthly and maximum daily enterococci respectively. The graphs of pollutants of concerns listed in the current NPDES permit are included in **Section 6.2.9** of **Chapter 6**.

The capacities of major elements within each process are shown in **Figure ES - 5** for existing conditions and **Figure ES - 6**. for future conditions. All equipment has adequate capacity under current and future conditions. The incoming flow to the influent pumps exceeds the 85% firm capacity limit under current flows (black dashed line in the figures below). Hence, these pump upgrades should be prioritized in the future. Although the influent pump station and clarifier section of the clarigesters have sufficient capacity for future flows, the incoming flow capacities of these units are above the 85% firm capacity mark. ASPA should observe the capacities of these processes in the coming years and reevaluate the need for expansion in the next facility plan.

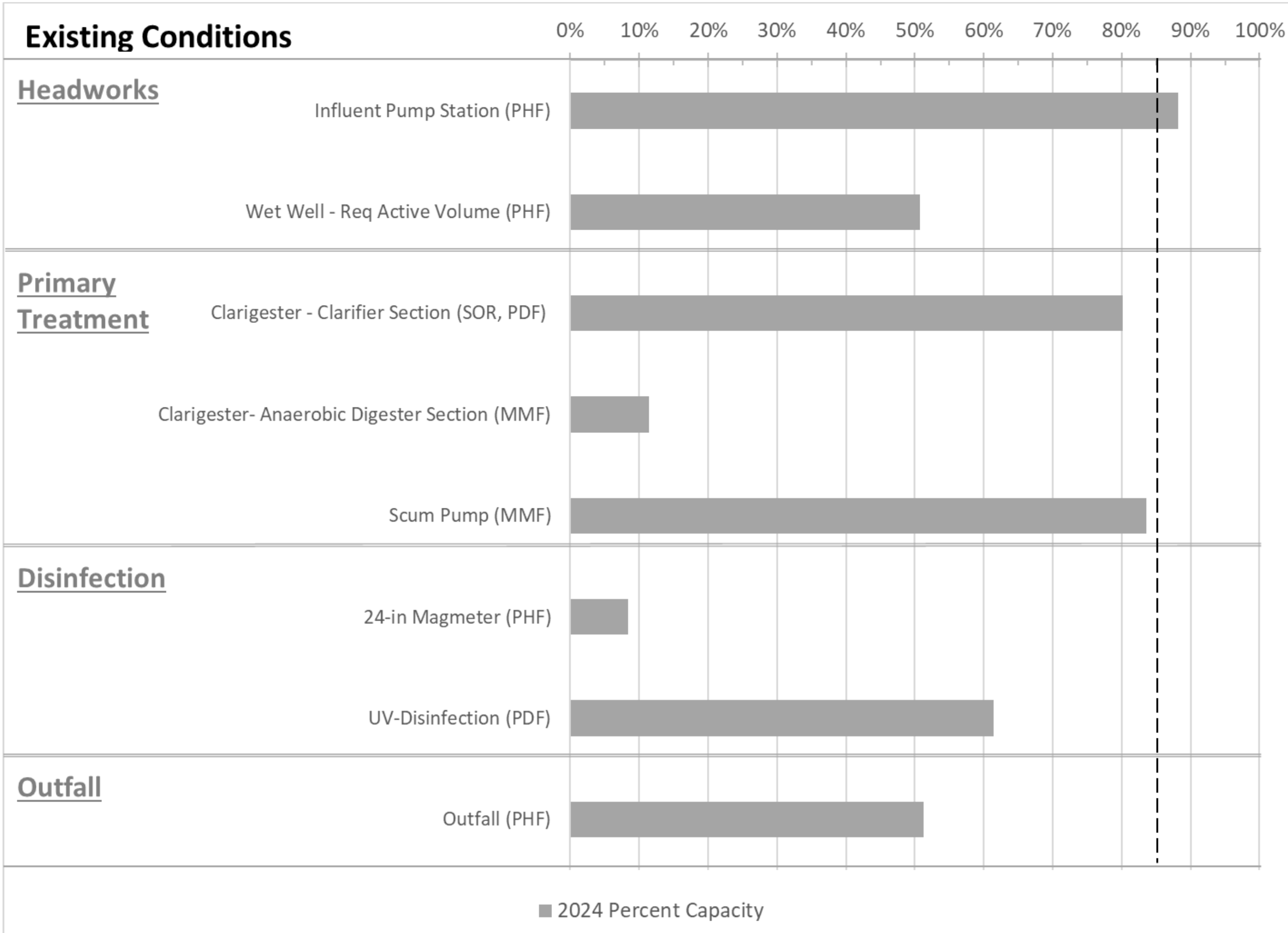

Figure ES - 5: Utulei WWTP – Capacity at Existing Conditions

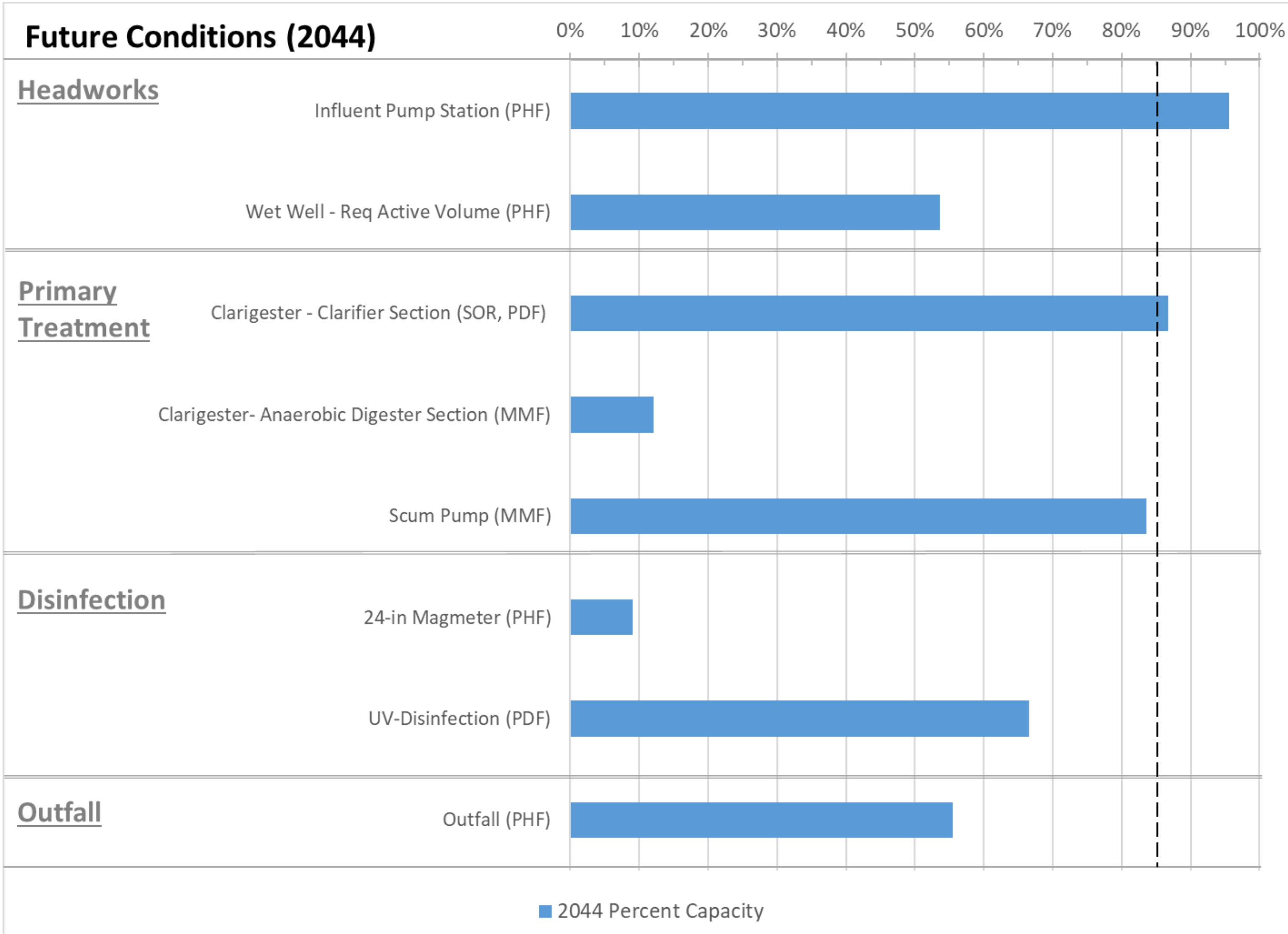

Figure ES - 6: **Utulei WWTP – Capacity at Future Conditions**

ES.6.4 Conclusions

The evaluation of the Tafuna and Utulei WWTPs underscores the importance of ongoing maintenance and timely upgrades to ensure compliance with regulatory requirements and protect environmental and public health. **Chapter 8** lists the recommended capital improvement projects for the wastewater treatment facilities based on the analysis presented in **Chapter 6**. By addressing the identified deficiencies and implementing the recommended improvements, ASPA can enhance the performance and reliability of its wastewater treatment infrastructure, ensuring a sustainable future for the region. The success of these initiatives will depend on the commitment of all stakeholders, including plant personnel, regulatory authorities, and the community, to support and invest in the necessary improvements.

ES.7 Chapter 7 – Collection System Evaluation

ES.7.1 Background

ASPA operates three sanitary sewer collection systems: the Tafuna, Utulei, and Aunu'u collection systems. Each of these systems serves a different region, with the Tafuna and Utulei systems located on the island of Tutuila and routing wastewater to their own WWTP's, and the Aunu'u system located on the island of Aunu'u and routing wastewater directly to the ocean. This evaluation serves as the System Evaluation and Capacity Assurance Plan (SECAP) and assesses the performance of the collection systems using a combination of hydraulic modeling and engineering calculations under both existing and future conditions. Future conditions anticipated collection system growth for 10-year, 20-year, and buildout (75-year) scenarios. The SECAP had the following primary goals:

- Provide a snapshot of current system flows.
- Calibrate unit flows for use in future model scenarios based on flow data that is currently available.
- Calibrate infiltration amounts and inflow responses based on flow data that is currently available.
- Identify existing capacity issues.

This methodology ensures a comprehensive analysis of the current state and future needs of the collection systems. Hydraulic modeling of all major gravity mains was completed using Aquanuity's AquaTwin Sewer software. The sections below provide a brief summary of each component of the SECAP and the associated results.

ES.7.2 Data and Collection System Management Plan

ASPA maintains GIS mapping for the entire sanitary sewer system and updates it with as-built drawings following infrastructure improvements. The primary GIS data used in the hydraulic model includes gravity mains, force mains, manholes, and lift stations. This data is crucial for accurate modeling and helps in planning for future infrastructure needs.

Asset management was categorized into four approaches: Operative-Reactive, Inspection-Condition Based, Proactive, and Predictive. Historically, ASPA has applied the first two approaches. It is recommended that ASPA move toward a Proactive approach to minimize asset failure risk. A proactive strategy will help in extending the lifecycle of the infrastructure and reducing unexpected system maintenance.

ES.7.3 Tafuna Collection System

ES.7.3.1 Existing System Summary

The Tafuna collection system, the largest of ASPA's systems, includes approximately 46 miles of gravity mains and 11 lift stations, and serves an estimated population of 19,854. Most of the gravity mains are made of polyvinyl chloride (PVC), with a small proportion consisting of asbestos cement (AC) and unknown materials. The average age of the system is about 42.2 years. J-U-B conducted site visits to each of the lift stations and observed conditions and deficiencies to identify potential lift station improvement projects.

ES.7.3.2 Existing Model

Until this utility plan, ASPA has not used a hydraulic model to evaluate the performance and capacity of the Tafuna collection system. A model was created utilizing ASPA's GIS dataset, field survey data, and the Aquanuity AquaTwin software. This new model includes the major gravity mains identified in **Figure E-3-1** located in **Appendix E**.

The Existing Model utilizes a service area layer and the estimated sewered population described in **Chapter 3** to establish existing flows for the model. The model was calibrated to lift station flow metering data located at the WWTP, Airport Lift Station, and Papa Stream Lift Station. See **Appendix E-4** for calibration results.

Section 7.3.2.5.4 in **Chapter 7** identifies that the Airport Lift Station and Papa Stream Lift Station sewer basins have excessive infiltration and inflow as defined by the United States Environmental Protection Agency (USEPA). **Figures E-3-4** and **E-3-5 in Appendix E-3** show the resulting depth over diameter and reserve capacity of the existing collection system during a design storm event.

Four areas within the collection system show surcharging, with some of the surcharging being high enough to spill out of the system. Through coordination with ASPA staff, it was determined that the model depicts overflows at locations where ASPA has observed overflows in the past during large rain events. Each of these four areas is described in additional detail in **Section 7.3.2.7.1**. The model also identified several lift stations that are over capacity or are nearing capacity during wet weather conditions. However, the model also confirmed that there are only minor capacity issues throughout the system during dry weather conditions. It is the storm events that produce greater than 3 inches of rain that create large capacity concerns. Model results from the Existing Model scenario are included in **Appendix E-5**.

ES.7.3.3 10-year Model

The 10-year model projects future collection system expansion within the next decade. For Tafuna, this includes connecting the following villages:

- 75% of the current population of the Vaitogi and the southern edge of Iliili villages (area south of Route 014).

- 50% of the current population of the Leone, Malaeloa Aitulagi, Malaeloa Ituau, Taputimu, Vailoatai, and Futiga villages.
- 50% of the current population of the Mapusagafou, Pavaiai, Aasu, and Aoloau villages.

Figure E-3-6 (**Appendix E**) shows the future growth areas and where they are expected to connect to the current collection system. **Figures E-3-7** and **E-3-8** from **Appendix E** show the resulting depth over diameter and reserve capacity of the existing collection system with 10-year flows during a design storm event. One new capacity concern on the 24-inch gravity main going under the airport runway was identified from the 10-year Model.

ES.7.3.4 20-year Model

The 20-year model projects future collection system expansion within the next 20-years. For Tafuna, this includes connecting the following villages:

- The remaining 25% of the current population of the Vaitogi and the southern edge of Iliili villages (area south of Route 014).
- The remaining 50% of the current population of the Leone, Malaeloa Aitulagi, Malaeloa Ituau, Taputimu, Vailoatai, and Futiga villages.
- The remaining 50% of the current population of the Mapusagafou, Pavaiai, Aasu, and Aoloau villages.

Figures E-3-9 and **E-3-10** from **Appendix E-3** show the resulting depth over diameter and reserve capacity of the existing collection system with 20-year flows during a design storm event. No new bottlenecks or capacity concerns were identified from the 20-year Model.

ES.7.3.5 Buildout Model (75-year)

The buildout model considers complete development and infill of the villages that are partially served by the current system. It assumes all areas will be connected to the sewer within 75 years. The analysis indicates that most existing capacity issues will persist or worsen, requiring significant infrastructure improvements.

Future capital improvements were not included in the buildout model, which allowed for identification of all capital improvements needed to address collection system capacity. **Figures E-3-11** and **E-3-12** from **Appendix E-3** show the resulting depth over diameter and reserve capacity of the existing collection system with buildout flows during a design storm event. Descriptions of capital improvement projects based on the findings from this SECAP can be found in **Chapter 8**.

ES.7.3.6 Recommendations

To address the identified issues, the following recommendations are made:

- Implement a proactive asset management approach to minimize the risk of asset failure.
- Complete an infiltration and inflow study to find the areas contributing to excessive infiltration and inflow.
- Resolve the number of residences and GIS mapping through field verification.

- Reduce infiltration and inflow through targeted repairs and maintenance, particularly by replacing or rehabilitating aging AC pipes in low-lying areas.
- Improve lift station capacities and performance by upgrading electrical components and installing new pumps where necessary.

See **Chapters 8** and **9** for a full list of capital improvement projects.

ES.7.4 Utulei Collection System

ES.7.4.1 Existing System Summary

The Utulei collection system, the second largest, encircles the Pago Pago Harbor and serves an estimated population of 7,675. It comprises roughly 15 miles of gravity mains and 13 lift stations. The gravity mains are primarily made of PVC and AC pipes, with the average system age being around 29.9 years. J-U-B conducted site visits to each of the lift stations and observed conditions and deficiencies to identify potential lift station improvement projects.

ES.7.4.2 Existing Model

Until this utility plan, ASPA has not used a hydraulic model to evaluate the performance and capacity of the Utulei collection system. A model was created utilizing ASPA's GIS dataset, field survey data, and the Aquanuity AquaTwin software. This new model includes the major gravity mains identified in **Figure E-3-13 (Appendix E-3)**.

The Existing Model utilizes a service area layer and the estimated sewered population described in **Chapter 3** to establish existing flows for the model. The model was calibrated to lift station flow metering data located at the WWTP and Malaloa Lift Station. See **Appendix E-4** for calibration results.

Section 7.4.2.3.4 identifies that the Utulei collection system suffers from excessive infiltration and inflow as defined by the United States Environmental Protection Agency (USEPA). **Figures E-3-16** and **E-3-17** from **Appendix E-3** show the resulting depth over diameter and reserve capacity of the existing collection system during a design storm event.

Four areas within the collection system show surcharging, with some of the surcharging being high enough to spill out of the system. Through coordination with ASPA staff, it was determined that the model depicts overflows at locations where ASPA has observed overflows in the past during large rain events. Each of these four areas is described in additional detail in **Section 7.4.2.5.1**. The model also identified several lift stations that are over capacity or are nearing capacity during wet weather conditions. However, the model also confirmed that there are only minor capacity issues throughout the system during dry weather conditions. It is the storm events that produce greater than 3 inches of rain that create large capacity concerns. Model results from the Existing Model scenario are included in **Appendix E-5**.

ES.7.4.3 10-year Model

Recently the Utulei collection system was expanded to service the entire Aua village. Within the next 10-years, there are no anticipated areas of growth and no significant changes in existing flows. Therefore, the previous model results listed from the Existing Model do not change.

ES.7.4.4 20-year Model

Within the next 20-years, there are no anticipated areas of growth and no significant changes in existing flows. Therefore, the previous model results listed from the Existing Model do not change.

ES.7.4.5 Buildout Model (75-year)

The buildout model considers complete development and infill of all the villages that are partially served by the current system as well as the expansion of the system to serve the Matu'u and Faganeanea villages. It assumes all areas will be connected to the sewer within 75 years. The analysis indicates that most existing capacity issues will persist or worsen, requiring several infrastructure improvements.

Future capital improvements were not included in the buildout model, which allowed for identification of all capital improvements needed to address collection system capacity. **Figures E-3-23** and **E-3-24** from **Appendix E-3** show the resulting depth over diameter and reserve capacity of the existing collection system with buildout flows during a design storm event. Descriptions of capital improvement projects based on the findings from this SECAP can be found in **Chapter 8**.

ES.7.4.6 Recommendations

To address the identified issues, the following recommendations are made:

- Implement a proactive asset management approach to minimize the risk of asset failure.
- Complete an infiltration and inflow study to find the areas contributing to excessive infiltration and inflow.
- Resolve the number of residences and GIS mapping through field verification.
- Reduce infiltration and inflow through targeted repairs and maintenance, particularly by replacing or rehabilitating aging AC pipes in low-lying areas.
- Improve lift station capacities and performance by upgrading electrical components and installing new pumps where necessary.

See **Chapters 8** and **9** for a full list of capital improvement projects.

ES.7.5 Aunu'u Collection System

ES.7.5.1 Existing System Summary

The smallest system, the Aunu'u collection system, consists of about one mile of gravity mains and one lift station, and serves the island of Aunu'u. The majority of the gravity mains are PVC. There is currently no wastewater treatment plant for the Aunu'u system and raw sewage is discharged directly into the ocean. Action is required to develop a treatment facility to prevent environmental contamination and to ensure compliance with health regulations.

ES.7.5.2 Existing Model

Until this utility plan, ASPA has not used a hydraulic model to evaluate the performance and capacity of the Aunu'u collection system. A model was created utilizing ASPA's GIS dataset and the Aquanuity

AquaTwin software. This new model includes the major gravity mains identified in **Figure E-3-25** in **Appendix E-3**.

The Existing Model utilizes a service area layer and the full village population to establish existing flows for the model. There is no available flow meter data on the island of Aunu'u and the unit flows and I/I rates determined by the Tafuna and Utulei models were averaged and used to assign existing flows to the system. See **Appendix E-4** for calibration results.

ES.7.5.3 Future Model

The Aunu'u area is considered to have reached buildout conditions; therefore, future development in the area is not anticipated. Full buildout flows were used for the existing model analysis, which resulted in identical model results for existing and future conditions.

While there are some buildings that are not currently connected to the collection system, such as a church and an elementary school on the southern border of the island, connecting these buildings to the collection system is not anticipated to result in any system capacity issues.

ES.7.6 Conclusion

This Collection System Evaluation and Capacity Assurance Plan (SECAP) provides a comprehensive assessment of the Tafuna, Utulei, and Aunu'u collection systems. The evaluation highlights existing bottlenecks and capacity issues, projects future growth impacts, and outlines potential improvements to ensure long-term system performance and reliability. By implementing the recommended actions listed in **Chapters 7** and **8**, ASPA can effectively manage its sewer collection systems, accommodate future growth, and protect environmental and public health.

The recommendations provided offer a clear roadmap for addressing both current and future challenges. Transitioning to a proactive asset management approach will significantly reduce the risk of infrastructure failure and extend the lifespan of the system. Replacing aging pipes, improving lift station capacities, and reducing infiltration and inflow are crucial steps towards enhancing system efficiency and reliability.

Furthermore, strategic expansion of the collection systems is essential to support the ASPA's focus on reducing potential pollution to groundwater from cess pools and septic systems. By focusing on the areas identified in the future scenarios, ASPA can ensure that the infrastructure is adequately prepared to handle increased flows as more of the island population is serviced by the collection system. The development of a wastewater treatment plant for the Aunu'u system is a critical priority, as it will prevent environmental contamination and protect public health.

Overall, implementing these recommendations will position ASPA to effectively manage its sewer collection systems for the long term. The proactive measures outlined in this plan will not only address existing issues but also ensure that the systems are resilient and capable of meeting future demands. By taking a strategic and comprehensive approach, ASPA can safeguard the well-being of the community and the environment while supporting sustainable collection system expansion in the region.

It is imperative that ASPA secures the necessary funding and resources to implement these improvements. Collaboration with local, regional, and national stakeholders will be essential in achieving the goals outlined in this plan. By working together, ASPA can ensure the successful execution of the SECAP and the continued provision of reliable and efficient wastewater services to the community.

ES.8 Chapter 8 – Potential Improvements

ES.8.1 Overview

Chapter 8 provides an overview of potential improvements for the general wastewater system, the WWTPs, and the collection systems, and estimates construction costs for each project. All potential improvements are conceptual and are intended to be used for planning purposes only. The potential improvement projects are divided into three primary sections: General Wastewater Improvements, Wastewater Treatment Plant Improvements, and Collection System Improvements. Each section addresses existing deficiencies and improvements that will be required to accommodate future growth.

ES.8.2 General Wastewater Improvements

The general improvements include projects that apply generally to ASPA's wastewater systems and to ASPA's Wastewater Division. These projects relate to condition, capacity, key infrastructure, and lift stations and impact both the collection systems and WWTPs. **Table ES - 3** provides a summary of the general CIP projects. The engineer's opinion of probable costs was developed for each project and is included in **Chapter 9** and **Appendix G-1**.

Table ES - 3: General - CIP Projects

No.	Description
G.1	I/I Study
G.2	GIS & Asset Management
G.3	CCTV Inspections
G.4	Wastewater Construction Standards Update

ES.8.3 Wastewater Treatment Plant Improvements

ES.8.3.1 Introduction

This section evaluates the Tafuna and Utulei WWTPs' ability to satisfy current permit conditions with the observed deficiencies identified in **Chapter 6** and projected flow changes over the next 20 years. Potential improvements are identified that are necessary to maintain reliable operations and effluent quality now and in the future. The improvement projects are categorized into four groups: Process Optimization/Permit Compliance, Condition of Equipment, Capacity, and Redundancy.

ES.8.3.2 WWTP Improvement Projects

Table ES - 4 and **Table ES - 5** list the prioritized improvement projects that are recommended for the Tafuna WWTP and the Utulei WWTP. The engineer's opinion of probable costs was developed for each project and is included in **Chapter 9** and **Appendix G-2**. The project description and cost of CIP projects related to treating wastewater outside the collection system of Tafuna and Utulei were provided by ASPA and are listed in **Table ES - 6.** The project description for each project is elaborated in **Section 8.2** of **Chapter 8**.

Table ES - 4: Tafuna WWTP – Prioritized CIP Projects

Process Area	Category	No.	Description
Highest Priority Projects (red level, 25 points)			
Headworks	Condition of Equipment	TWT.3	Miscellaneous Electrical Improvements of Screens
Headworks	Redundancy	TWT.8	Install a New Bypass Pipe
Clarigesters	Condition of Equipment	TWT.10	Replace Drive for Clarigester #2 and #3
Clarigesters	Condition of Equipment	TWT.11	Replace Grating of the Walkway and Railing of the Clarigester
Flow Measurement	Process Optimization	TWT.12	Record Hourly Flow
Disinfection	Condition of Equipment	TWT.15	New UV Shed for Corrosion Protection
Disinfection	Redundancy	TWT.17	Provide Backup Power to the AC unit in the UV Control Room
Disinfection	Redundancy	TWT.18	Backup Disinfection Design Study
Solids Dewatering and Disposal	Condition of Equipment	TWT.20	Ensure Working Conditions of Screw Press
Support Facilities	Process Optimization	TWT.21	Install New SCADA System
Support Facilities	Process Optimization	TWT.23	Coordinate Permit Conditions with EPA
Support Facilities	Condition of Equipment	TWT. 26	Raise the Grade of Plant Drain Lift Station
Support Facilities	Capacity	TWT.28	Generator Upgrades
Support Facilities	Redundancy	TWT.29	Install Redundant Utility Water Pump
High Priority Projects (orange level, 16-20 points)			
Headworks	Process Optimization	TWT.1	Install Influent WWTP Flow Meter
Headworks	Condition of Equipment	TWT.2	Corrosion Protection for Headworks
Clarigesters	Condition of Equipment	TWT.9	Replace Piping in Scum Pits
Flow Measurement	Condition of Equipment	TWT.13	Recoat Exposed Piping
Disinfection	Process Optimization	TWT.14	Recalibrate UVT meter
Disinfection	Condition of Equipment	TWT.16	Miscellaneous Channel Improvements
Outlet Box and Outfall Line	Process Optimization	TWT.19	Outfall Modification Study

Process Area	Category	No.	Description
Support Facilities	Condition of Equipment	TWT.25	Investigate Sampling and Testing Practices
Support Facilities	Capacity	TWT.27	Wastewater Operations Building Upgrades and Remodeling Study
Medium Priority Projects (yellow level, 11-15 points)			
Headworks	Condition of Equipment	TWT.4	Install FRP grating Over the Grit Channels
Headworks	Condition of Equipment	TWT.5	Provide Spare Pump and Parts for Influent Pump Station
Headworks	Capacity	TWT.6	Upsize Influent Pumps
Headworks	Capacity	TWT.7	Install a Parallel Headworks Train
Support Facilities	Process Optimization	TWT.22	Install Refrigerated Composite Samplers
Low Priority Projects (green level, 6-10 points)			
Support Facilities	Condition of Equipment	TWT.24	Install Filter for Incoming Power

Table ES - 5: Utulei WWTP – Prioritized CIP Projects

Process Area	Category	No.	Description
Highest Priority Projects (red level, 25 points)			
Clarigester	Condition of Equipment	UWT.7	Replace Drive for Clarigester #2 and #3
Clarigester	Condition of Equipment	UWT.8	Replace Walkway and Railing of the Clarigester
Clarigester	Condition of Equipment	UWT.9	Study Cracks in the Clarigester
Clarigester	Process Optimization	UWT.10	Record Hourly Flow
Disinfection	Redundancy	UWT.15	Backup Disinfection Design Study
Disinfection	Redundancy	UWT.16	Provide Backup Power to the AC unit in the UV Control Room
Disinfection	Process Optimization	UWT.17	Outfall Modification Study
Outlet Box and Outfall Line	Process Optimization	UWT.18	Install New SCADA System
Support Facilities	Process Optimization	UWT.20	Coordinate Permit Conditions with the EPA
Support Facilities	Capacity	UWT.25	Generator Upgrades
High Priority Projects (orange level, 16-20 points)			
Headworks	Process Optimization	UWT.3	Install Influent Flow Meter
Headworks	Condition of Equipment	UWT.4	Corrosion Protection for Headworks
Flow Measurement	Process Optimization	UWT.12	Recalibrate UVT meter

Process Area	Category	No.	Description
Disinfection	Condition of Equipment	UWT.13	New UV Shed for Corrosion Protection
Disinfection	Condition of Equipment	UWT.14	Miscellaneous Channel Improvements
Support Facilities	Condition of Equipment	UWT.22	Investigate Sampling and Testing Practices
Support Facilities	Capacity	UWT.23	Replace Pumps in the Utility Water System
Medium Priority Projects (yellow level, 11-15 points)			
Headworks	Condition of Equipment	UWT.5	Provide Spare Pump and Parts for Influent Pump Station
Headworks	Condition of Equipment	UWT.6	Replace Piping in Scum Pits
Flow Measurement	Condition of Equipment	UWT.11	Recoat Exposed Piping
Support Facilities	Process Optimization	UWT.19	Install Refrigerated Composite Samplers
Support Facilities	Capacity	UWT.24	Wastewater Operations Building Upgrades and Remodeling Study
Low Priority Projects (green level, 6-10 points)			
Process Area	Process Optimization	UWT.1	New Headworks Building with Screen and Grit Removal
Headworks	Process Optimization	UWT.2	Install Automatic Wet Basket Screen
Support Facilities	Condition of Equipment	UWT.21	Install Filter for Incoming Power

Table ES - 6: Other Prioritized Wastewater Treatment Related CIP Projects

Category	No.	Description
Highest Priority Projects (red level, 25 points)		
Process Optimization	OWT.1	Aunu'u Wastewater System Treatment and Design Study
Process Optimization	OWT.2	Manua Islands Septic Tank Installation
High Priority Projects (orange level, 16-20 points)		
Condition of Equipment	OWT.3	Tutuila On-Site Septic System Upgrade

ES.8.4 Collection System Improvements

ES.8.4.1 Introduction

This section evaluates the Tafuna, Utulei, and Aunu'u collection systems, identifying potential improvements necessary to maintain reliable operations and address future flow changes. The projects are categorized into the following groups:

- **Condition** – Projects required to maintain or improve the integrity of the existing system, manage associated risks, and to address excessive I/I.

- **Capacity** – Projects required to remove bottlenecks in the system that propagate significant upstream surcharging. Each bottleneck has a section with a reserve capacity less than zero (“over capacity”) and a d/D greater than one otherwise known as a full pipe.
- **Key Infrastructure** – Projects to serve growth in specific areas or otherwise accomplish ASPA’s goals to preserve groundwater aquifer water quality and the marine environment.
- **Lift Station Projects** – Projects required to improve the condition and/or capacity of existing lift stations that have condition concerns and/or do not have adequate capacity.

It is recommended that ASPA focus on the General Wastewater Improvements and the condition-based projects first to eliminate as much of the I/I as possible. By lessening the I/I flow entering the systems it is possible that the capacity-based projects could be eliminated while also removing the potential of a future SSO at locations currently known to overflow.

The engineer’s opinion of probable costs was developed for each project and is included in **Chapter 9** and **Appendix G-3**.

ES.8.4.2 Tafuna Collection System Improvement Projects

Condition projects focus on rehabilitating pipes in the Coconut Point, Papa Stream, Vaitele, Skill Center, and Airport lift station areas to address high I/I and restore system integrity. Capacity projects include upsizing the Tafuna gravity main, the Vaitele gravity main, the Papa Stream gravity main, and gravity mains in the Coconut Point area to alleviate capacity issues and reduce surcharging.

Key infrastructure projects involve extending the collection system in Vaitogi, Leone, Malaeimi, Upper Pavaiai, and Aoloau to protect groundwater and marine environments. Lift station upgrades in the Tafuna area include electrical control improvements, capacity enhancements, and addressing corrosion and infiltration issues. **Table ES - 7** provides a summary of the prioritized Tafuna collection system CIP projects.

Table ES - 7: Prioritized Tafuna Collection System CIP Projects

No.	Description
Highest Priority Projects (red level, 25 points)	
TCS.16	Overall Tafuna Lift Station Electrical/Control Upgrades
TCS.2	Papa Stream LS Condition Assessment & Rehabilitation
TCS.3	Vaitele LS Condition Assessment & Rehabilitation
TCS.23	Vaitele Lift Station Upgrades
TCS.1	Coconut Point Condition Assessment & Rehabilitation
TCS.13	Malaeimi Sewer Extension Expansion
TCS.14	Upper Pavaiai Collection System Expansion
TCS.6	Overall Tafuna Inflow and Infiltration Inspection/Maintenance
High Priority Projects (orange level, 16-20 points)	
TCS.22	Papa Stream Lift Station Upgrades
Medium Priority Projects (yellow level, 11-15 points)	
TCS.9	Papa Stream Gravity Main Upsize
TCS.7	Tafuna Gravity Main Upsize
TCS.8	Vaitele Gravity Main Upsize
TCS.10	Coconut Point Gravity Main Upsize
TCS.19	Coconut Point #1 Lift Station Upgrades
TCS.17	Coconut Point #3 Lift Station Upgrades
TCS.18	Coconut Point #2 Lift Station Upgrades
TCS.24	Lavatai Lift Station Upgrades
Low Priority Projects (green level, 6-10 points)	
TCS.25	Skill Center Lift Station Upgrades
TCS.4	Skill Center LS Condition Assessment & Rehabilitation
TCS.5	Airport LS Condition Assessment & Rehabilitation
Lowest Priority Projects (gray level, 1-5 points)	
TCS.20	Andy's Lift Station Upgrades
TCS.21	Sagamea Lift Station Upgrades
TCS.26	Freddie's Beach Lift Station Upgrades
TCS.11	Vaitogi Collection System Expansion
TCS.12	Leone Collection System Expansion
TCS.15	Aoloau Collection System Expansion

ES.8.4.3 Utulei Collection System Improvement Projects

Condition projects include rehabilitating pipes in the Leloaloa, Atu’u, Satala, Korean, Malaloa, and Faga’alu lift station areas to address condition and I/I concerns. Capacity projects focus on upsizing the Malaloa gravity main to reduce surcharging and SSOs. Key infrastructure projects involve extending the collection system in the Matu’u to Faganeanea area and the Upper Pago Pago Bay area for environmental protection.

Lift station upgrades in the Utulei area include electrical control improvements, capacity enhancements, and addressing corrosion and infiltration issues. **Table ES - 8** provides a summary of the prioritized Utulei Collection system CIP projects.

Table ES - 8: Prioritized Utulei Collection System CIP Projects

No.	Description
Highest Priority Projects (red level, 25 points)	
UCS.5	Malaloa LS Condition Assessment & Rehabilitation
UCS.2	Atu'u LS Condition Assessment & Rehabilitation
UCS.12	Overall Utulei Lift Station Electrical/Control Upgrades
UCS.8	Overall Utulei Inflow and Infiltration Inspection/Maintenance
UCS.11	Upper Pago Pago Bay Area Extension
UCS.17	Faga'alu Lift Station Upgrades
High Priority Projects (orange level, 16-20 points)	
UCS.14	Satala Lift Station Upgrades
UCS.6	Utulei WWTP Condition Assessment & Rehabilitation
Medium Priority Projects (yellow level, 11-15 points)	
UCS.9	Malaloa Gravity Main Upsize
UCS.16	Malaloa Lift Station Upgrades
UCS.15	Korean Lift Station Upgrades
UCS.10	Matu'u to Faganeanea Collection System Extension
UCS.3	Satala LS Condition Assessment & Rehabilitation
UCS.4	Korean LS Condition Assessment & Rehabilitation
UCS.7	Faga'alu LS Condition Assessment & Rehabilitation
UCS.13	Atu'u Lift Station Upgrades
Low Priority Projects (green level, 6-10 points)	
UCS.1	Leloaloa LS Condition Assessment & Rehabilitation
Lowest Priority Projects (gray level, 1-5 points)	
UCS.18	Matafao Lift Station Upgrades

ES.8.4.4 Aunu'u Collection System Improvement Projects

Lift station upgrades in Aunu'u involve improving capacity and addressing corrosion and electrical issues. **Table ES - 9** provides a summary of the Aunu'u collection system CIP projects. There are no condition, capacity, or key infrastructure projects within the Aunu'u system.

Table ES - 9: Aunu'u Collection System CIP Projects

No.	Description
High Priority Projects (orange level, 16-20 points)	
ACS.1	Aunu'u Lift Station Improvements

ES.9 Chapter 9 – Capital Improvement Plan and Implementation

ES.9.1 Overview

The purpose of the Capital Improvement Plan (CIP) is to provide ASPA with a prioritized list of capital improvement projects that address existing wastewater system deficiencies, account for future growth and system expansion, and replace aging infrastructure as it reaches the end of its useful life. Each project was ranked using a system defined at the beginning of **Chapter 9**. Most of the project equipment and construction materials need to be shipped from overseas to American Samoa, which results in higher construction costs than the mainland U.S. The construction costs were calculated based on material, equipment, services, and labor typically found in the United States, mostly in Utah and Idaho, and then was multiplied by a factor of 2.0 to estimate the likely cost of these construction items in American Samoa.

ES.9.2 General Improvement Projects

The general improvements include projects that apply generally to ASPA's wastewater systems and to ASPA's Wastewater Division. These projects relate to condition, capacity, key infrastructure, and lift stations and impact both the collection system and WWTPs. The General Wastewater CIP projects are recommended to be included in the 0-5 year timeframe as they will provide valuable information that will aid ASPA in identifying where improvements are needed, which will allow ASPA to spend funds more efficiently. A total of four general improvement projects are prioritized, with an estimated total capital cost of $2.28 million. **Table ES - 10** provides a summary of the General Improvement Projects and their estimated costs.

Table ES - 10: General – CIP Projects and Costs (0-5 years)

No.	Description	Capital Cost (2025 Dollars)
G.1	I/I Study	$805,000
G.2	GIS & Asset Management	$21,000
G.3	CCTV Inspections[1]	$1,332,000
G.4	Wastewater Construction Standards Update	$121,000
	TOTAL (2025 Dollars)	**$2,279,000**

1. Project includes operation and maintenance costs that do not represent capital costs but are included for financial planning.

ES.9.3 WWTP Capital Improvement Plan Projects

ES.9.3.1 Tafuna WWTP Improvement Projects

A total of 29 projects were identified for the Tafuna WWTP to satisfy current needs and projected flow changes. The engineer's opinion of the probable total capital cost for all the proposed projects for the Tafuna WWTP is **$9.7 million**, and the cost for projects still needing funding is **$5.9 million**. A detailed cost opinion for each project and a list of projects prioritized for each phase are described in **Chapter 9**. Among them, the projects that should be prioritized for implementation for the Tafuna WWTP are in Phase 1 (0-

5) years and summarized in **Table ES - 11.** Similarly, **Table ES - 12** summarizes the Tafuna WWTP improvement project costs by timeframe.

Table ES - 11: Tafuna WWTP - Phase 1 Projects and Costs (0-5 years)

No.	Description	Capital Cost (2025 Dollars)
TWT.3	Miscellaneous Electrical Improvements of Screens	$610,000
TWT.8	Install a New Bypass Pipe	$132,000
TWT.10	Replace Drive for Clarigester #2 and #3[1]	$1,433,000
TWT.11	Replace Grating of the Walkway and Railing of the Clarigester[1]	$693,000
TWT.12	Record Hourly Flow	$0
TWT.15	New UV Shed for Corrosion Protection[1]	$654,000
TWT.17	Provide Backup Power to the AC unit in the UV Control Room	$225,000
TWT.18	Backup Disinfection Design Study[1]	$212,000
TWT.20	Dewatering Infrastructure Improvements	$289,000
TWT.21	Install New SCADA System[1]	$700,000
TWT.23	Coordinate Permit Conditions with EPA	$101,000
TWT.26	Raise the Grade of the Plant Drain Lift Station	$9,100
TWT.28	Generator Upgrades	$591,000
TWT.29	Install Redundant Utility Water Pump[1]	$109,000
	TOTAL (2025 Dollars)	**$5,758,100**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented yet.

Table ES - 12: Tafuna WWTP - Project Cost Summary

CIP Project Timeframe	Total Cost (2025 Dollars)	Capital Cost (2025 Dollars) [1]
0-5 years	$5,758,100	$1,957,100
5-10 years	$942,140	$942,140
10-20 years	$2,654,360	$2,654,360
20+ years	$397,000	$397,000
As needed with Growth	-	-
Total (2025 Dollars)	**$9,751,600**	**$5,950,600**

1. Portion of total cost after grant funding

ES.9.3.2 Utulei WWTP Improvement Projects

A total of 25 projects were identified for the Utulei WWTP to satisfy current needs and projected flow changes. The engineer's opinion of the probable total capital cost for all the proposed projects for Utulei WWTP is **$22 million**, and the cost of projects still needing funding is **$18.4 million**. A detailed cost opinion for each project and a list of projects prioritized for each phase are described in **Chapter 9**. Among them, the projects that should be prioritized for implementation for the Utulei WWTP are in Phase 1 (0-5) years and summarized in **Table ES - 11**. Similarly, **Table ES - 12** summarizes the Tafuna WWTP improvement project costs by timeframe.

Table ES - 13: Utulei WWTP – Phase 1 Projects and Costs (0-5 years)

No.	Description	Capital Cost (2025 Dollars)
UWT.7	Replace Drive for Clarigester #2 and #3[1]	$1,433,000
UWT.8	Replace Walkway and Railing of the Clarigester[1]	$703,000
UWT.9	Study Cracks in the clarigester	$51,000
UWT.10	Record Hourly Flow	$0
UWT.15	Backup Disinfection Design Study	$212,000
UWT.16	Provide Backup Power to the AC unit in the UV Control Room	$225,000
UWT.17	Outfall Modification Study	$202,000
UWT.18	Install New SCADA System[1]	$700,000
UWT.20	Coordinate Permit Conditions with EPA	$101,000
UWT.25	Generator Upgrades[1]	$754,000
	TOTAL (2025 Dollars)	**$4,381,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time.

Table ES - 14: Utulei WWTP - Project Cost Summary

CIP Project Timeframe	Total Cost (2025 Dollars)	Capital Cost (2025 Dollars) [1]
0-5 years	$4,381,000	$791,000
5-10 years	$1,294,400	$1,294,400
10-20 years	$305,000	$305,000
20+ years	$16,061,000	$16,061,000
As needed with Growth	-	-
Total (2025 Dollars)	**$22,041,400**	**$18,451,400**

1. Portion of total cost after grant funding

ES.9.3.3 Other Treatment-Related Improvement Projects

A total of 3 projects were identified for improving wastewater treatment outside Tafuna and Utulei's collection systems. The probable total capital cost for all the proposed projects in this category is **$4.25 million** and the cost of projects still needing funding is **$3.75 million**. The projects are listed in **Table ES - 15**. ASPA provided the estimated cost of these projects and J-U-B Engineers did not evaluate these costs.

Table ES - 15: Other Treatment-Related Improvement Projects

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years
OWT.1	Aunu'u Wastewater System Treatment and Design Study[1]	$500,000	$500,000	
OWT.2	Manua Islands Septic Tank Installation	$1,250,000	$1,250,000	
OWT.3	Tutuila On-Site Septic System Upgrade	$2,500,000		$2,500,000
	TOTAL (2025 Dollars)	**$4,250,000**	**$1,750,000**	**$2,500,000**
	TOTAL (2025 Dollars)-Non-Funded Projects	**$3,750,000**	**$1,250,000**	**$2,500,000**

1. This project is already funded under ASPA's Bill Grant Funds as listed in FY24-25 Clean Water Act Infrastructure Project Ranking, which was provided by ASPA through email on 6/26/2024.

ES.9.4 Collection System Capital Improvement Plan Projects

ES.9.4.1 Tafuna Collection System

A total of 26 projects were identified for the Tafuna collection system to satisfy current needs and projected flow changes. The total estimated capital cost for all 26 of the Tafuna collection system improvements is $313.9 million. A detailed engineer's opinion of probable cost for each project and a list of projects prioritized for each phase are described in **Chapter 9**. Among them, the projects that should be prioritized for implementation for the Tafuna collection system in Phase 1 (0-5 years) are summarized in **Table ES - 16**. Similarly, **Table ES - 17** provides a summary of the Tafuna collection system CIP project costs by timeframe.

Table ES - 16: Tafuna Collection System CIP Projects and Costs (0-5 years)

No.	Description	Capital Cost (2025 Dollars)
TCS.1	Coconut Point Condition Assessment & Rehabilitation	$392,000
TCS.2	Papa Stream LS Condition Assessment & Rehabilitation	$190,000
TCS.3	Vaitele LS Condition Assessment & Rehabilitation[1]	$104,000
TCS.6	Overall Tafuna Inflow and Infiltration Inspection/Maintenance[1]	N/A
TCS.13	Malaeimi Sewer Extension Expansion[1]	$4,500,000
TCS.14	Upper Pavaiai Collection System Expansion[1]	$4,159,000 $841,000
TCS.16	Overall Tafuna Lift Station Electrical/Control Upgrades[1]	N/A
TCS.23	Vaitele Lift Station Upgrades[1]	$3,152,000
	TOTAL (2025 Dollars)	**$13,338,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time. The cost shown here is the engineer's opinion of probable cost and is not included in the total cost of improvements for Tafuna Collection System.

Table ES - 17: Tafuna Collection System CIP Project Cost Summary

CIP Project Timeframe	Total Cost (2025 Dollars)	Capital Cost (2025 Dollars)[1]
0-5 years	$13,338,000	$4,741,000
5-10 years	$7,286,000	$1,521,000
10-20 years	$18,769,000	$18,769,000
20+ years	$1,390,000	$1,390,000
As needed with Growth	$273,094,000	$273,094,000
Total (2025 Dollars)	**$313,877,000**	**$299,515,000**

1. Portion of total cost after grant funding

ES.9.4.2 Utulei Collection System

A total of 18 projects were identified for the Utulei collection system, with an estimated total capital cost of $19.9 million. A detailed engineer's opinion of probable cost for each project and a list of projects prioritized for each phase are described in **Chapter 9**. Among them, the projects that should be prioritized for implementation for Utulei's collection system in Phase 1 (0-5 years) are summarized in **Table ES - 18**. Similarly, **Table ES - 19** provides a summary of Utulei's collection system CIP project costs by timeframe.

Table ES - 18: Utulei Collection System CIP Projects and Costs (0-5 years)

No.	Description	Capital Cost (2025 Dollars)
UCS.2	Atu'u LS Condition Assessment & Rehabilitation	$135,000
UCS.5	Malaloa LS Condition Assessment & Rehabilitation	$889,000
UCS.7	Faga'alu LS Condition Assessment & Rehabilitation	$876,000
UCS.8	Overall Utulei Inflow and Infiltration Inspection/Maintenance[1]	N/A
UCS.11	Upper Pago Pago Bay Area Extension[1]	$3,500,000
UCS.12	Overall Utulei Lift Station Electrical/Control Upgrades[1]	N/A
UCS.17	Faga'alu Lift Station Upgrades	$1,966,000
	TOTAL (2025 Dollars)	**$7,366,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time. The cost shown here is the engineer's opinion of probable cost and is not included in the total cost of improvements for Tafuna Collection System.

Table ES - 19: Utulei Collection System CIP Project Cost Summary

CIP Project Timeframe	Total Cost (2025 Dollars)	Capital Cost (2025 Dollars) [1]
0-5 years	$7,366,000	$3,866,000
5-10 years	$3,192,000	$3,192,000
10-20 years	$8,609,000	$8,009,000
20+ years	$393,000	$393,000
As needed with Growth	$388,000	$388,000
Total (2025 Dollars)	**$19,948,000**	**$15,848,000**

1. Portion of total cost after grant funding

ES.9.4.3 Aunu'u Collection System

A single project was identified to address lift station needs in the Aunu'u collection system, with an estimated total capital cost of $292,000. **Table ES - 20** provides a summary of the single 5-10 year Aunu'u collection system CIP project and its capital cost.

Table ES - 20: Aunu'u Collection System CIP Projects and Costs (5-10 years)

No.	Description	Capital Cost (2025 Dollars)
ACS.1	Aunu'u Lift Station Improvements	$292,000
	TOTAL (2025 Dollars)	**$292,000**

ES.9.1 Conclusion

The CIP provides prioritized improvement projects that are recommended to maintain and enhance the wastewater infrastructure of American Samoa. By addressing current deficiencies, planning for future growth, and replacing aging infrastructure, ASPA will be able to provide a wastewater system that operates more effectively and efficiently to meet the needs of the community for years to come.

ES.10 Chapter 10 – Financial Assessment

Chapter 10 provides the Financial Assessment based on the projects and phasing plan from **Chapter 9**.

J·U·B ENGINEERS, INC.

CHAPTER 1

INTRODUCTION

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Chapter 1 Introduction

1.1 Introduction

American Samoa Power Authority (ASPA) contracted with J-U-B Engineers, Inc. (J-U-B) to prepare an updated Wastewater Utility Plan (WWUP) for the wastewater systems and infrastructure under the ownership and control of ASPA. The updated plan will help ASPA to identify needed improvements to the wastewater systems and to develop plans for routine maintenance of the wastewater systems to improve their longevity. Additionally, this WWUP will assist ASPA in fulfilling its mission, which is outlined in ASPA's mission statement, provided in **Figure 1-1**.

> American Samoa Power Authority Mission Statement
>
> *"Provide quality, safe, economical and sustainable utility service in partnership with our customers, the Community of American Samoa and the Pacific Region".*

Figure 1-1: American Samoa Power Authority Mission Statement

1.2 Background

ASPA owns and operates three sanitary sewer collection systems: the Tafuna collection system, the Utulei collection system, and the Aunu'u collection system. These collection systems serve approximately 28,000 residents, with some unsewered population adjacent to the main collection systems being served by septic systems. The Tafuna and Utulei collection systems are located on the island of Tutuila, while the Aunu'u collection system is located on the island of Aunu'u. The collection systems include miles of collection system pipes and multiple lift stations. The Manu'a Islands do not have any sanitary sewer collection systems, only cesspools and septic tank systems.

In addition to the collection systems, ASPA owns and operates two wastewater treatment plants (WWTPs): the Tafuna WWTP and the Utulei WWTP. Both WWTPs are located on the island of Tutuila and provide primary treatment and disinfection prior to discharging to the Pacific Ocean. The Tafuna WWTP serves the western-central area of Tutuila, including the Tafuna collection system, and the Utulei WWTP serves the eastern-central area of Tutuila, including the Utulei collection system. The Aunu'u collection system is not connected to a WWTP and discharges to an outfall that is located approximately 280 feet from the shoreline. **Figure 1-2** shows ASPA's existing wastewater systems.

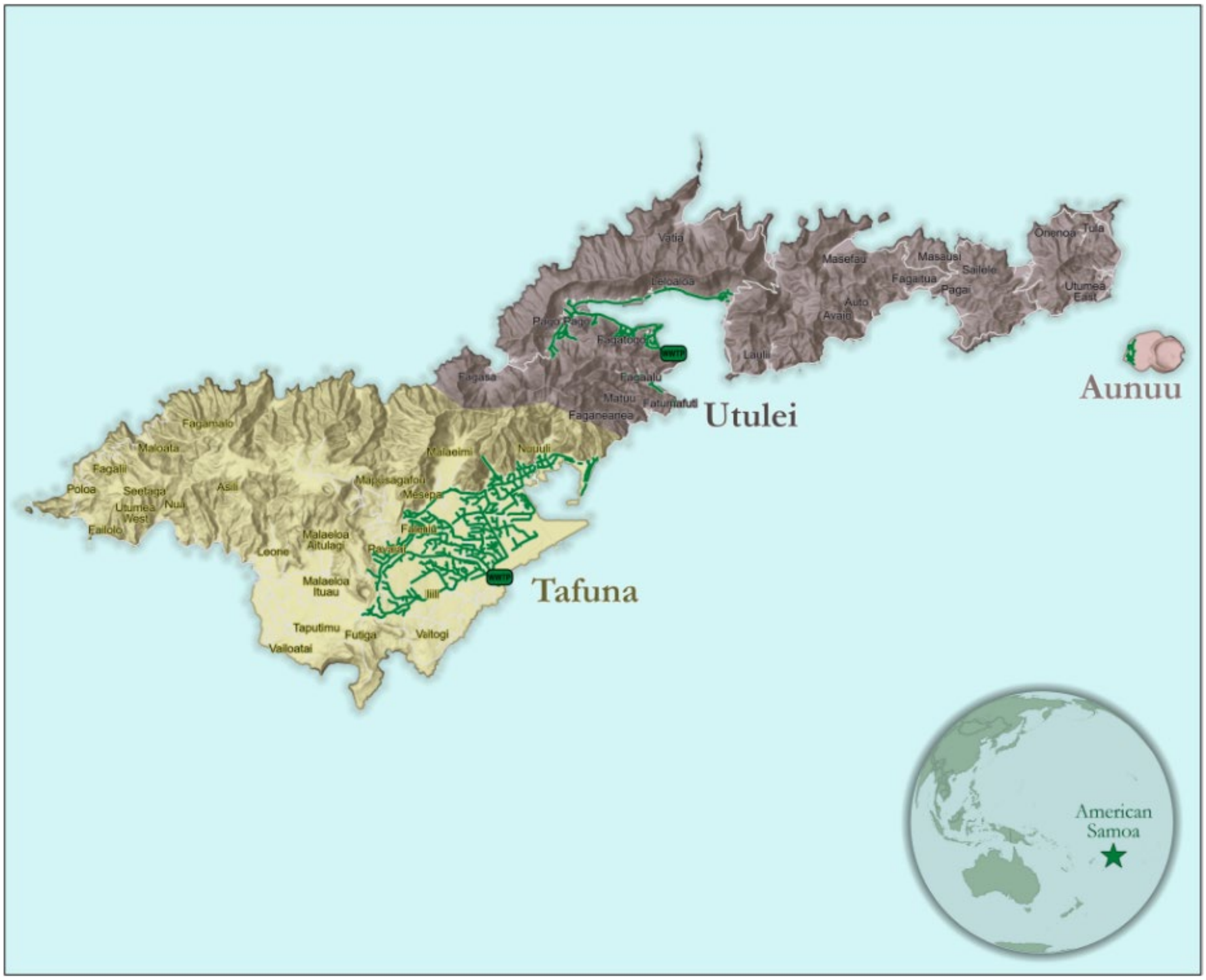

Figure 1-2: Existing Wastewater Systems

This WWUP serves as an update to ASPA's 2003 Utilities Master Plan (Pedersen Planning Consultants, 2003) and provides critical planning information for the Secondary Treatment Feasibility Study. The following documents, reports, and studies provided critical background information and data that were used in preparing this WWUP:

- American Samoa Power Authority Utilities Master Plan, Pedersen Planning Consultants, July 2003
- American Samoa Water Use Data: A Workplan for Evaluation and Improvement, Shuler Hydrologic LLC, 2018
- Diffuser Configuration and Performance: Scoping Studies for the Tafuna and Utulei WWTPs, GDC, 2012
- Identification of projects to increase the critical initial dilution factor for both the Tafuna and Utulei Ocean Outfalls, Coe & Van Loo Consultants, Inc., June 2012
- Leone – Vaitogi Feasibility Study, Pryzm Consulting LLC, March 2024

- Utulei Sewage Treatment Plant 301(h)-Modified NPDES Permit Reissuance Questionnaire for Small Dischargers Submitted in Support of Renewal of a Waiver from Secondary Treatment, ASPA, June 2024

1.3 Planning Approach

The planning approach to this WWUP was informed largely by guidance outlined in the document *Planning for Sustainability – A Handbook for Water and Wastewater Utilities* by the United States Environmental Protection Agency (USEPA, 2012). The handbook discusses typical utility planning processes and outlines areas in which long term utility/environmental sustainability should be considered. The handbook further refines the wastewater utility planning process into four core elements that are consistently used in many effective planning efforts. The four core elements described by the handbook are Goal Setting, Developing Objectives and Strategies, Performing Alternatives Analyses, and Developing a Financial Strategy. Each element is critical to the planning process; descriptions of the various elements are provided below.

- Setting Goals:

  The USEPA defines goals as broad, qualitative statements of what the utility hopes to achieve. Setting goals aligns the planning process with the values and mission of the utility. Goals are also often based on meeting regulatory/legal requirements, or addressing known vulnerabilities related to sustaining operations and financing.

- Developing Objectives and Strategies:

  Objectives, as defined by the USEPA, are statements of what will be done to achieve goals within a defined time frame. Objectives should be “SMART”: Specific, Measurable, Attainable, Realistic, and Time-based. If a utility’s goal is to reduce inflow and infiltration into the collection system, for example, a corresponding objective may be to replace aging infrastructure.

  According to the USEPA, strategies are general approaches or methods for achieving objectives or resolving issues. Strategies can be (but are not limited to) construction of infrastructure, implementation of administrative changes, or development of organizational partnerships.

- Performing Alternatives Analyses:

  After development of strategies to meet organizational objectives, multiple projects (or alternatives) to implement a strategy will likely be available. If an organization’s strategy, for example, is to implement additional wastewater treatment, there may be various treatment methodologies that could meet the goal upon their implementation. Evaluating alternatives based on consistent criteria that is in alignment with project goals allows utilities to quickly identify the most impactful potential projects.

  While assessing alternatives, it is important to examine a project’s potential impact on both the subject (or primary) objective and its impact on any secondary objectives. Projects that both meet an immediate objective and benefit another should be given additional merit beyond those that simply satisfy the subject objective.

- Developing a Financial Strategy:

  Utilities must develop financial strategies to fund projects over specific time horizons. Utilities must also remain financially sustainable while executing projects. Using the results of alternative analyses, utilities can create strategies to finance projects by using existing revenue streams, expanding revenue collection programs, or utilizing grant opportunities.

The structure of this WWUP is largely based on the progression of the planning elements described above. The descriptions of the activities above, however, do not include descriptions of the auxiliary work/activities that must be performed between the planning elements. The auxiliary activities, as defined by this WWUP, are described below:

- Gathering Background Information:

  An understanding of background information is crucial to the planning process. This information allows planners to understand internal and external factors influencing the utility. Background information is primarily used to provide data for technical investigations and to help develop goals and objectives.

- Performing Technical Investigations:

  Technical investigations are critical to the planning process. For Wastewater Utilities, these investigations include existing conditions assessments, capacity assessments, and treatment assessments. The results (or findings) of technical investigations heavily inform the development of objectives and strategies. Additionally, the technical investigations allow for appropriate and effective project development.

- Developing Projects/Alternatives:

  Alternatives cannot be analyzed if they are not first developed. Ideally, discrete projects with opinions of probable cost (OPCs) can be developed during this phase, as informed by the findings of the technical investigation and the objectives of the plan. The projects developed in this activity are analyzed as alternatives in the planning process.

1.4 Sustainability and Resiliency Goals

As ASPA operates and maintains its wastewater systems, it is important to do so in a manner that is both sustainable and resilient. Incorporating the planning approach that is outlined in the previous section will allow ASPA to realize its mission statement and to establish a wastewater system that will meet the needs of the residents of American Samoa for generations to come.

Below is a list of ASPA's sustainability and resiliency goals:

- When sanitary sewer overflows (SSOs) occur, quickly identify and mitigate the issue by following the Sanitary Sewer Overflow Response Plan that is outlined in the Collection System Management Plan (CSMP), which is included in Appendix C-1.

- Develop a plan for regular infrastructure inspections and condition assessments to monitor the rate of degradation of infrastructure, and schedule replacement or rehabilitation of infrastructure prior to failure.
- Improve asset management recording keeping.
- Reduce the number of septic tanks by expanding the sanitary sewer collection system.
- Protect public health through proper, sanitary, and safe wastewater collection and disposal.
- Protect drinking water sources (underground freshwater aquifers) from potential contamination.
- Meet all American Samoa Environmental Protection Agency (ASEPA) and USEPA wastewater collection and disposal regulations and permit requirements.
- Utilize this WWUP to provide a cost-effective and implementable roadmap to upgrade, expand, and maintain the wastewater systems.
- Meet NPDES permit requirements and plan for future growth.

1.5 Wastewater Utility Plan Organization

This WWUP consists of the following chapters:

Chapter 1 – Introduction

Introduction to the WWUP and background information.

Chapter 2 – Existing Environment

Overview of the environmental conditions and potential improvements to reduce environmental impacts.

Chapter 3 – WWTP Flows and Loads

Overview of the existing flows and loads and projections of future flows and loads at the 20-year condition for the Tafuna and Utulei WWTPs.

Chapter 4 – WWTP Permit Conditions

Overview of the existing and draft permit conditions and future potential regulations, including review of the USEPA and ASEPA regulations.

Chapter 5 – Existing Management Evaluation

Evaluation of operation and maintenance activities and standards, with recommended improvements.

Chapter 6 – Existing WWTP Evaluation

Evaluation of WWTP facilities and operations, process schematics, hydraulic profiles, mass balances, site plans, liquid streams, solid streams, and overall performance.

Chapter 7 – Existing Collection System Evaluation/SECAP

Evaluation of the capacity and condition of the Tafuna, Utulei, and Aunu'u wastewater collection systems based on hydraulic modeling results and known pipe age and material.

Chapter 8 – Wastewater System Potential Project Improvements

Overview of the potential improvements for the collection systems and WWTPs, and estimated construction costs for each improvement project. The Secondary Treatment Feasibility Study covers upgrading the WWTP(s) for secondary, or biological, treatment, so that is not covered in this Wastewater Utility Plan.

Chapter 9 – Capital Improvement Plan

Overview of the recommended system improvements, including prioritization and phasing.

Chapter 10 – Financial Assessment

Financial assessment of the recommended improvements.

1.6 References

United States Environmental Protection Agency, February 2012, *Planning for Sustainability – A Handbook for Water and Wastewater Utilities*, EPA-832-12-001.

Pedersen Planning Consultants. July 2003. *American Samoa Power Authority Utilities Master Plan.*

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CHAPTER 2

EXISTING ENVIRONMENT

Contents

Tables

Figures

Appendix

No appendices.

Chapter 2 Existing Environment

This chapter includes an overview of the environmental conditions and potential improvements to reduce environmental impacts.

2.1 Study Boundary

American Samoa is an island chain made up of 5 islands and 2 atolls (Tutuila, Aunu'u, Ofu, Olosega, Ta'u, Swain's Island [also called Swain's Coral Atoll] and Rose Island [also called Rose Atoll]). American Samoa is divided into three districts: Western, Eastern, and Manu'a. The study boundary for this Wastewater Utility Master Plan includes all of the Eastern and Western Districts, as shown in **Figure 2-1**.Physical Aspects: Topography, Geology and Soils

The islands are characterized by a backbone of volcanoes with a highly irregular coastline. There is significant geological and geographical variation across the Samoan island. Key points regarding the topography, geology, and geography of the islands within the study boundary are summarized below:

- Tutuila: Tutuila is the largest and most populated island in American Samoa with approximately 95% of American Samoa's population. The island is approximately 55 square miles and is approximately 18 miles long and 6 miles across at its widest point. The majority of the population live along the southern coast of Tutuila, as much of the island's interior and northern coast are mountainous and offer little room for development. The backbone of the island is a steep ridge formed by four shield volcanoes. Erosion of the shield volcanoes has resulted in the creation and deposition of sedimentary rock including talus, alluvium, calcareous sand, and corraline gravel.
- Aunu'u: Aunu'u is a small island less than 1 mile off the Eastern coast of Tutuila. The island has less than 1 square mile of surface area, and only the western end of the island is populated. Weathering of the tuff has made it nearly impermeable. However, the coastal flat on the northern and western sides of the island is partially underlain by permeable deposits of calcareous sand and gravel (Davis, 1963).

Figure 2-2 through **Figure 2-4** show the existing land uses within the study area.

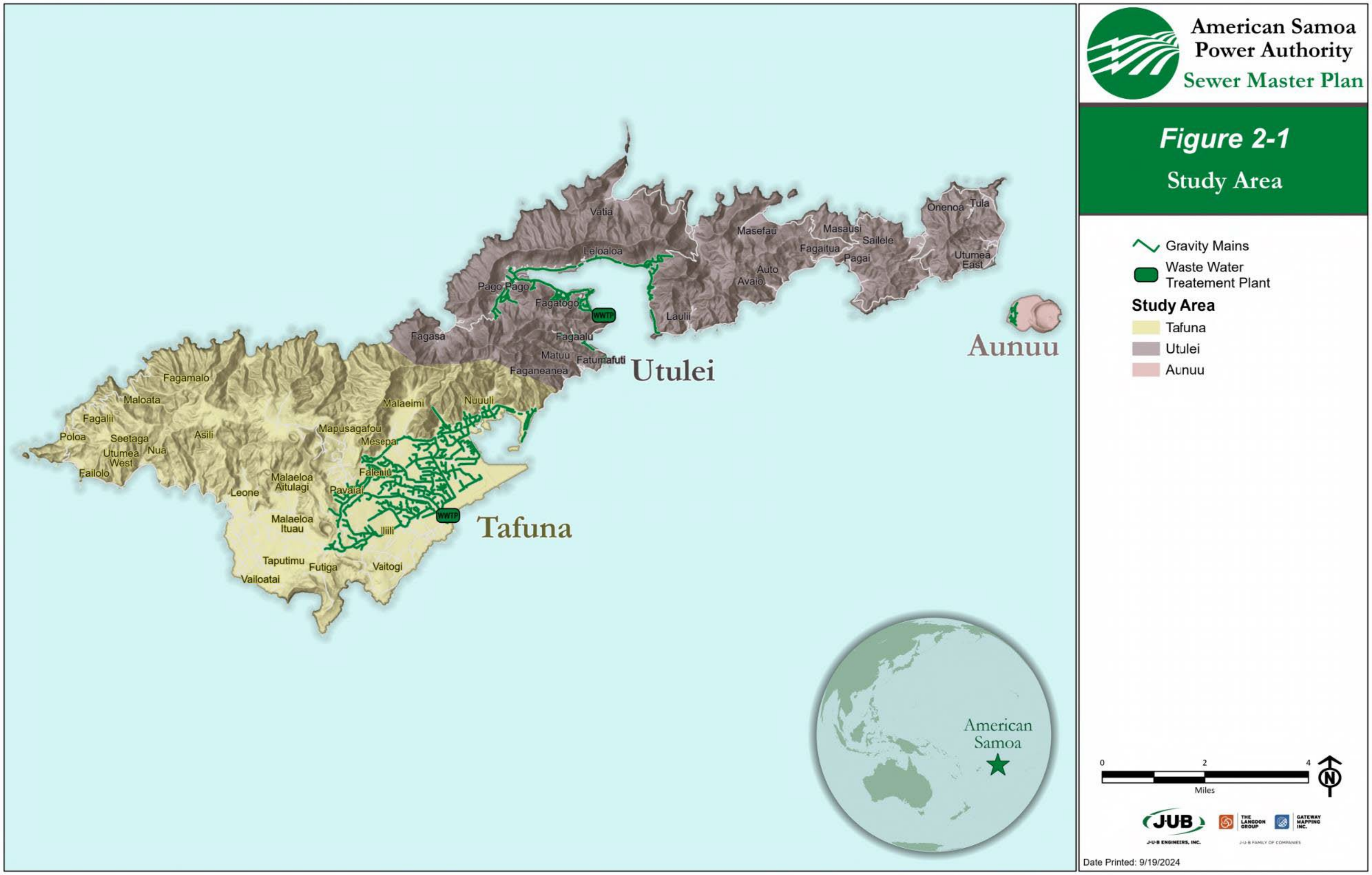

Figure 2-1: **Study Boundary**

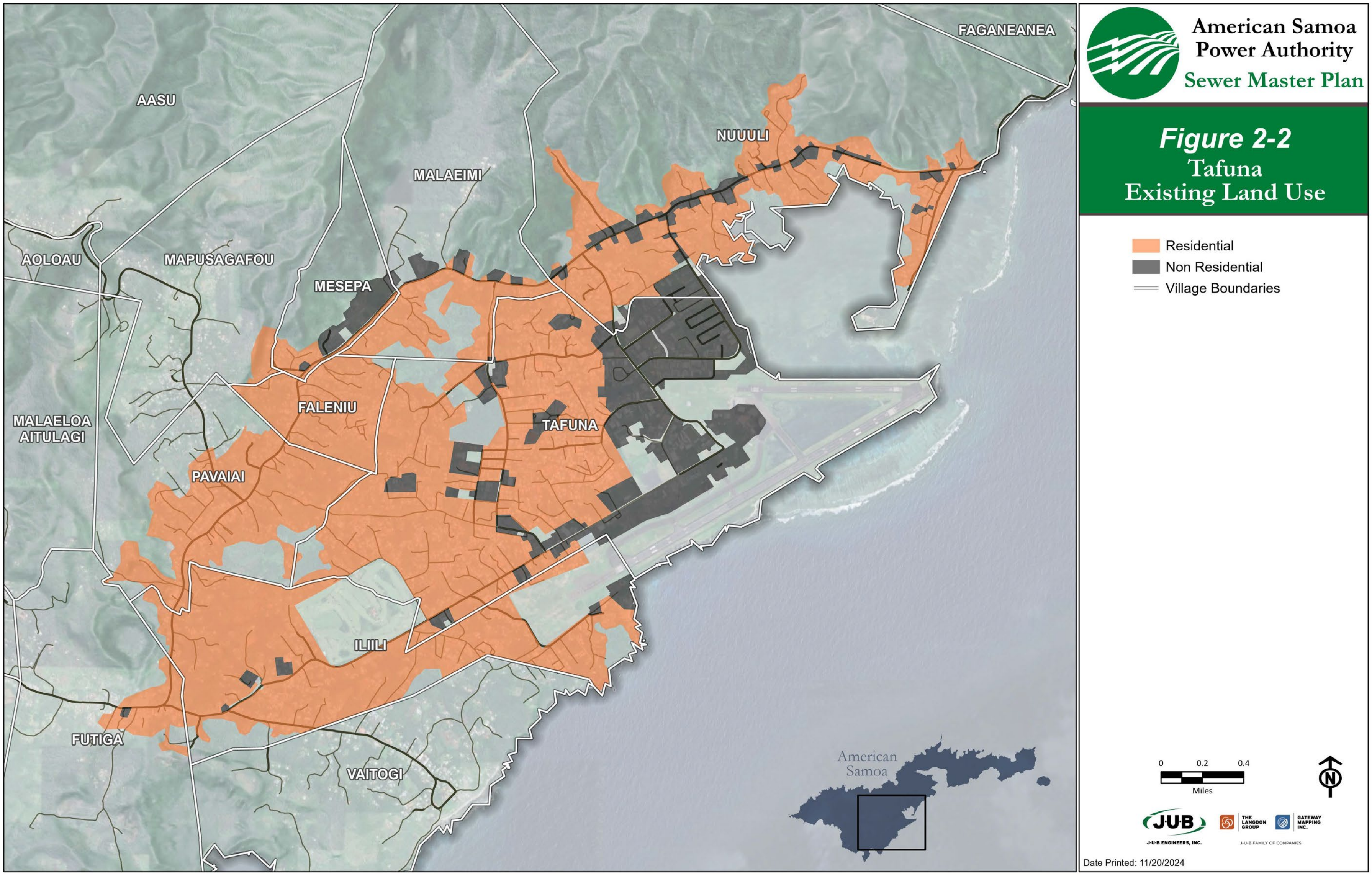

Figure 2-2: Tafuna Existing Land Use Map

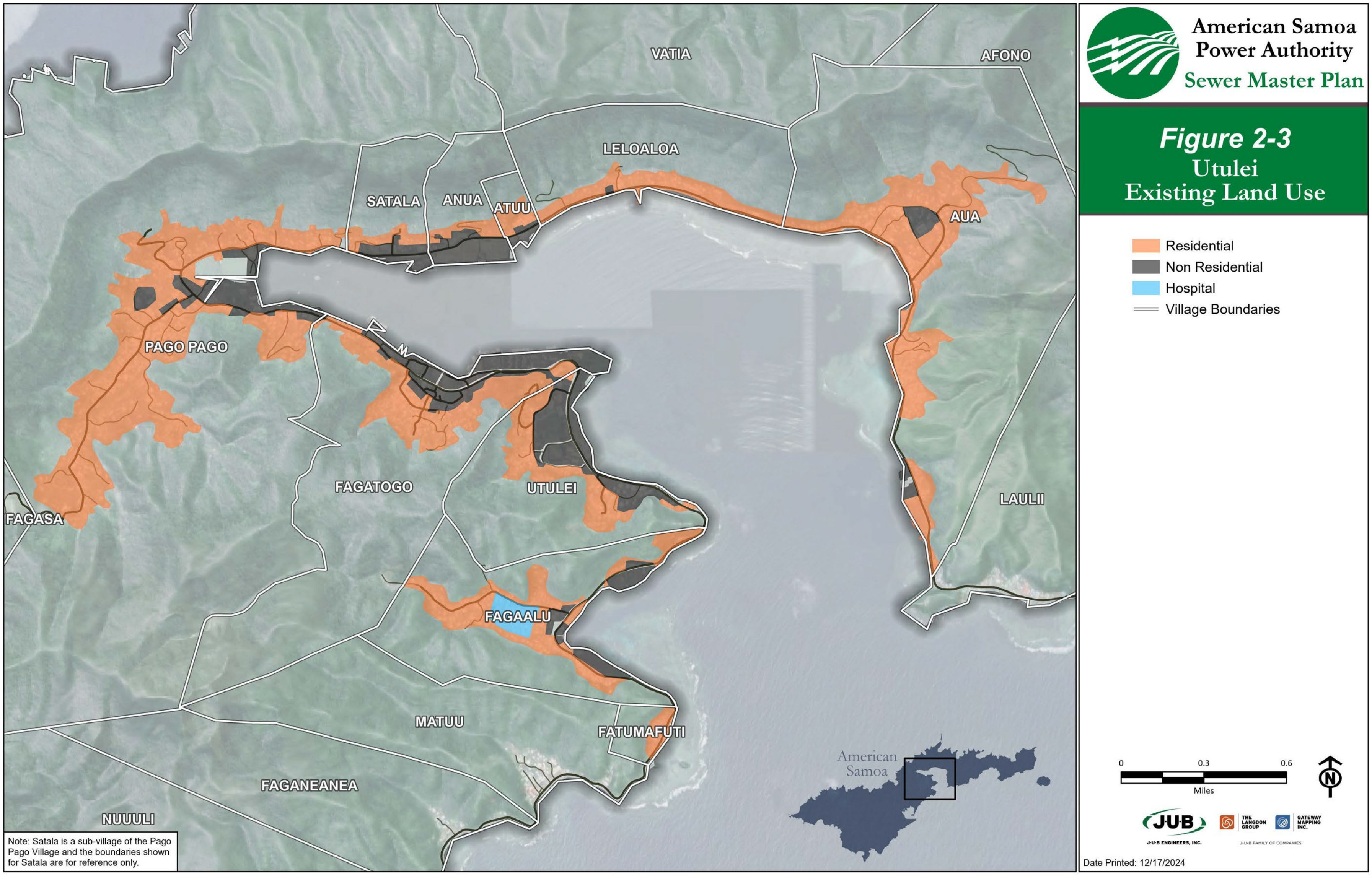

Figure 2-3: Utulei Existing Land Use Map

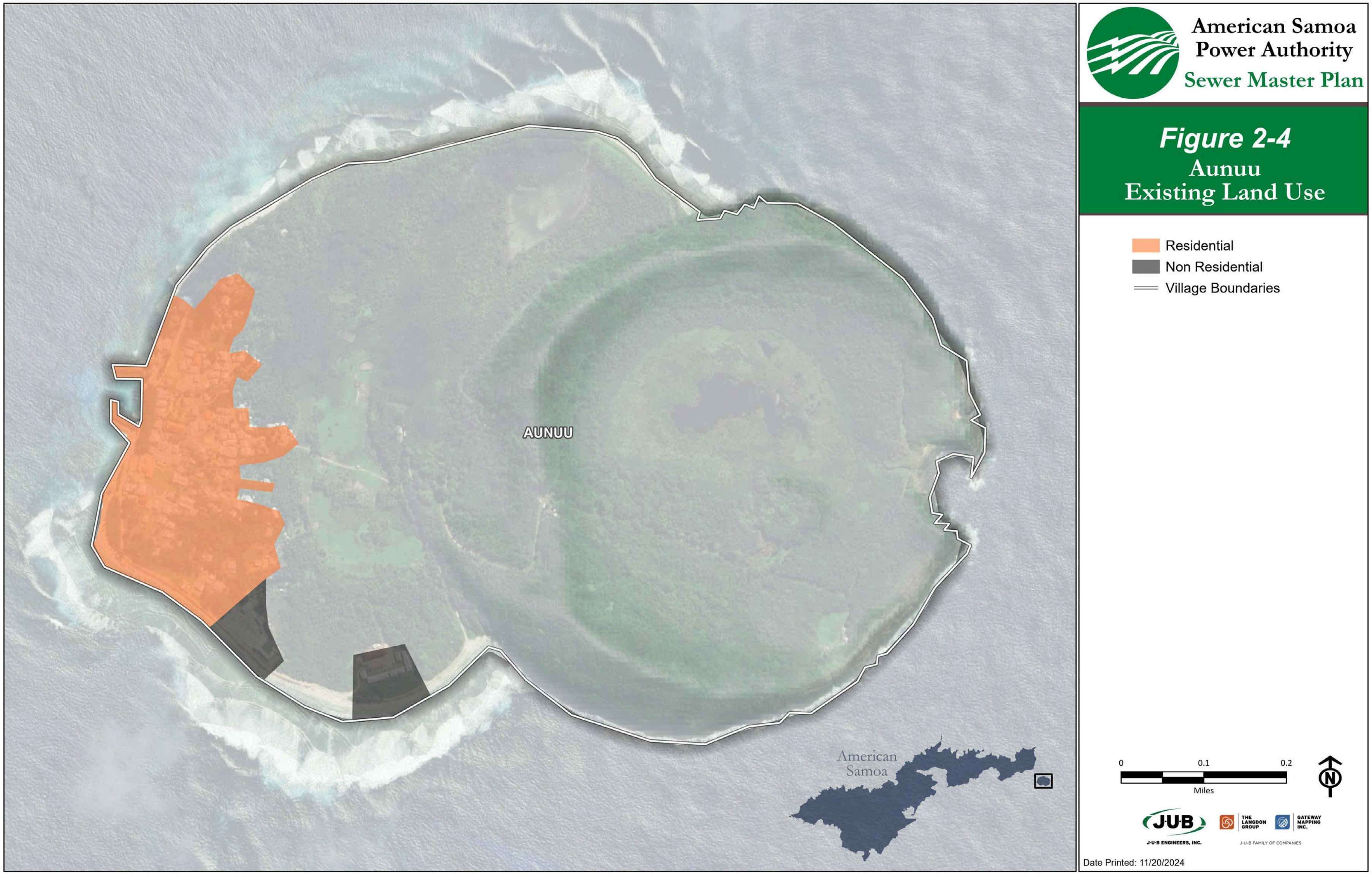

Figure 2-4: Aunu'u Existing Land Use Map

2.1.1 Temperature

Due to its position between the Equator and the Tropic of Capricorn, American Samoa has a tropical climate consisting of warm, humid, and generally rainy weather. The area has little seasonal temperature variation and a yearly average temperature of 82° F (NOAA, 2024b). The average annual temperatures for 2010-2022 are shown on **Figure 2-5** (NWS, 2024).

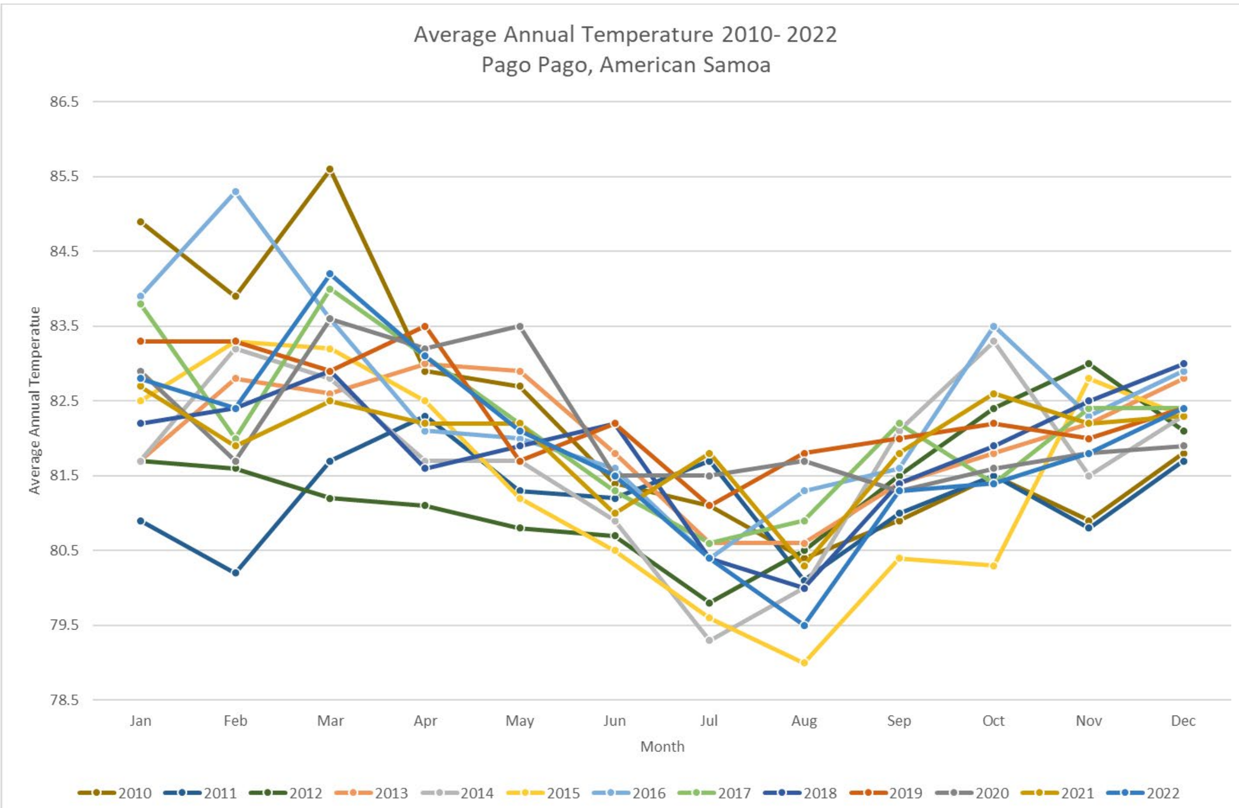

Figure 2-5: Average Temperature Pago Pago, American Samoa 2010-2022

2.1.2 Precipitation

The rainy season on the island chain lasts from November to April, but rain is common year-round (NOAA, 2024b). According to the National Parks Service, which monitors rain throughout the islands, the drier portions of the island chain receive an average of 125 inches of rain each year while the wetter portions of the islands, typically higher in the mountains, receive as much as 300 inches of rain each year (NPS, 2015). Overall, the average annual rainfall for Tutuila is approximately 152 inches of rainfall. The average monthly precipitation for 2010-2023 are shown on **Figure 2-6** (NWS, 2024).

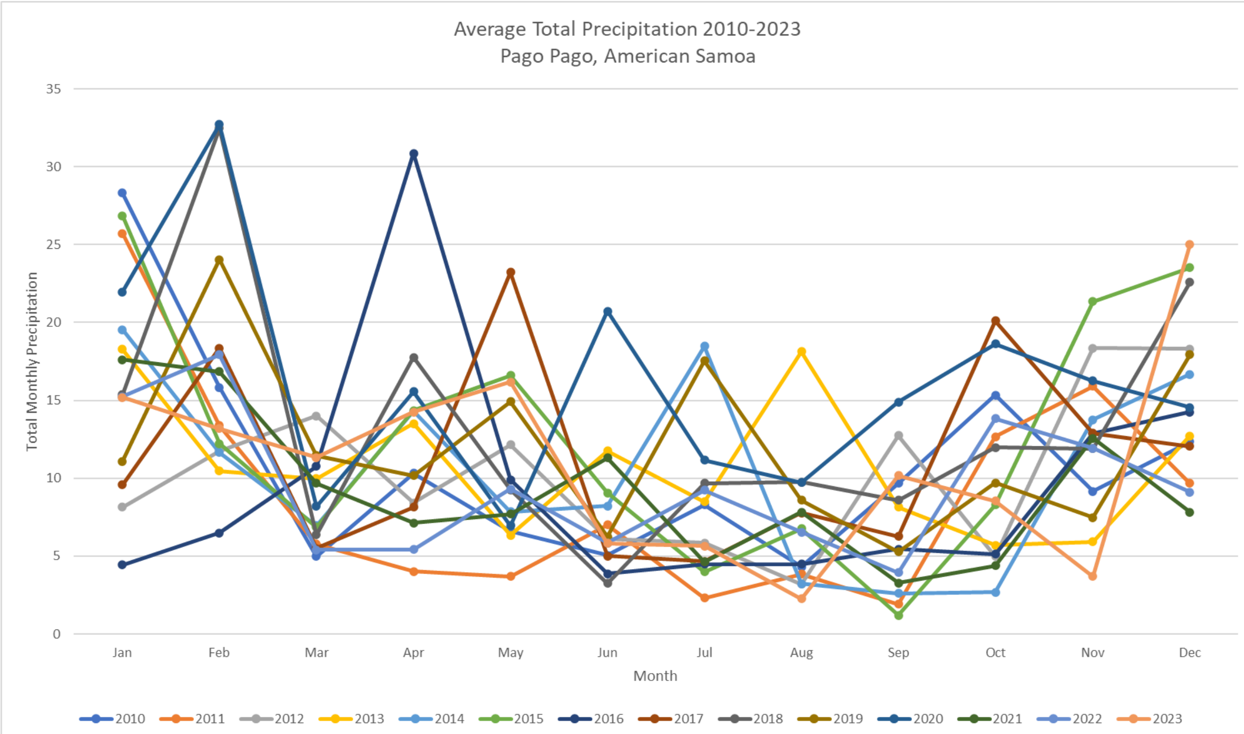

Figure 2-6: Average Annual Precipitation Pago Pago, American Samoa 2010-2022

2.1.3 Surface Water and Groundwater

American Samoa is located within the South Pacific Region (Hydrologic Unit Code [HUC] 22) which covers more than 2 million acres of the Pacific Ocean. According to the U.S. Geological Service's (USGS) National Watershed Dataset, the islands are located within 41 major watersheds. The study boundary is located within the Pago Pago Harbor-South Pacific Ocean watershed (HUC 2203000102), which covers approximately 144,382 acres and the Tutuila Island subwatershed (HUC 220300010100), which covers approximately 34,063 acres (USGS, 2024a).

2.1.3.1 Surface Water

The USGS National Hydrology Dataset (NHD) identified multiple drainages within Tutuila and Aunu'u that drain into the Pacific Ocean (**Figure 2-7**; USGS, 2024a). The small size of the watersheds and minimal land area for reservoirs mean surface water availability is typically scarce. ASPA has one micro infiltration plant and one reverse osmosis (RO) facility in Tutuila to treat surface water with an additional RO facility coming online by the end of 2024. ASPA's drinking water facilities supply the vast majority of residents with water, according to the APSA Drinking Water Master Plan (JUB, 2023). Small areas of American Samoa use surface water through "Village Water" systems to fulfill their water needs. Village water systems are independent of ASPA and are typically supplied by surface streams or springs. These water systems are locally maintained, and the water is generally untreated.

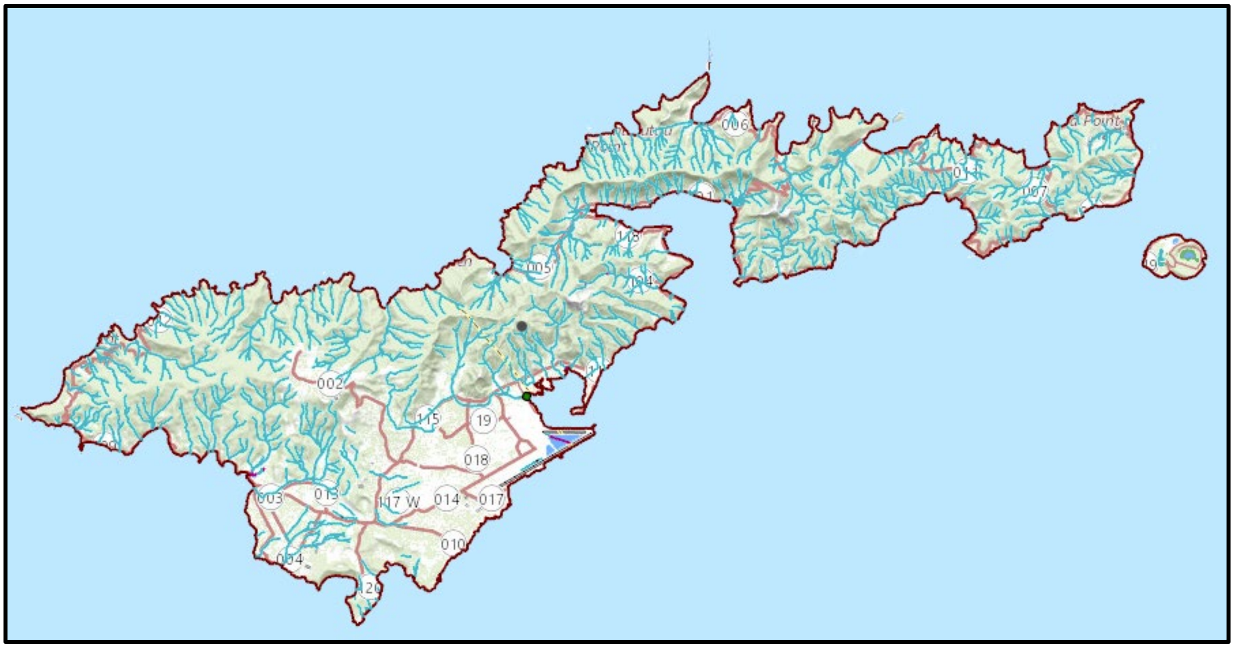

Figure 2-7: National Hydrology Dataset (NHD) Map – Tutuila and Aunu'u Islands

2.1.3.2 Groundwater

Groundwater is the primary source of water and only active source of drinking water throughout American Samoa and is the sole water source of the ASPA system. The high levels of precipitation on Tutuila result in high recharge, while demands on the island require relatively high levels of well production. **Figure 2-8** shows the well fields in Tutuila and Aunu'u and the location of the treatment plants.

There are 58 wells on Tutuila and Aunu'u (JUB, 2023). The wells in the eastern district have an average depth of 194.8 feet while the wells in the western district have an average depth of 221 feet, according to the USGS national Water Information System (USGS, 2024b). The wells utilize submersible pumps to provide between 29 gallons per minute (GPM) to 450 GPM from each well (JUB, 2023). A list of ASPA's wells, location, and nominal production rates are located in their 2023 Drinking Water Master Plan (JUB, 2023).

On Tutuila, groundwater recharge estimates exceed 105 million gallons per day (MGD) while daily usage throughout the island is estimated at only 12.6 MGD (JUB, 2023). Based on previous scientific data collection and research on the groundwater availability on Tutuila, it is believed that groundwater quantities are sufficient to supply water production for ASPA's needs on Tutuila, if sustainable withdrawal measures are adopted. However, due to the nature of recharge, there are periods when drawdown of the groundwater exceeds the recharge rate, which results in even poorer water quality than normal. Similarly, drinking water on Aunu'u is supplied by groundwater. However, on Aunu'u, groundwater is of a poorer quality and results in high treatment requirements. In all, groundwater supplies appear sufficient for ASPA's needs (JUB, 2023).

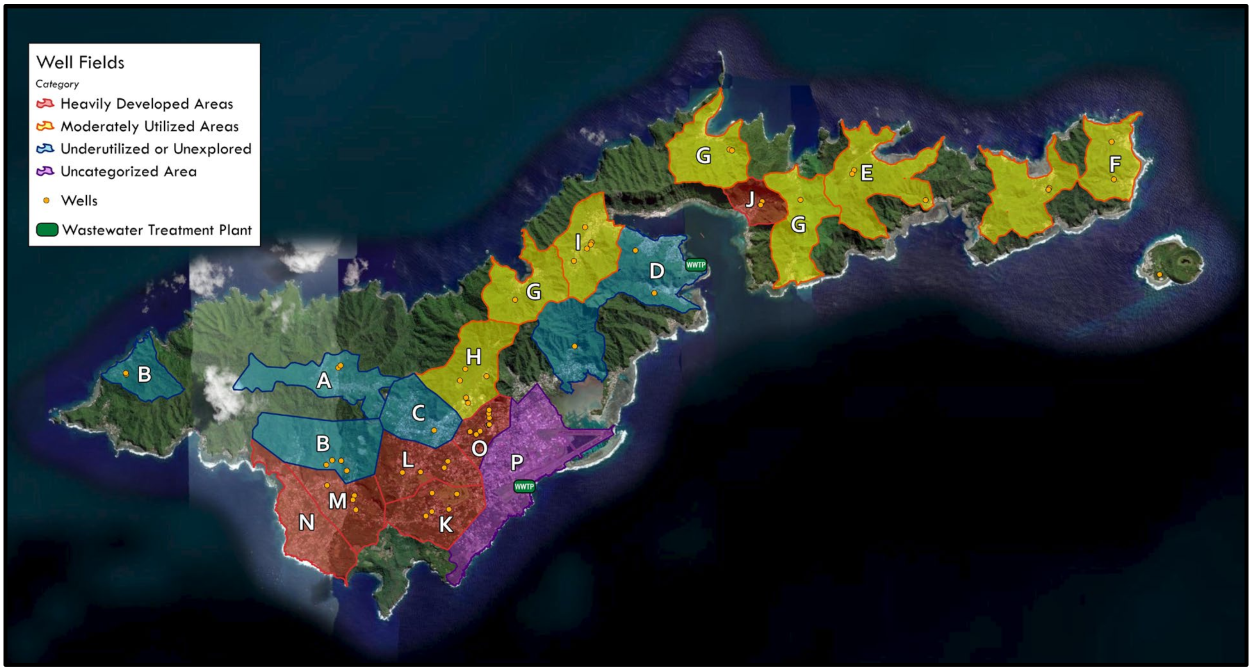

Figure 2-8: Groundwater Well Fields – Tutuila and Aunu'u

2.1.4 Wildlife Habitat

The topography of the islands includes mountainous interiors with few access roads and low-lying coastal areas where 95% of the island's population resides. The vegetation communities on Tutuila and Aunu'u are predominantly coastal lowland forest and montane forest with very small areas of cloud forest. The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) database was queried to determine if any Endangered Species Act (ESA) listed plant or animal species have the potential to occur on Tutuila and Aunu'u. The IPaC identified five endangered species, as shown on **Table 2-1** (USFWS, 2024). No ESA-listed plant species were listed in the IPaC report. No designated critical habitat is present for any designated plant or animal species.

Table 2-1: ESA-Listed Species with the Potential to Occur in the Project Area

Common Name	Scientific Name	ESA Status	Critical Habitat Present?
Pacific sheath-tailed bat	*Emballonura semicaudata semicaudata*	endangered	No
mao (honeyeater)	*Gymnomyza samoensis*	endangered	No
green sea turtle	*Chelonia mydas*	endangered	No
snail	*Eua zebrina*	endangered	No
snail	*Ostodes strigatus*	endangered	No

Several additional species are protected by regional and territorial regulations. In 2003, American Samoa declared all its territorial seas to be whale and turtle sanctuary, providing additional protections outside the federal regulations, including the ESA. Further protections have recently been extended to the Maori wrasse (*Cheilinus undulatus*) and the bumphead parrotfish (*Bolbometopon muricatum*). Furthermore, American Samoa contains suitable habitat for green sea turtles, hawksbill turtles (*Eretmochelys imbricata*), loggerhead turtles (*Caretta caretta*), leatherback turtles (*Dermochelys coriacea*), and olive ridley turtles (*Lepidochelys olivacea*), all of which are considered threatened or endangered under the ESA. All marine mammals are protected federally by the Marine Mammal Protection Act. Humpback whales (*Megaptera novaeangliae*) are provided additional protections by American Samoan regulations and through the National Marine Sanctuary of American Samoa (NOAA, 2021b). Although none of these species are listed in the IPaC, suitable habitat for all these species occurs in the waters off the coast of Tutuila.

The IPaC Report listed no migratory bird species as potentially occurring on Tutuila or Aunu'u. Given that coastal habitat is located nearby, migratory birds, sea birds, and resident species are likely to frequent portions of the study boundary.

2.1.5 Cultural Resources and the Human Environment

The Samoan culture places a high value on family, or "aiga", which are extended families led by "matai", or chiefs, who are responsible for making major decisions for the aiga, including management of the land within the aiga's territory. Aiga land is culturally sacred and may not be split or subdivided. The Samoan cultural beliefs are that everyone within an aiga has the communal right to use the existing environmental resources of the land and the management by the matai protect the lands to preserve environmental resources, including land, sea, and archaeological resources, for the common good. Additionally, the constitution of American Samoa protects Samoans against alienation of their lands.

2.1.6 Cultural and Historic Values

The American Samoa Coastal Management Program, approved in 1980, is directed by the American Samoa Department of Commerce and includes approximately 126 miles of coastline across all 7 islands. American Samoa's economy is primarily ocean based, employs up to 4,800 people annually (approximately 40% of the territory's total employment), and coastal resources, including coral reefs, provide over $33 million to the economy yearly (NOAA, 2021a).

The National Marine Sanctuary of American Samoa, operated by the National Oceanic and Atmospheric Administration (NOAA), currently protects coral reef on the south side of Tutuila and on the south side of Aunu'u, as well as several historic shipwrecks surrounding the islands (ACHP, 2021). **Figure 2-9** shows the areas around American Samoa designated as coastal protection areas (NOAA, 2024a).

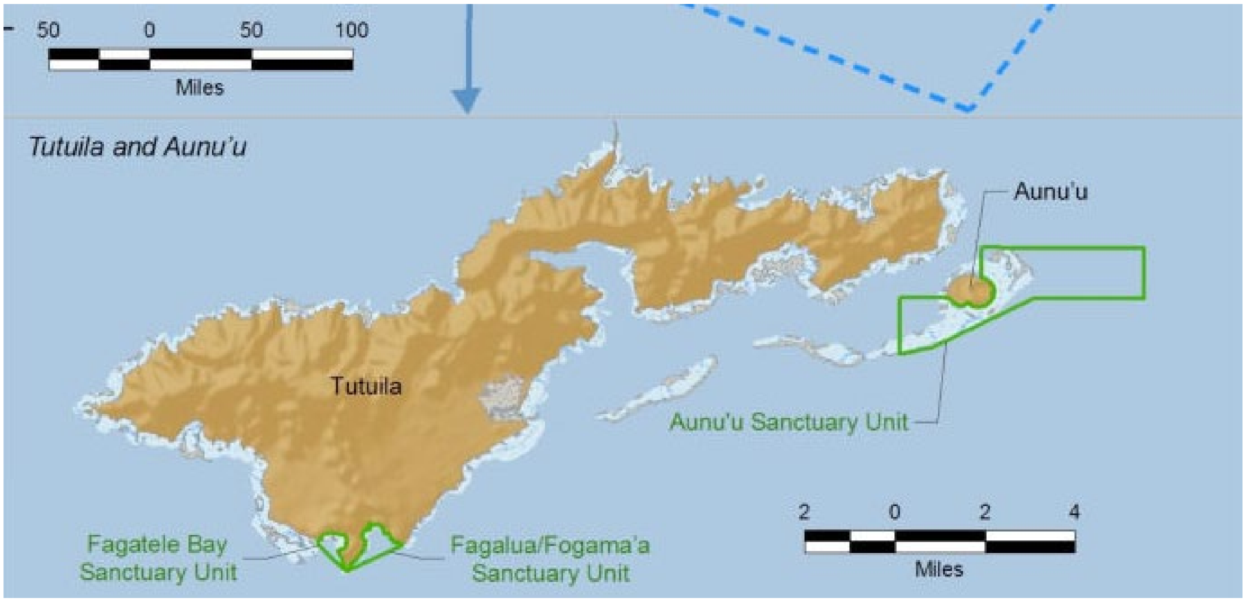

Figure 2-9: Designated Coastal Protection Areas

A search of formally classified lands and public lands identified the following items:

- The National Park of American Samoa is located within the northern portion of the island. The park consists of approximately 2,500 acres of land and 1,200 acres of ocean, including the only rainforest community on U.S. soil, beach, and coral reef communities, and houses hundreds of plant and animal species (NPS, 2021).
- Two National Historic Landmarks, the Blunts Point Battery and the Government House, are both recorded as being on Tutuila Island (NPS, 2024a).
- Six Natural Landmarks, including Vai'ava Strait in the National Park of American Samoa, Rainmaker Mountain, Matafao Peak, Fogama'a Crater, Le'ala Shoreline, and Cape Taputapu, are located on Tutuila Island (NPS, 2023). The island of Aunu'u is also considered to have significant national features.

Several important historic resources and archaeological sites are known to exist on American Samoa. Much of the cultural and archaeological history of American Samoa is tied to myths, legends, and stories important to the Samoan culture. For example, Vaitogi Village, located on the Tafuna Plain in southern Tutuila, is known for its rich cultural remains despite its heavy development. On Tutuila, there are 27 National Register of Historic Places (NRHP) listed sites, as shown in **Table 2-2** (NPS, 2024b). There are no NRHP listed sites on Aunu'u.

Table 2-2: NRHP Listed Sites on Tutuila

Site Name	Site Location	Date Listed
Eastern District, Tutuila		
Blunts Point Naval Guns	Matautu Ridge, Pago Pago	April 1973
Breakers Point Naval Guns	Breakers Point, Lauli'i	October 1999
Courthouse of American Samoa	Pago Pago Harbor, Pago Pago	February 1974
Fagatele Bay Site	Futiga	June 1997

Site Name	Site Location	Date Listed
Government House	Togotogo Ridge, Pago Pago	March 1972
Michael J. Kirwan Educational Television Center	American Samoa Highway 118, Utulei	October 2009
Lau’agae Ridge Quarry	Tula	March 2000
Masefau Defensive Fortifications	Masefau Beach	November 2012
Navy Building 38	Pago Pago Harbor	March 1972
Navy Building 43	Pago Pago Harbor	March 1972
Satala Cemetery	American Samoa Highway 001, Lalopua	October 2006
Sadie Thompson Building	Fagotogo	July 2003
Tulauta Village	Tula	June 1997
U.S. Naval Station Tutuila Historic District	Fagotogo and Utulei	June 1990
Western District, Tutuila		
A’a Village	Tapua’ina	November 1987
Aasu	Massacre Bay, Aasu	April 1972
Afao Beach	Afao	November 2012
Atauloma Girls School	Afao	March 1972
Fagalele Boys School (considered to be the oldest surviving building on Tutuila)	Leone	March 1972
Governor H. Rex Lee Auditorium	Utulei	November 2010
Maloata Village	Tapua’ina	June 1997
Poloa Defensive Fortifications	Paloa	November 2012
Site AS-31-72 (prehistoric site)	Faleniu	June 1997
Tataga-Matau Fortified Quarry Complex	Leone	November 1987
Tupapa Site	A’asufou Village	October 2009
Turtle and Shark	Vaitogi	November 2014
Old Vatia	Vatia Village	November 2006

2.1.7 Growth and Infrastructure Policies

ASPA is subject to both federal U.S. and territorial laws governing water providers, including the American Samoa government, the American Samoa Environmental Protection Agency (ASEPA), and the U.S. Department of Agriculture (USDA) through programs such as the National Resource Conservation Service (NRCS), Farms Service Agency (FSA), and Rural Development (RD).

Additionally, lands held by an aiga are traditionally seen as common property for all members of the aiga. Thus, when decisions regarding land use need to be made, it is common for matai to require unanimous consent from all members of the aiga, making some decisions regarding land use difficult.

2.1.8 Socioeconomics

The U.S. Census Bureau (Census) considers each of the three districts (Western, Eastern, and Manu’a) as county equivalents for statistical data collection purposes. As shown on **Figure 2-1**, above, the study boundary covers both the Western and Eastern districts. Nearly all inhabitants of American Samoa identify as indigenous Samoans of Polynesian ancestry. Only approximately 7.4% of the island chain’s population does not identify as native Hawaiian or Other Pacific Islander. The demographics of the Western and Eastern districts, as well as American Samoa overall are shown on **Table 2-3**.

Table 2-3: Demographics of the Western and Eastern Districts, Tutuila Island, American Samoa

Socioeconomic Criteria		Western District	%	Eastern District	%	American Samoa	%
Total Population[1]		31,819	100	17,059	100	49,710	100
Gender[2]	Female	15,763	49.5	8,296	48.6	24,456	49.2
	Male	16,056	50.5	8,763	51.4	25,254	50.8
Age[3]	Under 18	11,911	37.9	5,990	36.3	18,213	37.7
	18 & Over	19,506	62.1	10,497	63.7	30,523	62.3
Race[4]	White	215	0.7	157	0.9	374	0.8
	African American	14	0.0	10	0.1	24	0.0
	American Indian or Alaskan Native	11	0.0	2	0.0	13	0.0
	Asian	1,767	5.6	1,111	6.5	2,878	5.8
	Native Hawaiian or Other Pacific Islander	28,334	89.0	14,956	87.7	44,090	88.7
	Some Other Race	20	0.1	119	0.7	139	0.3
	Two or More Races	1,458	4.6	704	4.1	2,192	4.4
Ethnicity[4]	Hispanic or Latino	166	0.5	237	1.4	406	0.8
	Not Hispanic or Latino	31,653	99.5	16,822	98.6	49,304	99.2

Source: U.S. Census Bureau's American Community Survey (ACS) Decennial Census of Island Areas (DCIA), 2020a; ACS-DCIA, 2020b; ACS-DCIA, 2020c

[1] Table P1: Total Population 2020

[2] Table CT1: Sex, Age, marital Status, and Children Ever Born (Fertility) By Race 2020.

[3] Table P10: Population in Households by Age 2020. Note, table uses a different population total so percentage calculations are based on population total from P10 table, not from P1 table. This difference is likely due to the acceptable margin or error within the collection and reporting system.

[4] Table DP1: General Demographic Characteristics 2020

Note: Totals may not equal 100% due to rounding. Western and Eastern totals data may not equal American Samoa data due to U.S. Census Bureau's collection and reporting data margins of error.

The estimated median household income in 2010 for the Western District was $28,250 and was $28,736 in the Eastern District; the estimated median household income for American Samoa is $28,352. Approximately 55.7% of individuals in the Western District and 52.2% of individuals in the Eastern District are below the poverty level, which represents a slightly higher poverty rate than the 54.6% overall in American Samoa and much higher than the 12.8% overall in the United States (ACS-DCIA, 2020a; ACS-DCIA, 2020b; ACS-DCIA, 2020c; ACS-DCIA, 2020d). Approximately 90.9% of the population over 5 years of age speak the Samoan language (Office, 2024).

2.2 Transportation and Utility Use

Given American Samoa's location, their utilities and transportation infrastructure are wholly contained within the study boundary, as outlined in **Figure 2-1** above.

Major roadways on Tutuila include Highway 001, Highway 005, and Highway 006. Highway 001 runs along the coast of the island from Onenoa at the far northeastern tip of the island to Fagamalo on the southwestern side of the island. Highways 005 and 006 run from Highway 001 through the interior of the island to the northern side of the island. The Pago Pago International Airport is located adjacent to Pala Lagoon on the southern coast of the island.

ASPA provides electricity, water, wastewater, and solid waste services to over 43,000 residents on the American Samoa islands (ASPA, 2024). Their wastewater infrastructure system is summarized on **Figure 2-10**. ASPA's system has several current issues, including aging infrastructure, excessive energy consumption, degraded water quality, increasing water demand, and non-compliance with standards, see Sections 2.2.2 through 2.2.5 below. ASPA's current wastewater service area is shown on **Figure 2-11** through **Figure 2-13**. The pipe sizes are outlined on **Figure 2-14** through **Figure 2-16**.

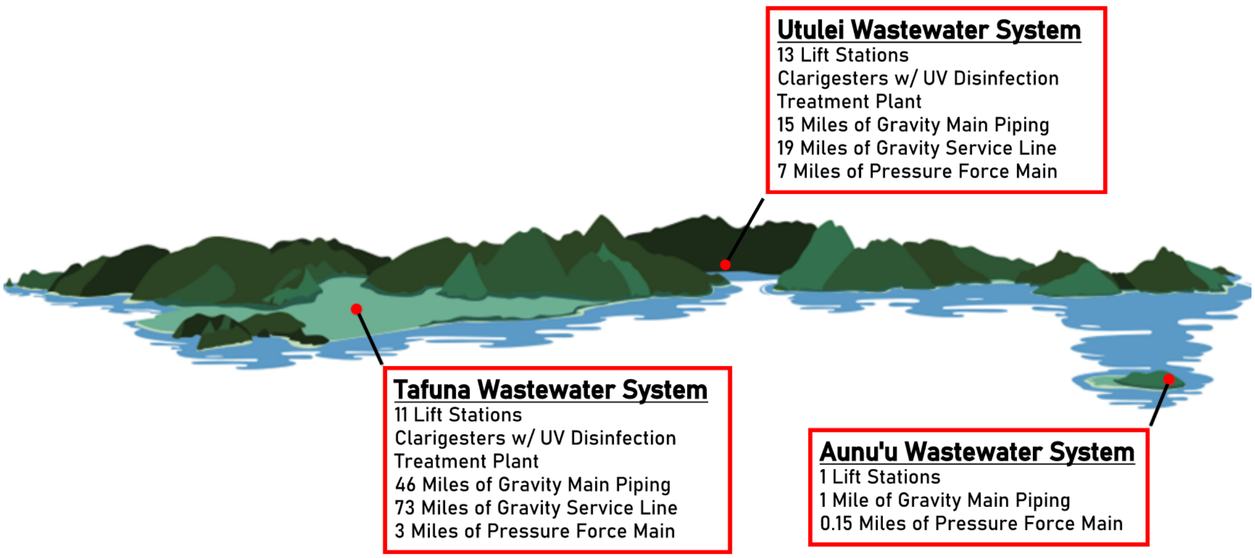

Figure 2-10: Summary of ASPA's Wastewater Infrastructure

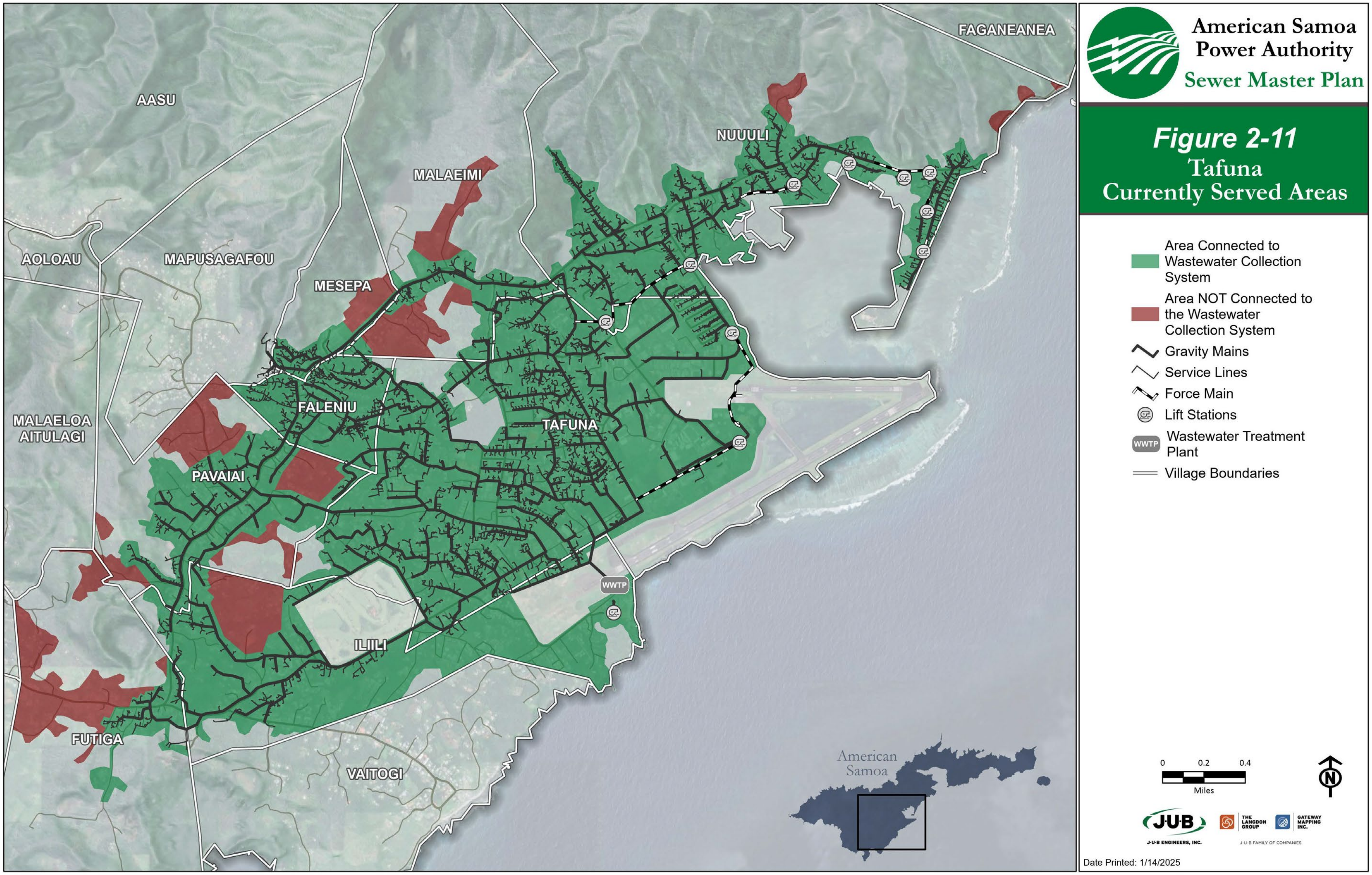

Figure 2-11: Tafuna Service Area Map

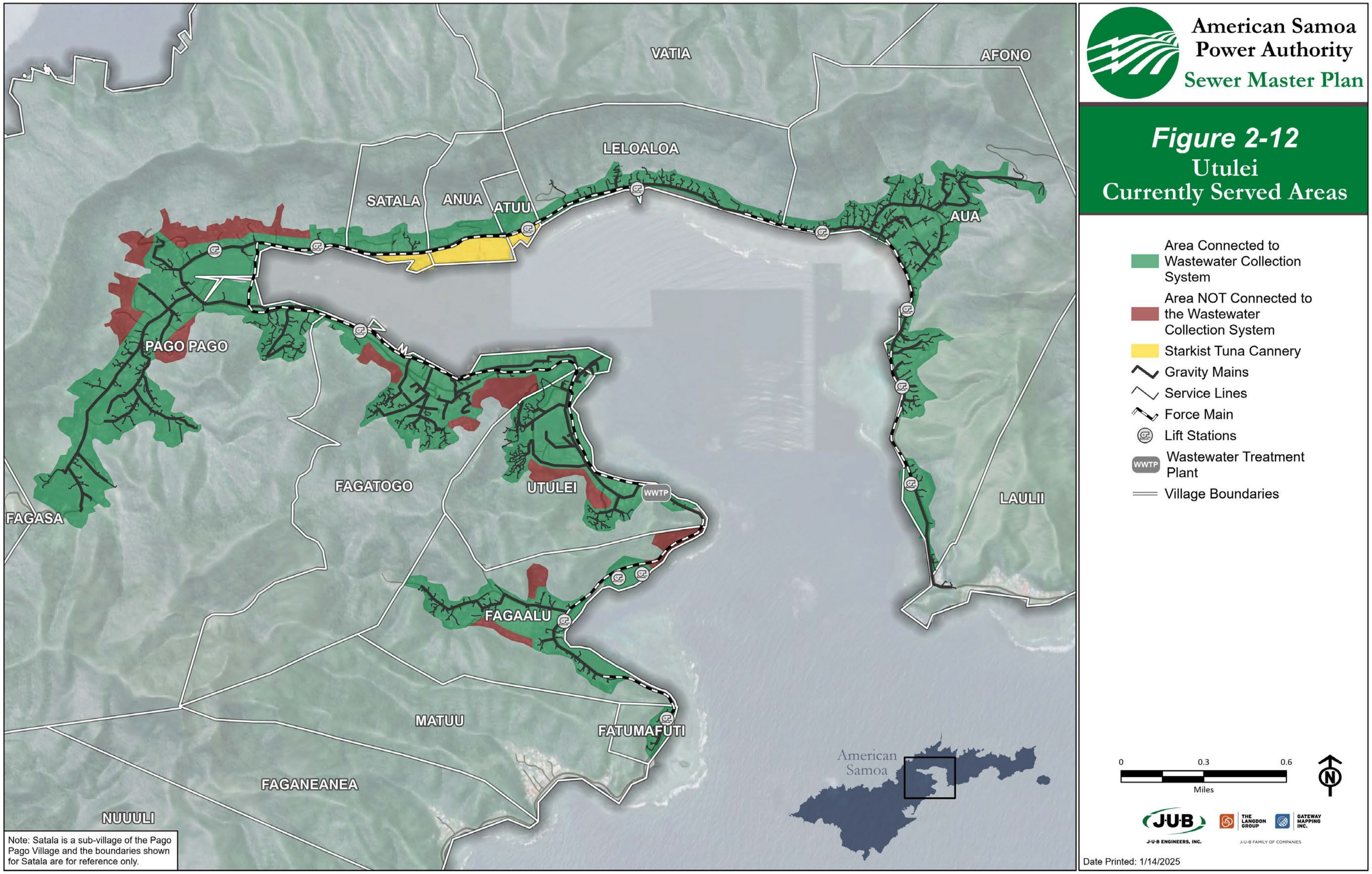

Figure 2-12: Utulei Service Area Map

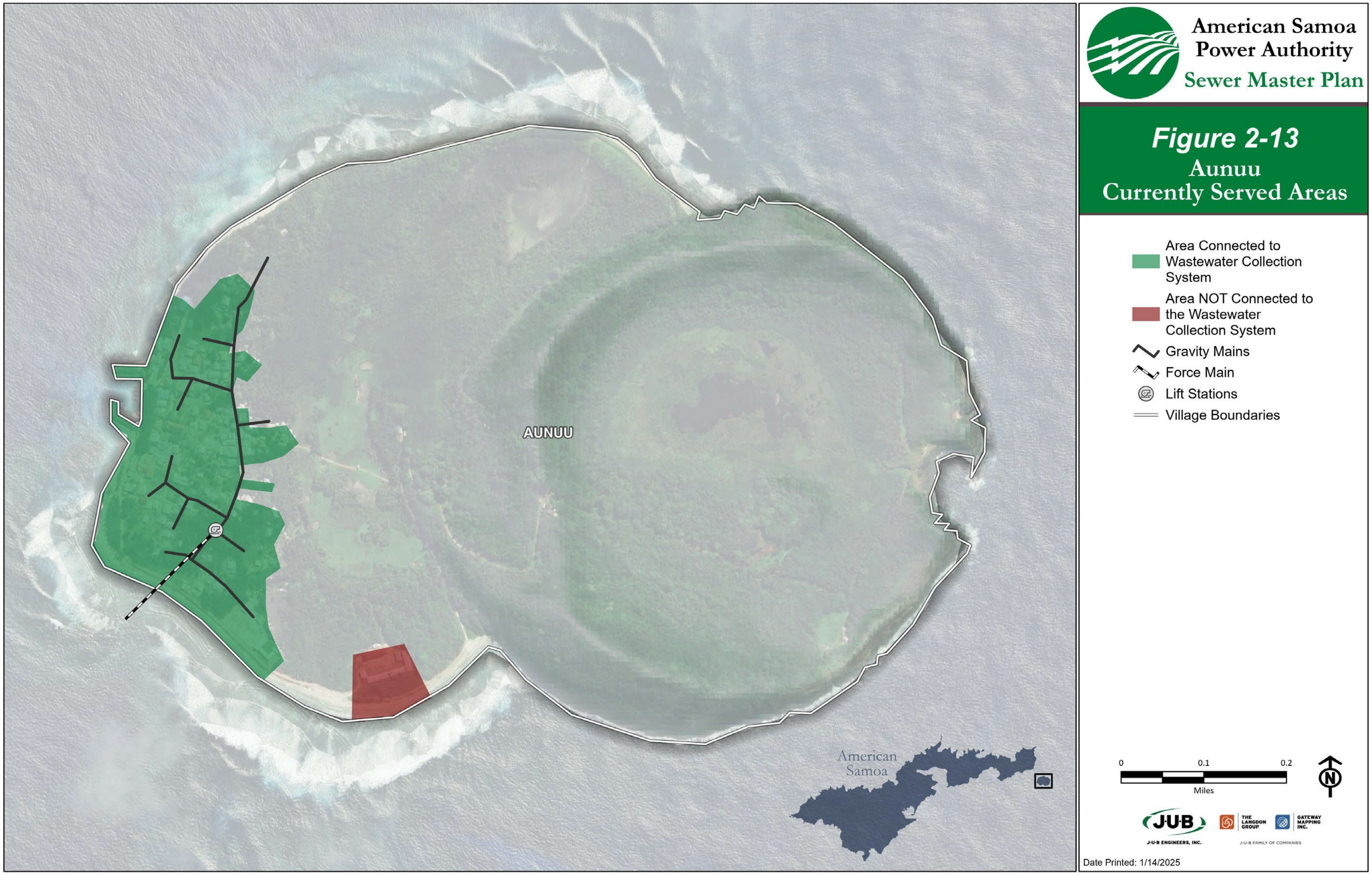

Figure 2-13: Aunu'u Service Area Map

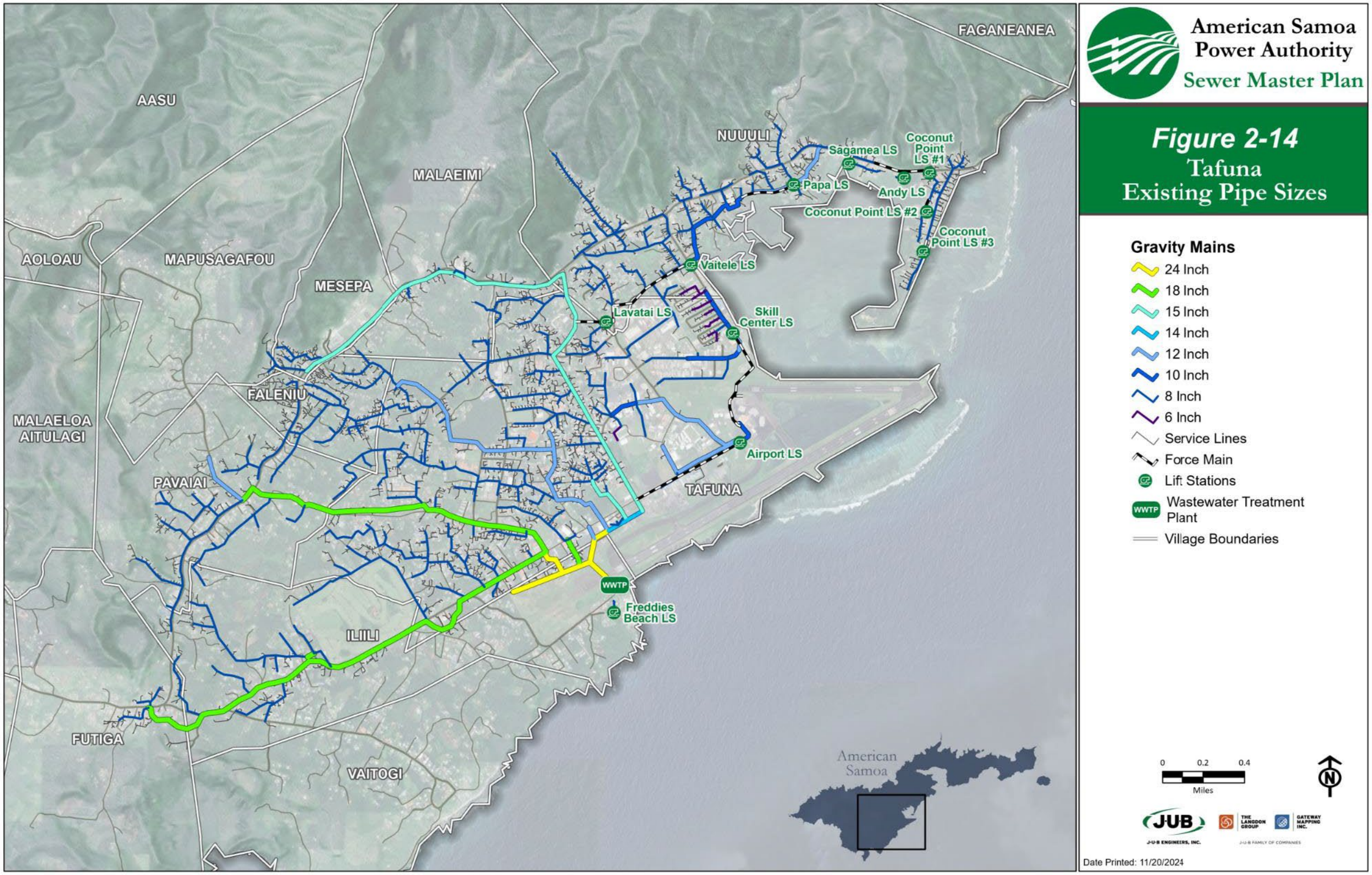

Figure 2-14: Tafuna Existing Pipe Size Map

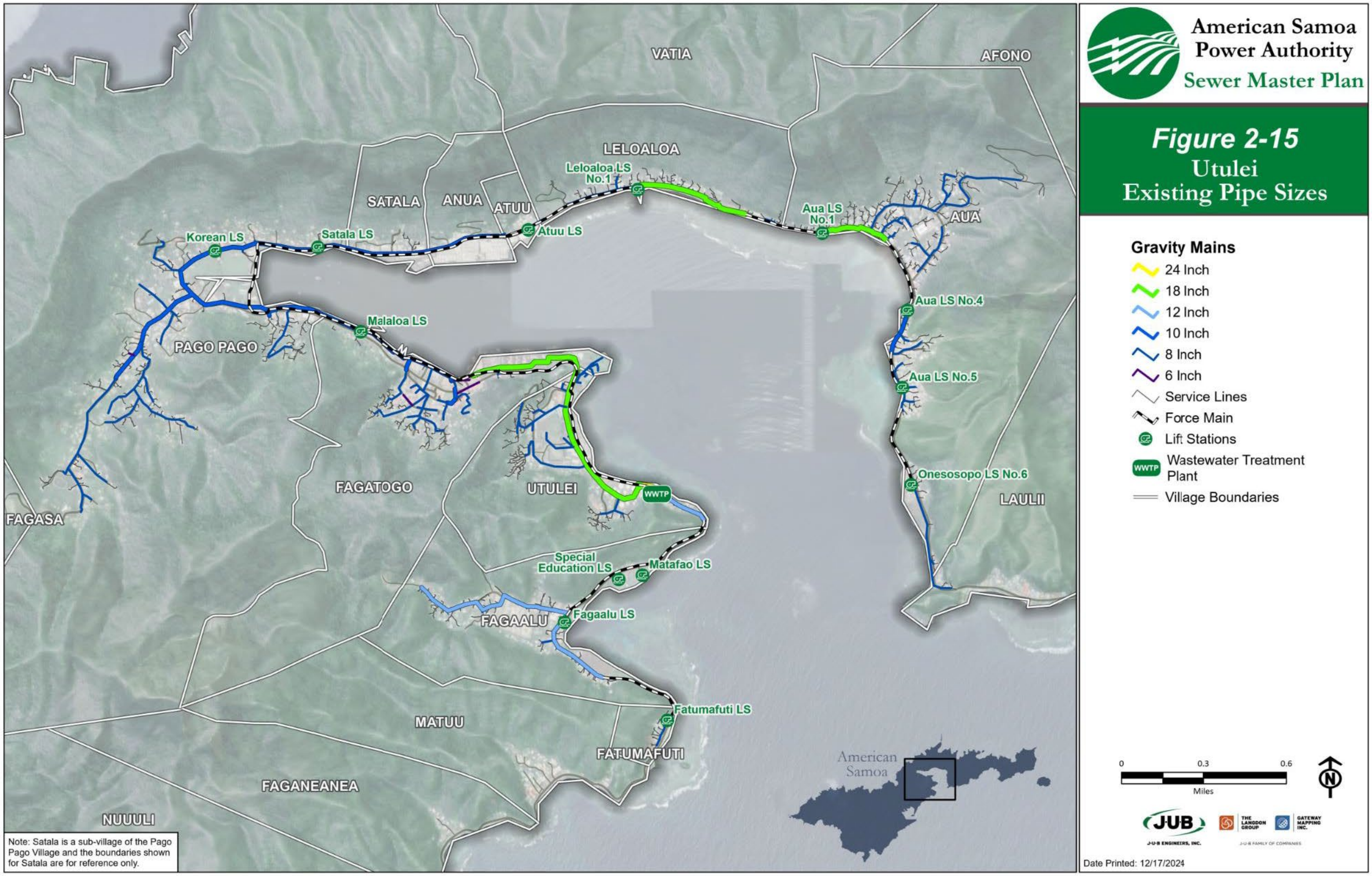

Figure 2-15: Utulei Existing Pipe Size Map

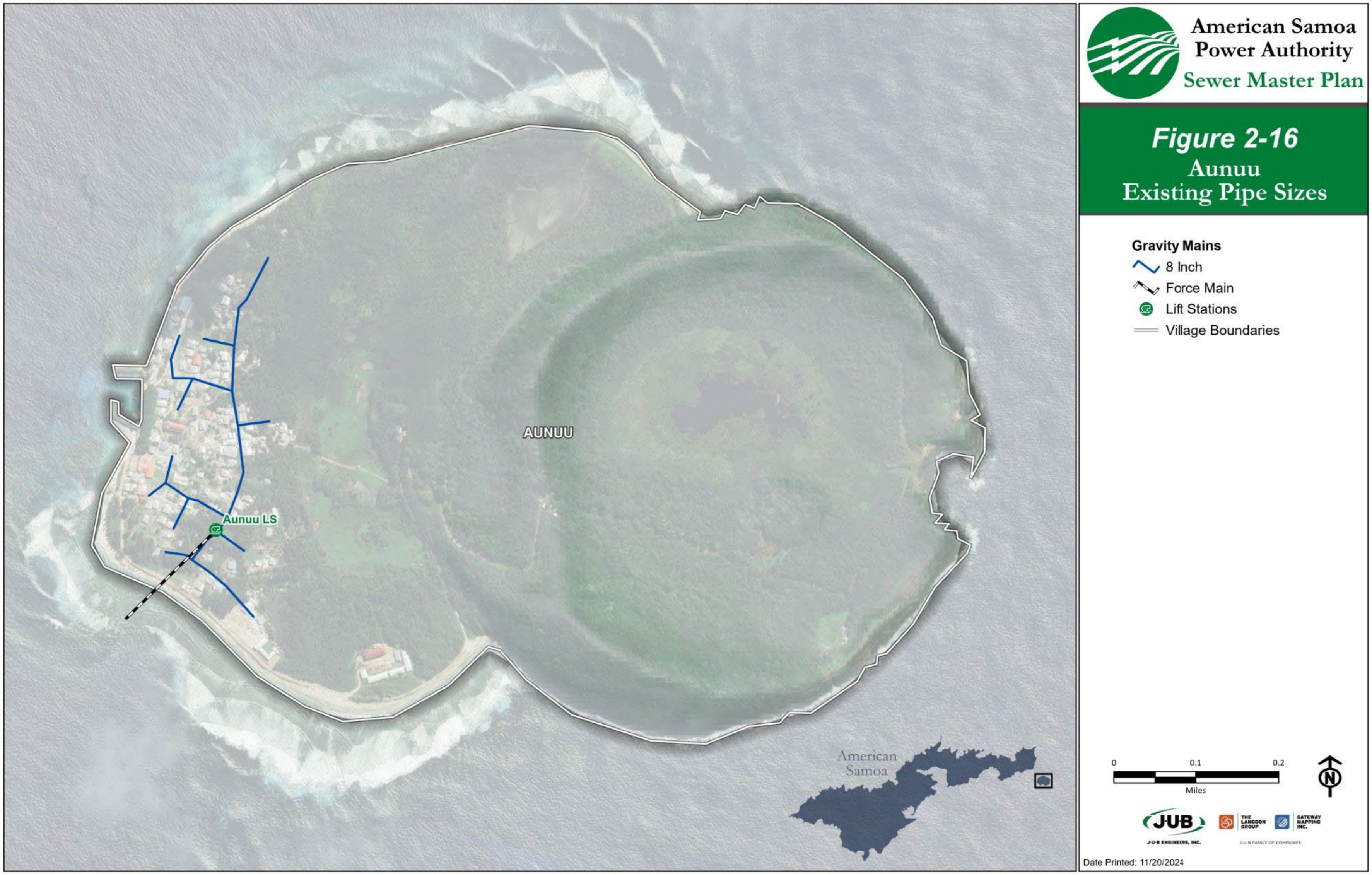

Figure 2-16: Aunu'u Existing Pipe Size Map

2.2.1 Public Health and Water Concerns

As mentioned above, ASPA's system has several current issues, including aging infrastructure, degraded water quality, increasing water demand, and non-compliance with standards. An additional ASPA system issue, excessive energy consumption, is discussed in Section 2.2.5, below.

2.2.2 Aging Infrastructure

Several documents have already been finalized to address water quality issues on the islands, including the 2003 Utilities Master Plan (Pedersen Planning Consultants), the 2016 Water Supply Asset Management Plan (Thomas Civil & Environmental Consultants Ltd.), and the 2023 Drinking Water Master Plan (J-U-B Engineers Inc.). Although these documents have provided guidance to solve some of ASPA's identified water quality issues, the existing infrastructure system is aging and much of it is in poor condition. ASPA's existing infrastructure system in summarized in **Figure 2-10**, above.

ASPA faces high operational and maintenance costs, including very high Non-Revenue Water (NRW) numbers (water produced by the system but not sold to consumers) due to the overall age of the system, which was installed 30 years ago. ASPA tracks its total water volume produced and compares it to total water output at customer meters, allowing ASPA to determine if and where water losses are occurring within the system. According to ASPA's 2023 Drinking Water Master Plan, NRW ranged from 26% to as high as 82% in 2021, with a systemwide average of 61% (J-U-B, 2023). This very high NRW is the result of extremely high water losses in the system. These water losses also result in high pumping costs and high energy consumption, increased use of groundwater aquifers and degraded water quality, potential subsurface erosion and sinkholes, further degradation of adjacent infrastructure, and ongoing poor mainline pressure (J-U-B, 2023).

2.2.3 Water Quality

ASPA's drinking water facilities supply the vast majority of residents with potable water, according to the APSA Drinking Water Master Plan (J-U-B, 2023). ASPA has recently completed construction of a micro filtration plant and a reverse osmosis (RO) facility (Aua) on Tutuila. An additional RO facility in Aoa is planned to be online by the end of 2024. Together, these new treatment plants have an anticipated capacity of approximately 3,500 gpm.

According to the U.S. Army Corp of Engineers (USACE), 26 of the 41 watersheds in American Samoa do not meet water quality standards set by the U.S. Environmental Protection Agency (USEPA) (USACE, 2022). Impairments to these waters are from a variety of nutrients, metals, waste collection system failures, animal feeding operations, and natural systems (USACE, 2022). Currently, 100% of the water provided to residents by ASPA is pumped from the groundwater aquifer, a highly permeable unconfined aquifer. Since Tutuila contains multiple septic tanks, cesspools, and piggeries close to drinking water wells, especially along the populated coastal areas, the groundwater aquifer is high in chlorides, particularly in eastern Tutuila and Aunu'u, and requires large amounts of chlorine to disinfect the water within the system (WRRC, 2014). The most recent Drinking Water Report available for ASPA's system is dated 2015. The report shows that the Central System tested high 4 times for total coliform in 2015, resulting in Maximum Contaminant Level (MCL) violations for both the Total Coliform Rule and the Groundwater Rule. The Aoa

Satellite District also tested positive for Total Coliform. However, neither of the systems tested positive for Fecal Coliform. When water tests high for total coliform, it indicates that the water conditions can support the growth of other harmful bacteria that could harm those drinking the water. As a result, portions of ASPA's customers in both the Central System and the Aoa Satellite District were put under a Boil Water Notice, which is scheduled to be lifted by mid-2024 for the Central System and by early 2025 in Aoa. The continued existence of potential pollutants near the only groundwater aquifer means water quality concerns remain high.

2.2.4 Water Demand

Water demand on Tutuila is anticipated to change in the future. The 2003 Utilities Master Plan estimated a forecasted population increase of 22% by 2020, to between approximately 74,000 and 76,000 persons (J-U-B, 2023). In contrast, however, the 2020 Census data indicates that the population of American Samoa has actually decreased by up to 10.5% in all areas except Tutuila (J-U-B, 2023). **Figure 2-17** shows the change in population for each area of Tutuila between 2010 and 2020. Population changes such as these can put strain on infrastructure in growth areas and make future infrastructure growth or modifications difficult to plan and budget for in a timely manner.

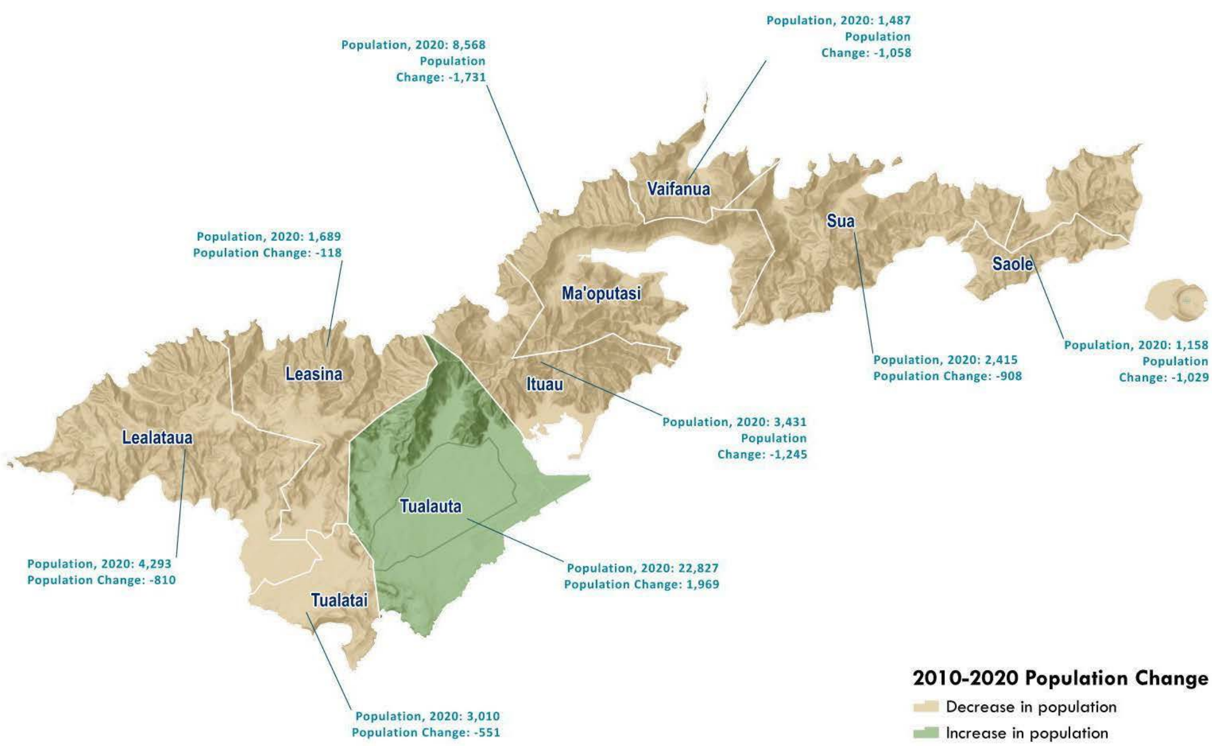

Figure 2-17: Population Change in Tutuila 2010-2020

Significant changes in demand for water are also expected from the tuna processing and canning industry in the future. StarKist currently operates a large cannery operation on Tutuila, called Starkist Samoa, which accounts for approximately 15% of the total employment in the territory, according to the American Samoa Department of Commerce (J-U-B, 2023). The tuna industry is a major source of water use on

American Samoa. It is believed that the tuna canning industry on American Samoa is expanding and will require more water to meet the need.

2.2.5 Energy Production and Consumption

ASPA's existing water supply system is supplied entirely by water pumped from the local groundwater aquifer. Due to water demand and water losses within the aging system, continual pumping is required to meet water demand. These pumps use diesel-powered electrical grid energy, costing approximately $0.53/kilowatt hour (kWh). According to ASPA, utilities costs amount to more than $608,000 in 2022 and more than $971,000 in 2023, with more than 90% of that yearly cost coming from electrical costs. High electrical costs associated with pumping needs result in higher costs for water consumers, which can cause economic strain. As discussed in Section 2.1.9, 56.1% of the population of American Samoa is below the poverty level.

2.2.6 Unique Challenges

Land uses on Tutuila and Aunu'u are predominantly undeveloped forested inlands with urban, commercial, and residential development along the flatter ocean shoreline. The topography of the study area includes a mountainous interior with few access roads and low-lying coastal areas where most of the island's population resides.

2.2.7 Remote Location and Limited Conveniences

American Samoa is located approximately 2,400 miles east of Australia and 2,500 miles southwest of Hawaii. Further still is the west coast of the mainland United States; Los Angeles, CA is approximately 4,800 miles northeast of the island chain. Proximity to the mainland U.S. is important for the supply of many drinking water infrastructure materials, including pipes, valves, etc., but it is also of particular importance due to the "Build America, Buy America" requirements of certain funding sources which require American products to be used. All major supplies, whether from the U.S. or Oceania, require trans-pacific shipment. This results in extended lead times for supply acquisitions (leading to logistical challenges) and significantly higher costs.

Recruitment and retention of technical staff in American Samoa has also been a challenge for ASPA. It is believed that the remote location of the islands, coupled with its limited conveniences, adversely impact recruitment and retention of technical staff. The difficulties surrounding recruitment/retention are perhaps best illustrated by the severely limited number of Professional Engineers currently residing in American Samoa (J-U-B, 2023).

2.2.8 Samoan Culture and Land

The extents of Aiga Land are vast and often extend from the coast into island interiors. Since land use decisions are at the discretion of the matai who often require unanimous decisions from the entire aiga, obtaining easements for infrastructure placement/access can be difficult and can extend project timelines significantly.

Watershed management and protection is also affected by land ownership. Since Aiga Land is largely under the authority of the matai (i.e., privately owners), private interests can sometimes conflict with efforts to protect watersheds. More than in many places, watershed protections in American Samoa, require significant cooperation between matai, regulatory agencies, and interested parties.

2.2.9 Climate Change & Rising Sea Levels

Most climate change models indicate that the South Pacific islands, including American Samoa, would be significantly impacted by climate change and rising sea levels. According to climate studies completed for American Samoa in 2016, rainfall will increase by 20-25% by the late 21st Century (J-U-B, 2023). Other climate studies completed for the islands indicate that not only will this increased rainfall cause water levels to rise, but that the islands themselves are sinking due to earthquakes and subsidence, which would make rising sea levels more apparent. It is estimated that between rising sea levels and island subsidence, water levels will rise by approximately 30-40 cm by the end of the century (J-U-B, 2023).

Increased rainfall, rising sea levels, and island subsidence will all have significant impacts on the groundwater aquifer American Samoa's population depends on for their water supply. While it is assumed that freshwater levels within the groundwater aquifers will rise along with sea levels, water quality may decrease as brackish water in the aquifers comes into contact with existing water supply wells (J-U-B, 2023). While it may not impact the total amount of fresh water available within the aquifer, rising sea levels may require additional treatment and require additional maintenance, increasing operational costs over time.

2.2.10 Corrosive Environment

American Samoa has both a tropical climate and a significant coastal climate, as discussed above. It is well known that both coastal and tropical atmospheres experience very high corrosion rates due to high temperatures, high relative humidity, and high airborne salinity. Coastal atmospheric testing on both copper and steel in other tropical coastal areas indicate that metals in tropical coastal climates experience higher rates of corrosion than those exposed to urban industrial or rural atmospheres (Corvo et al., 2009). The majority of ASPA's existing wastewater infrastructure is located in an outdoor environment and is exposed to the high humidity, rainwater, and high salinity content in the air. This combination of elements has caused high maintenance costs to the system, requiring maintenance such as equipment painting every 3 months and requiring a higher turnover in parts.

Additionally, the higher chloride rates in the water have caused rapid internal and external corrosion rates of the piping and equipment. Testing conducted in other tropical coastal areas shows that exposure to chloride causes a significant acceleration of corrosion rates (Corvo et al., 2009). Studies of the chloride levels on American Samoa from 2014-2022 indicate that the approximately half of the tested wells are above the maximum level of chloride (MCL) allowed by the EPA (J-U-B, 2023) and several of the average chloride levels in many of ASPA's source wells is well above the MCL as well. This is indicative of a very high chloride content in the underlying groundwater aquifer. This in turn results in a very high chloride content in the resulting wastewater as well, increasing the rate of corrosion within ASPA's wastewater system.

Recommendations on specific non-corrosive materials suggested for use in ASPA's system can be found in Chapter 8.

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J·U·B ENGINEERS, INC.

CHAPTER 3

WWTP FLOWS AND LOADS

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No appendices.

Chapter 3 Flows and Loads

It is important for Wastewater Treatment Plants (WWTP)s to have an understanding of the wastewater influent flows and loading coming into the plant, so that they can accurately evaluate the capacity of their existing infrastructure in terms of the demands on it and determine if modifications need to be made based on increases or decreases in either the flows or loading. Loading refers to the organic and solids demand exerted by the incoming waste stream on the plant and consists of the influent 5-day biochemical oxygen demand (BOD_5) load, the total suspended solids (TSS) load, and various nutrients (nitrogen and phosphorus). This Chapter presents the existing flows and loads and projections of future flows and loads at the 20-year condition for the Tafuna and Utulei WWTPs.

3.1 Tafuna WWTP

3.1.1 General

The plant flow is measured using two electromagnetic (mag) meters upstream of the UV disinfection unit, as shown in the process schematic (**Figure 6-2**) in **Chapter 6**. These mag-meters measure the total effluent volume, in gallons; influent flow rate is not monitored. A 14-inch mag-meter records the volume of effluent wastewater through the pipe coming from clarigester 1, and an 18-inch mag-meter records the volume of effluent wastewater through the pipe coming from clarigesters 2 and 3. The plant operator manually records the volume readings in gallons once per day and subtracts them from the volume readings from the previous day to calculate the daily wastewater flow through each pipe. It is assumed that the operator records the readings at approximately the same time each day. The daily flow rates calculated from the mag-meter readings are added to obtain the daily plant flow rate.

Grab composite samples of the influent are collected and tested weekly for the following parameters: 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS). The influent grab samples for BOD_5 and TSS testing are collected upstream of the headworks screens every hour for 8 hours and combined to form a daily composite sample for that week. ASPA submits the flow, influent BOD_5, and influent TSS from the Tafuna WWTP to the Environmental Protection Agency (EPA) as part of their Discharge Monitoring Report (DMR) and to stay in compliance with the National Permit Discharge Elimination System (NPDES) discharge permit.

3.1.2 Existing Flows

3.1.2.1 Background

The flowing parameters are calculated to understand the flow coming into the wastewater plant at various conditions:

- **Average Day Flow (ADF):** ADF is the average annual flow rate observed at the facility. The ADF rate is used to estimate annual average pumping and chemical costs, solids production, and organic loading rates during the dry weather season.

- **Maximum Month Flow (MMF):** MMF is the observed flow for the peak month in the year. This flow factor is typically used to design unit processes for permit compliance. MMF is typically determined as the maximum value of the average monthly flows in the study period.
- **Peak Day Flow (PDF):** The expected flow for the peak day in the year. The PDF is used to size processes for peak events. For this analysis, PDF is used to determine the firm capacity for headworks, pump stations, and maximum hydraulic throughput for the basins and channels.
- **Peak Hour Flow (PHF):** The observed flow for the peak one-hour period in the year. Typically, the PHF is used to size firm capacity for headworks, pump stations, and maximum hydraulic throughput for basins and channels.

Typically, five years of influent flow data are used to determine the average daily, maximum month, and peak day flows of wastewater systems. For this analysis, ASPA provided the daily flow measurements for 2022, and they indicated that 2022 was a typical year of wastewater flow. In addition to daily flow data from ASPA, five years of average monthly flow and maximum daily flow for each month were downloaded from the EPA's online database, Enforcement and Compliance History Online (ECHO), from October 2018 through September 2023.

The current practice of flow measurement presents challenges in understanding the actual influent flow rate of the wastewater treatment plant. Some of these challenges are:

- WWTPs are typically designed around the influent flow rate coming into the plant. The clarigester basins could attenuate peak hourly flows, which would not be represented in the effluent flow meter downstream of the UV disinfection unit.
- Typically, five years of daily influent flow data are used to establish the range of flow conditions. Five years of monthly data for average monthly flow and maximum daily flow for that month reported in the Discharge Monitoring Report (DMR) from October 2018 to September 2023 were analyzed in this report. Only one year of daily influent flow measured in 2022 was provided. I/I estimation, flow trends, etc., are challenging to deduce from such a small daily flow dataset. The average day flow and maximum month flow from the five years of DMR data is similar to that from the one-year of 2022 data that was analyzed and is discussed in section 3.1.2.3.
- Some process equipment, like headworks, is evaluated based on peak hour flow. The daily flow data provided by ASPA does not capture the peak hour flow coming into the plant. During a site visit on January 17, 2024, operations staff indicated that the peak flows following storm events have been around 6.4 MGD for a few hours, but there is, unfortunately, no flow data to support this claim.
- It is not known if the daily readings were taken exactly 24 hours apart. Variability in the time of measurement can result in an inconsistent and unreliable understanding of the flow rates. This analysis assumes that the totalizer readings for the daily flow rate were recorded every 24 hours. There are also periods of no recording between regular flow recordings for a day or two. It is uncertain if the flow recording following that no-record day is a totalized flow over a period of multiple days or just for 24 hours. Most of these flow recordings are closer to average flows and, therefore, are assumed to be flow-recorded for 24 hours.

3.1.2.2 Prior Studies

Past studies have used different approaches to establish flow conditions to address the limitations of the measurement practice and availability of data. **Table 3-1** summarizes the Tafuna WWTP's wastewater flow estimates from other studies conducted in the past.

Table 3-1: Tafuna WWTP - Flow Rate Derivation Comparison from Other Studies

Parameter	Scoping Report for CIP to increase initial Dilution Factor for both the Tafuna and Utulei Ocean Outfalls (Coe & Van Loo, 2012)		Leone Vaitogi Feasibility Study (Pryzm, 2024)	
	Dry Weather	Wet Weather	Dry Weather	Wet Weather
Average Day Flow, ADF (MGD)	-	-	2.16	
ADF (MGD) based on weather conditions	1.6	2.7	1.4	2.6
Peak Day Flow, PDF (MGD)	3.7	6.2	6.0	
Peaking Factor	2.3	2.3	2.8	

The following paragraphs in this section include a summary of the approach used to calculate the flow rate in previous studies. This is not our analysis or critic of their approach.

The Scoping Report (Coe & Van Loo Consultants, 2012) used rainfall data from the National Oceanic and Atmospheric Administration (NOAA) to identify the wet and dry seasons. Total rainfall for one day exceeding 5 inches was considered a significant rain event. ASPA submits on their DMR, which is then recorded in ECHO, only one flowrate per month, which is the maximum of the average daily flows for that month. The maximum daily flow reported in the DMR from September 15 to October 12 in 2009 and 2011 was used to establish the baseline dry weather average daily flow. These were weeks with minimal rainfall. The maximum daily flow reported in the DMR in December 2009, January 2010, and January 2011 were used to calculate wet weather flows. These months had the highest rainfall for 2009-2011 data set. The average daily flows during wet weather were not consistent. To be conservative, a month with high-intensity rainfall and a large amount of rain was considered as a representative wet weather month, and the ratio of this month to the baseline flow was calculated to be 169%. Therefore, the average wet weather flow was estimated to be 69% higher than the average dry weather/baseline flow. The peak day flow for the dry weather condition is based on the average peaking factor (peak day/average day) of 2.3. The peak day flow during wet weather was calculated using the same peaking factor (2.3) as the dry peak day to average day factor. It is important to note that there was no actual observed flow of 6.2 MGD(calculated peak day flow during wet weather) in the plant during the study period but given the limitations in the data the study used this flow rate to model the wastewater collection and treatment system. The limitations on the data set are that the wet weather and dry weather flow analyses are based on a total of six weeks of daily flow data.

Similarly, the Leone Vaitogi Feasibility Study (Pryzm Consulting, 2024) explores various datasets, including the daily flow in 2022 and 2023, and DMR data from 2017-2023, to evaluate flow conditions. The dry and wet weather baseline flows were estimated using the 2022 and 2023 datasets. The wet and dry seasons were identified based on rainfall data. Dry and wet weather wastewater flows are defined as the quantity of wastewater immediately after no rainfall and significant rainfall, respectively, for approximately seven days. The maximum values among the flow observed during the dry and wet weather periods were considered the average flow for dry and wet weather conditions. An existing average day flow of 2.16 MGD and an existing peak day flow of 6 MGD based on the plant capacity of the existing WWTP were established. This summary is based on the first draft of the feasibility study; any further changes in their flow evaluation method or determination are not elaborated on in this summary.

Most key process items, including the clarigesters, were designed in 1992 and constructed shortly thereafter. The original design flow conditions of the existing plant are summarized in **Table 3-2** based on the as-built drawings provided by ASPA (Westech, 1992). As seen in the table below, peak hour was not included in the plant design conditions.

Table 3-2: Tafuna WWTP – Design Flow Conditions of Existing Infrastructure

Items	Design Criteria
Minimum Daily Flow (MGD)	0.60
Average Daily Flow (MGD)	2.16
Peak Day Flow (MGD)	6.00

These studies demonstrate that various approaches have been used to estimate the flow conditions of influent wastewater at the Tafuna WWTP at different periods. The previous studies are relatively consistent with the peak day flow and plant capacity of 6 MGD. The methodology used for analyzing flow conditions for this report is discussed in Section 3.1.2.3.

3.1.2.3 Data Analysis and Discussion

ASPA submits the average monthly flow and the maximum daily flow for each month to EPA on their DMR as required by the Tafuna WWTP's permit. The DMR data includes two flow numbers for each month, which are the maximum of the daily flows and the average of the daily flows for each month. EPA then posts the information from the DMR on ECHO. Initially, the flow data reported by ASPA in Tafuna's DMR from October 2018 to September 2023 was used to calculate the design flow conditions, including the ADF, MMF, and PDF. The ADF and MMF calculated from the DMR dataset were around the same range (+ 5% to - 10%) as the ADF and MMF calculated from the 2022 dataset, which shows that the DMR data set encompasses the trends noticed in the 2022 dataset. Therefore, the flow values calculated from the DMR dataset were used to establish current baseline flow conditions.

Some flow readings for the 2022 daily flow and DMR dataset were removed and modified. These changes include:

- Days with zero reported flow or no flow were not included in the analysis.

- On November 28, 2022, a high flow event of 4.4 MGD was reported in the 2022 daily dataset. No flow was reported for November 26th and 27th. High rainfall events were not observed during this period. It is assumed that the high flow event of November 28 is a cumulative flow of three days. Therefore, flows for these three days were replaced by 1.46 MGD (4.4 divided by 3). November 28th, 2022 was a Monday, and November 26th and 27th were a Saturday and Sunday following the Thanksgiving holiday. The WWTP often goes unstaffed or has limited staff on Saturdays and Sundays.
    - The DMR data set reported a peak flow of 4.4 MGD for November 2022. As stated above, it is assumed that this reported flow is a cumulative flow of three days and was removed from the analysis.

Figure 3-1 shows the daily flows recorded in 2022 from January to December. **Figure 3-2** shows the maximum daily and average monthly flows from 2018 to 2023 from the DMR data used in the flow analysis.

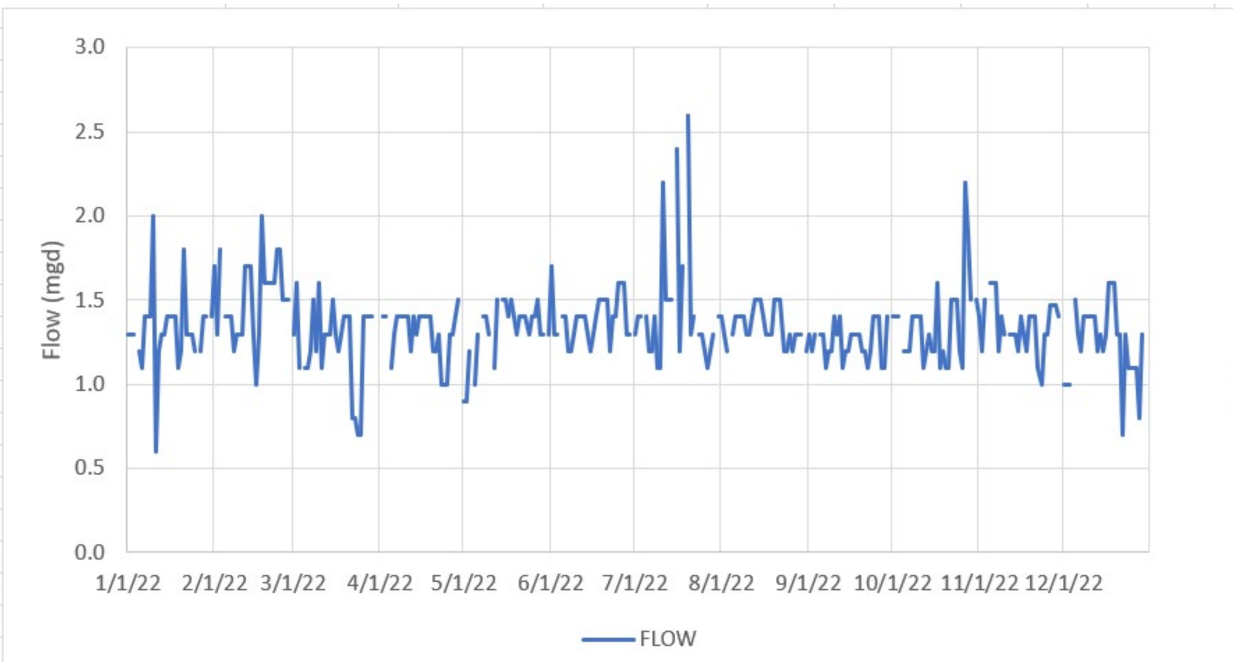

Figure 3-1: Tafuna WWTP - Daily Flows Observed in 2022

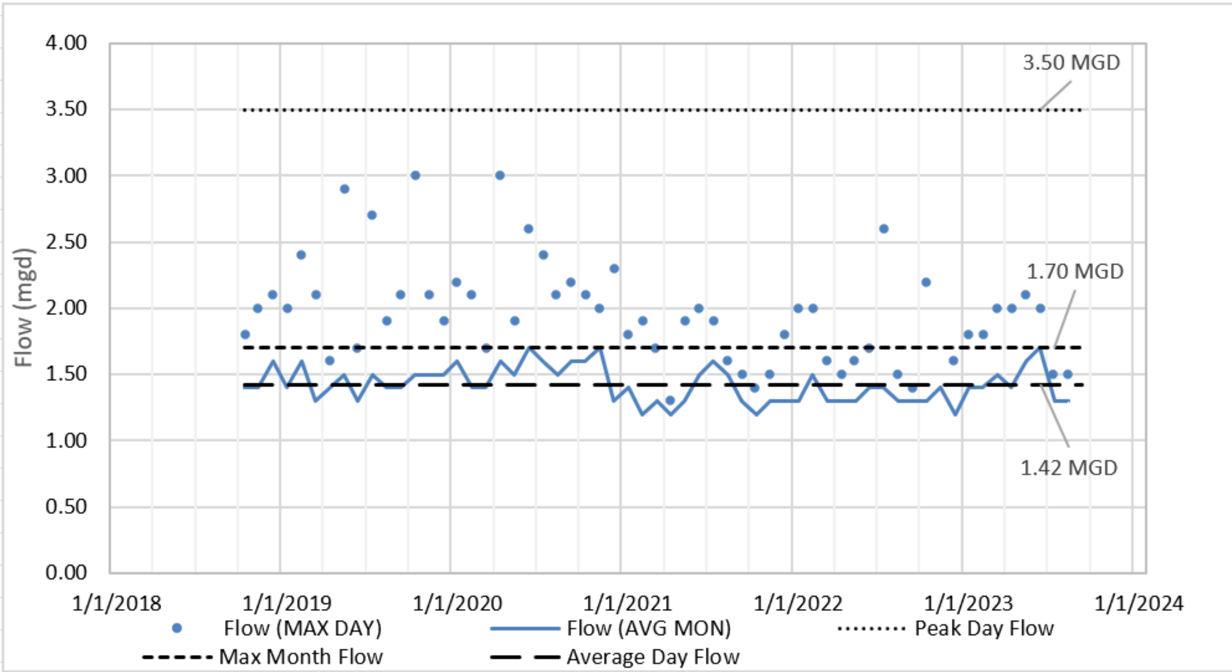

Figure 3-2: Tafuna WWTP - Flows reported in DMR for the last five years

The maximum observed peak day flow from late 2018 through mid-2023 was 3.00 MGD. The observed peak day flow value for this data set is considerably lower than prior estimates; therefore, the maximum daily flows reported in the DMR for the last five years (Oct. 2018- Sep. 2023) were plotted on a log-normal plot to determine the statistically probable peak day flow. A confidence interval (CI) is a statistical concept used to estimate the range of plausible values of the parameter and a level of confidence that the actual parameter lies within that range. The confidence intervals of peak day flow can be calculated from the log-normal plot and are summarized in **Figure 3-3**. Based on the log-normal probability plot at a 99.9% confidence interval in **Table 3-3** the existing peak day flow is 3.50 MGD.

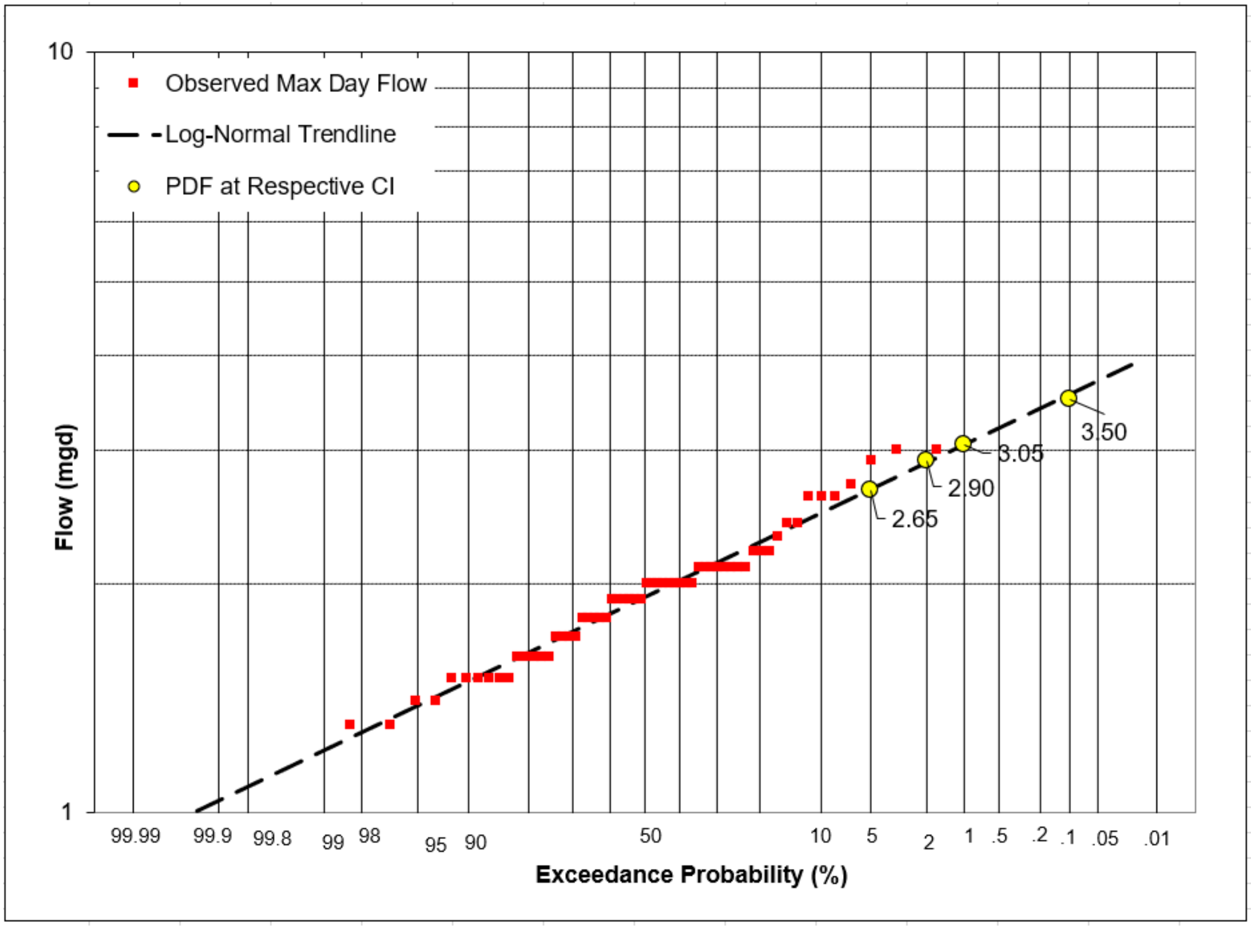

Figure 3-3: Tafuna WWTP - Log-normal plot of maximum daily flows

Table 3-3: Tafuna WWTP - Influent Peak Day Flow Probability

Confidence Interval (CI)	Corresponding Peak Day Flow (MGD)
95%	2.65
98%	2.90
99%	3.05
99.9%	3.50

The last flowrate parameter that is typically determined for a WWTP is the peak hour flowrate. Since the treatment plant does not have an influent flow meter, the flow value recorded by the effluent mag-meter was analyzed to establish the influent flow conditions. The effluent flow meter is located after the clarigester. Therefore, the peak hourly flows coming into the treatment plant might be buffered in the clarigester tanks and may not be recorded by the mag-meter.

The 10-State Standards provides guidelines for designing wastewater facilities and is primarily tailored to facilities in the ten states around the Great Lakes in the upper Mississippi River (BSPPHEM, 2014). The 10-

State Standards recommends typical peaking factors for peak hourly flows based on the population served by the sewer system. Figure 1 in the 10 State Standards correlates the population for a given area to the peak hourly flow rate factor. The estimated population that contributes to sewer flow to the Tafuna WWTP is 19,854, as discussed in section 3.1.4.1. Based on the population, a peaking factor of 2.65 is determined using the 10 State Standards figure to calculate peak hourly flows, which is a peak hour flow (PHF) of 3.55 MGD. In the preceding analysis, the peak day flow (PDF) for the Tafuna WWTP was estimated as 3.50 MGD, which correlates to a peaking factor of 2.61. The 10-State Standard's recommendation of the peak hourly peaking factor is in the same range as the peak day peaking factor calculated in our analysis. This is unusual since PHF is typically distinctively higher than PDF. The 10-State Standards method greatly underestimates the peak hourly flowrate at the WWTP as it does not consider the large contributions from I/I.

Previous design projects and studies did not analyze peak hour flows separately. ASPA provided instantaneous flow data recorded every minute by the UV system for most days in July through December in 2019, January through December in 2020, and January through September in 2021. The hourly flows were calculated by taking an average of the instantaneous flows recorded within an hour. **Figure 3-4** and **Figure 3-5** show the observed hourly flow recorded in 2019-2020 and 2021. The hourly effluent flow from the Tafuna WWTP decreased from 2019 to 2021, as seen in the figures below. However, this analysis cannot establish concrete conclusions or trends since only two months of hourly flow data were available during the dry season of 2021. The peak hour flow is estimated to be 5.5 mgd and was calculated based on the entire available dataset from 2019 to 2021.

During J-U-B's site visit on January 16, 2024, the operators mentioned that the Tafuna WWTP experienced a peak instantaneous flow of 6.4 MGD for a few hours on the previous day. The WWTP General Manager has also reported that they need to adjust the flow rate of the WWTP influent pumps regularly in order not to flood downstream processes. However, available data indicate peak hourly flows have been below this reported flow.

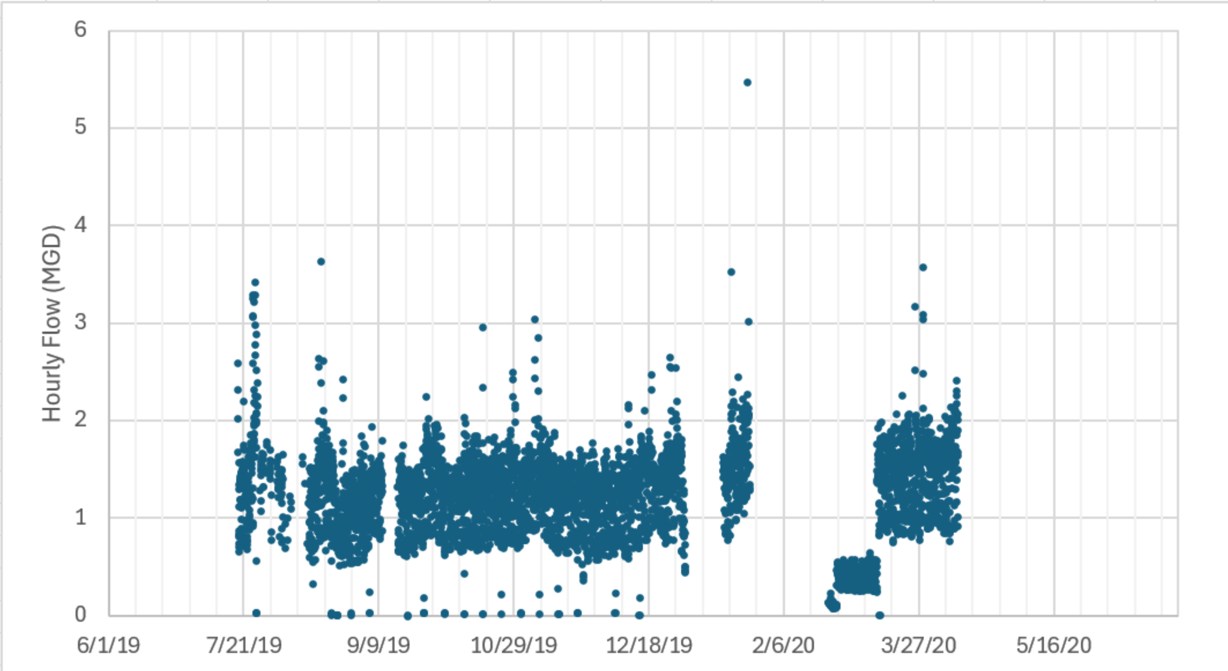

Figure 3-4: Tafuna WWTP – Hourly Effluent Flow 2019-2020

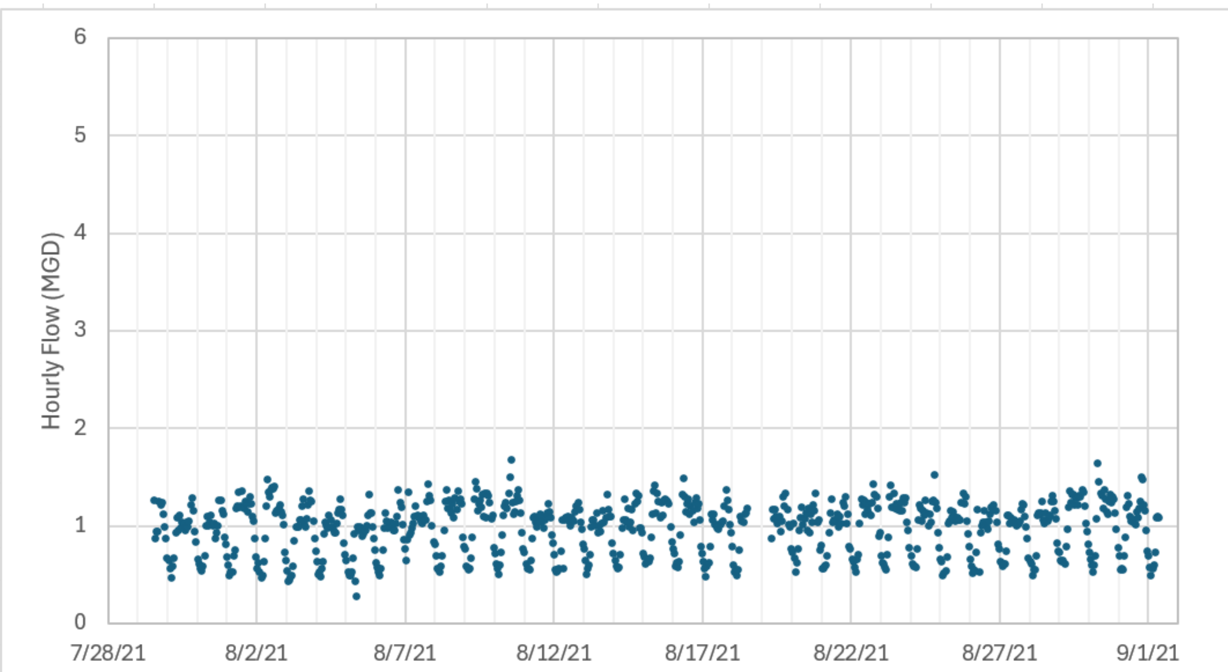

Figure 3-5: Tafuna WWTP – Hourly Effluent Flow 2021

3.1.2.4 Existing Flow Summary

Based on the review of the historical flow rates and standards, the existing flow rates for the Tafuna WWTP are summarized in **Table 3-4**. The data sources analyzed to calculate flow at various conditions is summarized in **Table 3-16** in section 3.1.7.

Table 3-4: Tafuna WWTP - Existing Flow Conditions

Parameter	Flow (MGD)	Flow (gallons/capita/day)
Average Day Flow, ADF	1.42	71.7
Maximum Month Flow, MMF	1.70	85.6
Peaking Factor (MMF : ADF)	*1.20*	-
Peak Day Flow, PDF	3.50	176.3
Peaking Factor (PDF : ADF)	*2.46*	-
Peak Hourly Flow, PHF	5.5	-
Peaking Factor (PHF : ADF)	*3.87*	-

3.1.3 Existing Loading

3.1.3.1 Previous Studies

Two previous studies have utilized loads associated with the Tafuna WWTP for different goals in the context of primary treatment. The 2012 scoping report by Coe & Van Loo was focused on methods to improve the critical initial dilution factor measured at the point of effluent discharge to reduce pollutant concentrations in the receiving environment, not the treatment capabilities of the WWTP. The final recommendation of the 2012 Scoping Report was to modify the effluent diffuser with the goal of providing improved pollutant dilution.

The 2024 Leone-Vaitogi Feasibility Study utilized average month effluent BOD_5 loads from 2022-2023 DMR data to calculate the existing capacity of effluent BOD_5 loads that can be discharged from the Tafuna WWTP based on the current NPDES permit. The 2024 study noted that the Tafuna WWTP does have additional capacity to meet the current NPDES permit for average day BOD_5 and TSS loads, but also acknowledged that the existing WWTP will not be able to meet the discharge requirements associated with secondary treatment. The recommendations of the 2024 report focused on improving the sewage conveyance system for the Tafuna WWTP.

This Utility Plan focuses on the influent pollutant loading to the Tafuna WWTP in the context of analyzing and organizing data for the goal of performing an in-depth analysis of the current and future pollutant loads. This loading information will then be utilized in a separate Secondary Treatment Feasibility Study to investigate options to meet more stringent secondary treatment requirements included in the draft Tafuna NPDES permit.

3.1.3.2 Influent Five-Day Biochemical Oxygen Demand (BOD_5)

The concentration of BOD_5 is measured in the ASPA's laboratory at the Utulei Plant. The BOD_5 loading is calculated numerically by multiplying the BOD_5 concentration with the daily flow measured on the day of sample collection. The influent BOD_5 concentration and loading for January through December of 2022 were provided by ASPA and are shown graphically in **Figure 3-6**. The average monthly and maximum daily concentration and loading of influent BOD are reported from Tafuna's DMR data from 2018 to 2023. These influent BOD_5 concentrations and loadings values from October 2018 to September 2023 were analyzed, and the graph of this dataset is shown in **Figure 3-7.** The average day BOD_5 concentration and loading from the daily 2022 dataset were comparable to the average day BOD_5 concentration and loading calculated from the 5-year DMR dataset. Therefore, the loading calculated from the DMR dataset was used to establish current baseline conditions, as was done with flow data. **Figure 3-8** summarizes the existing BOD_5 loading.

The observed influent BOD_5 concentration does not maintain a consistent trend throughout the years likely due to significant influence by I/I. The average day BOD_5 concentration is approximately 166 mg/L, which is slightly less than 195 mg/L, the concentration reported for typical, medium-strength wastewater (See **Table 3-5**). Typical literature values for residential BOD_5 loading in the US are 0.11 to 0.26 ppcd; therefore, the average day BOD_5 pounds per capita per day is 0.10 ppcd (as shown in **Table 3-5**) appears to represent a typical low-strength wastewater.

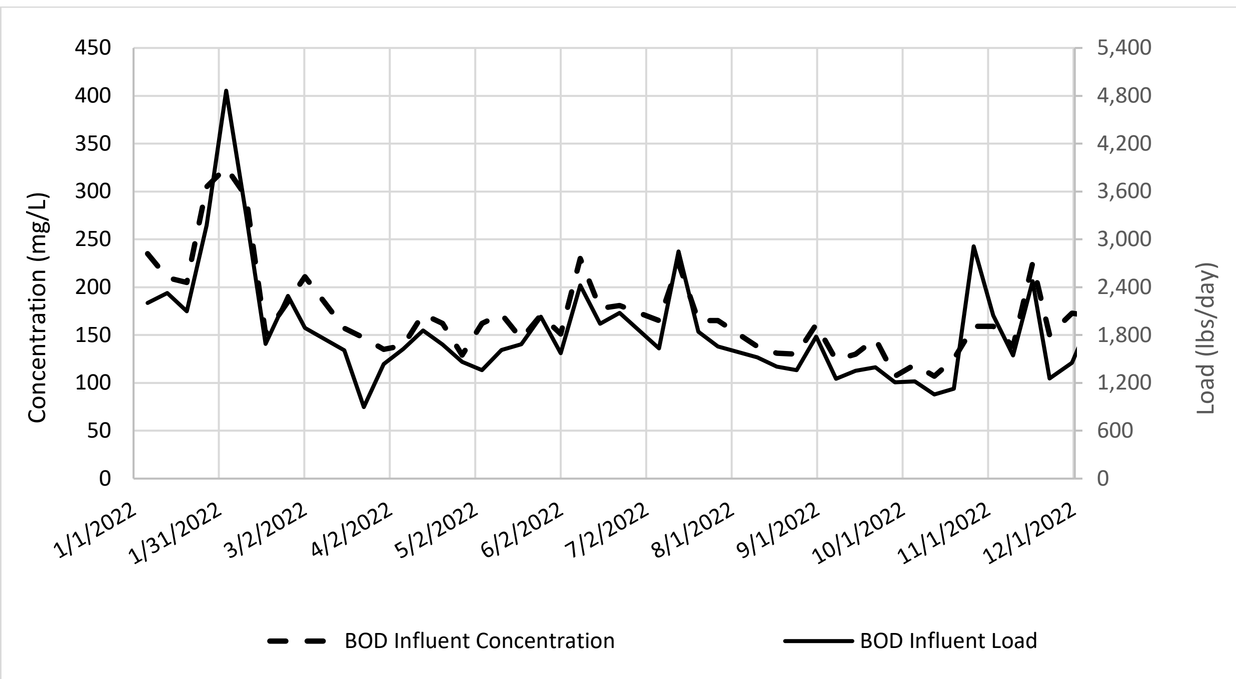

Figure 3-6: Tafuna WWTP - Influent BOD_5 from 2022 Dataset

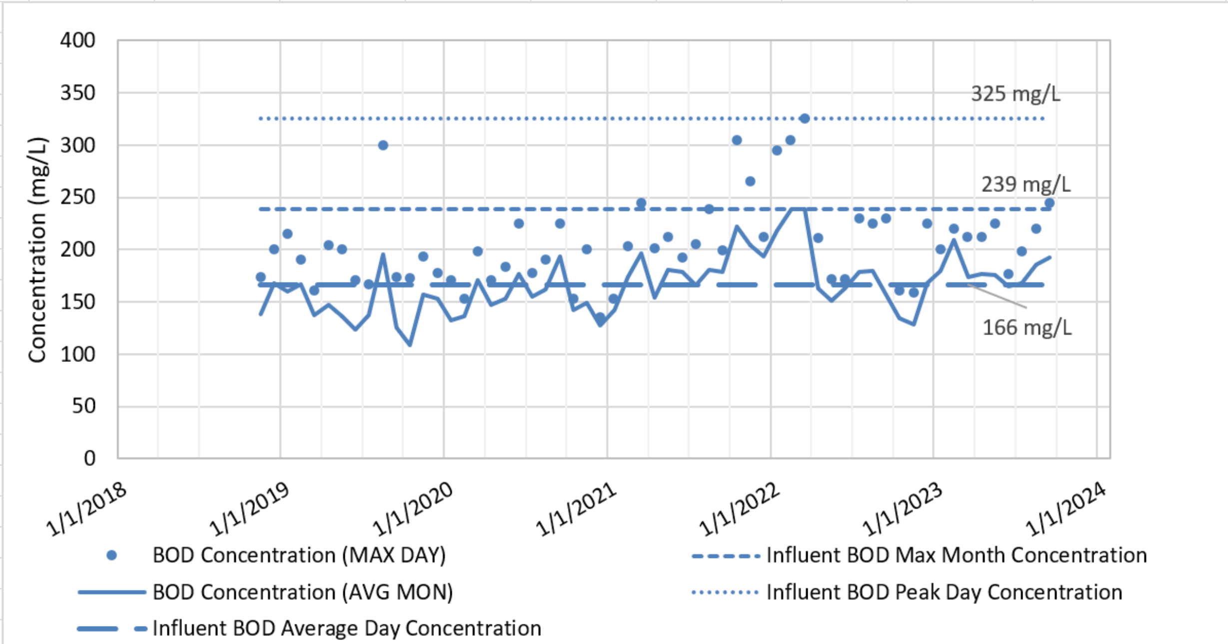

Figure 3-7: Tafuna WWTP - Influent BOD_5 Concentrations from DMR Dataset

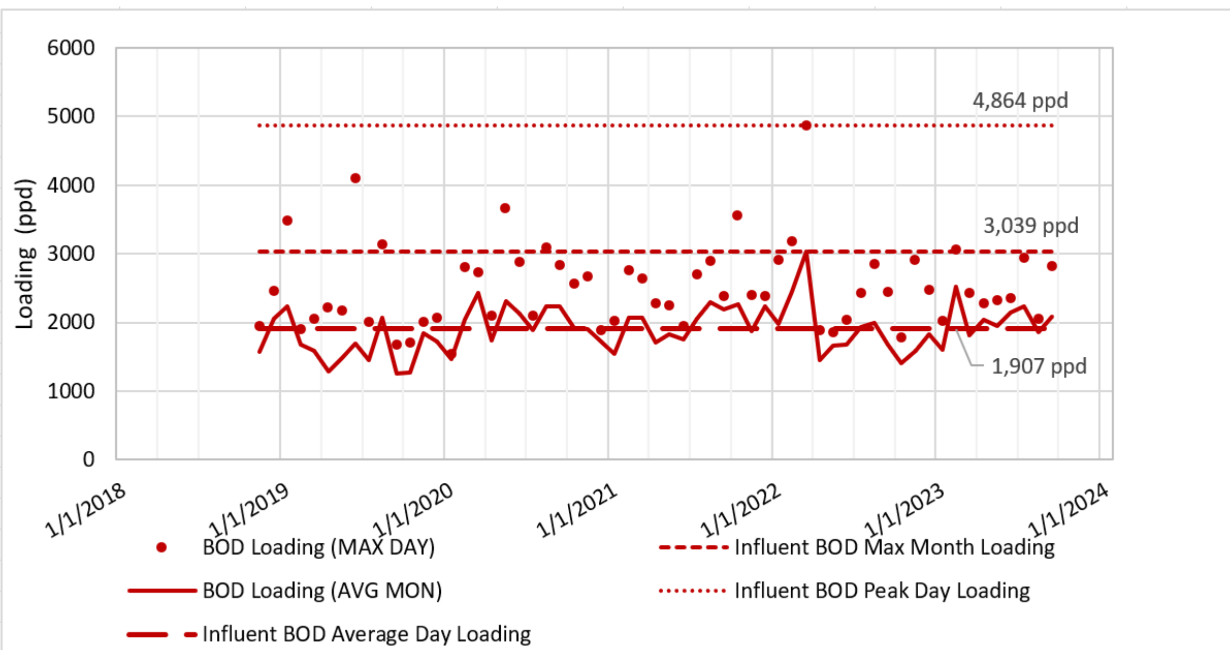

Figure 3-8: Tafuna WWTP - Influent BOD_5 Loading from DMR Dataset

Table 3-5: Tafuna WWTP - Influent BOD_5 Loads

Parameter	BOD_5 Concentration (mg/L)	BOD_5 Loading (ppd)	BOD_5 (lbs/capita/day)
Average Day, AD	166	1,907	0.10
Maximum Month, MM	-	3,039	0.15
Peaking Factor (MM:AD)	-	*1.60*	-
Peak Day, PD	-	4,864	0.24
Peaking Factor (PD:AD)	-	*2.55*	-

Previous studies utilized Tafuna WWTP influent BOD_5 data differently for different goals. The 2012 scoping report by Coe & Van Loo was focused on methods to improve the critical initial dilution factor measured at the point of effluent discharge, not the treatment capabilities of the WWTP. Coe & Van Loo (2012) did note that the 2011 DMR average month influent BOD_5 concentration at the Tafuna WWTP was 137 mg/L. This report found that the 2018-2023 DMR average month BOD_5 concentrations have increased since 2011 at the Tafuna WWTP by roughly 30 mg/L.

The 2024 Leone-Vaitogi Feasibility Study utilized average month effluent BOD_5 loads from 2022-2023 DMR data to calculate the existing capacity of effluent BOD_5 loads that can be discharged from the Tafuna WWTP based on the current NPDES permit.

3.1.3.3 Influent Total Suspended Solids (TSS)

The influent total suspended solids (TSS) data were analyzed similarly to those of BOD_5. The individual influent TSS concentration and loading for January through December of 2022 were provided by ASPA and are shown graphically in **Figure 3-9**. The average monthly and maximum daily concentration and loading of influent TSS are reported from Tafuna's DMR data from 2018 to 2023. These influent TSS concentration and loading values from October 2018 to September 2023 were analyzed, and the graph of this dataset is shown in **Figure 3-10**. The average day TSS concentration and loading from the daily 2022 dataset were comparable to the average day TSS concentration and loading calculated from the 5-year DMR dataset. Therefore, the loading calculated from the DMR dataset was used to establish current baseline conditions. **Figure 3-8** summarizes the existing TSS loading. **Table 3-6** summarizes the existing TSS concentration, loading, and loading per capita.

The observed influent TSS concentration does not maintain a consistent trend throughout the years primarily due to significant influence by I/I. The average day TSS concentration is approximately 80 mg/L which is significantly less than 130 mg/L, the concentration reported for typical, low-strength wastewater. Typical literature values for residential TSS loading in the US are 0.13 to 0.33 ppcd; therefore, the average day influent TSS pounds per capita per day is 0.05 ppcd (as shown in **Table 3-6**) appears to represent extremely low-strength wastewater.

TSS consists of all suspended solids in wastewater, part of which could be inert/inorganic matter like fine sand, microplastics, algae, etc and the other part is organic matter. BOD5 represents the amount of oxygen consumed by microorganisms to decompose the organic matter in wastewater. Typically, the influent TSS concentration in a wastewater treatment plant is greater than BOD since TSS analysis accounts for both inorganic and organic matter. However, the influent TSS is about half of the influent BOD_5 in Tafuna WWTP, which is not scientifically possible. This suggests that there is an error in either sample collection, handling, or testing for these two parameters. In discussions with ASPA, it was mentioned that the influent samples are collected at the end of the long grit channel. There is a possibility that some solids are settled before the sampling point or that wastewater is not mixed properly at that location. We recommend that ASPA evaluate their sample collection and testing protocol.

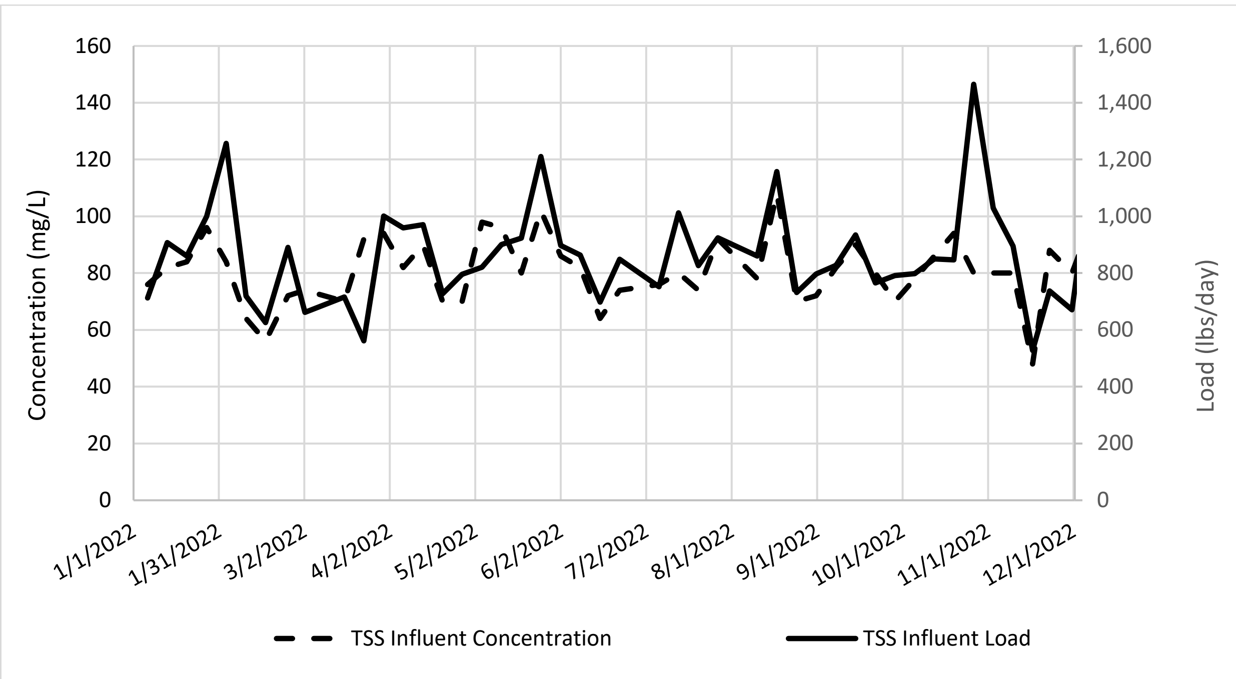

Figure 3-9: Tafuna WWTP - Influent TSS Demands from 2022 Dataset

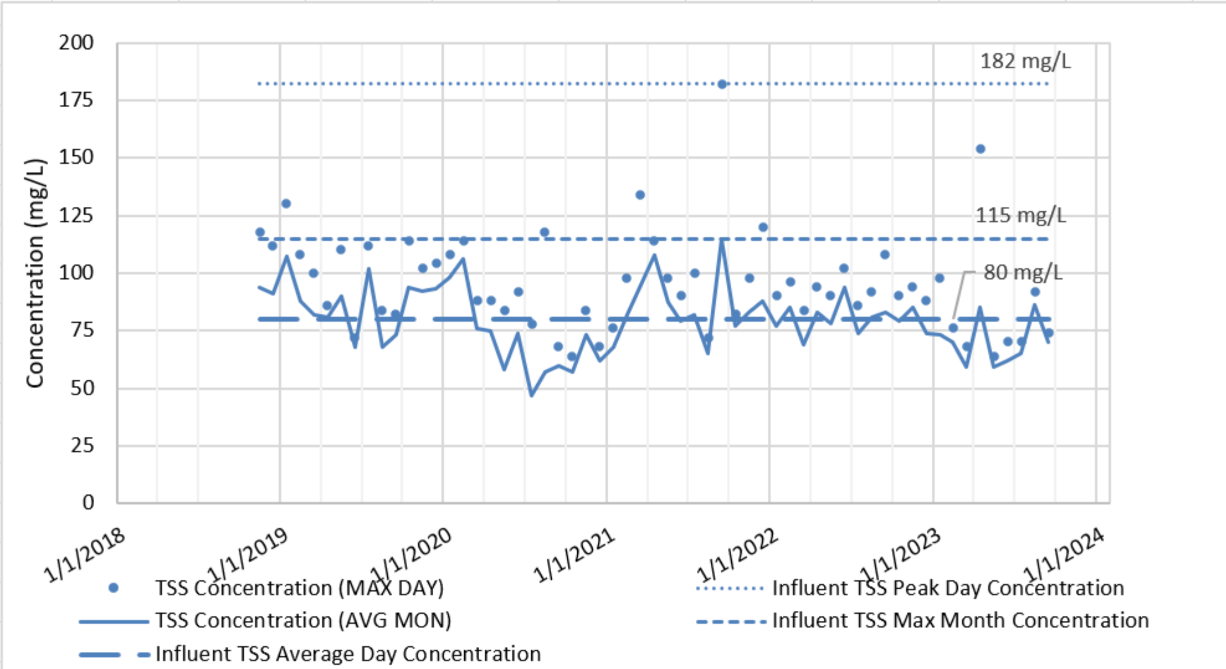

Figure 3-10: Tafuna WWTP - Influent TSS Concentrations from DMR Dataset

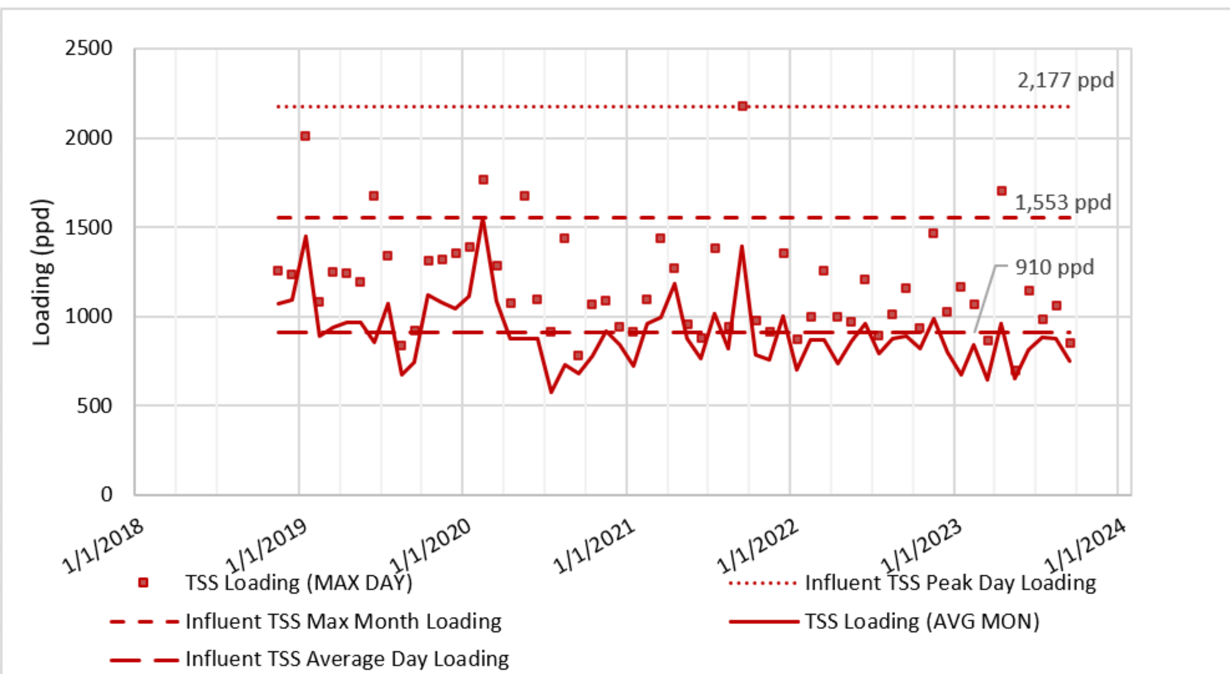

Figure 3-11: Tafuna WWTP - Influent TSS Loading from DMR Dataset

Table 3-6: Tafuna WWTP - Influent TSS Loads

Parameter	TSS Concentration (mg/L)	TSS Loading (ppd)	TSS (lbs/capita/day)
Average Day, AD	80	910	0.05
Maximum Month, MM	-	1,553	0.08
Peaking Factor (MM:AD)	-	*1.71*	-
Peak Day, PD	-	2,177	0.11
Peaking Factor (PD:AD)	-	*2.40*	-

Previous studies utilized influent TSS data differently for different goals. The 2012 scoping report by Coe & Van Loo did not utilize TSS data in their analysis to improve the critical initial dilution factor at the point of effluent discharge. The 2024 Leone-Vaitogi Feasibility Study utilized average month effluent TSS loads from 2022-2023 DMR data to calculate the existing capacity of effluent TSS loads that can be discharged from the Tafuna WWTP based on the current NPDES permit. This study expands on the previous efforts to meet primary treatment requirements for TSS removal and provides additional influent TSS characterization required to plan for secondary treatment.

3.1.3.4 Influent Nitrogen

The current NPDES discharge permit for the Tafuna WWTP does not include effluent requirements for nitrogen (N) and phosphorus (P), but effluent requirements for N and P are included in the DRAFT Tafuna WWTP NPDES discharge permit. ASPA provided monthly N and P influent and effluent concentration data spanning December 2011 through March 2018. Effluent flow data was also provided to allow calculation of loads. Specific parameters measured included TAN (total ammonia nitrogen), nitrate-N + nitrite-N (NO_X-N), total Kjeldahl nitrogen (TKN), TN, and TP. This data is more than five years old but provides valuable information for characterizing the facility’s influent waste stream. Testing for nitrogen species was performed at Eurofins Laboratories (Monrovia, California).

Figure 3-12 provides the influent nitrogen parameters TN, TKN, TAN, and NO_X-N measured monthly between 2012 through 2018. The dissolved inorganic oxidized chemical forms of nitrogen, nitrite (NO_2) and nitrate (NO_3), are not typically found in municipal wastewater influent in significant concentrations. This was the case for the Tafuna WWTP’s influent. TAN is the dissolved inorganic reduced chemical form of nitrogen and includes both ammonium (NH_4^+) and unionized ammonia (NH_3). TKN is the sum of TAN and organic nitrogen. Since TKN is always greater or equal to TAN, three TKN samples were removed from this analysis when TAN was greater than TKN (4% of samples). TN is the sum of TKN and NO_X-N and since NO_X-N was negligible in the Tafuna WWTP influent, TN is equal to TKN which is typical. The three TKN samples that were removed from this analysis were sampled on:

- August 20th, 2012
- September 24th, 2012
- May 25th, 2015

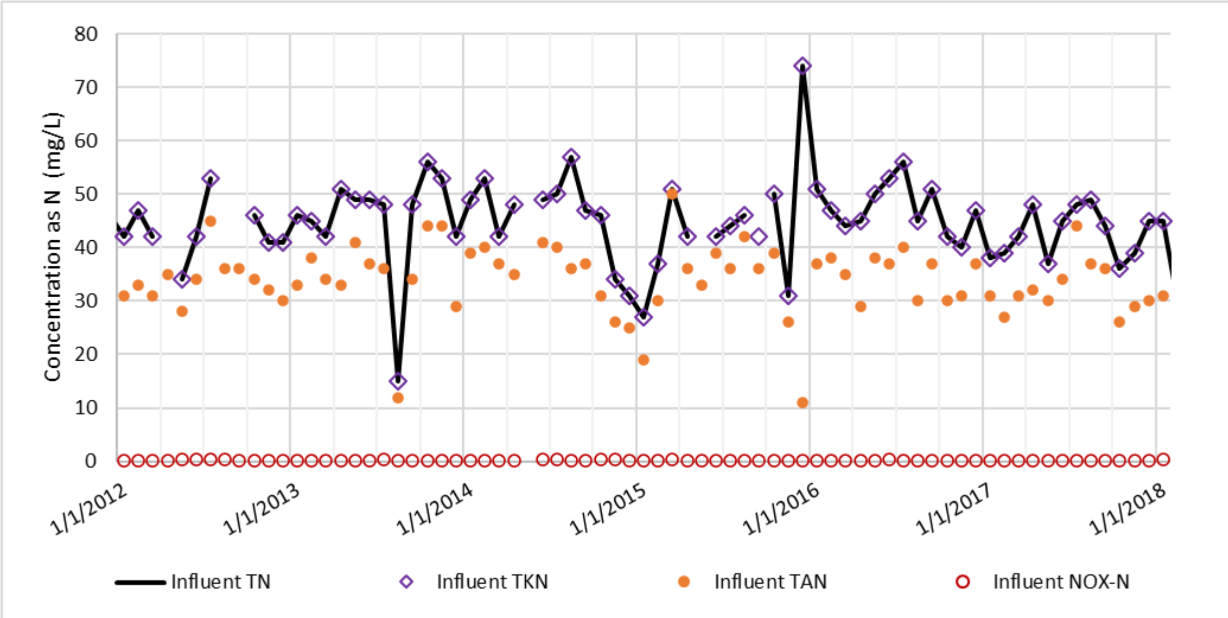

Figure 3-12: Tafuna WWTP - Influent Nitrogen Parameter Concentrations (2012-2018)

Figure 3-13 shows the TN influent loads to the Tafuna WWTP measured monthly between 2012 and 2018. Since nutrient data was collected monthly over the six-year period at the Tafuna WWTP, average weekly and maximum daily influent concentrations cannot be calculated. For the Tafuna WWTP influent nutrient analysis average month and max month (or highest value observed in the 2012-2018 dataset) are provided in this section. For reporting and calculation purposes it was assumed that the average month represents the average day conditions in the tables below. Influent TN loads are summarized in **Figure 3-13**.

Figure 3-14 provides the per capita TN loads to the Tafuna WWTP. A typical per capita load is 0.029 lbs TN/capita/day with a range between 0.020-0.048 lbs/capita/day (Metcalf & Eddy, 2014). The Tafuna WWTP experienced typical per capita TN loads between 2012-2018. This is in contrast to the low strength of BOD and TSS loading observed for the influent wastewater, further supporting the need for evaluating ASPA's sampling and testing protocol. **Table 3-7** provides the influent TN loads, peaking factors, and per capita TN loads to the Tafuna WWTP measured monthly between 2012-2018.

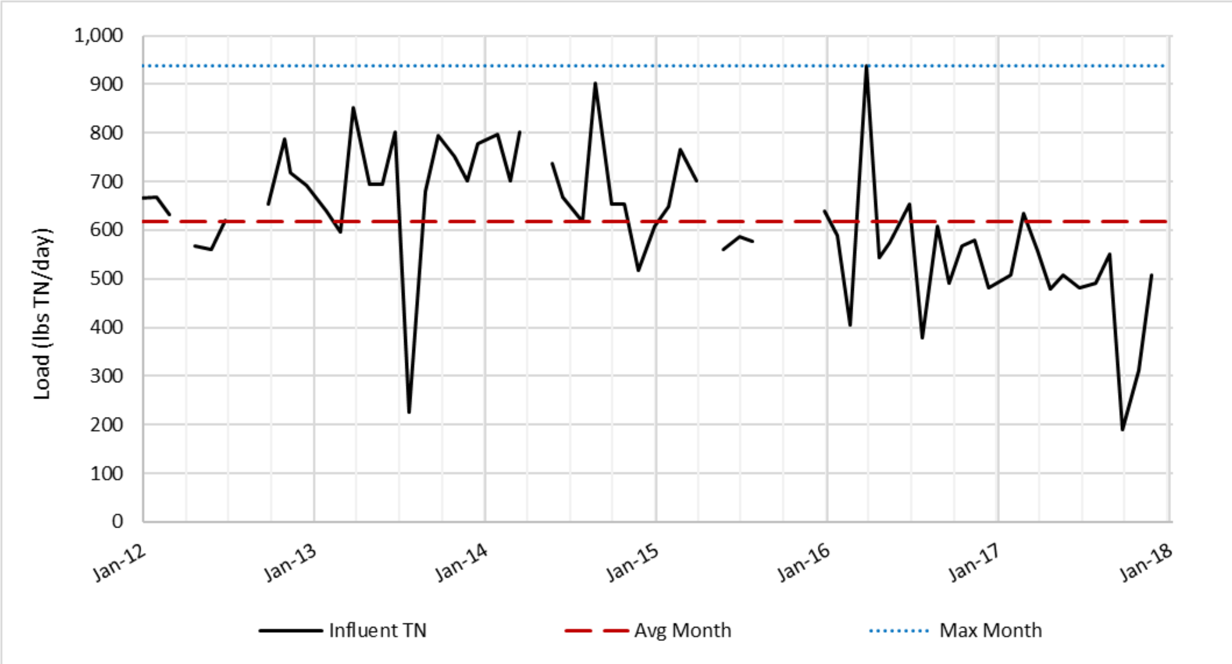

Figure 3-13: Tafuna WWTP - Influent TN Load (2012-2018)

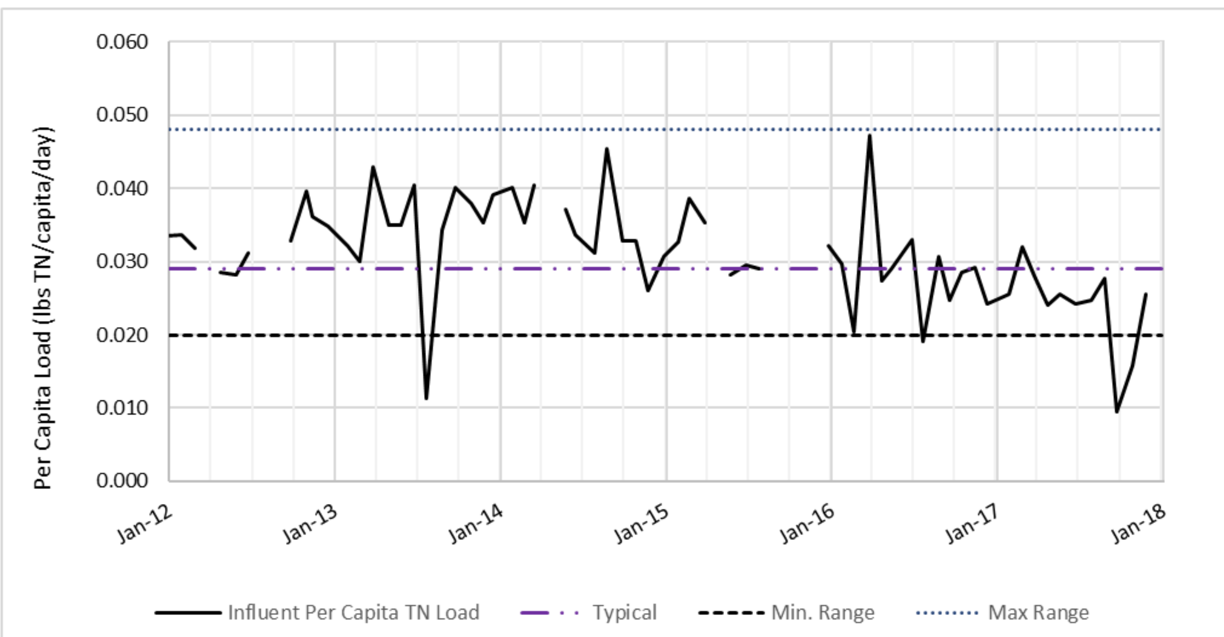

Figure 3-14: Tafuna WWTP - Influent TN Per Capita Load (2012-2018)

Table 3-7: Tafuna WWTP - Influent TN Loads

Parameter	TN Concentration (mg/L)	TN Loading (ppd)	TN (lbs/capita/day, ppcd)
Average Day, AD	44	610	0.031
Maximum Month, MM	-	939	0.047
Peaking Factor (MM:AD)	-	*1.54*	-
Peak Day, PD[1]	-	NA	N/A
Peaking Factor (PD:AD)	-	*NA*	-

[1]Insufficient data to determine peak day value.

Figure 3-15 provides the influent TAN loads to the Tafuna WWTP between 2012-2018. **Figure 3-16** provides the per capita TAN loads to the Tafuna WWTP. A typical per capita load is 0.017 lbs TAN/capita/day, with a range between 0.011-0.026 lbs/capita/day (Metcalf & Eddy, 2014). The Tafuna WWTP experienced high per capita TAN loads between 2012-2016, and then more typical loads between 2016-2018.

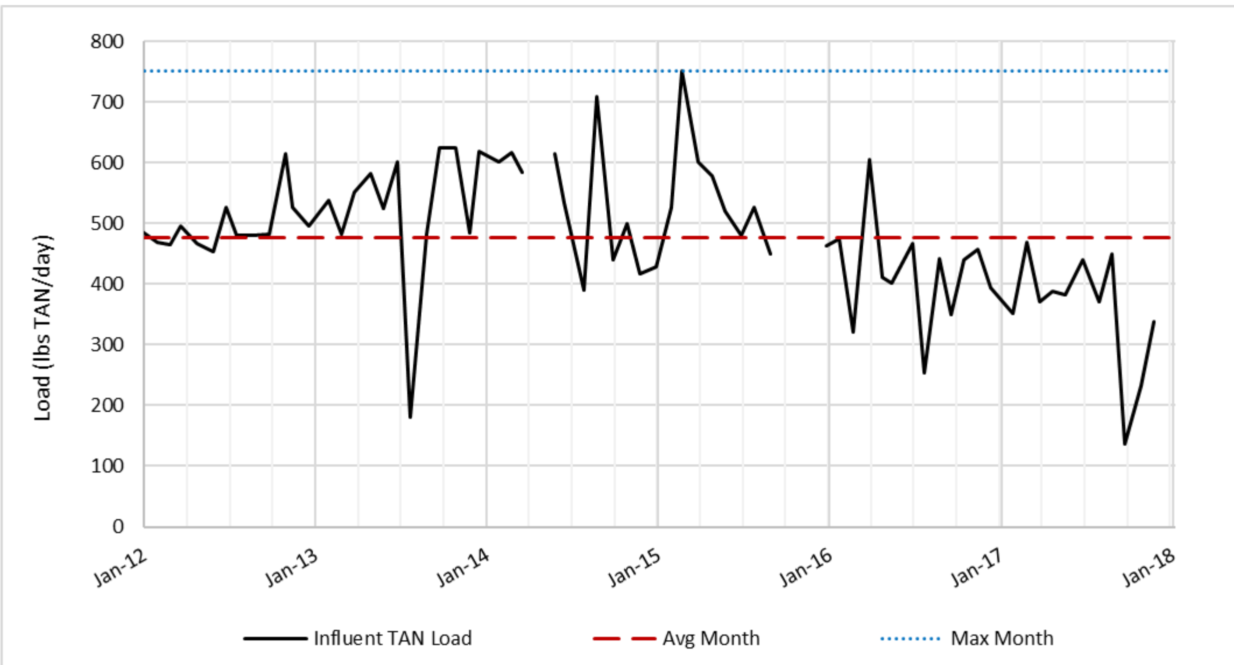

Figure 3-15: Tafuna WWTP - Influent TAN Load (2012-2018)

Table 3-8 provides the influent total ammonia nitrogen (TAN) loads, peaking factors, and per capita TAN loads to the Tafuna WWTP measured monthly between 2012-2018. Previous studies did not characterize influent nitrogen loads to the Tafuna WWTP.

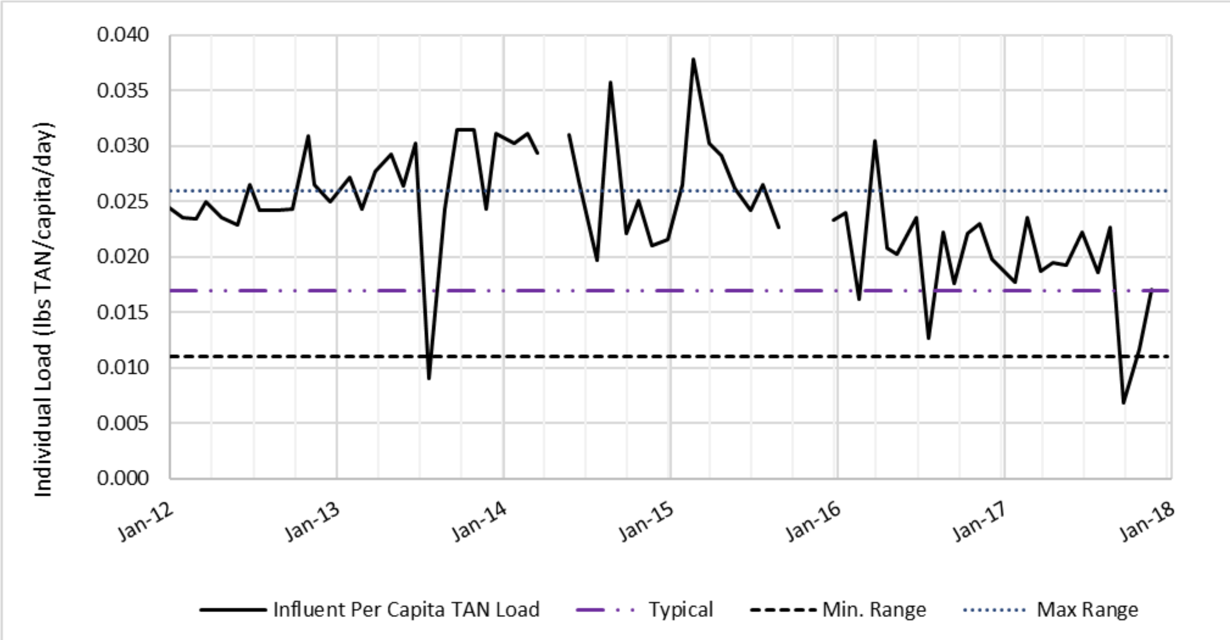

Figure 3-16: Tafuna WWTP - Influent TAN Per Capita Load (2012-2018)

Table 3-8: Tafuna WWTP - Influent TAN Loads

Parameter	**TAN Concentration (mg/L)**	**TAN Loading (ppd)**	**TAN (lbs/capita/day)**
Average Day, AD	34	471	0.024
Maximum Month, MM	-	751	0.038
Peaking Factor (MM:AD)	-	*1.60*	-
Peak Day, PD[1]	-	N/A	N/A
Peaking Factor (PD:AD)	-	*N/A*	-

[1]Insufficient data to determine peak day value.

3.1.3.5 Influent Phosphorus

Although phosphorus in the influent wastewater is not regularly monitored at the Tafuna WWTP, ASPA provided historical sampling data collected between 2012-2018 and tested at Eurofins Laboratories (Monrovia, California). These data are graphically shown in **Figure 3-17**. **Figure 3-18** provides the influent TP loads to the Tafuna WWTP between 2012-2018.

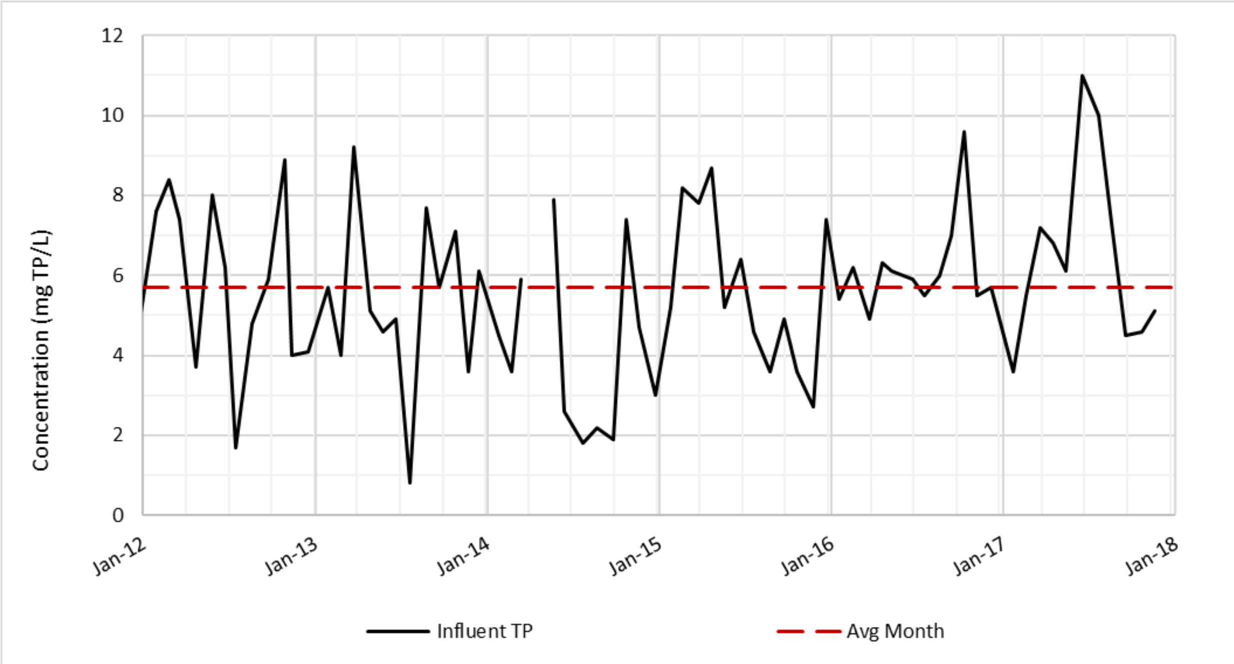

Figure 3-17: Tafuna WWTP - Influent Total Phosphorus Concentrations (2012-2018)

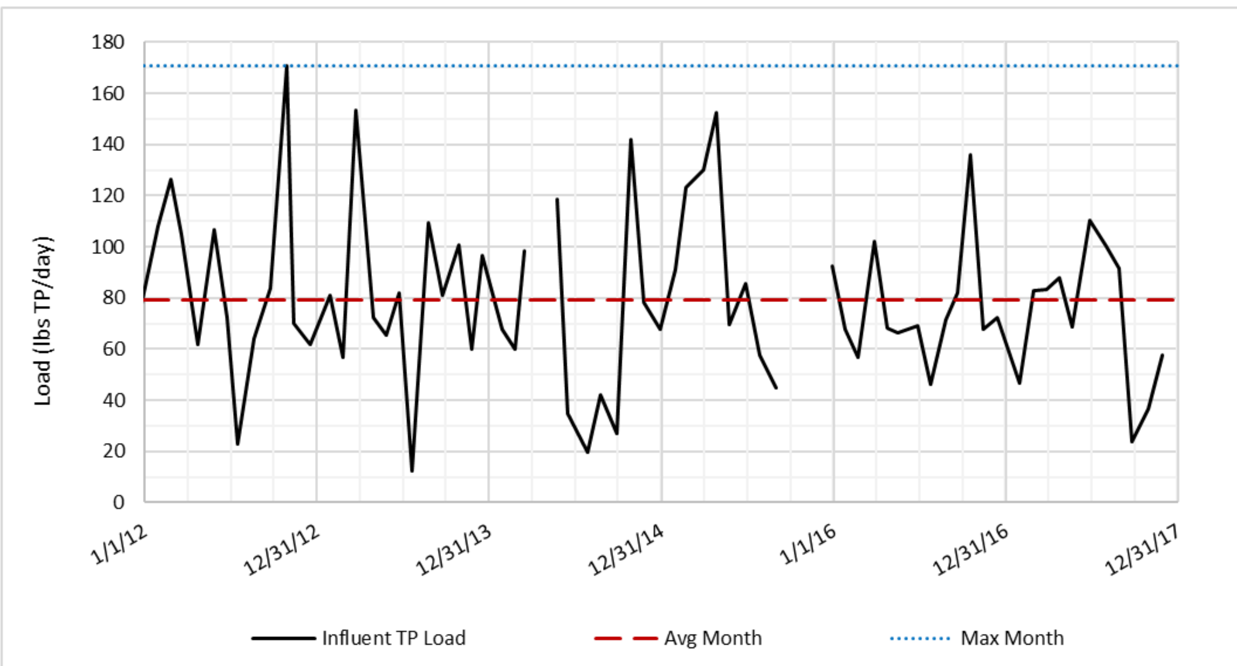

Figure 3-18: Tafuna WWTP - Influent TP Load (2012-2018)

Figure 3-19 provides the per capita TP loads to the Tafuna WWTP. A typical per capita load is 0.0046 lbs TP/capita/day with a range between 0.003-0.010 lbs/capita/day (Metcalf & Eddy, 2014). The Tafuna WWTP experienced typical to low per capita TP loads between 2012-2018. **Table 3-9** provides the influent

TP loads, peaking factors, and per capita TP loads to the Tafuna WWTP measured monthly between 2012-2018. Previous studies did not characterize influent phosphorus loads to the Tafuna WWTP.

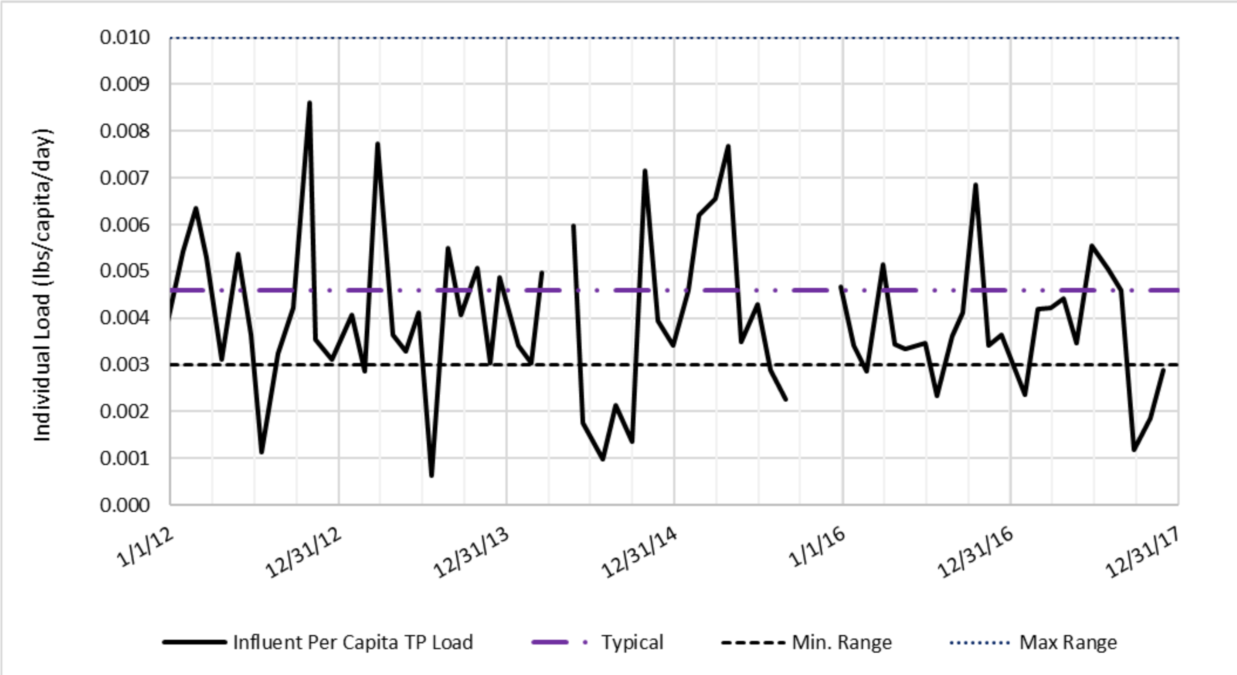

Figure 3-19: Tafuna WWTP - Influent TP Per Capita Load (2012-2018)

Table 3-9: Tafuna WWTP - Influent TP Loads

Parameter	TP Concentration (mg/L)	TP Loading (ppd)	TP (lbs/capita/day)
Average Day, AD	5.7	80	0.004
Maximum Month, MM	-	171	0.009
Peaking Factor (MM:AD)	-	*2.16*	-
Peak Day, PD[1]	-	N/A	N/A
Peaking Factor (PD:AD)	-	*N/A*	-

[1]Insufficient data to determine peak day value.

3.1.3.6 Existing Loading Summary

Table 3-10 summarizes the influent wastewater characteristics of low-strength, medium-strength, and high-strength wastewater. Some additional observations of the data include as follows:

- The average day BOD5 concentration is approximately 166 mg/L, which is slightly less than the concentration reported for typical, medium-strength wastewater. However, the average TSS concentration in the influent wastewater is 80 mg/L, which is below the concentrations typically reported for low-strength wastewater.

- Typically, the BOD_5 and TSS influent concentrations should be somewhat similar, but the TSS is about half of the BOD_5. Additionally, the nitrogen concentration is closer to medium and high strength, whereas the BOD concentration is between low and medium strength. Since the samples are collected towards the end of the long grit channel, it is probable that some organic solids settled before the sampling point. This explains the low strength of BOD and TSS and the higher strength of nutrients since nutrients are usually in soluble form. Any contamination during sample collection, handling, and testing could also result in erroneous results.
- The 2012 scoping report by Coe & Van Loo noted an average monthly influent BOD_5 concentration of 137 mg/L for the year 2011. This suggests that the Tafuna influent BOD_5 strength has increased from low to low-medium since 2011.

The data sources analyzed to calculate BOD_5, TSS, and nutrient loading at various conditions are summarized in **Table 3-16** in section 3.1.7. Since the available loading data is not consistent among itself or with typical literature parameters, literature values for BOD and TSS were used to recommend appropriate secondary treatment technology and are discussed in detail in Chapter 3 of the Secondary Feasibility Study (J-U-B Engineers, 2024).

Table 3-10: Influent Wastewater Strength Comparison

Wastewater Influent	Influent BOD_5 (mg/L)	Influent TSS (mg/L)	Influent TAN (mg/L)	Influent Total Nitrogen (mg/L)	Influent P (mg/L)
Typical Values:					
Low Strength [1]	133	130	14	23	3.7
Medium Strength[1]	200	195	20	35	5.6
High Strength[1]	400	389	41	69	11
Tafuna WWTP[2]	**166**	**80**	**34**	**44**	**5.7**

[1]As defined by Metcalf and Eddy Fifth Edition, Wastewater Engineering (2014), Table 3-18 (Metcalf & Eddy, 2014).
[2]Average Day Loading calculated in this report. See prior sections for more information.

3.1.4 Population

3.1.4.1 Existing Population

The wastewater collection system for the Tafuna WWTP spans eight villages in the western region of the island. The populations reported for these villages in the US Census are summarized in **Table 3-11**. The population of the Tafuna region has remained relatively unchanged in the last couple of decades. According to the 2020 US census data, the total population and people per household in the Tafuna region are 22,260 and 4.28, respectively. However, not all areas currently have sewer service.

Table 3-11: Historical Population of Tafuna Region

Year	Population	Average Annual Growth Rate over Prior Period
1980	7,601	-
1990	15,415	7.30%
2000	22,620	3.90%
2010	21,792	-0.40%
2020	22,260	0.20%

The Tafuna region is occupied mostly by residential homes. There is no industrial wastewater coming into the treatment plant. **Table 3-11** shows the population of the entire region. However, not all areas are currently sewered. For example, although most households in Iliili village have sewer collection lines and contribute to wastewater flow into the Tafuna WWTP, some areas do not have sewer connections, and sewage is managed with septic tanks or cess pools. The collection system service areas for each village in the Tafuna region are visually shown in **Figure 3-20**. The ratio of the area serviced to the total developed area for each village was calculated to estimate the existing population serviced by the wastewater collection system. This service ratio was then multiplied by the village's population to estimate the total population currently served by the collection system. This method assumes that the population of each village is equally dispersed throughout the developed area of the village. **Table 3-12** summarizes the estimated population and housing units contributing wastewater flow for each village and the entire Tafuna region. The estimated current population contributing to sewer flow to the Tafuna WWTP is 19,854.

In the Water Use Data Workplan (Shuler Hydrologic LLC, 2018), the total population served by the ASPA sewer systems (Tafuna and Utulei collection system) was estimated to be 29,200 people in 2017 based on 4,300 residences and 1,300 businesses connected to the ASPA sewer system. In this Utility Plan, the total population contributing to sewer flows (Tafuna and Utulei collection systems) is estimated to be 27,529 people. This estimation includes the recent expansion of the collection system in the Aua village to Breaker's Point, which was not constructed in 2017. The analysis of the existing population in this study is considered reasonable since the population connected to ASPA's sewer system, calculated in this Utility Plan, is slightly low but comparable to the population reported in the Water Use Data Workplan.

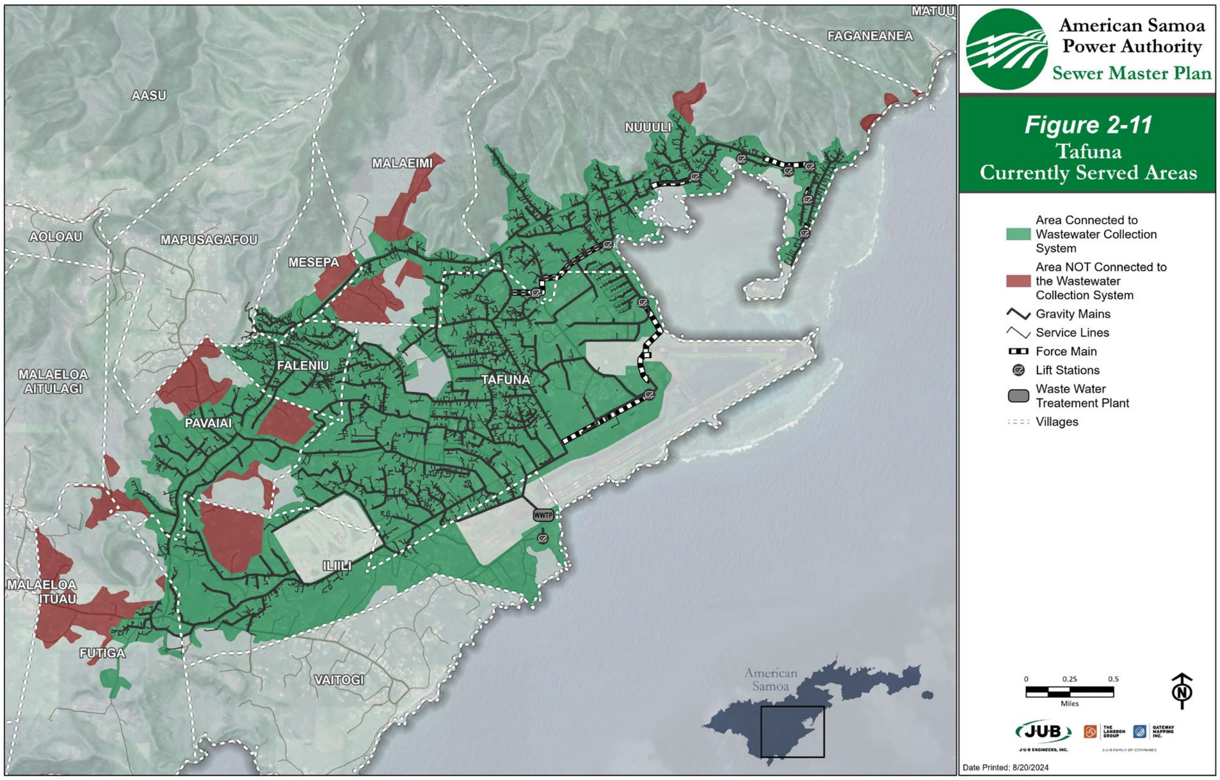

Figure 3-20: Tafuna - Areas With and Without Sewer Collection Connections

Table 3-12 Tafuna WWTP – Estimated Population with Sewer Connections

Village	Population (Census 2020)	Estimated Sewered Population	Estimated Sewered Housing Units	% of Sewered Population
Faleniu	1953	1,953	456	100.0%
Mesepa	415	267	62	64.3%
Malaeimi	1046	517	121	49.4%
Pavaiai	2112	1,422	332	67.3%
Nuuuli	4991	4,766	1,112	95.5%
Futiga	682	232	54	34.0%
Tafuna	7988	7,979	1,862	99.9%
Iliili	3073	2,718	634	88.4%
Total	**22,260**	**19,854**	**4,634**	**89.2%**

3.1.4.2 Future Population

The expected future population in 20 years is typically used as a benchmark to calculate future wastewater flows. For the Tafuna region, the population served by the existing sewer collection system is assumed to remain the same based on historical population trends, i.e. no appreciable growth. However, ASPA plans to expand its collection system to areas that do not currently have sewer service and is conducting studies to estimate the additional wastewater flow. As new collection lines are added in the future, the population contributing to wastewater flows also increases. Based on feedback from ASPA, Tafuna's sewer collection system will be expanded to serve the Upper Pavaiai and Leone-Vaitogi regions. The anticipated populations of these regions are discussed below:

- **Upper Pavaiai Region**: ASPA released a request for proposal (RFP No. ASPA24.006) to design the expansion of the existing sewer collection line to the Upper Pavaiai region. This sewer expansion project would likely include the Mapusagafou, Aoloau, Aasu, and Northern Unsewered region of Pavaivai Village. To be conservative, it is assumed that the future sewer expansion in this region will serve the entire population of this area. Therefore, the total population served by this expansion project is 3,175 new people based on the population reported in the US Census 2020.
- **Leone-Vaitogi Region:** The sewer collection system expansion in this region is estimated to include 7,143 new people based on the Leone-Vaitogi Feasibility Study conducted by Pryzm Consulting (Pryzm, 2024). Based on their analysis, the population in this region is expected to remain the same during the planning period of the next 20 years.

Table 3-13 shows the anticipated villages, houses, population, and additional wastewater flows generated through this collection system expansion project.

Table 3-13: Anticipated Flow from Leone-Vaitogi Region[1]

Village	Housing Units	Population	Average Wet Weather Flow (GPD)
Vaitogi	465	1,921	246,272
Leone	397	1,598	204,864
Futiga	162	682	87,715
Malaeoloa/Aitulagi	132	614	78,715
Malaeloa/Ituau	98	424	54,357
Vailoatai	301	1,195	153,199
Tapitumu	179	709	90,894
Total	**1,734**	**7,143**	**916,016**

[1]This table is derived from Table 8-1 of the Leone-Vaitogi Feasibility Study by Pryzm Consulting LLC [2].

The planned sewer collection system expansions will add 10,318 people, bringing the anticipated total future sewered population to 30,172.

3.1.5 Future Flows

Additional future flows are anticipated for Tafuna WWTP resulting from the expansion of the collection system and the addition of new institutions. The population served by the existing sewer collection system is assumed to remain unchanged during the planning period, as discussed in **section 3.1.4.2**. Based on ASPA's feedback, additional flows are anticipated from the following sources during the 20-year planning period:

- **Tech Park and Hospital:** The construction of a tech park, including a new hospital, has started and is anticipated to be finished by the end of 2024. Approximately 50 houses will be removed to build the tech park area. The wastewater generated from the tech park is estimated to be similar to the wastewater generated by the existing houses; therefore, additional wastewater is not anticipated to be contributed from the tech park besides the waste from the hospital. The average wastewater generated from a typical hospital is 150 gallons per bed per day and 7.5 gallons per employee per day (Metcalf & Eddy, 2014). The hospital has 40 beds and is assumed to have 20 full-time employees. The total additional flow generated by the new hospital is 0.00615 MGD.
- **Sewer Collection Expansion in Leone-Vaitogi:** The new sewer lines in the Vaitogi region are anticipated to be completed in the next five years and in Leone in the next ten years. The Leone-Vaitogi Feasibility Study conducted by Pryzm Consulting estimated an additional average wet weather wastewater flow of 0.916 mgd from this region (Pryzm Consulting, 2024). The flow analysis done by Pryzm used 128 gpd which was initially calculated by the scoping study in 2012. For consistency in this planning document, an annual average day flow of 71.7 gpcd is assumed, which is based on the recent flow reported in DMR from 2018-2023. Therefore, the estimated future flow from the Leone-Vaitogi region in 20 years is 0.51 mgd (7,143 people x 71.7 gpcd).
- **Sewer Collection Expansion in Upper Pavaiai Region:** The planning and design of the collection system in the Upper Pavaiai region is anticipated to be completed in the next 5-20 years. The estimated future flow from this region in 20 years is 0.228 mgd (3,175 people x 71.7 gpcd).

The additional flow anticipated during the planning period of 20 years is 0.746 MGD annual average day flow. Entirely new sources contributed to this additional flow. The future ADF was calculated by adding the expected additional flow from the new sources to the existing ADF coming into the plant. In doing so, we assumed that the I/I contribution as a percentage of the ADF remains constant. The current peaking factors for MMF, PDF, and PHF shown in **Table 3-4**, are used to calculate the future MMF, PDF, and PHF. If I/I reduction projects are implemented, the peak day and peak hour factors may be lower than projected in the future. The projected future flow rates are summarized in **Table 3-14**.

Table 3-14: Tafuna WWTP – Future Flow Conditions

Parameter	Future Flow - 2044 (MGD)	Future Flow - 2044 (gpcd)
Average Day Flow, ADF	2.17	71.7
Maximum Month Flow, MMF	2.60	85.6
Peaking Factor (MMF : ADF)	*1.20*	-
Peak Day Flow, PDF	5.34	176.3
Peaking Factor (PDF : ADF)	*2.46*	-
Peak Hourly Flow, PHF	8.40	-
Peaking Factor (PHF : ADF)	*3.87*	-

3.1.6 Future Loading

The concentration and loading of BOD_5, TSS, and nutrients in influent wastewater from the regions connected to the existing collection system are anticipated to remain unchanged in the future since the population of the existing region is projected to stay the same. The average loadings per capita per day of the BOD_5, TSS, and nutrients in the influent wastewater from the new sources are anticipated to be the same as the current loading per capita per day. The future average day loadings of BOD_5, TSS, and nutrients are calculated by multiplying the observed loading per capita per day and the anticipated future. The current peaking factors for MMF and PDF are used to calculate the future MMF and PDF. The projected future BOD_5, TSS, and nutrient loadings are summarized in **Table 3-15**.

Table 3-15: Tafuna WWTP – Projected Future Loading

Parameter	Projected Future Loading (ppd)[1]	Loading (lbs/capita/day)[1]
BOD_5:		
Average Day	2,899	0.10
Maximum Month	4,638	-
Peaking Factor	1.60	-
Peak Day	7,392	-
Peaking Factor	2.55	-
TSS:		
Average Day	1,381	0.05
Maximum Month	2,362	-
Peaking Factor	1.71	-
Peak Day	3,315	-
Peaking Factor	2.40	-
Ammonia (TAN):		
Average Day	715	*0.024*
Maximum Month	1145	-
Peaking Factor	1.60	-
Peak Day	N/A	-
Peaking Factor	*N/A*	-
TN:		
Average Day	930	*0.031*
Maximum Month	1430	-
Peaking Factor	1.54	-
Peak Day	N/A	-
Peaking Factor	*N/A*	-
TP:		
Average Day	122	*0.004*
Maximum Month	260	-
Peaking Factor	2.13	-
Peak Day	N/A	-
Peaking Factor	*N/A*	-

[1] The projected future loadings were calculated using a 20-year population.

3.1.7 Flow and Loading Summary

Data from various sources were used to calculate the existing flow and loading for Tafuna WWTP; these data sources are summarized in **Table 3-16**.

Table 3-16: Tafuna WWTP – Data Sources Summary

Parameter	Average Day	Maximum Month	Peak Day	Peak Hour[1]
Flow	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	Statistical Analysis of 2018-2023 DMR	Flow per minute recorded by UV system (7-18-2019 to 4-10-2020 & 5-4-2021 to 9-1-2021)
BOD_5	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	-
TSS	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	-
Ammonia (TAN)	Dec. 2011 – Mar. 2018 monthly data	Dec. 2011 – Mar. 2018 monthly data	-	-
TN	Dec. 2011 – Mar. 2018 monthly data	Dec. 2011 – Mar. 2018 monthly data	-	-
TP	Dec. 2011 – Mar. 2018 monthly data	Dec. 2011 – Mar. 2018 monthly data	-	-

[1]PHF is used to assess and design the hydraulic capacity of the headworks. PH Loading is not typically considered for designing treatment systems.

The existing and future conditions of the Tafuna WWTP's influent flow and loading are summarized in **Table 3-17**.

Table 3-17: Tafuna WWTP – Existing and Future Flow and Loads Summary

Parameter	Existing Conditions (2024)	Projected Future Conditions (2044)
Estimated Population (sewered)	19,854	30,172
Flow		
Average Day (MGD)	1.42	2.18
Maximum Month (MGD)	1.70	2.62
Peak Day (MGD)	3.50	5.34
Peak Hour (MGD)	5.50	8.40
BOD_5		
Average Day (ppd)	1,907	2,899
Maximum Month (ppd)	3,039	4,638
Peak Day (ppd)	4,864	7,392
TSS		
Average Day (ppd)	910	1,381
Maximum Month (ppd)	1,553	2,362
Peak Day (ppd)	2,177	3,315
Ammonia (TAN)		
Average Day (ppd)	471	715
Maximum Month (ppd)	751	1,145
Peak Day (ppd)	N/A	N/A
TN		
Average Day (ppd)	610	930
Maximum Month (ppd)	939	1430
Peak Day (ppd)	N/A	N/A
TP		
Average Day (ppd)	80	122
Maximum Month (ppd)	171	260
Peak Day (ppd)	N/A	N/A

3.2 Utulei WWTP

3.2.1 General

The flow measurement, operations, and treatment process of the Utulei WWTP are similar to those of the Tafuna WWTP. The plant flow is measured using one 24-inch electromagnetic flow meter upstream of the UV disinfection unit and recorded daily in gallons. The wastewater flow rate is determined by subtracting the manually recorded total volume readings of the mag-meter between successive days. Composite samples of the influent are collected and tested weekly for the following parameters: 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS). The influent grab samples for BOD_5 and TSS testing are collected upstream of the headworks/influent lift station every hour for 8 hours and combined to form a daily composite sample for that week. ASPA submits the flow, influent BOD_5, and influent TSS data from the Utulei WWTP to the EPA on a monthly basis as part of their DMR and NPDES discharge permit.

3.2.2 Existing Flows

3.2.2.1 Background

ASPA provided the daily flow measurements for 2022 and indicated that 2022 was a typical year of wastewater flow. In addition to daily flows from ASPA, five years of average monthly flow and maximum daily flow for each month were downloaded from the EPA's online database, ECHO. Subsequent sections discuss the analysis and discussion of these data. The definitions of and the methods for determining the flow characteristics, including average day flow, maximum month flow, and peak day flow, analyzed in this chapter for the Utulei WWTP, are similar to those of the Tafuna WWTP and are elaborated on in section 3.1.2. The challenges in flow measurement practices and data availability for the Utulei WWTP are similar to those for the Tafuna WWTP.

3.2.2.2 Prior Studies

Past studies have used different approaches to establish flow conditions to address the limitations of the measurement practice and availability of data. **Table 3-18** summarizes the Utulei WWTP's wastewater flow from past studies.

Table 3-18: Utulei WWTP - Flow Rates from Other Studies

Parameter	Scoping Report for CIP to increase initial Dilution Factor for both the Tafuna and Utulei Ocean Outfalls (Coe & Van Loo, 2012)	
	Dry Weather	Wet Weather
Average Day Flow, ADF (MGD)	1.0	2.8
Peak Day Flow, PDF (MGD)	3.4	6.0
Peaking Factor (PDF:ADF)	*3.4*	*2.14*

The Scoping Report (Coe & Van Loo Consultants, 2012) used rainfall data from NOAA to identify the wet and dry seasons, similar to the approach for Tafuna's wastewater system data. The maximum daily flow reported in the DMR from September 15 to October 12 in 2009 and 2011 was used to establish a baseline flow, whereas the maximum daily flow reported in the DMR in December and January of 2009, 2010, and 2011 was used to calculate wet weather flows. Unlike Tafuna's wastewater system, the flow observed in 2009 was inconsistent, which they attributed to the tsunami in September 2009. The peaking factor during dry weather flows ranged from 2.7 to 4.6, and a peaking factor of 3.4 was used. The authors believed that this peaking factor was representative of the dry weather flow in Utulei. It was noted that the average daily flows during the wet weather period increased from 40% to 180% above the average daily flows during the dry weather season. To be conservative, the month with the highest-intensity rainfall and a large amount of rain was considered the representative wet weather month, so the average wet weather flow was calculated to be 180% higher than the average dry weather flow. Applying the same dry weather peaking factor of 3.4 would result in an extraordinarily high and unlikely wet weather peak day flow of 9.5 mgd. Therefore, the observed maximum flow (from 2007 to 2011) of 6 mgd was used as the peak day flow. Their analysis shows that adjustments need to be made to calculate the appropriate flow conditions for the Utulei system. The methodology used for analyzing flow conditions for this report is discussed in section 3.1.2.3.

Most key process items, including the clarigesters, were designed in 1992 and constructed shortly after. The original design flow conditions of the existing plant are summarized in **Table 3-19** based on the as-built drawings provided by ASPA (Westech, 1992). As seen in the table below, peak hour was not included in the plant design conditions.

Table 3-19: Utulei WWTP – Design Flow Conditions of Existing Infrastructure

Items	Previous Design Conditions
Minimum Daily Flow (MGD)	0.80
Average Daily Flow (MGD)	2.21
Peak Day Flow (MGD)	6.13

3.2.2.3 Data Analysis and Discussion

The dataset and approach used in the Utulei WWTP's flow analysis are similar to those used for the Tafuna WWTP as described in Section 3.1.2.3. The ADF and MMF calculated from the DMR dataset were around the same range (+ 3% to +5%) as the ADF and MMF calculated from the 2022 dataset, which shows that the DMR data set encompasses the trends noticed in the 2022 dataset. The flow values calculated from the DMR dataset were used to establish current baseline flow conditions. The DMR data includes two flow numbers for each month, which are the maximum of the daily flows and the average of the daily flows for each month from October 2018 to September 2023.

Figure 3-21 shows the daily flows recorded in 2022. **Figure 3-22** shows the maximum daily and average monthly flow report from the DMR data used in Utulei's flow analysis.

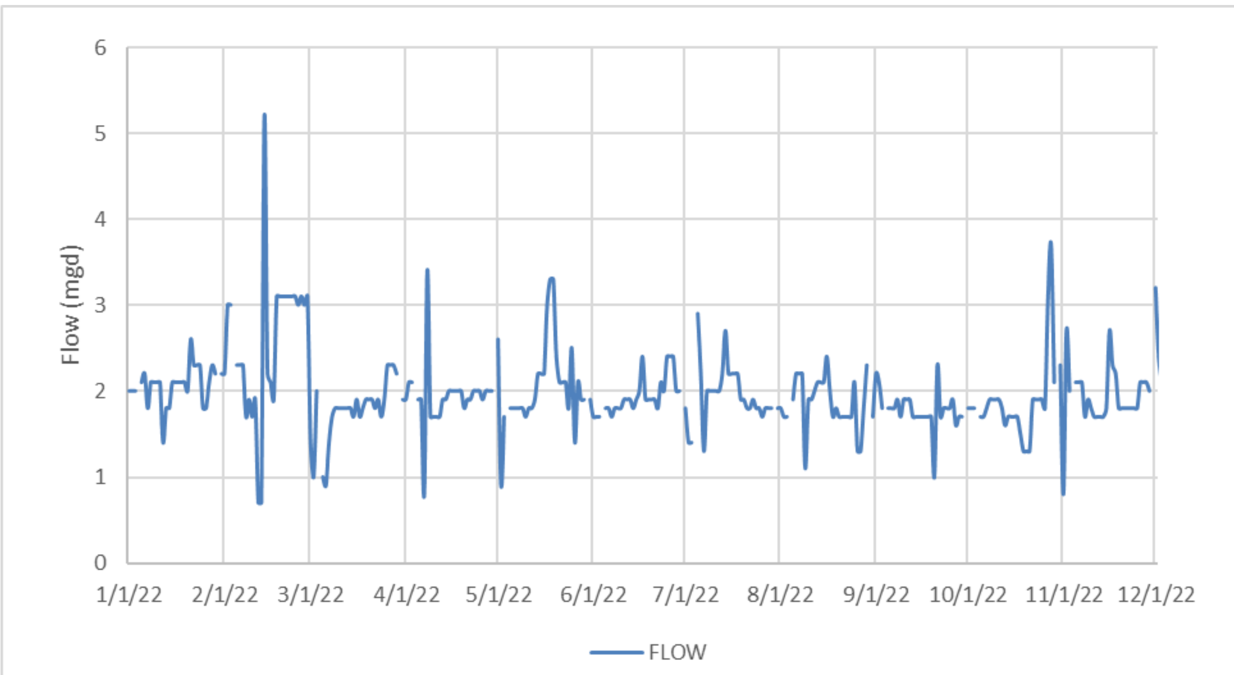

Figure 3-21: Utulei WWTP - Daily Flows Observed in 2022

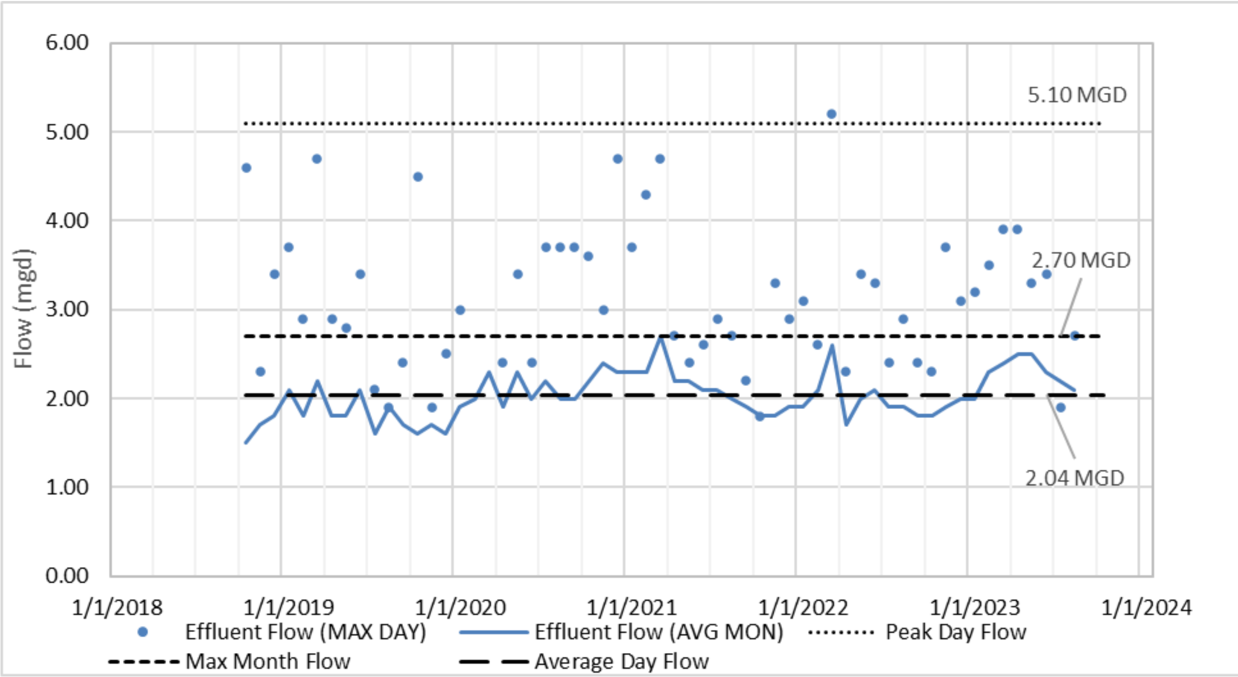

Figure 3-22: Utulei WWTP - Flows reported in DMR for the Last Five Years

The maximum daily flows reported in the DMR for the last five years were plotted on a log-normal plot to determine the statistically probable peak flow as shown in **Figure 3-23**. The confidence intervals of peak day flow were determined from the log-normal plot and are summarized in **Table 3-20**.

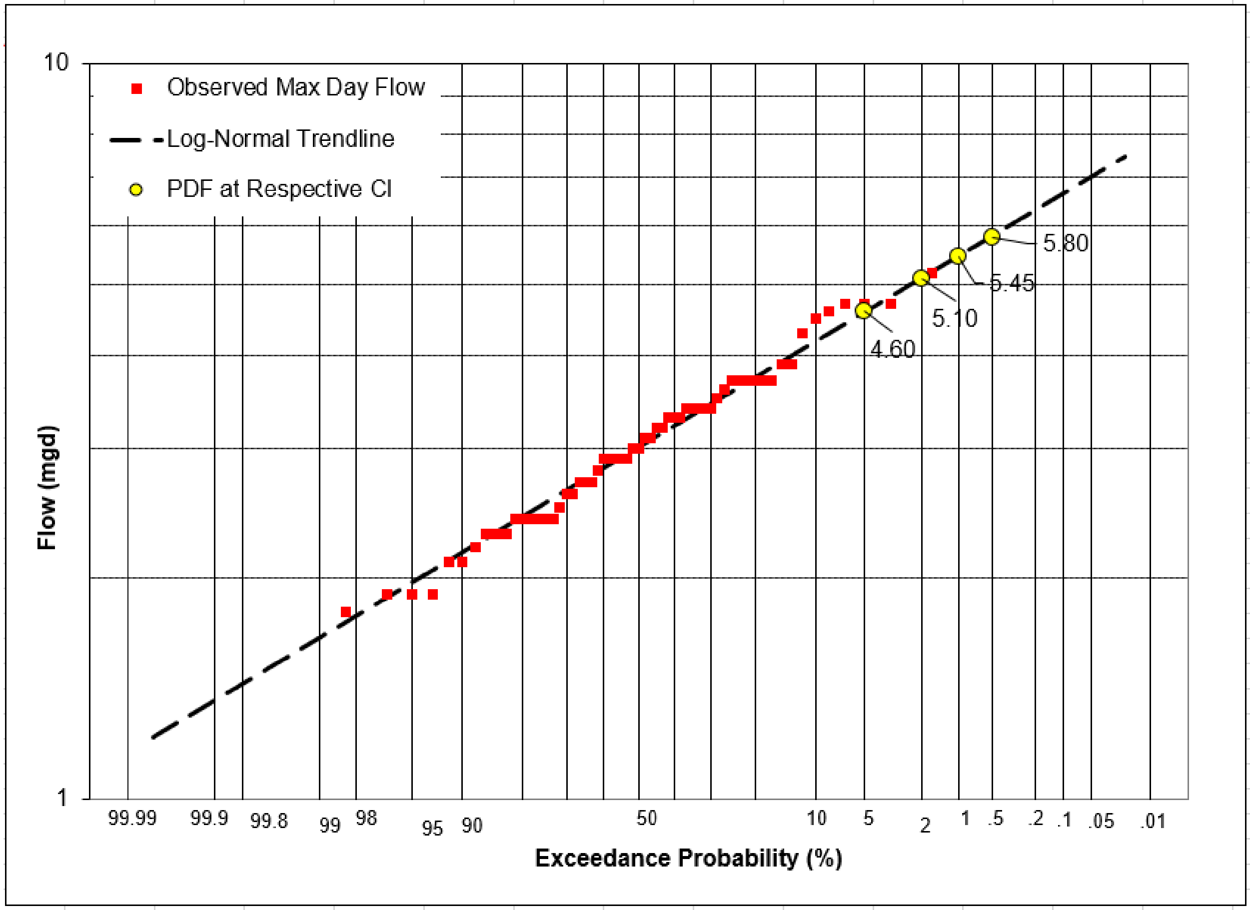

Figure 3-23: Utulei WWTP - Log-normal plot of maximum daily flows

Table 3-20: Utulei WWTP - Influent Flow Probability of Peak Day Flow

Confidence Interval (CI)	Corresponding Peak Flow (MGD)
95%	4.60
98%	5.10
99%	5.45
99.9%	5.80

From **Table 3-20**, it can be inferred that the peak day flow is within the range of 4.6 to 5.8 MGD with 95% - 99.9% confidence. The flow rate of 5.1 MGD with a confidence of 98% was chosen as the peak day flow for this analysis. This compares favorably with the peak observed flow of 5.2 MGD on February 28th, 2022.

The estimated population that contributes to sewer flow to the Utulei WWTP is 7,675, as discussed in section 3.2.4.1. For Utulei's population, 10-States Standard's recommends multiplying ADF with a peaking factor of 3.06 to calculate PHF. In the analysis mentioned in previous paragraphs, the peak day flow for the Utulei WWTP was calculated as 5.1 MGD, which correlates to a peaking factor (PDF:ADF) of 2.5. Similar to the Tafuna WWTP, the 10-State Standard greatly underestimates the peak hourly flowrate at the WWTP as it does not consider the large contributions from I/I.

Previous design projects and studies did not analyze peak hour flows separately. ASPA provided instantaneous flow data recorded every minute by the UV system for most days in January through April in 2019 and June through August in 2021. The hourly flows were calculated by taking an average of the instantaneous flows recorded within an hour. **Figure 3-24** show the observed hourly flow recorded in 2019 and 2021. The peak hour flow is estimated to be 5.2 mgd with a peaking factor (PHF: ADF) of 2.55. The peaking factors for peak day flow and peak hour flow are almost the same which has also been noticed in other sewer systems with extremely high I/I.

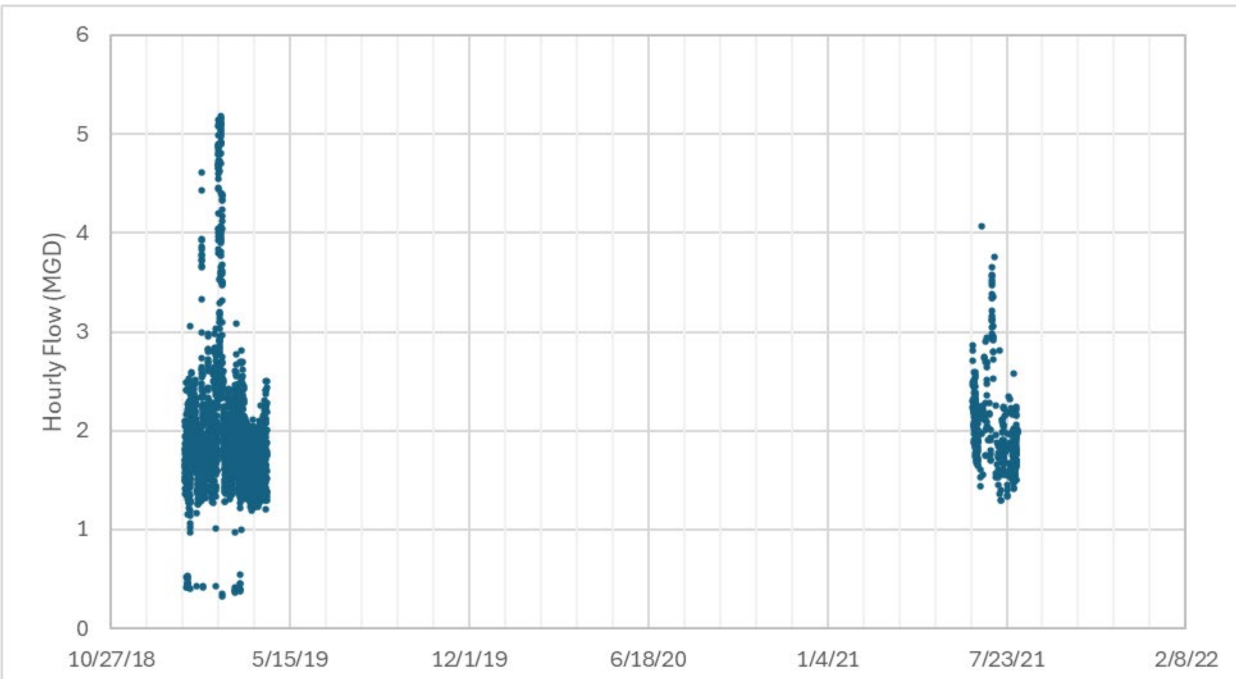

Figure 3-24: Utulei WWTP – Hourly Effluent Flow 2019 - 2021

3.2.2.4 Existing Flow Summary

Based on the review of the historical flow rates and standards, the existing flow rates for Utulei WWTP are summarized in **Table 3-21**. The data sources analyzed to calculate flow at various conditions are summarized in **Table 3-33** in section 3.2.7.

Table 3-21: Utulei WWTP – Existing Flow Conditions

Parameter	Flow (MGD)	Flow (gallons/capita/day)
Average Day Flow, ADF	2.04	266
Maximum Month Flow, MMF	2.70	351.8
Peaking Factor (MMF : ADF)	*1.33*	-
Peak Day Flow, PDF	5.10	664.5
Peaking Factor (PDF : ADF)	*2.50*	-
Peak Hourly Flow, PHF	5.20	-
Peaking Factor (PHF : ADF)	*2.55*	-

3.2.3 Existing Loading

3.2.3.1 Prior Studies

One previous study utilized loads associated with the Utulei WWTP for different goals and in the context of primary treatment. The 2012 scoping report by Coe & Van Loo was focused on methods to improve the critical initial dilution factor measured at the point of effluent discharge to reduce pollutant concentrations in the receiving environment, not the treatment capabilities of the WWTP. The final recommendation of the 2012 Scoping Report was to modify the effluent diffuser with the goal of providing improved pollutant dilution. The 2024 Leone-Vaitogi Feasibility Study was focused on the Tafuna WWTP and did not include the Utulei WWTP in the analysis.

This Utility Plan focuses on the influent pollutant loading to the Utulei WWTP in the context of analyzing and organizing data for the goal of performing an in-depth analysis of the current and future pollutant loads. This loading information will then be utilized in a separate Secondary Treatment Feasibility Study to investigate options to meet more stringent secondary treatment requirements.

3.2.3.2 Influent Five-Day Biochemical Oxygen Demand (BOD_5)

The concentration of BOD_5 is measured in the ASPA's laboratory at the Utulei Plant. The BOD_5 loading is calculated numerically by multiplying the BOD_5 concentration with the daily flow measured on the day of sample collection. The influent 5-day BOD_5 concentration and loading for January through December of 2022 were provided by ASPA and are shown graphically in **Figure 3-25**. The average monthly and maximum daily concentration and loading of influent BOD_5 are reported from Utulei's DMR data. The influent BOD_5 concentration and loading values from October 2018 to September 2023 were analyzed, and the graph of this dataset is shown in **Figure 3-26**. The average day BOD_5 concentration and loading from the daily 2022 dataset were comparable to the average day BOD_5 concentration and loading calculated from the 5-year DMR dataset. Therefore, the loading calculated from the DMR dataset was used to establish current baseline conditions as was done with flow data. The average day, maximum month, and peak day BOD_5 loads in influent wastewater with their respective peaking factors are summarized in **Figure 3-27**.

The observed influent BOD_5 concentration has not maintained a consistent trend throughout the years, primarily due to the significant influence of I/I. The average day BOD_5 concentration is approximately 92 mg/L which is less than 133 mg/L, the concentration reported for typical, low-strength wastewater (See **Table 3-22**). The lower observed concentration is likely the result of high I/I contributing to a lower-strength wastewater, diluting the total WWTP influent concentration. Typical literature values for residential BOD_5 loading in the US are 0.11 to 0.26 ppcd; therefore, the annual average day influent load of 0.2 ppcd (see Table 3-5) represents typical wastewater (Metcalf & Eddy, 2014).

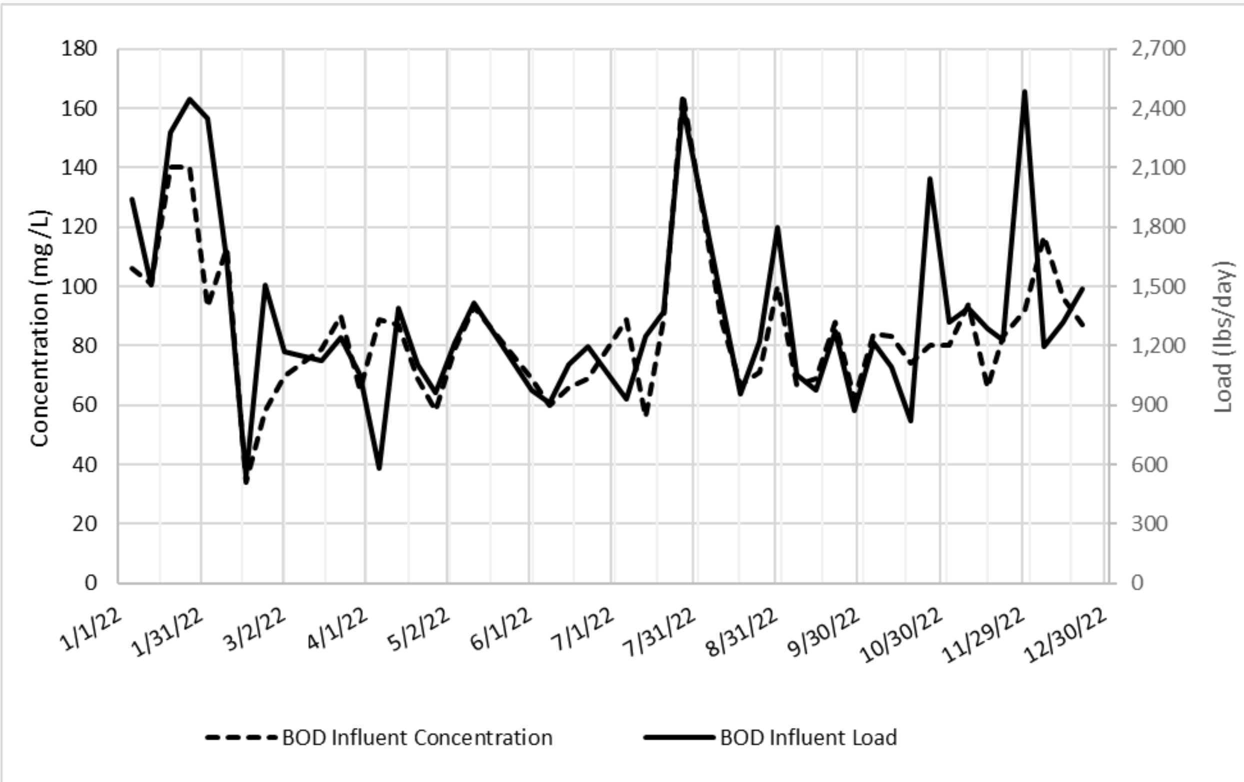

Figure 3-25: Utulei WWTP - Influent BOD_5 from 2022 Dataset

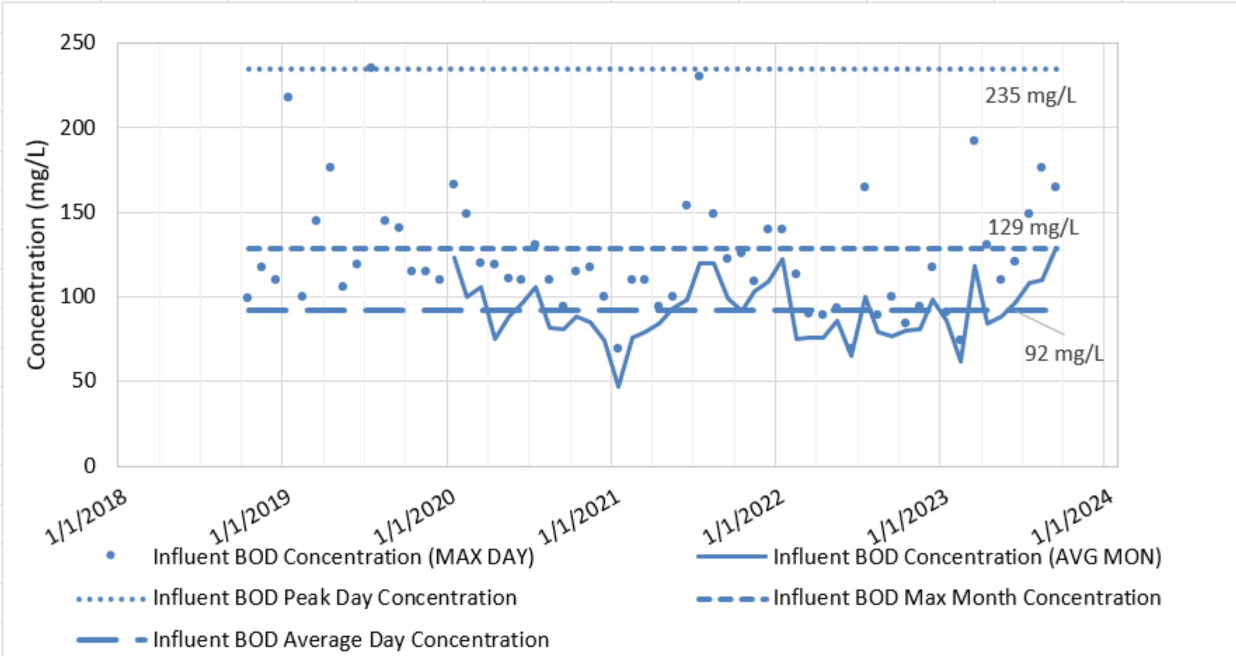

Figure 3-26: Utulei WWTP - Influent BOD_5 Concentrations from DMR Dataset

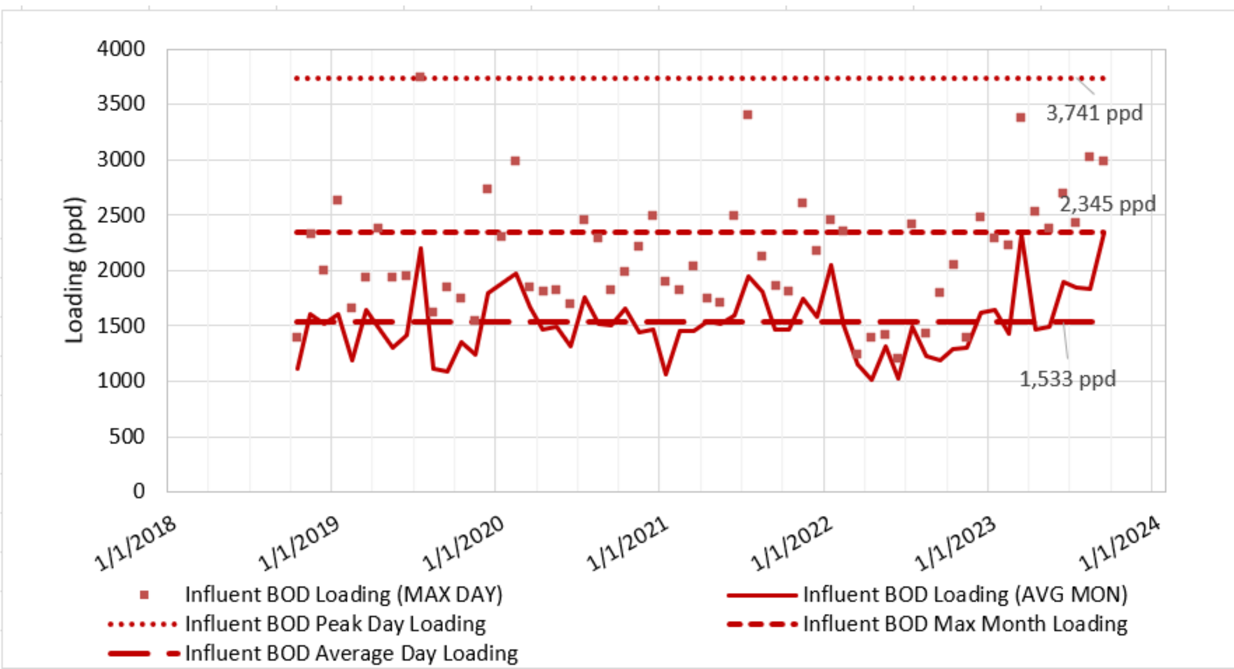

Figure 3-27: Utulei WWTP - Influent BOD_5 Loading from DMR Dataset

Table 3-22: Utulei WWTP - Influent BOD_5 Demands

Parameter	BOD_5 Concentration (mg/L)	BOD_5 Loading (ppd)	BOD_5 (lbs/capita/day)
Average Day, AD	92	1,533	0.20
Maximum Month, MM	-	2,345	0.31
Peaking Factor (MM : AD)	-	*1.54*	-
Peak Day, PD	-	3,741	0.49
Peaking Factor (PD : AD)	-	*2.45*	-

Previous studies utilized Utulei WWTP influent BOD_5 data differently for different goals. The 2012 scoping report by Coe & Van Loo was focused on methods to improve the critical initial dilution factor measured at the point of effluent discharge, not the treatment capabilities of the WWTP. Coe & Van Loo, 2012 did note that the 2011 DMR average month influent BOD_5 concentration at the Utulei WWTP was low at 109 mg/L. They also noted that the Utulei WWTP influent was very dilute compared to Tafuna's influent and this was attributed to excessive I/I in the Utulei conveyance system. The BOD_5 data analyzed in this Utility Plan using data from 2018-2023 showed that the influent average month BOD_5 concentrations have decreased by 15 mg/L between 2011 to 2023 to 92 mg/L, might suggest increased I/I in the Utulei conveyance system since 2011. The 2024 Leone-Vaitogi Feasibility Study was based on the Tafuna WWTP and did not include the Utulei WWTP.

3.2.3.3 Influent Total Suspended Solids (TSS)

The influent TSS data were analyzed similarly to those of BOD_5. The influent TSS concentration and loading for January through December of 2022 were provided by ASPA and are shown graphically in **Figure 3-28**. The average monthly and maximum daily concentration and loading of influent TSS are reported in Utulei's DMR data. The influent TSS concentration and loading values from October 2018 to September 2023 were analyzed, and the graph of this dataset is shown in **Figure 3-29** . The average day TSS concentration and loading from the daily 2022 dataset were comparable to the average day TSS concentration and loading calculated from the 5-year DMR dataset. Therefore, the TSS loading calculated from the DMR dataset was used to establish current baseline conditions. The average day, maximum month, and peak day TSS loads in influent wastewater with their respective peaking factors are summarized in **Figure 3-27**. The average day, maximum month, and peak day TSS concentrations in influent wastewater with their respective peaking factors are summarized in **Table 3-23.**

The average day TSS concentration is approximately 57 mg/L which is drastically less than 130 mg/L, the concentration reported for typical, low-strength wastewater (See **Figure 3-30**). Typical literature values for residential TSS loading in the US are 0.13 to 0.33 ppcd; therefore, the influent load (see **Table 3-23**) appears to represent typical wastewater (Metcalf & Eddy, 2014). Previous studies did not characterize influent TSS loads to the Tafuna WWTP.

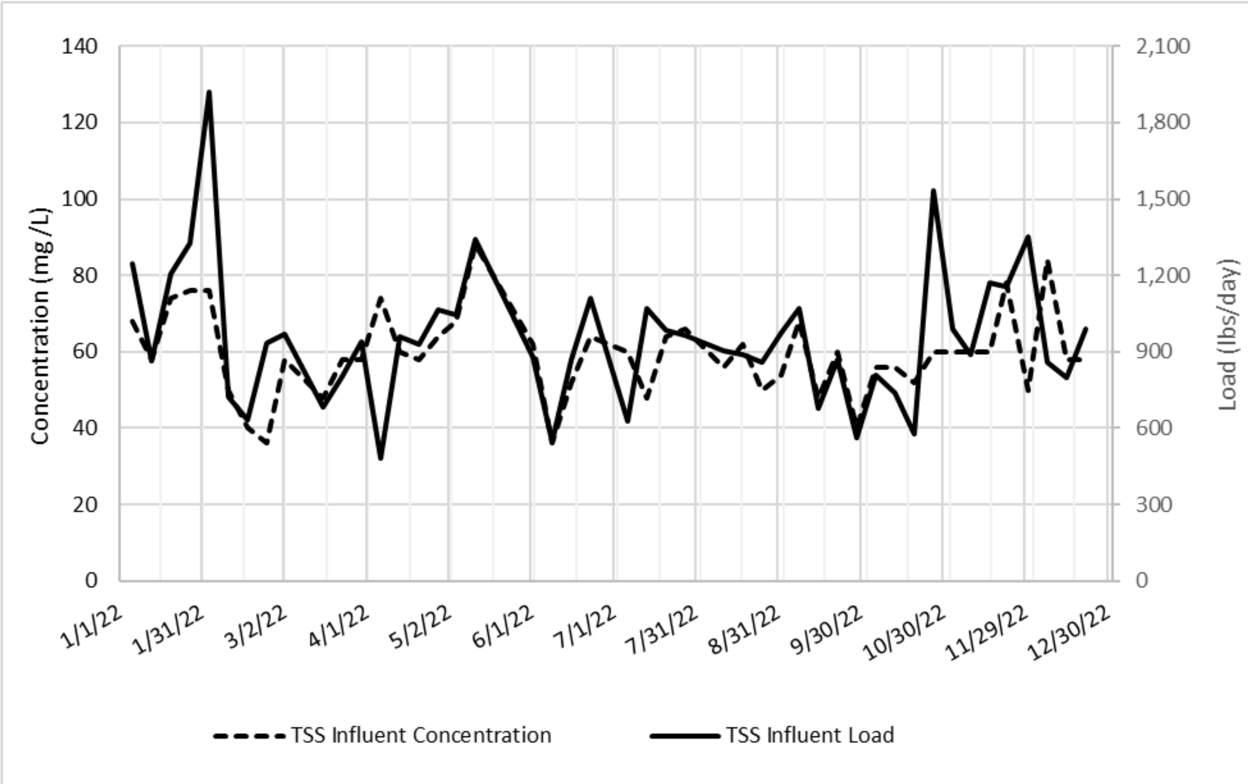

Figure 3-28: Utulei WWTP - Influent TSS from 2022 Dataset

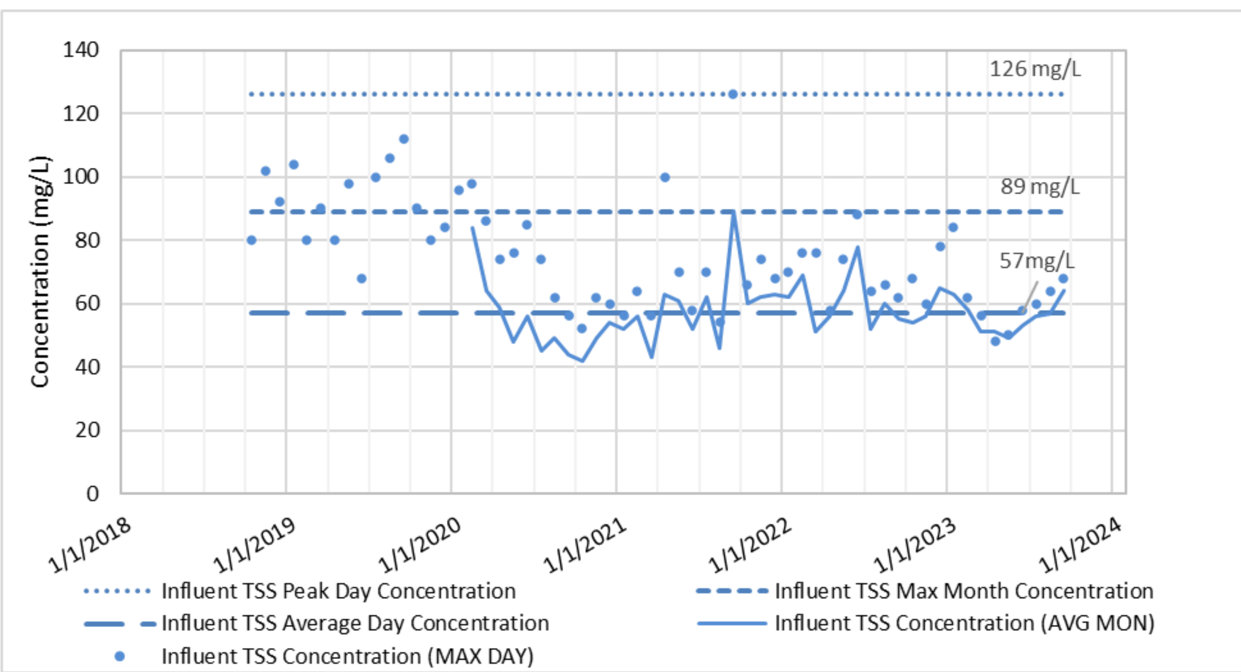

Figure 3-29: Utulei WWTP - Influent TSS Concentrations from DMR Dataset

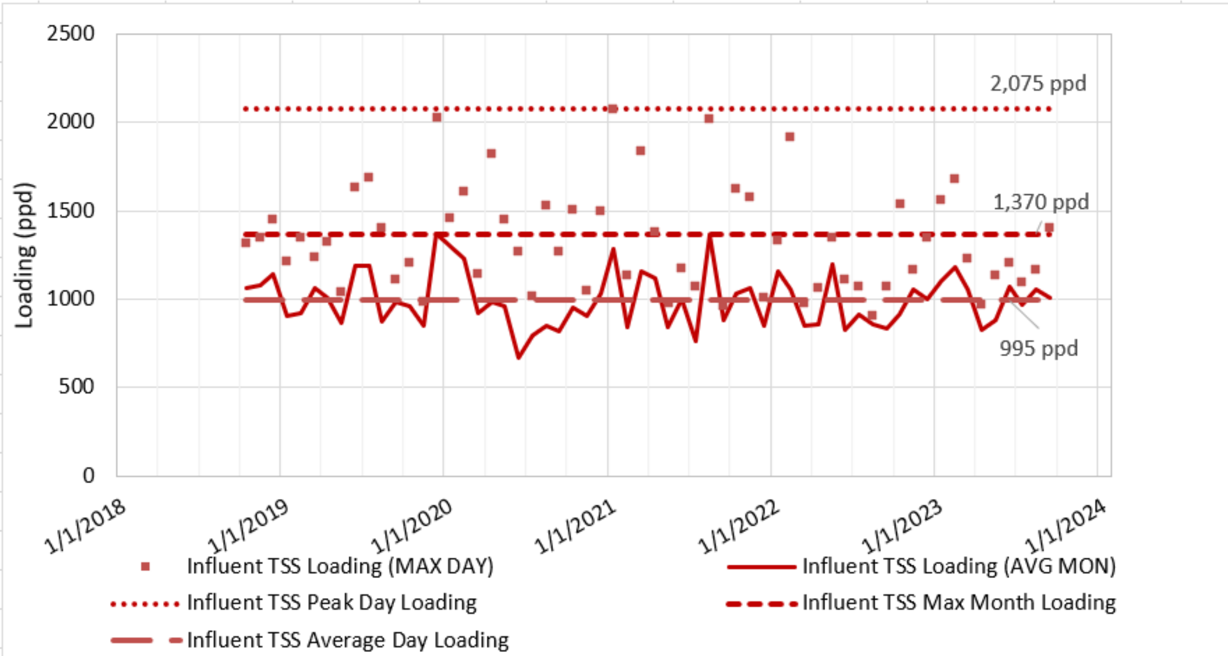

Figure 3-30: Utulei WWTP - Influent TSS Loading from DMR Dataset

Table 3-23: Utulei WWTP - Influent TSS Demands

Parameter	TSS Concentration (mg/L)	TSS Loading (ppd)	TSS (lbs/capita/day)
Average Day, AD	57	995	0.13
Maximum Month, MM	-	1,370	0.18
Peaking Factor (MM : AD)	-	*1.38*	-
Peak Day, PD	-	2,075	0.27
Peaking Factor (PD : AD)	-	*2.09*	-

3.2.3.4 Influent Nitrogen

Nitrogen does not need to be monitored in the influent per the Utulei permit. However, nitrogen is monitored in the effluent wastewater based on the Utulei WWTP's NPDES permit requirements. ASPA provided the historical sampling data sets of total ammonia nitrogen (TAN), Total Kjeldahl Nitrogen (TKN), nitrate plus nitrite (NO_X-N), and total nitrogen (TN) in the influent wastewater from December 2011 through March 2018 and September 2021 through August 2022. Similar nitrogen loading was noticed among the two datasets after visually analyzing their graphs. The recent sampling data from September 2021 through August 2022, tested at Eurofins Laboratories (Monrovia, California), was considered to accurately represent the current conditions. This dataset is graphically shown in **Figure 3-31** and is analyzed further in subsequent paragraphs.

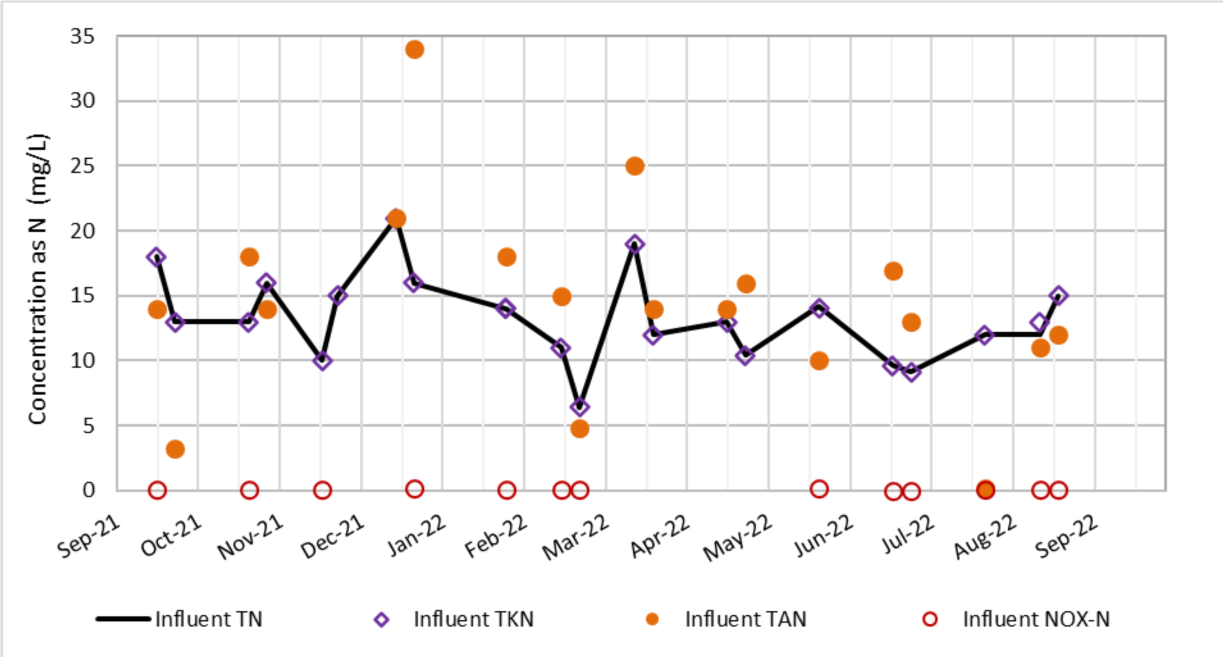

Figure 3-31: Utulei WWTP - Influent Nitrogen Concentrations

TKN is the sum of TAN and organic nitrogen compounds. The TN is the sum of TKN and NO_X-N, which includes nitrate and nitrite. Therefore, the concentration of TAN cannot be greater than the concentration of TKN and TN. However, the concentration of ammonia-N reported by Eurofins Laboratory is greater than the concentration of both TKN and TN in the influent wastewater for more than half of the samples tested during the study period, as shown in **Table 3-24**. Influent wastewater sampled on the following days had concentrations of ammonia greater than concentrations of TKN from September 2021 through August 2022:

- October 21st, 2021
- December 23rd, 2021
- January 27th, 2022
- February 17th, 2022
- March 17th, 2022
- March 24th, 2022
- April 21st, 2022
- April 28th,2022
- June 23rd,2022
- June 30th, 2022

Based on the report from the Eurofin laboratory, the TN value was calculated arithmetically rather than through analytical sampling. Sampling or testing errors in ammonia-N or TKN analysis could cause erroneous results. It is recommended that ASPA investigate the cause of the testing error since nitrogen concentrations in the effluent wastewater samples are also tested in the same laboratory and are reported in their DMR for permit compliance.

Given the potential error in the available dataset, two assumptions can be made to estimate the nitrogen loading for this report, which are discussed below:

- First Case: There is no organic nitrogen present, which is not likely. The concentration of influent ammonia reported by Eurofins Laboratory is incorrect. Therefore, TN is calculated as the sum of the reported TKN concentration and NO_X-N (nitrate-N + nitrite-N).
- Second Case: There is no organic nitrogen present. The concentration of influent TKN reported by Eurofins Laboratory is incorrect. The actual TKN concentration is assumed to be the same as the reported ammonia concentration. Therefore, TN is calculated as the sum of the reported ammonia concentration and NO_X-N (nitrate-N + nitrite-N).
- Third Case: There is an unknown amount of organic nitrogen present. The concentration of influent TKN reported by Eurofins Laboratory is incorrect, but the reported ammonia concentration is correct. Influent TKN is unknown and estimated based on a typical TKN to TAN ratio of 1.7:1 (Metcalf & Eddy, 2014).

Table 3-24 summaries the number of sampling points, along with the average day, maximum month, and peak day concentrations of TAN, TKN, NO_X-N, and TN reported by Eurofins Laboratory and the calculated concentration of TN based on the two cases stated above.

Table 3-24: Utulei WWTP – Reported and Calculated Nitrogen Loading

Parameter	Report By Eurofins Laboratory				First Case	Second Case	Third Case
	TAN (mg/L)	TKN (mg/L)	NO_X-N (mg/L)	TN (mg/L)	TN (mg/L)	TN (mg/L)	TN (mg/L)
Total number of data points	19	21	11	16	-	-	-
Average Day	14.5	13.3	0.09	14.1	13.4	14.6	24.6
Maximum Month	27.5	18.5	0.2	18.5	18.7	27.7	46.75
Peak Day	34	21	0.2	21	21.2	34.2	57.8

The TN calculated using the second case description is higher than the TN calculated with the first case. TN calculated using the third case is considered to be an overestimate. Therefore, the TN calculated with the second case is recommended. **Table 3-25** summarizes the influent nitrogen concentration in the Utulei WWTP. The average day mass loadings of ammonia, TKN, TN, nitrate, and nitrite were calculated by multiplying average day concentration and ADF, as shown in **Table 3-25**. The maximum month and peak day loading were calculated by multiplying the average day loading with the peaking factors as the concentration values. Previous studies did not characterize influent nitrogen loads to the Utulei WWTP.

Table 3-25: Utulei WWTP - Influent Nitrogen Concentration

Parameter	TKN[1] (mg/L)	Nitrate-N + Nitrite-N[a] (mg/L)	TN[1] (mg/L)
Average Day	14.5	0.087	14.6
Maximum Month	27.5	0.2	27.2
Peaking Factor (MM:AD)	*1.89*	*2.29*	*1.86*
Peak Day	34	0.2	34.2
Peaking Factor (PD:AD)	*1.78*	*2.29*	*2.34*

[1] Concentration is calculated based on the assumptions described in the second case.

Table 3-26: Utulei WWTP - Influent Nitrogen Loading

Parameter	TKN	NO_X-N	TN
Average Day (ppcd)	0.031	0.000187	0.031
Average Day (ppd)	240	1.5	241
Maximum Month (ppd)	455	2.9	458
Peaking Factor (MM:AD)	*1.90*	*1.9*	*1.86*
Peak Day (ppd)	563	3.5	567
Peaking Factor (PD:AD)	*2.34*	*2.34*	*2.34*

3.2.3.5 Influent Phosphorus

Although phosphorus in the influent wastewater is not regularly monitored at the Utulei WWTP, ASPA provided historical sampling data from September 2021 to August 2022. These data are graphically shown in **Figure 3-32**. The number of sampling points, along with the average day, maximum month, and peak day concentrations, are summarized in **Table 3-27.** Previous studies did not characterize influent phosphorus loads to the Utulei WWTP.

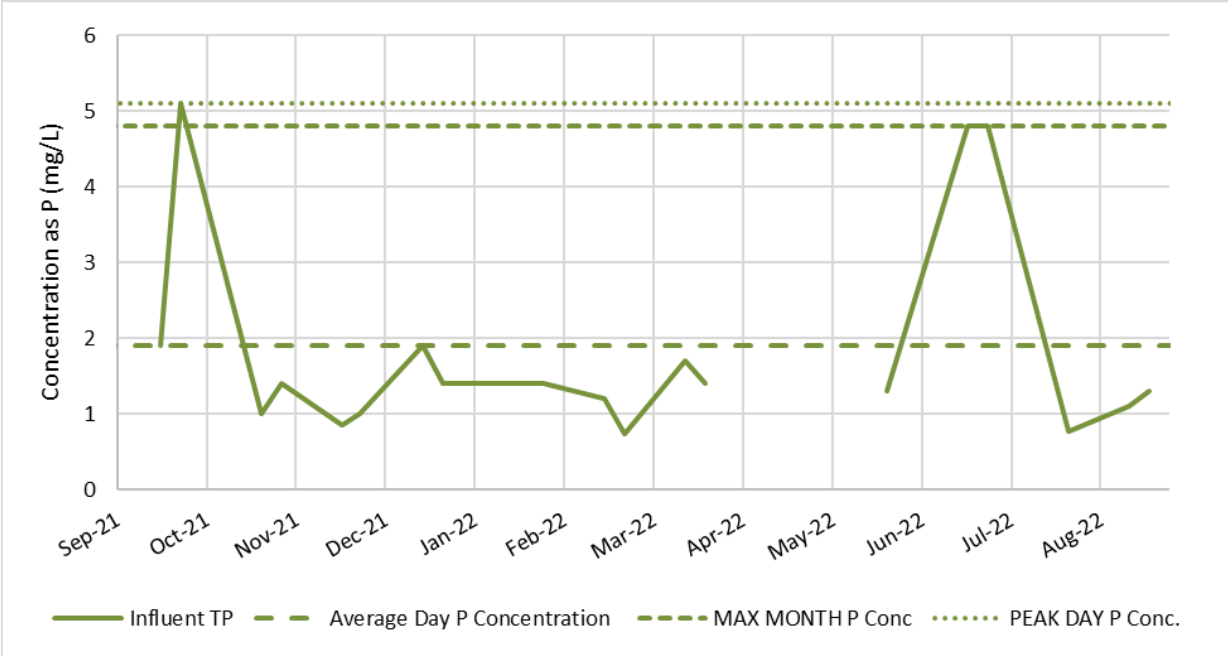

Figure 3-32: Utulei WWTP - Influent Phosphorus Concentrations

Table 3-27: Utulei WWTP - Influent Phosphorus Load

Parameter	**TP (mg/L)**	**TP (ppd)**	**TP (lbs/capita/day)**
Total number of data points	19	-	-
Average Day	1.9	31	0.004
Maximum Month	4.8	79	0.010
Peaking Factor (MM:AD)	*2.53*	*2.53*	-
Peak Day	5.1	84	0.011
Peaking Factor (PD:AD)	*2.68*	*2.68*	-

3.2.3.6 Existing Loading Summary

Table 3-28 summarizes the influent wastewater characteristics of low-strength, medium-strength, and high-strength wastewater. The influent BOD_5 and TSS concentration of Utulei WWTP is significantly below the typical concentrations reported for low-strength wastewater. The low concentration of solids in wastewater suggests that the influent wastewater is very diluted as a result of I/I. Similar to the Tafuna WWTP, the influent TSS is lower than the influent BOD_5 for Utulei, which is unusual and hints toward potential sampling error.

The average total ammonia nitrogen concentration is 14.5 mg/L, similar to the typical concentration for low-strength wastewater. The total nitrogen and total phosphorus concentration in Utulei's influent wastewater are 14.6 mg/L and 1.9 mg/L, which is below the typical concentration for low-strength wastewater.

The data sources analyzed to calculate BOD_5, TSS, and nutrient loading at various conditions are summarized in **Table 3-33** in section 3.1.7.

Table 3-28: Influent Wastewater Strength Comparison

Wastewater Influent	Influent BOD_5	Influent TSS	Influent TAN	Influent TN	Influent P
Low Strength (mg/L)[1]	133	130	14	23	3.7
Medium Strength (mg/L)[1]	200	195	20	35	5.6
High Strength (mg/L)[1]	400	389	41	69	11
Typical (ppcd)	0.2 (0.11-0.26)	0.19 (0.13-0.33)	0.029 (0.011-0.026)	0.037 (0.020-0.048)	0.005 (0.006-0.010)
Utulei WWTP (mg/L)[2]	**92**	**57**	**14.5**	**14.6**	**1.9**
Utulei WWTP (ppcd)[2]	**0.24**	**0.15**	**0.031**	**0.031**	**0.004**

[1]As defined by Metcalf and Eddy Fifth Edition, Wastewater Engineering (2014), Table 3-18 (Metcalf & Eddy, 2014).
[2]Average Day Loading calculated in this report. See prior sections for more information.

3.2.4 Population

3.2.4.1 Existing Population

The wastewater collection system for Utulei WWTP spans nine villages in the eastern region of the island. The total populations reported for these villages in the five prior US Censuses are summarized in **Table 3-29**. The population of the Utulei region has slightly decreased in the last couple of decades. The total population and person per household in the Utulei region are 8,568 and 4.38 based on the 2020 US Census data.

Table 3-29: Historical Population of Utulei Region

Year	Population	Average Annual Growth Rate over Prior Period
1980	9135	-
1990	10640	0.02%
2000	11695	0.01%
2010	10002	-0.02%
2020	8568	-0.02%

Sewer collection lines are not connected to all households. Some areas do not have sewer connections, and sewage is managed with septic tanks or other technologies. The collection system service areas for each village in the Utulei region are visually shown in **Figure 3-33**. The ratio of the area serviced to the total developed area for each village was calculated to estimate the existing population serviced by the wastewater collection system. This service ratio was then multiplied by the village's population to estimate the total population currently served by the collection system. This method assumes that the population of each village is equally dispersed throughout the developed area of the village. The estimated current population contributing to sewer flow to Utulei WWTP is 7,675.

The Utulei region has a hospital, a tuna cannery, small businesses, and residential homes. The tuna cannery (Starkist Samoa Inc.) has its own wastewater treatment plant and discharge permit for the process water used in tuna processing and packaging. However, the Starkist Tuna Cannery employs several thousand people and contributes flow to the collection system via bathrooms and hand-washing sinks. The wastewater quality from the tuna cannery is expected to be similar to that of domestic wastewater. The cannery is spread across portions of three villages, including Anua, Satala, and Atuu. Based on the visual inspection of the aerial images of these villages, the number of residential homes in this area is minimal. However, the US Census 2020 reports a significant number of people residing in these areas, as shown in **Table 3-30.** The population of employees working in the tuna cannery could be included in the village population. To be conservative, all people reported for the three villages in the US census are assumed to be contributing wastewater flow to the Utulei plant.

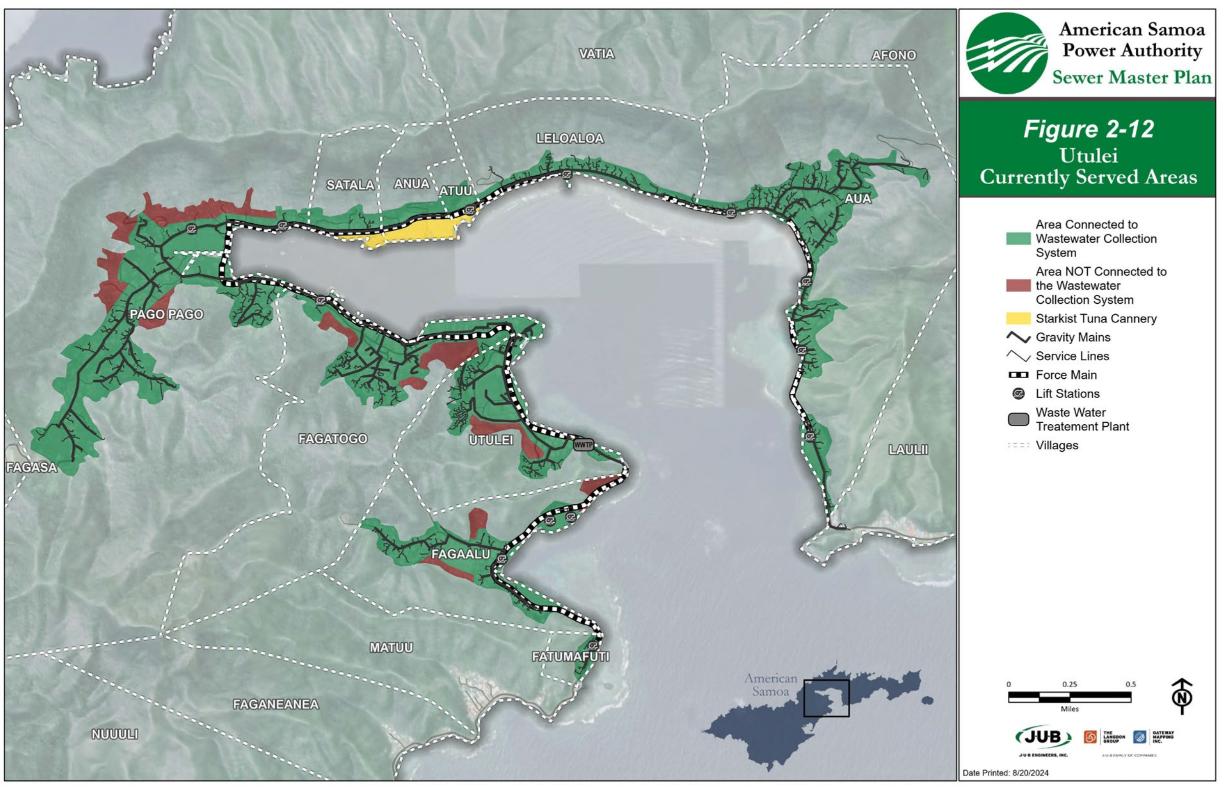

Figure 3-33: Utulei - Areas with and without Sewer Collection Connections

Table 3-30 Utulei WWTP – Estimated Population with Sewer Connections

Village	Population (Census 2020)	Estimated Sewered Population	Estimated Sewered Housing Units	% Sewered Population
Anua	473	473	108	100.0%
Fagatogo	1445	1197	273	82.8%
Fatumafuti	72	72	16	100.0%
Leloaloa	365	365	83	100.0%
Utulei	479	427	98	89.1%
Pago Pago	3000	2535	579	84.5%
Aua	1549	1549	354	100.0%
Fagaalu	731	603	138	82.5%
Atuu	236	236	54	100.0%
Satala[1]	218	218	50	100.0%
Total	**8,568**	**7,675**	**1,753**	**89.6%**

[1] Satala is an area located within the Pago Pago village. However, the population of this region was reported separately in the US Census 2020 and the ASG Statistical Yearbook 2022. To be consistent with prior work done by ASPA, the Satala region is considered a separate village in this report.

3.2.4.2 Future Population

The expected future population in 20 years is typically used as a benchmark to calculate future wastewater flows. For the Utulei region, the population served by the existing sewer collection system may decline based on historical trends over the last 20 years. To be conservative, the population of the regions currently served by the Utulei WWTP is anticipated to remain the same during the 20-year planning period. In addition to the current service areas, the following regions are anticipated to be added to Utulei's collection system:

- **Matuu Region**: ASPA is planning to extend the sewer collection system to include the village of Matuu. According to the 2020 census, the village has a population of 317. The population of Matuu is assumed to remain the same for the planning period of 20 years.
- **Faganeanea Region**: ASPA is planning to extend the sewer collection system to include the east side of the village of Faganeanea. According to the 2020 census, the village has a total population of 93 people. To be conservative, the entire population of Faganeanea is expected to contribute sewer to the Utulei WWTP in the future.
- **Pago Pago Village**: ASPA is planning to connect an additional 50 homes to the existing collection system in Pago Pago. Based on the people per household of 4.38 calculated from the 2020 census, an additional 220 people will be contributing to sewer flows after collection system expansion in this region.

These planned sewer collection system expansions will add 630 people, bringing the anticipated total future sewered population to 8,305.

3.2.5 Future Flows

Additional future flows are anticipated for Utulei WWTP resulting from the expansion of the collection system. The wastewater flow from the current service area is anticipated to remain the same in the future. The additional flows are from the following regions:

- **Matuu Region**: Construction of this new sewer collection is anticipated to be begin within the next 5 years. The future ADF flow from this region is estimated to 0.084 MGD, which was calculated based on the existing gallons per capita per day and the estimated future population.
- **Faganeanea Region**: Construction of this new sewer collection is anticipated to be begin within the next 10 years. The future ADF flow from this region is estimated to be 0.024 MGD, which was calculated based on the existing gallons per capita per day and the estimated future population.
- **Pago Pago Region**: The future ADF flow from the collection system expansion in this region is estimated to be 0.058 MGD, which was calculated based on the existing gallons per capita per day and the estimated future population.

The future flow for Utulei WWTP was calculated similarly to the Tafuna WWTP. The additional ADF flow anticipated during the planning period of 20 years is 0.168 MGD. Entirely new sources contribute to this additional flow. The future ADF was calculated by adding the expected additional flow from the new sources to the existing ADF coming into the plant. In doing so, we assumed that the I/I contribution as a percentage of the ADF remains constant. The current peaking factors for MMF, PDF, and PHF are used to calculate the future MMF, PDF, and PHF. If I/I reduction projects are implemented, the peak day and peak hour factors may be lower than projected in the future. The projected future flow rates are summarized in **Table 3-31**.

Table 3-31: Utulei WWTP – Future Flow Conditions

Parameter	Future Flow - 2044 (MGD)	Future Flow - 2044 (gpcd)
Average Day Flow, ADF	2.21	265.8
Maximum Month Flow, MMF	2.94	351.8
Peaking Factor (MMF : ADF)	*1.33*	-
Peak Day Flow, PDF	5.52	664.5
Peaking Factor (PDF : ADF)	*2.50*	-
Peak Hourly Flow, PHF	5.63	-
Peaking Factor (PHF : ADF)	*2.55*	-

3.2.6 Future Loading

The concentration and loading of BOD_5, TSS, and nutrients in influent wastewater from the regions connected to the existing collection system are anticipated to remain unchanged in the future since the population of the existing region is projected to stay the same. The average loadings per capita per day of the BOD_5, TSS, and nutrients in the influent wastewater from the new sources are anticipated to be the same as the current loading per capita per day. The future average day loadings of BOD_5, TSS, and nutrients are calculated by multiplying the observed loading per capita per day and the anticipated future population. The current peaking factors for MMF and PDF are used to calculate the future MMF and PDF. The projected future BOD_5, TSS, and nutrient loadings are summarized in **Table 3-32**.

Table 3-32: Utulei WWTP – Projected Future Loading

Parameter	Total Future Loading (ppd)[1]	Loading (lbs/capita/day)[1]
BOD_5:		
Average Day	1,658	0.20
Maximum Month	2,554	-
Peaking Factor	*1.54*	-
Peak Day	4,063	-
Peaking Factor	*2.45*	-
TSS:		
Average Day	1,077	0.13
Maximum Month	1,486	-
Peaking Factor	*1.38*	-
Peak Day	2,250	-
Peaking Factor	*2.09*	-
Ammonia (TAN):		
Average Day	260	0.031
Maximum Month	493	-
Peaking Factor	*1.90*	-
Peak Day	610	-
Peaking Factor	*2.34*	-
TN:		
Average Day	260	0.031
Maximum Month	486	-
Peaking Factor	*1.90*	-
Peak Day	611	-
Peaking Factor	*2.34*	-
TP:		
Average Day	34	0.004
Maximum Month	85	-
Peaking Factor	*2.53*	-
Peak Day	91	-
Peaking Factor	*2.68*	-

[1]The projected future loadings were calculated using a 20-year population.

3.2.7 Flow and Loading Summary

Data from various sources were used to calculate the flow and loading for Tafuna WWTP; these data sources are summarized in **Table 3-33**.

Table 3-33: Utulei WWTP – Data Sources Summary

Parameter	Average Day	Maximum Month	Peak Day	Peak Hour
Flow	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	Statistical Analysis of 2018-2023 DMR	Flow per minute recorded by UV system (1-17-2019 to 4-19-2019 & 6-15-2021 to 8-3-2021)
BOD_5	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	-
TSS	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	Oct. 2018- Sep. 2023 DMR	-
Ammonia (TAN)	Sep. 2021- Sep. 2022 biweekly data	Sep. 2021- Sep. 2022 biweekly data	Sep. 2021- Sep. 2022 biweekly data	-
TN	Sep. 2021- Sep. 2022 biweekly data	Sep. 2021- Sep. 2022 biweekly data	Sep. 2021- Sep. 2022 biweekly data	-
TP	Sep. 2021- Sep. 2022 biweekly data	Sep. 2021- Sep. 2022 biweekly data	Sep. 2021- Sep. 2022 biweekly data	-

The existing and future conditions of the Utulei WWTP's influent flow and loading are summarized in **Table 3-34**.

Table 3-34: Utulei WWTP – Existing and Future Flow and Loads Summary

Parameter	Existing Conditions	Projected Future Conditions (2044)
Estimated Population (sewered)	7,675	8,305
Flow		
Average Day (MGD)	2.04	2.21
Maximum Month (MGD)	2.70	2.94
Peak Day (MGD)	5.10	5.52
Peak Hour (MGD)	5.20	5.63
BOD_5		
Average Day (ppd)	1,533	1,658
Maximum Month (ppd)	2,345	2,554
Peak Day (ppd)	3,741	4,063
TSS		
Average Day (ppd)	995	1,077
Maximum Month (ppd)	1,370	1,486
Peak Day (ppd)	2,075	2,250
TAN		
Average Day (ppd)	240	260
Maximum Month (ppd)	455	493
Peak Day (ppd)	563	610
TN		
Average Day (ppd)	241	260
Maximum Month (ppd)	458	486
Peak Day (ppd)	567	611
TP		
Average Day (ppd)	31	34
Maximum Month (ppd)	79	85
Peak Day (ppd)	84	91

3.3 Aunu'u Wastewater

There is no wastewater treatment plant in Aunu'u island. Evaluation of the flows and loading of the wastewater in Aunu's collection system is beyond the scope of this study.

3.4 References

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Westech Engineering Inc. (Westech). 1992. Schedule B Plans Utulei Wastewater Treatment Plant Expansion. Prepared for American Samoa Power Authority; June 1992.

J·U·B ENGINEERS, INC.

CHAPTER 4
WWTP PERMIT CONDITIONS

Contents

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Appendix B

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Chapter 4 WWTP Permit Conditions

4.1 Regulatory Background

American Samoa Power Authority (ASPA) owns and operates two wastewater treatment plants. The Tafuna Wastewater Treatment Plant discharges disinfected effluent to the Vai Cove in the South Pacific Ocean in accordance with the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) Permit No. AS 0020010. The Utulei WWTP discharges disinfected effluent to the Outer Pago Pago Harbor in the South Pacific Ocean in accordance with the NPDES Permit No. AS 0020001. The agencies regulating operations and effluent discharges from Tafuna and Utulei's WWTPs are:

- US EPA Region 9 (Pacific Southwest): The EPA establishes regulations and standards for both WWTPs to ensure that they operate in an environmentally responsible manner and protect human health. These regulations cover various aspects of wastewater treatment, including the treatment process, discharge limits for pollutants, and the handling and disposal of sludge generated during treatment. EPA issues and enforces NPDES permit limits for both WWTPs relative to the Code of Federal Regulations.
- American Samoa EPA: AS-EPA supports the EPA in overseeing wastewater treatment operations and discharges. However, AS-EPA does not directly enforce permit limits. ASEPA also establish water quality criteria in the receiving marine water around the island.

In 1999, US EPA granted Tafuna and Utulei WWTPs a variance from secondary treatment requirements under Section 301 (h)of the Clean Water Act, also referred to as a 301-H waiver. Since then, the Tafuna and Utulei WWTPs have continued to treat and discharge sewage to the primary treatment level standard under these 301 (h) waivers. EPA released a new permit for Utulei on November 18, 2019, that incorporated additional effluent water quality limits but continued to allow a primary level of treatment for TSS and BOD under the ongoing 301(h) waiver. On January 14, 2009, EPA released a tentative decision to deny the 301 (h) waiver for the Tafuna WWTP in the next NPDES permit. The draft permit for Tafuna WWTP denies the 301(h) waiver and requires a secondary level of treatment of BOD and TSS along with nutrient removal. However, a final decision on a new NPDES permit and 301(h) waiver has not been made.

4.2 Tafuna WWTP Permit Conditions

4.2.1 Current NPDES Permit

The current NPDES Permit for the Tafuna WWTP was issued on September 30, 1999, and became effective on November 2, 1999. Although this permit expired at midnight on November 1, 2004, the EPA administratively extended the permit, and it remains in effect until a new permit is issued. ASPA can discharge treated wastewater meeting effluent discharge limits to the outfall in the South Pacific Ocean at 14° 20' 54" S 170° 43' 30" W. The current NPDES permit is included in **Appendix B-1**.

The effluent discharge limits are summarized in **Table 4-1** based on the permitted design annual flow of 2 MGD. The effluent wastewater samples are collected downstream of the UV disinfection equipment. The effluent data are reported to the EPA on a monthly basis as part of their DMR.

Table 4-1: **Tafuna WWTP - Effluent Discharge Limits Based on Current Permit**

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Monitoring Frequency	Sample Type
Biochemical Oxygen Demand (BOD_5)	lbs/day	1,669	2,504	3,338	Once/week	8 hr Composite
	mg/L	100	150	200		
BOD removal percentage[1]		≥ 30%				
Total Suspended Solids (TSS)	lbs/day	1,252	1,878	2,504	Once/week	8 hr Composite
	mg/L	75	113	150		
TSS removal percentage[1]		≥ 30%				
Settleable Solids	mL/L	1	n/a[2]	2	Once/day	Discrete
pH	std units		6.5 to 8.6		Once/day	Discrete

[1] The arithmetic means of the BOD and TSS values, by concentration, for effluent samples collected over 30 consecutive calendar days shall not exceed 70% of the arithmetic mean, by concentration, for influent samples collected at approximately the same times during the same period. Both influent and effluent concentrations of BOD and TSS are monitored.
[2] n/a = not applicable

Additional water quality parameters that must be monitored are listed in **Table 4-2.**

Table 4-2: **Tafuna WWTP - Additional Monitoring Requirements Based on Current Permit**

Parameter	Monitoring Frequency	Sample Type
Flow	Continuous	Continuous
Oil and grease	Quarterly (Nov/Feb/May/August)	Discrete
Whole Effluent Toxicity[1]	Quarterly (Nov/Feb/May/August)	Composite

[1] The Whole Effluent Toxicity test must be performed in a USEPA Region 9 laboratory. See section 4.2.2.2 for more information.

4.2.1.1 Additional Requirements

The NPDES permit has several additional requirements that are typical for issued permits. Some of the important requirements are discussed below.

4.2.1.1.1 Receiving Water Monitoring Requirements

ASPA is required to monitor the water quality of the water body in Vai Cove that receives the treated wastewater. The water quality parameters should be sampled at specified locations, which are referred to as the water column monitoring stations. These stations are shown in **Figure 4-1** and listed below:

- Station U (Diffuser midpoint): Latitude 14°20' 54" S and Longitude 170°43' 30" W
- Station A1 (Zone of Initial Dilution): 27.4 m (90 ft) northeast of the diffuser midpoint; 27.4 m (90 ft) depth
- Station A2 (Zone of Initial Dilution): 27.4 m (90 ft) southwest of the diffuser midpoint; 27.4 m (90 ft) depth
- Station B (Zone of Mixing): 190 m (627 ft) shoreward of the diffuser midpoint; 5.5 m (18 ft) depth
- Station C (Reference): 212 m (700 ft) northeast of the diffuser midpoint; 27.4 m (90 ft) depth

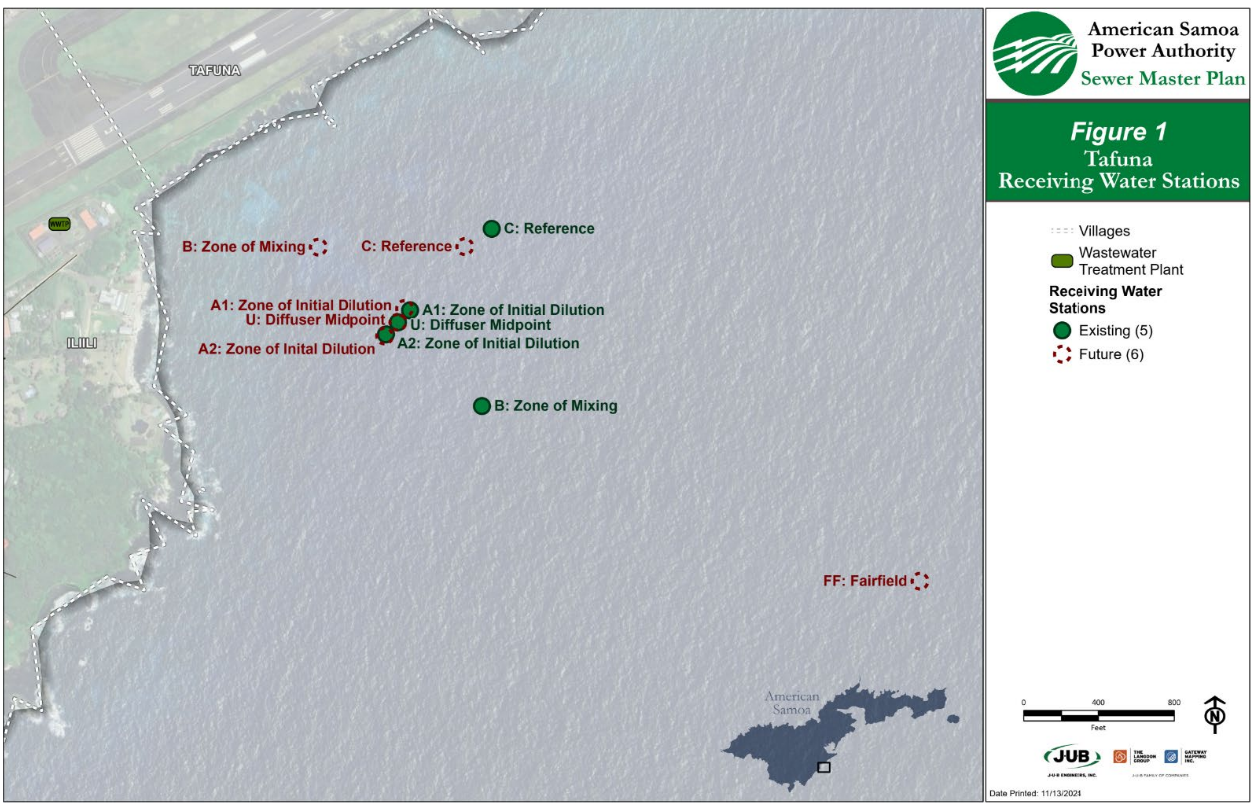

Figure 4-1: Tafuna WWTP – Receiving Water Station based on Current and Future Draft Permit

Table 4-3 summarizes the water column monitoring requirements for various water quality parameters.

Table 4-3: **Tafuna WWTP - Receiving Water Monitoring Requirements**

Receiving Water Characteristics	Units	Monitoring Frequency	Sample Type
Turbidity	NTU	Quarterly (Nov/Feb/May/August)	Nephelometer
Total Phosphorus	µg/L	Quarterly (Nov/Feb/May/August)	Grab
Total Nitrogen	µg/L	Quarterly (Nov/Feb/May/August)	Grab
Chlorophyll a	µg/L	Quarterly (Nov/Feb/May/August)	Grab
Light Penetration	Ft	Quarterly (Nov/Feb/May/August)	Secchi disk
Dissolved Oxygen	mg/L	Quarterly (Nov/Feb/May/August)	Grab
pH	pH units	Quarterly (Nov/Feb/May/August)	Grab
Enterococci	CFU/100 ml	Quarterly (Nov/Feb/May/August)	Grab

The effluent wastewater should not drastically change the natural state of the receiving water. Therefore, there are limitations on the allowable changes in the water quality of the water columns in the receiving water body caused by the discharge of the treated wastewater. **Table 4-4** summarizes these limitations.

Table 4-4: **Tafuna WWTP - Effluent Discharge Restriction for Receiving Water**

Receiving Water Characteristics	Station	Restrictions on Changes Caused by Effluent Discharge
Temperature	-	Temperature change shall be less than 1.5°F from the conditions that would naturally occur. Shall not fluctuate more than 1°F on an hourly basis Shall not exceed 85°F
Basin Geometry	-	Changes in basin geometry or freshwater inflow that will alter current patterns in such a way as to adversely affect existing biological populations or sediment distribution in the receiving water.
Average Turbidity	At and beyond the Zone of Initial Dilution	Shall not exceed 0.25 NTU
Average Total Phosphorus	At and beyond the Zone of Initial Dilution	Shall not exceed 15 µg/L
Average Total Nitrogen	At and beyond the Zone of Initial Dilution	Shall not exceed 130 µg/L
Average Chlorophyll a	At and beyond the Zone of Initial Dilution	Shall not exceed 0.25 µg/L
Light Penetration Depth	At and beyond the Zone of Initial Dilution	Shall not exceed 130 ft 50% of the time
Dissolved Oxygen Content	At and beyond the Zone of Initial Dilution	Shall not be less than 80% saturation or less than 5.5 mg/L
pH	At and beyond the Zone of Initial Dilution	Shall not be <6.5 or >8.6 or deviate 0.2 pH units from typical state
Enterococci Density	At and beyond the Zone of Mixing	Shall not exceed a geometric mean of 35 CFU/100ml (steady state geometric mean) or 124 CFU/100 ml (single sample)

4.2.1.1.2 Whole Effluent Toxicity Testing

Chronic Whole Effluent Toxicity (WET) testing, as a biomonitoring requirement, is included in all major and minor permits. The wastewater samples must be collected quarterly and shipped to a USEPA Region 9 Laboratory for testing. The toxicity test is to be conducted with sea urchins, *Strongylocentrotus purpuratus*, or sand dollar, *Dendraster excentricus* (fertilization test method 1008.0). Based on the current permit written in 1999, the testing frequency can be reduced to annually if the toxicity test for the previous two years is below the target values. ASPA currently tests for WET parameters on a quarterly basis. The chronic toxicity target values are a Maximum Daily Value of 347 TUc and an Average Monthly Value of 172 TUc. A detailed description of the WET testing criteria is discussed in section A.4 of the Current NPDES permit, which is included in Appendix B-1 of this report.

4.2.1.1.3 Industrial Pre-treatment

There are no significant industrial users discharging wastewater to the Tafuna WWTP. Currently, there is no industrial pretreatment program, but ASPA may want to consider putting in place an ordinance covering industrial pretreatment.

4.2.1.1.4 Non-Industrial Source Control Program Requirements

A public education program designed to minimize the entrance of non-industrial toxic pollutants into the Tafuna WWTP should be implemented based on the permit. Copies of all public educational materials designed to minimize the entrance of non-industrial toxic pollutants and pesticides into the Tafuna WWTP from the previous calendar year period shall be submitted with the quarterly water column monitoring report due every January 28 to USEPA Region 9 and ASEPA.

4.2.1.1.5 Sludge/Biosolids Requirements

The Tafuna WWTP has four drying beds to reduce moisture from the sludge drawn from the clarigesters of both the Tafuna WWTP and the Utulei WWTP. The sludge type is unclassified and is disposed of in the nearby landfill. A new dewatering facility using a screw press is under construction to produce biosolids with lower moisture content and reduce operational hassle and odor. The sludge should be tested semi-annually to demonstrate compliance with the 40 CFR 503.33(b) using the paint filter test. An annual biosolids report should be submitted to the USEPA Region 9 Biosolids Coordinator with the volume of generated sludge, operational practices, and monitoring requirements described in section D 12 of the permit.

4.2.2 Future NPDES Permit

A draft permit for the Tafuna plant is in development by the EPA and is not publicly available yet. EPA provided ASPA with a copy of the draft permit, and ASPA provided a copy to JUB Engineers to understand their future treatment needs – see **Appendix B-2**. The effective date of the draft permit is uncertain but expected to be in the next couple of years based on a discussion with EPA on January 4, 2024. The treated wastewater will be discharged into the same outfall as the current permit dictates. **Table 4-5** summarizes the effluent discharge limits for the Tafuna WWTP currently listed in the draft permit.

BOD and TSS removal requirements are based on technology-based effluent limits (TBEL) for secondary treatment. The water quality concerns identified by AS-EPA have also guided the EPA's draft NPDES permit. Some of the critical water quality concerns are impaired ocean shorelines and beach advisories due to potential bacteria exposure. The parameters pH, TN, AIR, TP, and Enterococci have discharge restrictions intended to comply with the receiving water quality based effluent limits (WQBEL) set by the AS-EPA and were calculated using a critical dilution factor of 109 (ASWQS, 2018 Revision, 001-2019; NPDES Fact Sheet, 2023). Discharge limits for the three organic chemicals (TCDD, Phthalate, and DTT) were calculated based on USEPA's recommended water quality criteria for human health for the consumption of aquatic organisms and a critical dilution factor of 109. In March 2024, AS-EPA issued a technical memorandum assessing the water quality at the Tafuna outfall based on data collected from 2005 through 2023. These statements indicate that a relaxation of the adopted water quality standards

(WQS's) or adoption of site-specific criteria may be possible by AS-EPA. It is not known to what degree this might be possible, nor if EPA would accept the revisions.

The future draft permit for Tafuna WWTP does not include the 301 (h) Waiver, but EPA has not released the final official decision on renewing the 301(h) waiver for Tafuna WWTP. The parameters and limits in the draft NPDES permit are the basis of the planning objective for the effluent water quality of Tafuna's WWTP in the Secondary Feasibility Study (J-U-B Engineers, 2025).

Table 4-5: Tafuna WWTP - Effluent Discharge Limits based on Draft NPDES Permit[1]

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Frequency	Sample Type
Biochemical Oxygen Demand (BOD_5)[2]	lbs/day	751	1,127	(3)	Weekly	24-hour composite
	mg/L	30	45	(3)		
BOD removal percentage[2]		≥ 85%				
Total Suspended Solids (TSS)[2]	lbs/day	751	1,127	(3)	Weekly	24-hour composite
	mg/L	30	45	(3)		
TSS removal percentage[2]		≥ 85%				
pH[4]	S.U.	6.5-8.6, within 0.2 pH of the value which would occur naturally			Weekly	Grab
Oil and grease, total recoverable	mg/L	10	-	15	Monthly	Grab
Total Nitrogen (as N)	mg/L	14.2	-	30.5	Monthly	24-hour composite
Ammonia Impact Ratio[5]	Ratio	1		1	Monthly	Calculated
Total Phosphorus	mg/L	1.6	-	5.5	Monthly	24-hour composite
2,3,7,8-Tetrachlorodibenzodioxin (TCDD)	µg/L	-	-	5.6×10^{-7}	Quarterly	24-hour composite
bis(2-ethylhexyl) Phthalate	µg/L	-	-	40.3	Quarterly	24-hour composite
4,4'-DDT	µg/L			0.0033	Quarterly	24-hour composite
Enterococci	CFU /100 mL	3,815	-	14,170	Weekly	Grab
Chronic Toxicity with *Strongylocentrotus purpuratus* or *Dendraster excentricus,* Method 1008.0 WI33L [5]	Pass (0) or Fail (1), Percent (%) Effect			Pass (0)	Quarterly	24- hour composite

[1] n/a = not applicable

[2] The average monthly effluent concentration of Biochemical Oxygen Demand (5-day) and Total Suspended Solids shall not exceed 15 percent of the average monthly influent concentration collected at the same time. Both influent and effluent concentrations of BOD and TSS are monitored.
[3] No effluent limits are set at this time but monitoring and reporting is required.
[4] Temperature and pH reading should be taken at the same time as the ammonia sample is collected during ammonia sampling event. These parameters will be used to calculate ammonia impact ratio.
[5] Ammonia Impact Ratio (AIR) is calculated as the ratio of the ammonia value in the effluent and the applicable ammonia standard in Appendix A of the draft NPDES permit which is included in Appendix B of this report. Ammonia standard is constant value dependent on the ambient salinity, effluent temperature, and effluent pH. The AIR value can be calculated using the following formula:

$$AIR = \frac{Ammonia\ Concentration\ in\ Effluent}{109 \times Ammonia\ Objective\ from\ Appendix\ E\ of\ draft\ permit}$$

[6] Monitoring is conditional in that only one of these two test species must be monitored for chronic toxicity during the calendar month for DMR reporting. See Part II.C.3. "Chronic Test Species and WET Methods" of this permit. An exceedance occurs if the Pass-Fail result is Fail

In addition to the discharge limitations, additional effluent monitoring is required for some water quality parameters, which are summarized in **Table 4-6**.

Table 4-6: Tafuna WWTP - Effluent Monitoring Requirements Based on Draft NPDES Permit

Parameter	Unit	Monitoring Frequency	Sample Type
Flow	MGD	Continuous	Continuous
Temperature[1]	°C	Weekly	Grab
Total Ammonia (as N)[1]	mg/L	Monthly	24-hour composite
Priority Pollutant Scan[2]	µg/L	Once during 4th year of the permit term	24-hour composite/Grab

[1] Temperature and pH readings should be taken at the same time as the ammonia sample is collected during the ammonia sampling event.
[2] See Attachment F for a list of priority pollutants. For the most current listing of all priority toxic pollutants, see 40 CFR § 423, Appendix A. The required priority pollutant scan should be conducted concurrently with that year's scheduled Whole Effluent Toxicity test.

The existing treatment process must be drastically upgraded or replaced to meet the effluent discharge limits proposed in the draft permit. The draft permit includes more water quality testing parameters than the current permit. Similarly, the effluent discharge limits for these parameters are more stringent than the current permit. The key changes between the current and draft permit are summarized below:

1. The required average monthly BOD and TSS percentage removal increased from 30% to 85%. Similarly, the limit for effluent concentration and daily loading of BOD and TSS are more stringent in the draft permit and decreased by approximately 30% and 40%, respectively, from the current permit limits. Moreover, the composite sample for BOD and TSS needs to be collected over a 24-hour period instead of the previous requirement of an 8-hour period.
2. There is no settleable solids discharge limit for the draft permit.
3. The discharge limits for the following parameters were added as follows.
    a. Oil and grease

   b. Total Nitrogen
   c. Ammonia Impact Ratio
   d. Total Phosphorus
   e. Herbicides and pesticides which includes 2,3,7,8-TCDD, bis(2-ethylhexyl) Phthalate, and 4,4'-DDT
   f. *Enterococci*
   g. Chronic Toxicity with *Strongylocentrotus purpuratus* or *Dendraster excentricus*
4. The following additional parameters need to be monitored:
   a. Temperature
   b. Total Ammonia
   c. Priority Pollutant Scan
5. There was no compliance period noted for any of the above-mentioned parameters.

4.2.2.1 Additional Requirements

4.2.2.1.1 Receiving Water Monitoring Requirements

Table 4-7 summarizes the receiving water requirement in the draft permit.

Table 4-7: Tafuna WWTP - Receiving Water Monitoring Requirements Based on Draft NPDES Permit

Receiving Water Characteristics	Units	Monitoring Frequency	Sampling Depth	Sample Type/Method
Temperature	°C	Semi-Annually (March-August)	1m below surface, mid-depth, and 1m above bottom	Field Sensor (e.g. CDT)
Salinity	PSU			Field Sensor
Dissolved Oxygen	mg/L			Field Sensor
pH	Standard Units			Field Sensor (pH meter)
Turbidity	NTU			Bench Meter or Field Sensor
Light Penetration	ft		Surface	Secchi desk
Total Phosphorus	µg/L as P		1m below surface, mid-depth, and 1m above bottom	Lab Sample (EPA 353.3)
Total Nitrogen	µg/L as N			Lab Sample (EPA 353.2 + EPS 351.2)
Chlorophyll a	µg/L			Lab Sample
Ammonia	mg/L as NH_3			Lab Sample (EPA 350.1)
Enterococci	CFY/100 ml			Lab Sample (AS-EPA)

Compared to the current permit, the following additional parameters were included in the receiving water monitoring requirement for the draft permit:

1. Temperature
2. Salinity
3. Ammonia

The limits for the change in temperature, basin geometry, and dissolved oxygen concentration in the receiving water caused by the effluent discharge are the same as the current requirements listed in **Table 4-8**. Additionally, the following receiving water requirements were included in the draft permit:

1. Total Mercury: In addition to the methyl mercury criteria for human health from the EPA's National Recommended Water Quality Criteria, the water column concentration of mercury shall not exceed 0.05 µg/l.
2. Total Residual Chlorine: Total residual chlorine in any ambient water shall not exceed 7.5 micrograms per liter for marine waters.
3. The concentration of toxic pollutants shall not exceed the more stringent of the aquatic life criteria for marine waters or the human health concentration criteria for consumption of organisms found in EPA's National Recommended Water Quality Criteria 2002, EPA-822-R-02-047 or the most recent version of the National Recommended Water Quality Criteria.

4.3 Utulei WWTP Permit Conditions

4.3.1 Current NPDES Permit

The current NPDES Permit for the Utulei WWTP was issued on November 18, 2019, and became effective on January 1, 2020. The current permit expired on December 31, 2024. ASPA submitted a renewal application on June 7th, 2024, and requested a 301(h) waiver. ASPA can discharge treated wastewater meeting effluent discharge limits to the outfall in the South Pacific Ocean at 14° 16' 59.6" S 170° 40' 28.1" W. The current NPDES permit is included in **Appendix B-3**, and the effluent discharge limits are summarized in **Table 4-8**. The effluent wastewater samples are collected downstream of the UV disinfection units in the outlet structure. The results of these parameters are reported to the EPA on a monthly basis, along with their DMR. There is no composite sampler, so grab samples are collected hourly, even during the middle of the night, and combined to form a composite sample.

Table 4-8: Utulei WWTP - Effluent Discharge Limits Based on Current Permit[1]

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Frequency	Sample Type
Biochemical Oxygen Demand (BOD_5)[2]	lbs/day	1,960	2,929	3,930	Weekly	24-hour composite
	mg/L	78.3	117	157		
BOD removal percentage[2]		≥ 30%				
Total Suspended Solids (TSS)[2]	lbs/day	1,878	2,829	3,755	Weekly	24-hour composite
	mg/L	75	113	150		
TSS removal percentage[2]		≥ 30%				
pH[3]	S.U.	6.5-8.6, within 0.2 pH of the value which would occur naturally			Weekly	Grab
Oil and grease, total recoverable	mg/L	10	-	15	Monthly	Grab
Settleable Solids	mL/L	1	n/a	2	Monthly	Grab
Total Nitrogen (as N)	mg/L	24.2	-	60.5	Monthly	24-hour composite
Ammonia Impact Ratio[3,4]	Ratio	1.0		1.0	Monthly	Calculated
Total Phosphorus	mg/L	3.63	-	10.89	Monthly	24-hour composite
Enterococci	CFU /100 mL	3,815	-	11,830	Weekly	Grab
Chronic Toxicity with *S. purpuratus*, Method 1008.0 WB33L[5]	Pass (0) or Fail (1), Test of Significant Toxicity (TST)	-	-	Pass (0)	Annually	24- hour composite
Chronic Toxicity with *D. excentricus*, Method 1008.0 WB33N[5]	Pass (0) or Fail (1), TST	-	-	Pass (0)	Annually	24- hour composite

[1] n/a = not applicable

[2] The arithmetic means of the BOD and TSS values, by concentration, for effluent samples collected over 30 consecutive calendar days shall not exceed 70% of the arithmetic mean, by concentration, for influent samples collected at approximately the same times during the same period. Both influent and effluent concentrations of BOD and TSS are monitored.

[3] Temperature and pH readings should be taken at the same time as the ammonia sample is collected during the ammonia sampling event. These parameters will be used to calculate the ammonia impact ratio.
[4] Ammonia Impact Ratio (AIR) is calculated as the ratio of the ammonia value in the effluent and the applicable ammonia standard in Appendix A of the draft NPDES permit which is included in Appendix B of this report. The ammonia standard is a constant value dependent on the ambient salinity, effluent temperature, and effluent pH. The AIR value can be calculated using the following formula:

$$AIR = \frac{Ammonia\ Concentration\ in\ Effluent}{109 \times Ammonia\ Objective\ from\ Appendix\ E\ of\ draft\ permit}$$

[5] Chronic WET testing can be conducted for either of these organisms based on spawning season during the reporting month. An exceedance occurs if the Pass-Fail result is Fail.

Table 4-9: Utulei WWTP - Additional Monitoring Requirements Based on Current Permit

Parameter	Unit	Monitoring Frequency	Sample Type
Flow	MGD	Continuous	Continuous
Temperature[1]	°C	Weekly	Grab
Total Ammonia (as N)[1]	mg/L	Monthly	Grab
Priority Pollutant Scan[2]	µg/L	Once during 4th year of the permit term	Grab

[1] Temperature and pH readings should be taken at the same time as the ammonia sample is collected during the ammonia sampling event.
[2] Attachment F of the modified NPDES permit has a list of the priority contaminants. This test should be concurrent with that year's Whole Effluent Toxicity test.

4.3.1.1 Additional Monitoring Requirements

The NPDES permit has several additional requirements that are typical for recently issued permits. Some of the crucial requirements are discussed below.

4.3.1.1.1 Receiving Water Monitoring Requirements

Along with the influent and effluent wastewater monitoring, ASPA is also required to monitor the water quality characteristics of the water body receiving the wastewater in Pago Pago Harbor. The water quality parameters should be sampled at specified locations, which are referred to as the water column monitoring stations. These stations are shown in **Figure 4-2** and listed below:

- Station U (Diffuser Midpoint Station): Latitude 14.2824° S and Longitude 170.6755° W
- Station A1 (Zone of Initial Dilution): Latitude: 14.2833° S and Longitude 170.6745° W
- Station B1 (Zone of Mixing): Latitude 14.2848° S and Longitude 170.6736° W
- Station C (Fairfield Stations): Latitude 14.2794° S and Longitude 170.6803° W
- Station 16 (Fairfield Stations): Latitude 14.2814° S and Longitude 170.6726° W
- Station 18 (Fairfield Stations): Latitude 14.2853° S and Longitude 170.6735° W
- Station FF (Offshore Fairfield Stations): Latitude 14.3144° S and Longitude 170.6661° W
- Station 5 (Reference Stations): Latitude 14.2950° S and Longitude 170.6690° W

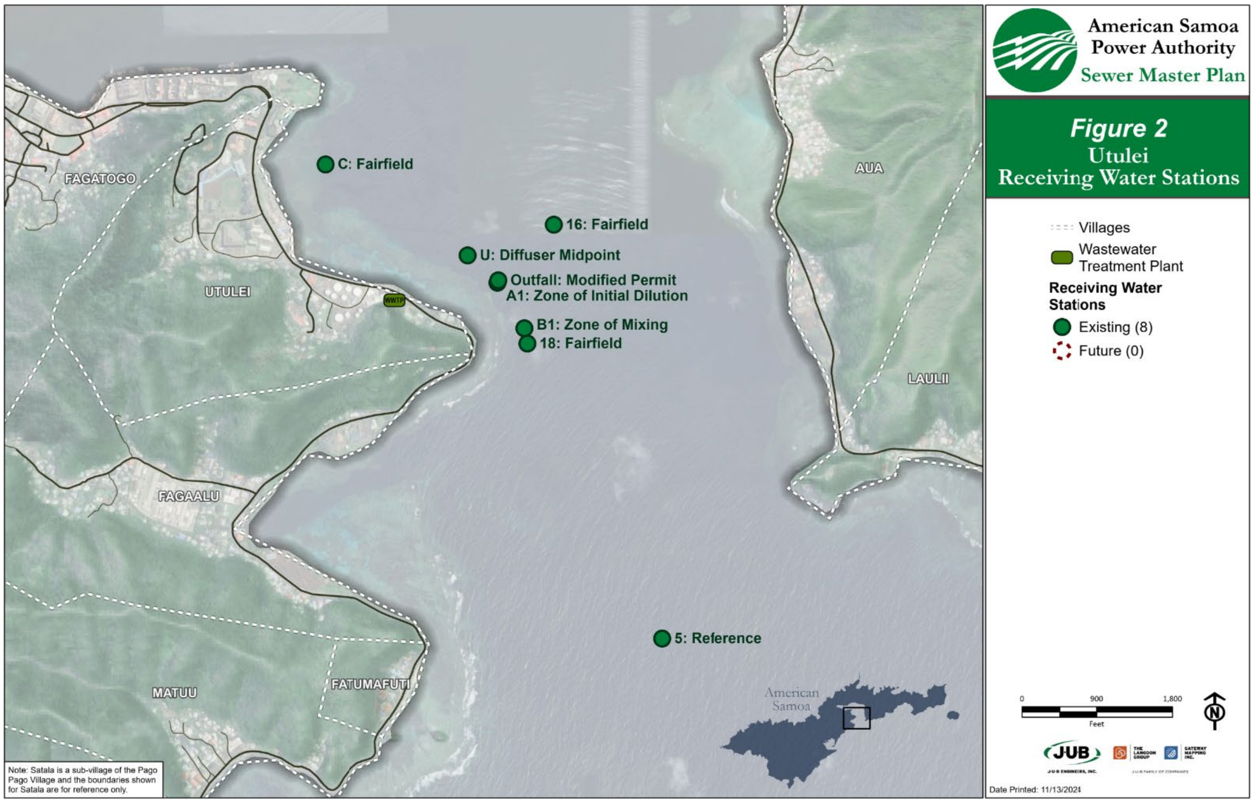

Figure 4-2: Utulei WWTP – Receiving Water Station based on Current Permit

Table 4-10 summarizes monitoring requirements for all of the stations. Water samples should be taken semiannually from each station at both the midpoint depth and 1 meter above the bottom.

Table 4-10: Utulei WWTP - Receiving Water Monitoring Requirements

Receiving Water Characteristics	Units	Sample Type/Method
Temperature	°C	Field Sensor (eg.CDT)
Salinity	PSU	Field Sensor
Dissolved Oxygen	mg/L	Field Sensor
pH	Standard Units	Field Sensor (pH meter)
Turbidity	NTU	Bench Meter or Field Sensor
Light Penetration	Ft	Secchi disk
Total Phosphorus	µg/L as P	Lab Sample (EPA 353.3)
Total Nitrogen	µg/L as N	Lab Sample (EPA 353.2 + 351.2)
Chlorophyll a	µg/L	Lab Sample
Ammonia	mg/L as NH_3	Lab Sample (EPA 350.1)
Entercocci	CFU/100 ml	Lab Sample (AS-EPA)

4.3.1.1.2 Whole Effluent Toxicity Testing

Chronic Whole Effluent Toxicity (WET) testing is a biomonitoring requirement included in all major and minor permits. Wastewater samples need to be collected, sampled, and reported annually. The toxicity test shall be conducted with either sea urchins, *Strongylocentrotus purpuratus*, or sand dollars, *Dendraster excentricus* (fertilization test method 1008.0). **Table 4-8** includes the requirement for chronic WET testing.

4.3.1.1.3 Industrial Pre-treatment

There is no industrial pretreatment program. Starkist Samoa Inc.'s tuna cannery has its own wastewater treatment plant and NPDES discharge permit (AS 0000019). There are no other significant industrial users.

4.3.1.1.4 Non-Industrial Source Control Program Requirements

A public education program designed to minimize the entrance of non-industrial toxic pollutants into the Utulei WWTP should be implemented based on the permit. Copies of all public educational materials designed to minimize the entrance of non-industrial toxic pollutants and pesticides into the Utulei WWTP from the period covering the previous calendar year shall be submitted with the quarterly water column monitoring report due every January 28 to USEPA Region 9 and ASEPA.

4.3.1.1.5 Sludge/Biosolids Requirements

The sludge generated at the Utulei WWTP is hauled to the Tafuna WWTP for dewatering before disposal at a nearby landfill. Reference **Section 4.2.2.5** for details on the sludge monitoring and dewatering practices at Tafuna WWTP.

4.3.2 Future NPDES Permit

There is no draft of a future permit for the Utulei WWTP. ASPA submitted a renewal application on June 7th, 2024, and requested a 301(h) waiver. Based on the meeting with EPA on January 4, 2024, the future permit for the Utulei WWTP will likely be similar to Tafuna's draft permit. The future permit would likely require secondary treatment of wastewater to remove 85% of influent BOD and TSS. Additionally, the water quality-based effluent limits like nitrogen, phosphorus, effluent toxicity, and other pollutants might be less stringent for the Utulei WWTP compared to the Tafuna WWTP because the Utulei WWTP has higher dilution credits and is discharging to Pago Pago Harbor, which has less stringent water quality regulations than the Open Coastal water where Tafuna WWTP discharges (EPA, 2024). Additional discharge limits for pesticides and herbicides like 2,3,7-8 TCDD, bis(2-ethylhexyl) Phthalate, and 4,4'-DDT could also be included. The uncertainty in the water quality parameter and limits of the future permit creates challenges in planning the location and potential treatment technologies for the Utulei WWTP. According to ASPA, the EPA is more likely to continue with a 301(h) waiver at the Tafuna WWTP compared to the Utulei WWTP, which in the near future will likely not be given a 301(h) waiver (EPA, 2024). However, as mentioned above, the water quality requirement less stringent for Utulei, and the dilution factor is greater than that of Tafuna, which makes it more likely for Utulei to receive 301(h) waiver. However, these are initial speculations and are not reliable for planning purposes. Since there is no other basis or clarity on the future permit limits of the Utulei WWTP, they are anticipated to be the same as the draft permit limits of the Tafuna WWTP and are shown in **Table *4-11***. The parameters and limits listed in **Table *4-11*** are also the basis of the planning objective for the effluent water quality of Utulei's WWTP. The current permit expires in December 2024, and the existing permit will likely be administratively extended until a new permit is finalized. Although the timeline for issuing a new permit is uncertain, the permit drafting process is anticipated to begin in 2025.

Table 4-11: Utulei WWTP – Anticipated Effluent Discharge Limits based on Tafuna's Draft NPDES Permit[1]

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Frequency	Sample Type
Biochemical Oxygen Demand (BOD_5)[2]	lbs/day	751	1,127	(3)	Weekly	24-hour composite
	mg/L	30	45	(3)		
BOD removal percentage[2]		≥ 85%				
Total Suspended Solids (TSS)[2]	lbs/day	751	1,127	(3)	Weekly	24-hour composite
	mg/L	30	45	(3)		
TSS removal percentage[2]		≥ 85%				
pH[4]	S.U.	6.5-8.6, within 0.2 pH of the value which would occur naturally			Weekly	Grab
Oil and grease, total recoverable	mg/L	10	-	15	Monthly	Grab
Total Nitrogen (as N)	mg/L	14.2	-	30.5	Monthly	24-hour composite
Ammonia Impact Ratio[5]	Ratio	1		1	Monthly	Calculated
Total Phosphorus	mg/L	1.6	-	5.5	Monthly	24-hour composite
2,3,7,8-Tetrachlorodibenzodioxin (TCDD)	µg/L	-	-	5.6×10^{-7}	Quarterly	24-hour composite
bis(2-ethylhexyl) Phthalate	µg/L	-	-	40.3	Quarterly	24-hour composite
4,4'-DDT	µg/L			0.0033	Quarterly	24-hour composite
Enterococci	CFU /100 mL	3,815	-	14,170	Weekly	Grab
Chronic Toxicity with *Strongylocentrotus purpuratus* or *Dendraster excentricus,* Method 1008.0 WI33L [5]	Pass (0) or Fail (1), Percent (%) Effect			Pass (0)	Quarterly	24- hour composite

[1] n/a = not applicable

[2] The average monthly effluent concentration of Biochemical Oxygen Demand (5-day) and Total Suspended Solids shall not exceed 15 percent of the average monthly influent concentration collected at the same time. Both influent and effluent concentrations of BOD and TSS are monitored.

[3] No effluent limits are set at this time but monitoring and reporting is required.

[4] Temperature and pH reading should be taken at the same time as the ammonia sample is collected during ammonia sampling event. These parameters will be used to calculate ammonia impact ratio.

[5] Ammonia Impact Ratio (AIR) is calculated as the ratio of the ammonia value in the effluent and the applicable ammonia standard in Appendix A of the draft NPDES permit which is included in Appendix B of this report. Ammonia standard is constant value dependent on the ambient salinity, effluent temperature, and effluent pH. The AIR value can be calculated using the following formula:

$$AIR = \frac{Ammonia\ Concentration\ in\ Effluent}{109 \times Ammonia\ Objective\ from\ Appendix\ E\ of\ draft\ permit}$$

[6] Monitoring is conditional in that only one of these two test species must be monitored for chronic toxicity during the calendar month for DMR reporting. See Part II.C.3. “Chronic Test Species and WET Methods” of this permit. An exceedance occurs if the Pass-Fail result is Fail.

4.4 Aunu’u Wastewater

There is no wastewater treatment plant in Aunu’u island and no NPDES permit. The evaluation of the wastewater disposal practices in Aunu’u island is beyond the scope of this study.

4.5 References

EPA. 2024. Response to 30% deliverable. July. 2024.

J-U-B Engineers. Secondary Feasibility Study. 2025.

J·U·B ENGINEERS, INC.

CHAPTER 5

EXISTING MANAGEMENT EVALUATION

Contents

Figures

Appendix C

Chapter 5 Existing Management Evaluation

This Chapter includes an evaluation of operation and maintenance activities and standards, with recommended improvements.

5.1 ASPA Organization

ASPA has five primary divisions: the Power Generation Division, the Transmission and Distribution Division, the Water Division, the Wastewater Division, and the Solid Waste Division. All wastewater infrastructure and operations appropriately fall under the purview of the Wastewater Division. ASPA is directed by a Board of Directors that is comprised of five chairpersons and is administered by an Executive Director. The chairpersons are nominated to the Board of Directors by American Samoa's Governor and are confirmed by the Legislature of American Samoa. **Figure 5-1** displays ASPA's leadership organization chart with current (2020) names of people serving in the organization (ASPA, 2020).

ASPA's Wastewater Division is run by the Wastewater Manager and is under the direction of the Executive Director. The Wastewater Manager has three direct reports: the Wastewater Construction Manager, the Wastewater Operations Manager, and the Wastewater Engineer. The Wastewater Construction Manager leads the construction division and oversees the construction of wastewater projects. The Wastewater Operations Manager leads and oversees the operation and maintenance of the collection systems and wastewater treatment plants (WWTPs). The Wastewater Engineer leads the engineering division and oversees project development and design. **Figure 5-2** displays ASPA's wastewater leadership organization chart based on conversations with ASPA management.

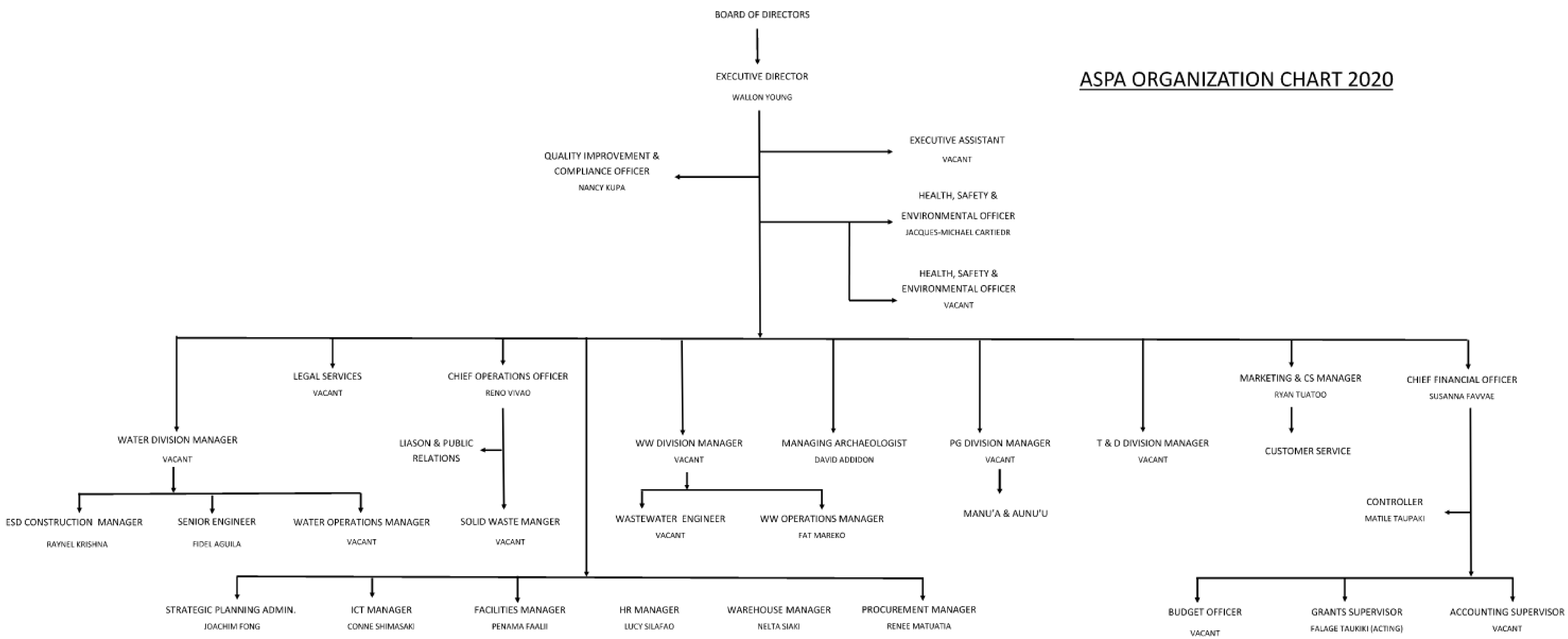

Figure 5-1: ASPA Leadership Organization Chart

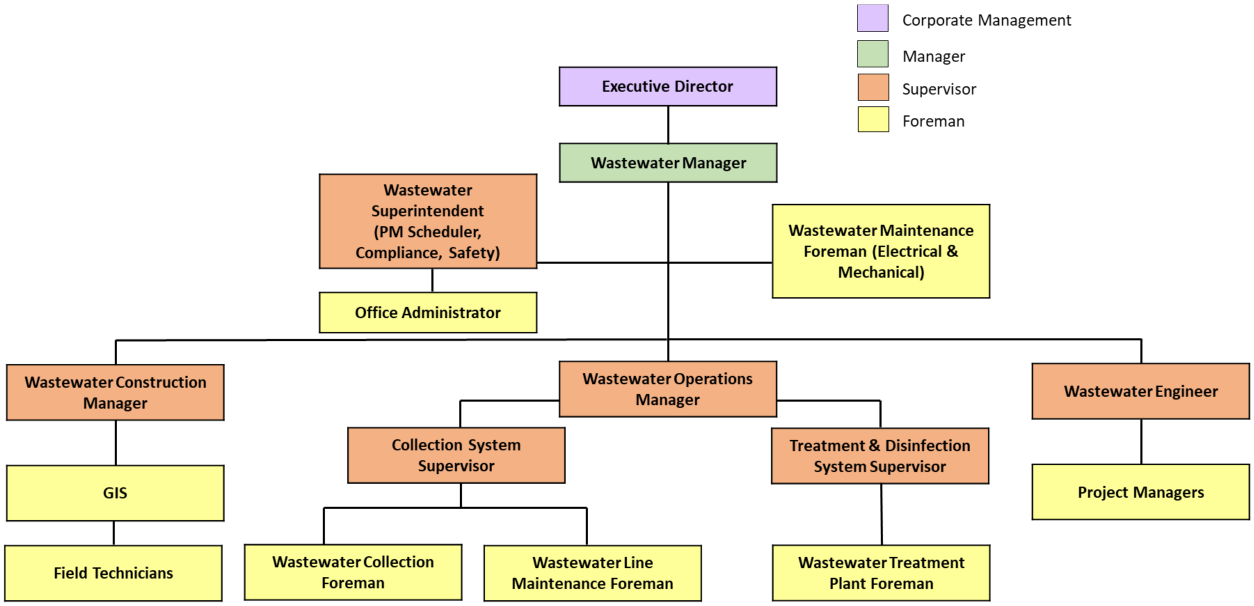

Figure 5-2: ASPA Wastewater Leadership Organization Chart

ASPA's Construction Division is responsible for constructing new projects. The division is headed by the Wastewater Construction Manager who oversees the field technicians. Field technicians are responsible for completing the construction projects. If a wastewater project is larger than what ASPA's Wastewater Construction Division can reasonably manage, the project is outsourced to a construction contractor.

ASPA's Operations Department is responsible for the day-to-day operations and maintenance of the wastewater systems. This department operates and maintains the wastewater system infrastructure, including pipes, manholes, lift stations, force mains, WWTPs, etc.

ASPA's Engineering Department is responsible for information management, project development, and project design. The department manages information regarding wastewater treatment, system efficiencies and inefficiencies, infrastructure condition, etc. Managing system and infrastructure information allows the engineers and technicians to monitor the wastewater systems and potentially identify issues and deficiencies. As issues and deficiencies are identified, projects are developed with the department and by consultants via planning efforts, such as this Wastewater Utility Plan.

As shown in the leadership organization charts in **Figure 5-1** and **Figure 5-2**, and as described above, ASPA's leadership organization includes many divisions, managers, and other leadership roles. J-U-B had the opportunity to meet with ASPA operations personnel both in person and virtually during this study to discuss and review ASPA's existing management process. The wastewater leadership is organized for effective operation of ASPA's wastewater division. The various divisions and departments work together to ensure the wastewater systems are operational and maintained to serve the citizens of American Samoa. With the many roles and responsibilities of ASPA's wastewater division being divided among various divisions, departments, and individuals, clear communication between divisions and those in leadership positions is crucial to ensure successful operation. It is also important that those who serve in leadership positions feel empowered to make decisions and to carry out tasks within their realm of responsibility.

5.2 Operation, Maintenance, and Construction Activities

ASPA regularly performs operation and maintenance activities throughout their wastewater systems. These activities ensure proper functionality, reduce infrastructure failure, and improve performance of the wastewater systems. The following activities are currently underway within the wastewater systems:

- Collection system pipes are regularly flushed on a rotational basis, with critical areas being monitored and receiving additional flushing each month.
- Lift stations and their associated piping and appurtenances are visually inspected each day during the work week, including observation of pumps and pressure lines to ensure there are no leaks.
- Lift stations are also monitored by visual inspection for alarms. Auto dialers are being added to lift stations to alert staff of emergencies.
- Oil and grease traps are regularly inspected and cleaned.
- Buried manholes at known locations are being raised.
- Pipes with high inflow and infiltration are being repaired and/or replaced.
- A new screw press is being added to the Tafuna WWTP.

In addition to the activities that are currently underway, ASPA performs a number of routine (occurring at least once per month) and non-routine (occurring less often than once per month) activities. Additional information regarding ASPA's operation and maintenance procedures, including responding to and reporting sanitary sewer overflows, can be found in *Chapter 5 – Operations and Maintenance Program* of the Collection System Management Plan (CSMP), which is included in **Appendix C-1**. Other routine maintenance and operation activity information is included in **Appendix C-3**.

ASPA established a Construction Division in 2020. The Construction Division regularly designs, constructs, and installs wastewater gravity mains, manholes, and service connections. Additionally, the Construction Division installs septic systems and inspects service connections and septic systems installed by others.

As ASPA staff performs operation and maintenance procedures, safety of the staff is a high priority. ASPA has both a confined space program and a lockout program that promote the safety of staff. Strict observance of the confined space and lockout programs allows ASPA staff to perform operation and maintenance procedures in a safe environment and reduces the potential for injury or harm.

5.3 Evaluation of Standards

ASPA utilizes the Ten States Standards, which provide guidelines for design, review, and approval of wastewater collection and treatment facilities. ASPA's Construction Division performs in-house quality control tests, such as the full moon test, low pressure air test, hydraulic test, level test, and manhole vacuum test, for wastewater collection system main lines, manholes, and service laterals. Additionally, ASPA has a standard for sewer service connections (see *Chapter 10 – Sewer Design Standards* of the CSMP, which is included in **Appendix C-1**) and a reference guide for the construction of septic tanks (see **Appendix C-2**).

ASPA would like to continue to develop and implement design and construction standards and specifications, as well as procedures and standards for inspections, to utilize within its Construction Division.

5.4 Recommended Improvements

ASPA's Wastewater Division strives to manage the wastewater system in a manner that is both effective and efficient. While the overall management of the wastewater system appears to be effective, there are areas in which improvements can be made. The following sections outline recommended improvements that will enhance the effectiveness and efficiency of the Wastewater Division in managing the wastewater system.

5.4.1 Improvements to ASPA's Wastewater Division

ASPA is a member of the Pacific Water and Wastewater Association (PWWA) and provides PWWA with data and benchmarking updates on an annual basis. Some ASPA employees have the opportunity to attend PWWA annual conferences, however, attendance is limited due to high travel and accommodation costs. While ASPA provides annual data and benchmarking updates and attends PWWA annual conferences, little collaboration, training, and networking takes place.

As ASPA strives to provide a positive experience and work environment for its employees, it is recommended that ASPA seek additional opportunities for its employees to receive training from and to collaborate and network with other wastewater professionals. Organizations such as the Water Environment Federation (WEF) can provide ASPA employees with valuable training opportunities through literature and online classes and workshops, allowing them to further develop the knowledge and skills necessary to provide improved wastewater management and services to the citizens of American Samoa. There are also multiple federal agencies that offer virtual or in-person technical assistance. The United States Environmental Protection Agency (USEPA) offers a Water Technical Assistance (WaterTA) program that can connect ASPA with experts to help assess and implement solutions for wastewater needs, including trainings (USEPA, 2024). In addition to the training opportunities, involvement in professional organizations will also provide ASPA employees with the opportunity to network and collaborate with other wastewater professionals. Such training, networking, and collaboration will establish a sense of ownership for employees, providing them with the opportunity to transform their jobs into careers.

Links for online literature and resources are provided below:

- WEF: www.wef.org
    - Wastewater Treatment Fundamentals: https://www.wef.org/publications/publications/books/wastewater-treatment-fundamentals/
    - Skills Builder: https://www.wef.org/events--education/online-education/skillsbuilder/
    - Operations Challenge: https://www.weftec.org/program/exhibition/operations-challenge/
    - Access Water: https://www.accesswater.org/home
- USEPA WaterTA: https://www.epa.gov/water-infrastructure/water-technical-assistance-waterta

ASPA currently has a four-year apprenticeship program that sends staff to school in Fiji and New Zealand to earn certificates and degrees to become electricians, mechanics, surveyors, etc. This apprenticeship program benefits both the staff members involved by providing them with the opportunity to receive education and training in their chosen field, as well as ASPA by providing qualified staff for its Wastewater Division. ASPA would like to strengthen the capacity of its Wastewater Division by increasing the number of certified wastewater operators. It is recommended that ASPA expand its apprenticeship program to include wastewater operator education and certification. Expanding the apprenticeship program will aid ASPA in increasing the number of certified wastewater operators as individuals who are interested in pursuing a career as wastewater operators will be provided with the opportunity to receive the necessary education, training, and certification.

5.4.2 Improvements to Operation, Maintenance, and Construction

Historically, ASPA has repaired and/or replaced wastewater system infrastructure when it has failed, or when a condition assessment indicates that it is approaching failure. While this approach to infrastructure repair and replacement generally keeps the wastewater system operational, it is recommended that ASPA work toward implementing a more proactive approach to operation, maintenance, and construction. Through regular infrastructure inspections and conditions assessments, ASPA can monitor the rate of degradation of the infrastructure and schedule replacement or rehabilitation prior its failure. Regular infrastructure inspections may include activities such as routine closed-circuit television (CCTV) inspections of the collection system pipes; current CCTV inspections are generally limited to times when ASPA identifies a problem area.

ASPA currently uses a combination of asset management tools, including software, spreadsheets, and GIS data. The ASPA Wastewater Division *Maintenance Management System Operation Manual* provides information on asset numbering, equipment numbering, use of the water and wastewater asset system, use of the MPS scheduler, performing inspections, use of the work order system, and use of the purchasing request system (ASPA, 2001). This manual was last updated in May 2001, which suggests that the procedures and software outlined in the manual are dated and due to be updated.

To improve its asset management capabilities, ASPA should further develop its existing tools and acquire additional tools. Further developing existing tools should involve expanding the wastewater system GIS data to include and track all infrastructure and its related information (e.g. installation date, maintenance and repairs performed, pipe size, pipe material, pump horsepower, condition, etc.). Acquisition of additional tools may involve replacing outdated software and spreadsheets with new or updated asset management software, such as CityWorks, Elements XS, Centralsquare, or Eptura, to maintain records for property, inventory, fleet, etc. ASPA should utilize computerized maintenance management system (CMMS) software to plan, schedule, track, and report maintenance activities and work orders. When selecting asset management and CMMS software, ASPA should assess the advantages, disadvantages, features, capabilities, cost (e.g., one-time cost vs. annual subscription), etc. to determine the software that will best meet its needs.

Additional information regarding asset management can be found in *Chapter 5 – Operations and Maintenance Program* of the CSMP, which is included in **Appendix C-1**.

The recommended improvements to operation, maintenance, and construction are further discussed and incorporated into the Capital Improvement Plan in Chapter 8 and Chapter 9 of this report.

5.4.3 Improvements to Standards

To further develop its design and construction standards and specifications, as well as procedures and standards for inspections, ASPA could utilize its in-house engineering staff, or contract with an engineering consulting firm. ASPA currently uses the Ten States Standards and could consider adopting additional standards and specifications from other organizations, such as the American Public Works Association (APWA). As additional standards and specifications are developed or adopted, the following items should be considered for inclusion:

- Standard construction contract language, such as that provided by the Engineers Joint Contract Document Committee (EJCDC).
- Pre-construction procedures and requirements for new construction and modifications/improvements to existing infrastructure.
- Design specifications for pipe sizes, pipe slopes, manhole spacing, manhole sizes, cleanout spacing, lift station pumps, lift station wet wells, etc.
- Material specifications for pipes, fittings, manholes, manhole rings and covers, lift station pumps and components, etc.
- Standard details for trenches/excavation, manholes, cleanouts, service connections, grease traps, pipe repairs, infrastructure abandonment, etc.
- Inspection requirements for new construction, modifications/improvements to existing infrastructure, video inspection, cleaning, abandonment of main lines and laterals, etc.
- Standards, procedures, and review requirements for environmental, historic, and all other required permitting for construction.

5.5 References

American Samoa Power Authority, 2024, March 4, *About Us,* *https://www.aspower.com/aspa-about.html.*

American Samoa Power Authority (ASPA) Wastewater Division, *Maintenance Management System Operations Manual,* May 2001.

American Samoa Power Authority (ASPA), wastewater organization chart, September 2020.

United States Environmental Protection Agency (USEPA), Water Technical Assistance (WaterTA), 2024. https://www.epa.gov/water-infrastructure/water-technical-assistance-waterta

J·U·B ENGINEERS, INC.

CHAPTER 6

EXISTING WWTP EVALUATION

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Chapter 6 Existing WWTP Evaluation

This Chapter describes the treatment process, hydraulic profile, site plan, equipment, and observed deficiencies in Tafuna and Utulei WWTP and evaluates their overall performance, condition, and capacity.

6.1 Tafuna WWTP - Existing System

6.1.1 Facility Overview

The Tafuna WWTP receives sewer from the villages in the western region of Tutuila Island in American Samoa. The WWTP is located in Fagagogo near the western end of the main runway at the Pago Pago International Airport. The existing treatment plant was initially constructed in 1977 and expanded in the 1990s. In subsequent years, additional treatment processes have been upgraded to increase capacity and improve effluent wastewater quality. The major process units in the treatment plant are:

- Headworks: Influent Pump Station, Screens, Washpress, and Grit removal
- Primary Treatment: Clarigester
- Disinfection: UV Disinfection
- Effluent Flow Measurement
- Outfall/ Effluent Disposal
- Solids processing and disposal: digestion (Clarigester), dewatering with a screw press and/or sludge drying beds, and landfilling

Figure 6-1 shows an aerial image of the facility with the site map. **Figure 6-2** shows the existing process schematic in its current configuration. **Figure 6-3** shows the hydraulic profile of the existing WWTP based on elevations reported in previous studies (Coe & Van Loo, 2012; Coe & Van Loo, 2016).

A general description, observed deficiencies, and capacity assessment for each process unit are presented in subsequent sections. In determining probable capacity, one must consider the following limitations and requirements:

- The facility is a dynamic system – a change in one process will likely affect performance, and hence capacity, in other processes.
- Limitations (bottlenecks) may exist for subsystems within a process.
- The effluent water quality of Tafuna and Utulei WWTPs was analyzed based on five years of effluent data reported in the DMRs from October 2018 to September 2023. Capacity evaluations are, therefore, based on the past years of operation and anecdotal evidence provided by the operators. The period analyzed constitutes data reported monthly and may, therefore, not fully capture variations in flow and waste strength that could potentially occur at the facility on a daily or hourly basis. Influent and effluent conditions, both flow and concentrations, should continue to be monitored following this facility planning effort to confirm conclusions reached in the preceding chapters and the validity of using those conclusions in this chapter. If significant differences are discovered, this facility plan should be revisited as appropriate, especially prior to any subsequent design activities.

- The performance and capacity of the current system of Tafuna and Utulei WWTPs are evaluated based on the current permit limits, which are discussed in Chapter 4, and on the existing and future flow and loading conditions, which are discussed in Chapter 3. The existing WWTPs cannot satisfy the probable future permit (based on the draft permit of Tafuna WWTP), which requires secondary treatment and nutrient removal. The Secondary Treatment Feasibility Study (J-U-B Engineers, 2025) will analyze the capacity of proposed secondary/biological treatment systems to meet future permit limits.

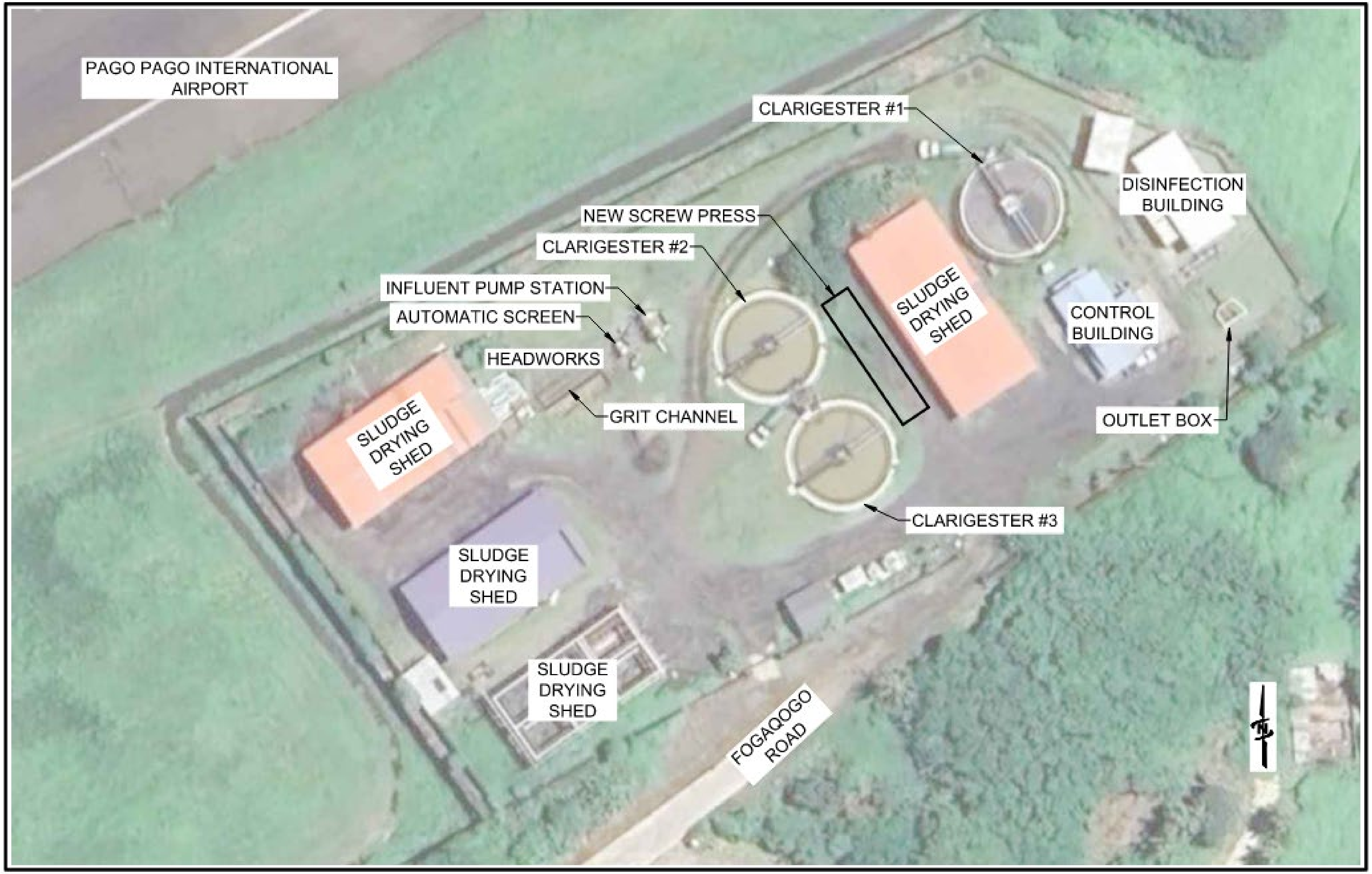


Figure 6-1: Tafuna WWTP – Site Map

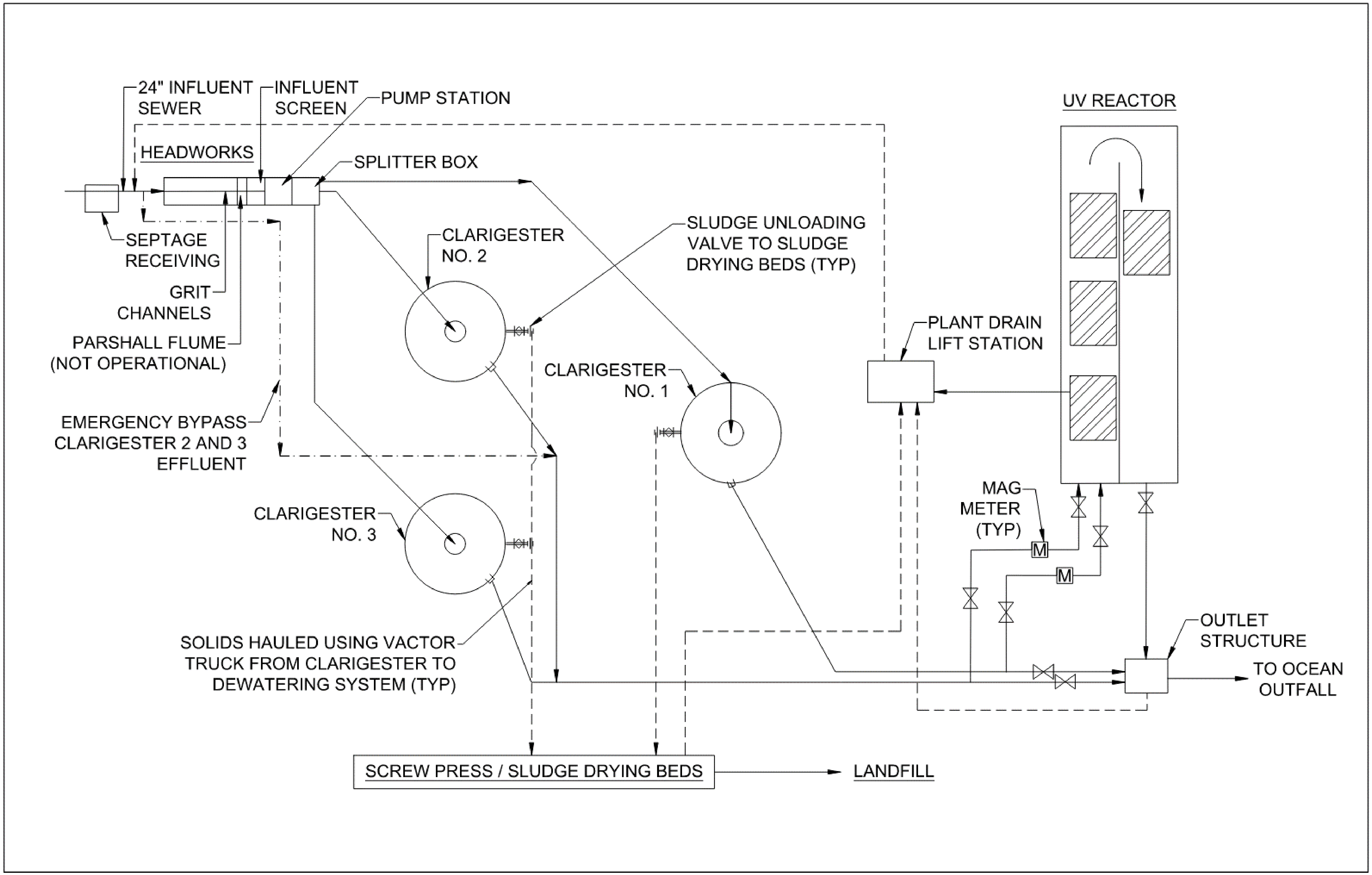
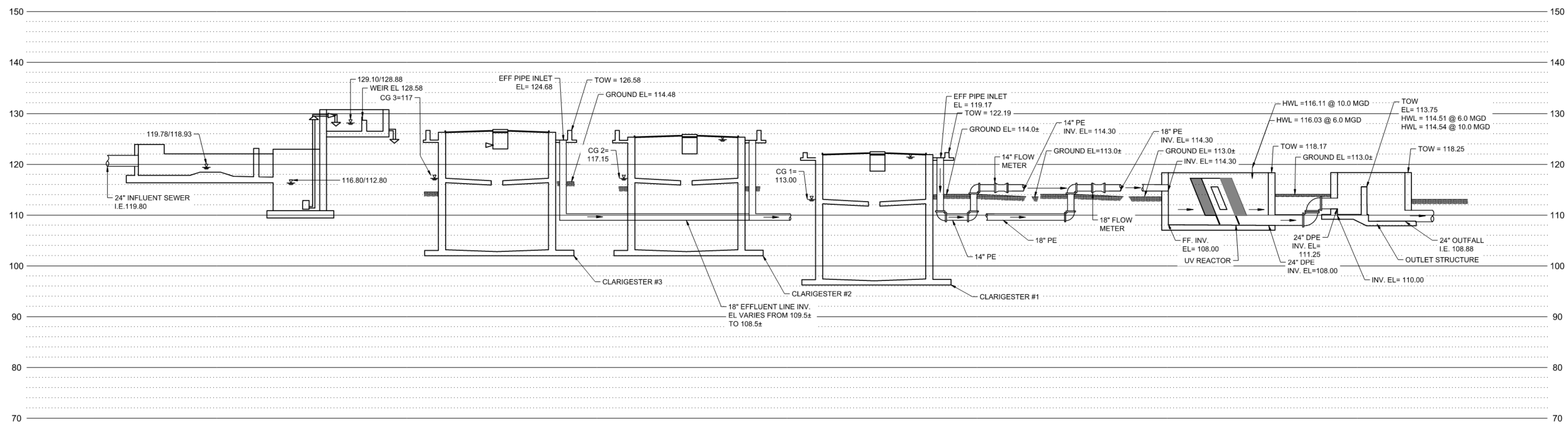


Figure 6-2: Tafuna WWTP - Process Flow Diagram



NOTE: THIS HYDRAULIC PROFILE IS BASED ON ELEVATIONS REPORTED IN PREVIOUS STUDIES (COE & VAN LOO, 2012 AND COE & VAN LOO, 2016)

Figure 6-3: Tafuna WWTP - Hydraulic Profile

6.1.2 Headworks

6.1.2.1 Description

The Tafuna WWTP receives sewer primarily from the collection system and some from the septage receiving station. ASPA's sewer division brings septage from septic tanks and grease traps to the plant in vactor trucks. Approximately three loads of septage per day are dumped directly into the concrete bay, passing through the grating and entering the sewer system.

The Headworks consist of two parallel trains of grit channels, automatic screens with wash press and bagger, an influent pump station, and a splitter box shown in **Figure 6-4**. Only one train is operational during low-flow conditions, and both trains are operational during high-flow conditions.

***Figure 6-4:* Tafuna WWTP – Headworks**

The first treatment process in the headwork is the grit channels. The influent flow is split into two parallel grit channels designed to separate inert, heavy particles such as sand, gravel, and grit from the wastewater stream. The grit particles remain at the bottom of the channel, whereas the wastewater goes through into the screens. The settled grit is manually removed from the channels every three weeks and discarded on the ground next to the grit channels.

Two new automatic bar screens (Rake Max by Huber Technologies) with ½ inch clearance were added in 2017. Each grit channel feeds into an individual screen. The capacity of each screen is 10 mgd. The material separated by both screens is passed to a wash press unit, where it is washed, compacted, and then dumped into a 30-gallon dumpster. The screenings from the dumpster are disposed of every two days. Operations staff noted that the hand-off-auto (HOA) and manual run switch for the wash press located at the headworks does not work and needs to be repaired. Currently, the operator runs the wash press from the control room. An ultrasonic sensor can automatically turn on the influent screens by measuring the water depth in the channel upstream. The screens operate in manual mode since the ultrasonic sensor is not functional. Because of the high humidity in American Samoa and salty air due to the proximity to the Pacific Ocean, the metal surfaces of the screen and electrical panels are corroded, as shown in **Figure 6-5**.

Figure 6-5: Tafuna WWTP – Screens in Parallel Channels

A Parshall flume is located in each channel before the screen. However, the flumes are not being used for influent flow measurement because the ultrasonic flow measurement device was not working in either channel. The ultrasonic sensor for the influent screen is conveniently located right at the beginning of the Parshall flume and could be calibrated to measure the influent flow rate coming into the treatment plant. However, there is no drop in elevation between the Parshall flume and the screens, so the screens have the potential to back flow up into the flumes rendering them unable to accurately measure the influent flow. J-U-B did not observe that the screens were shown on previous iterations of the hydraulic profile. Thus, the addition of the screens has removed the ability of the flumes to measure flow in their current configuration. The effluent flow meter is used to measure plant flow. The operating conditions of the effluent flow meter are discussed in **Section 6.1.4**.

The influent pump station consists of four submersible centrifugal pumps located in a wet well. All of the pumps were recently replaced in 2021. The pump size and operating conditions are summarized in **Table 6-1.** The pressurized wastewater is pumped to an elevated splitter box with weirs, which splits the flow into three streams. The screened wastewater then flows to each clarigester by gravity.

6.1.2.2 Design Criteria

Table 6-1 summarizes the design conditions of the equipment in headworks.

Table 6-1: **Headworks Design Conditions**

Parameter	Design Value
Grit Channel	
Quantity	2
Capacity, each (mgd)	3
Dimension, each (ft)	35 ft (length), 3 ft (width), 5.5 ft (depth)
Automatic Screens	
Manufacturer	Huber Technology (Model: RakeMax)
Quantity	2
Type	Mechanical Bar Screen
Capacity, each (mgd)	10
Clear Opening (inch)	½
Washpress	
Quantity	1
Capacity, each (cf/hr)	140
Wash Water Demand	16 gpm @ 60 psi
Influent Pump Station	
Manufacturer/Model Pump 1 and 2: Pump 3 and 4:	Flygt NP 3153 LT 3 NP 3127 LT 3
Quantity	3 Duty / 1 Standby
Type	Submersible Centrifugal
Capacity Pump 1 and 2: Pump 3 and 4:	 905 gpm at 30.2 ft TDH 2470 gpm at 17.2 ft TDH
Rated Power (HP) Pump 1 and 2: Pump 3 and 4:	 7.5 15

6.1.2.3 Observed Deficiencies

The following deficiencies were noted during the facility tour and discussions with operations staff:

- There is no flow meter to measure the actual influent flow coming into the plant accurately.
- The operations staff shared that the ultrasonic sensor is not currently working because of power fluctuations. This would enable the screens to be used automatically.
- Wet wipes are a big problem at the lift stations and the plant.

- The exposed electrical and metallic areas of the equipment at the headworks are corroded. Some metal is coated in wax.
- The manual run and HOA switch for the wash press at the headworks is not working and needs to be repaired.
- There is no grating over the grit channels, which is a safety hazard. Install FRP grating over the grit channels.
- The operator expressed the need for a larger wet well for the influent pumps. .
- There are no spare parts for the influent pumps.
- There is no influent refrigerated composite sampler. Typically, WWTPs use a composite sampler to automatically sample the flow at programmed intervals. Also discussed in **Section 6.1.8.6**.
- There is no WWTP SCADA system to monitor process areas remotely, alarm when processes are not functioning as designed, and record data, such as influent and effluent flow. Also discussed in **Section 6.1.8.6**.

6.1.3 Clarigester

6.1.3.1 Description

Primary treatment at the Tafuna plant is achieved with three clarigesters manufactured by Ovivo, as shown in **Figure 6-6**. A clarigester is a cylindrical two-story tank with a common mechanical drive for both compartments. The upper compartment is for clarification, and the lower compartment is for digestion. The screened sewage enters the clarifiers from the central influent well, and then the clarified effluent overflows the weir at the tank periphery. The settleable solids sink in the digester compartment, where the solids undergo anaerobic digestion. The extent of anaerobic digestion is not monitored. The settled solids from the digester compartment of the clarigester are hauled to the dewatering area with vactor trucks.

Figure 6-6: **Tafuna WWTP – Clarigester**

The scum floating at the top of the clarifier compartment and the supernatant from the digester compartment are passed to the scum and supernatant pit. The scum pump located in this pit can pump either scum or supernatant to the clarifier or the digester compartment by operating the three-way valve connected to the two discharge lines.

Clarigester 1 and 2 were constructed in 1977, whereas clarigester 3 was constructed in 1994. The following retrofits have been done for the clarigesters in recent years:

- Clarigester 1: Internal piping, shaft, and skimming arms were replaced. Influent wells were replaced.
- Clarigester 2: Request For Quote (RFQ) was issued on 09/18/2024 to replace all internal moving parts of the clarifier and the digester.
- Clarigester 3: Influent wells were replaced.

6.1.3.2 Design Criteria

Table 6-2 summarizes the design conditions of the clarigesters.

Table 6-2: **Tafuna WWTP - Clarigester Design Conditions**

Parameter	Design Value
Clarigester	
Quantity	3
Type	Center Feed, Peripheral Weir Clarifier on Anaerobic Digester
Manufacturer	Ovivo (Model: Dorr-Oliver Clarigester)
Clarigester – Clarifier Section	
Diameter (ft):	45
Sidewater Depth (ft): Clarigester 1 Clarigester 2 & 3	 8 9
Volume (gal): Clarigester 1, each Clarigester 2 & 3, each	 95,123 107,014
Clarigester – Anaerobic Digester Section	
Diameter (ft)	45
Height (ft)	12
Volume (gal), each	142,685
Scum Pump	
Manufacturer	Flygt
Quantity	1 per clarigester (3 total)
Capacity (GPM)	150
TDH (FT)	19
Power (HP/V/KW)	3 / 208 / 2.2

6.1.3.3 Observed Deficiencies

The following deficiencies were noted during facility tours and discussions with operations staff.

- The operator reported frequent blockage of the 3-way valve and pump. The scum pits need to be rehabilitated with new piping and pumps.
- All scum pumps are old and need to be replaced.
- The operator reported that there is an uneven flow split to the clarigesters.
- Clarigester 3 is in need of a new drive.
- The handrails and grating on the floor of the walkways, the steps on the metal stairs of the walkway and the handrail around the clarigester are currently made of wood. They are replaced every two years or so. The railings and walkways are generally dilapidated and in poor condition.

- The operators noted that wet solids from the clarigester cannot pass the paint filter test and, therefore, cannot be landfilled directly from the clarigester. This is typical for solids from the primary clarifiers.

6.1.4 Flow Measurement

6.1.4.1 Description

Wastewater flow is measured with two McCrometer electromagnetic flowmeters, also known as magmeters, upstream of the UV disinfection system, as shown in **Figure 6-7**. A 14-inch magmeter measures flow from Clarigester 1, and an 18-inch magmeter measures flow from Clarigesters 2 and 3. The flow meter-rated capacity and the expected flow in the respective pipeline are summarized in **Table 6-3**.The expected flow during the average day and peak hour conditions falls within the flow meters' rated capacity. The plant operator manually records the volume readings from the flow totalizer and subtracts them from the volume readings from the previous day to calculate the daily wastewater flow through each pipe. The daily flow rates calculated from the mag-meter readings are added to obtain the daily plant flow rate. The piping is exposed in this area and is showing signs of external corrosion.

Figure 6-7: **Tafuna WWTP - Effluent Magmeters**

WWTPs are typically designed around the influent flow rate coming into the plant. The clarigester basins could attenuate peak hourly flows, which would not be represented in the effluent flow meter downstream of the UV disinfection unit. The peak hourly flow is likely higher than the recorded effluent flow. Similarly, there is no guarantee that the daily readings were taken exactly 24 hours apart. Variability in the time of measurement can result in an inconsistent and unreliable understanding of the daily flow rates. Some process units like the headworks and UV disinfection are designed and evaluated around peak hour flow. Since the flow is recorded daily, peak hour flow is not captured in the current flow recording practice.

6.1.4.2 Design Criteria

Table 6-3 summarizes the design conditions of the effluent flow meter.

Table 6-3: **Tafuna WWTP – Flow Meter Design Conditions**

Parameter	Value
Flow Measurement	
Manufacturer	McCrometer (Model: Ultra Mag)
Rated Capacity: 14-in 18-in	 90.1 - 14,410 GPM 149 - 23,820 GPM
Expected Existing Flow in the Pipe[1]: 14-in 18-in	 295 – 1,145 GPM 690 – 2,675 GPM

[1] Expected Flow is calculated from the total measured flow during average day and peak hour conditions, assuming 30% of the flow is contributed by Clarigester 1 and 70% by Clarigester 2 & 3. Flow recordings of each magmeter were not provided.

6.1.4.3 Observed Deficiencies

The following deficiencies were noted during facility tours and discussions with operations staff.

- The effluent flow meter is the only flow measurement at the WWTP. Additional measurements of the plant influent should be added. See **Section 6.1.2.3**.
- The piping is exposed in this area and is showing signs of external corrosion.

6.1.5 Disinfection

6.1.5.1 Description

Following primary treatment, the effluent undergoes ultraviolet radiation (UV) disinfection for virus and pathogen inactivation. The UV system is manufactured by Trojan and was installed in 2017. The system is contained in an above-ground concrete channel, operates under gravity flow, and consists of a single channel looped in a U-shape with four banks and space allocated for a future 5th bank, as shown in **Figure 6-8** and **Figure 6-9**. Each bank has 32 bulbs, which are automatically cleaned every 2 hours. The metal shed housing the UV controls, the metal cover of the UV channels, and the electrical panels of the UV unit are severely corroded. The operating conditions of the UV system are summarized in **Table 6-4**. Since there is no redundant disinfection channel, UV system maintenance poses significant challenges. Because of the amount of debris settling in the UV channel, the operator drains the channel using the mud valve at the bottom of the channel into the plant drain lift station every 2 to 3 months. Additionally, the UV system is bypassed annually to thoroughly clean the channel, which involves removing debris using a Honey Wagon and an operator going into the channel and manually scrubbing the walls and floors.

Figure 6-8: **Tafuna WWTP - UV Disinfection System**

Figure 6-9: **Tafuna WWTP – Corrosion of the Metal Covering the UV Channels**

6.1.5.2 Design Criteria

Table 6-4 summarizes the design conditions of the UV disinfection system.

Table 6-4: Tafuna WWTP - Disinfection Design Conditions

Parameter	Design Value
UV-Disinfection	
Manufacturer	Trojan (Model: TrojanUVSigna)
No. of Channels	1
Banks per channel	4
Lamps per bank	32
Capacity, each channel (MGD)	6.0 MGD
Disinfection Goal, no./mL	3700 Enterococci / 100 ml
Design Minimum UVT, %	19.3% at 253.7 nm (minimum)

6.1.5.3 Observed Deficiencies

The following deficiencies were noted during facility tours and discussions with operations staff:

- During the site visit, JUB noticed that the UVT (87.71 %) and dose (899.74 mJ/cm2) of the UV units for Tafuna WWTP (flow of 1 mgd that day) were extremely high.
- The metal shed building and metal cover of the UV system are heavily corroded.
- Wastewater disinfection is achieved with the existing single-train UV disinfection system. There is no redundant UV train or backup chlorination system, making it difficult to clean and provide maintenance on the existing train.
- Backup power from the generator is not supplied to the air conditioning (AC) in the UV control room. All electrical components should always have AC to prevent overheating during electrical power outages.
- The UV channel's existing telescoping valve is not working. Once the channel is isolated, this valve helps drain it to maintain and clean the UV banks.
- Floatables/grease get caught upstream of the lamps and must be removed manually with a net.
- The UV disinfection process consumes a large amount of energy. The operator has expressed concern regarding the electrical cost of operating this system. High energy cost could signal overdosing of UV.

6.1.6 Outlet Box and Outfall Line

6.1.6.1 Description

After UV disinfection, the effluent wastewater flows into an outlet structure on site. An emergency bypass line with valves could divert flow from the headworks navigto the outlet structure. The outlet structure was in good condition during the site visit. The effluent is then discharged to the Vai Cove in the South Pacific Ocean via a 24-inch diameter HDPE pipeline that extends approximately 1,600 feet from the treatment plant and is located on the south side of Tutuila Island adjacent to the Pago Pago International

Airport (GDC, 2012). The diffuser manifold section is approximately 61 feet long. **Figure 6-10** shows the approximate location of the outfall line and diffuser.

In 2004, using the EPA-approved UFKHDEN model, ASPA estimated the dilution factor to be "187:1 at trapping depth of 16.1 ft for the predicted instantaneous maximum flow of 6.0 MGD" (US EPA Draft Fact Sheet, 2023, Page 13). Using the 2013 UDKHDEN model, ASPA proposed diffuser modification by replacing the existing side diffuser with six 8-inch HDPE blind flanges with 6-inch concentric port diffusers across approximately 50 feet and replacing the 24-inch blind flange with a 12-inch (I.D. 11-inch) end-gate port (GDC, 2016; US EPA Draft Fact Sheet, 2023, Page 13; Crux Diving, eTrac, 2019). In doing so, ASPA estimated the "flux-averaged critical initial dilution of 290:1 at trapping depth of around 9.6 feet" (US EPA Draft Fact Sheet, 2023, Page 13). ASPA made diffuser modifications in 2019. However, EPA determined that the 7-diffuser port (six diffusers and the end port) "do not appear to be functioning as a uniform line source and discharge from 11-inch end-gate port is dominant (i.e., 46% of total flow discharge)" (US EPA Draft Fact Sheet, 2023, Page 13). Hence, EPA granted a dilution factor of 109:1 for the instantaneous maximum flow through the modified diffusers based on the performance evaluation using the CORMIX model (a more detailed modeling software than UFKHDEN) (US EPA Draft Fact Sheet, 2023, Page 13). Dilution factor is one of the factors used by EPA to finalize the limit of contaminant loading in the wastewater effluent. Hence, a higher dilution factor can yield a comparatively less stringent effluent limit.

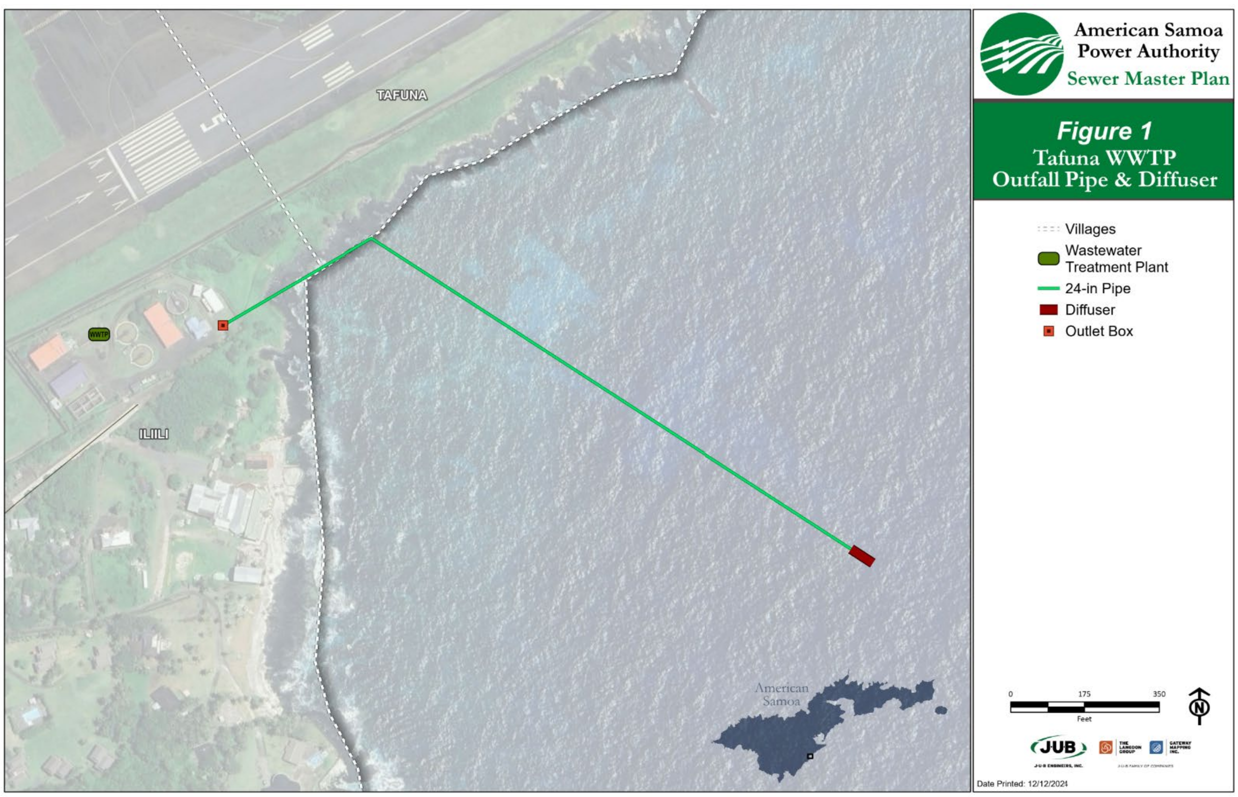


Figure 6-10: **Tafuna WWTP – Outfall and Diffuser Approximate Location (Draft NPDES Permit, 2024)**

6.1.6.2 Observed Deficiencies

- There is no effluent refrigerated composite sampler. Typically, WWTPs use a composite sampler to sample the flow automatically for flow-proportioned sampling. Also discussed in **section 6.1.8.6**.
- The dilution factor appears to be limited due to the majority of the flow going through the end port instead of being somewhat equally distributed across the diffusers.

6.1.7 Solids Dewatering and Disposal

6.1.7.1 Description

The settled solids from the anaerobic digester compartment of the clarigesters are hauled to the drying beds in vactor trucks. The sludge from the four clarigesters at the Utulei WWTP is also hauled 3-4 times a week to the Tafuna WWTP via a vactor truck for dewatering and disposal.

Because of the wet and humid weather in American Samoa, drying beds are not efficient at reducing the water content of the sludge. Dewatering is likely achieved more from water drained from the sludge in the drying beds over time than solar evaporation. Sludge is pumped into the drying beds at the height of 1 ft to 1.5 ft, and the sludge is removed from the beds at the height of 4-in to 6-in. The solids in the drying beds take approximately three months to dry. The roof of the shed for the drying beds was replaced with aluminum in October 2022. The dried solids are disposed at the landfill which is approximately a ten-minute drive away. The landfill, also managed by ASPA, does not charge any tipping fee for biosolids disposal.

During the site visit in January 2024, a dewatering building, set to house one new screw press, was under construction. Dewatering with a screw press would produce sludge with lower moisture content and reduce the operational time and labor associated with solids management. The filtrate from the screw press will presumably flow by gravity to the plant drain lift station. The screw press was operational fur dewatering during the site visit in January 2025 and is shown in **Figure 6-11**.

Figure 6-11: **Tafuna WWTP – Screw Press**

The screw press was designed to dewater the sludge from the Tafuna WWTP only. According to ASPA, a high-pressure flexi hose will be used to connect the sludge draw point of the clarigesters to the screw press inlet line. ASPA is planning to continue using the sludge drying beds for drying sludge from the Utulei WWTP and as a redundant dewatering system for the screw press.

6.1.7.2 Design Criteria

Table 6-5 summarizes the design conditions of the solids dewatering and disposal facility.

Table 6-5: **Tafuna WWTP - Solid Dewatering Design Conditions**

Parameter	Design Value
Estimated Digested Sludge Production	
Tafuna WWTP (Maximum Month, 5% solids)	11,700 dry lb / 28,000 gallons (per month)
Utulei WWTP (Maximum Month, 5% solids)	10,300 dry lb / 25,000 gallons (per month)
Screw Press[1]	
Quantity	1
Manufacturer	Huber (Model: Q-Press 440.2)
Nominal Hydraulic Loading Rate	29 gpm at 1% feed solids
Nominal Alternate Hydraulic Loading Rate	18 gpm at 2% feed solids
Nominal Solids Loading Rate	145 lb/hr at 1% feed solids
Nominal Alternate Solids Loading Rate	180 lb/hr at 2% feed solids
Average Washwater Demand	35 gpm for 46 seconds at 72.5 psi
Estimated Operating Time	3 days per week, 8 hours per day
Feed Pump[1]	
Quantity	1
Manufacturer	NETZSCH NM038BY01L06B
Flow rate	18-29 gpm at 45 psi
Motor Data	3 HP, 460 VAC, 60 Hz, 3 pH
Polymer System[1]	
Quantity	1
Manufacturer	Velodyne VM-2P-300-D
Neat Polymer Pump Motor	½ HP, 90 VDC
Mixer Motor	½ HP, 90 VDC
Drying Beds (ASPA,2021)	
Number of Sludge Drying Sheds	4
Dimension of Shed, each	92 ft x 40.6 ft x 2.8 ft
Number of Bays in each shed	Building 1 (older): 4 Building 2-4 (newer): 3

[1] Based on the design criteria listed in the screw press submittal by Huber (Huber, 2022).

6.1.7.3 Observed Deficiencies

The following deficiencies were noted during facility tours and discussions with operations staff:

- A flexible HDPE plastic pipe is used to connect the new screw press and the Tafuna digesters. The screw press can only connect to one clarigester at a time and the same pipe is moved to connected to all clarigester.
- The conveyor and dewatered solids are not covered. During rain event, the solids mix with rain creating a pool of slurry pile which is difficult to manage.
- The dewatered solids are dumped directly onto the ground instead of a dumpster.
- The sludge drying beds, which were designed to be solar evaporators, in a tropical environment are not efficient at removing water from solids.

6.1.8 Support Facilities

6.1.8.1 Operations Building

The Tafuna operation building needs upgrades and to be remodeled to accommodate new equipment that is currently congesting the existing building. The operation building will also need to accommodate the new SCADA system.

6.1.8.2 Electrical and Control Systems

The plant has 3-phase power. There is a 250-kW diesel generator on-site, **Figure 6-12**, which was manufactured by Cummins and installed in 2015. Power outages are frequent and can last a few hours several days a week. The generator starts up every two weeks. In case of a power outage, the backup generator automatically turns on but shuts down after five minutes. According to ASPA's electrical team, the frequency of the generator dips down to 51 Hz when the third UV bank is turned on, and the generator struggles to run before shutting off. After that, the generator needs to be turned on manually. ASPA’s mechanic and electrical team conducted an online full load test for around 20 minutes on May 15th, 2024. The load was 160 kW and 180 A, which the generator handled adequately, however, the actual plant load is greater than 160KW and the existing generator cannot provide the required load (full load for the existing generator is 300 A). On the same day, the fuel filters, air filters, and some rusted claps on the air intake manifold circuit were also replaced, and the generator was fully serviced.

There is no Supervisory Control and Data Acquisitions (SCADA) system in the plant. SCADA is a centralized digital network that gathers, analyzes, compiles and controls various process units.

Figure 6-12: **Tafuna WWTP – Generator Set**

6.1.8.3 Lab/Sampling

Weekly influent and effluent wastewater samples are collected and tested for parameters required by their permit, which are described in detail in **Chapter 4**. The influent samples are collected by hand upstream of the headworks, and the effluent samples are collected downstream from the UV units at the location of the UVT analyzer. Both influent and effluent grab samples are collected every hour for 8 hours to create respective composite samples at both locations. Only samples required by the permit are tested on a regular basis. There is no EPA-certified lab in American Samoa. BOD_5, TSS, pH, salinity, and turbidity are tested in-house in a laboratory at the Utulei WWTP control building. Oil and grease samples are shipped to Hawaii for testing every quarter. Wastewater samples for WET testing are shipped to California.

6.1.8.4 Utility Water System

Potable water is used as utility water around the plant for equipment washdown and cleaning. ASPA recently designed and installed two 2,500-gallon water storage tanks, a booster pump, and a 119 gallon hydropneumatic pressure tank to maintain utility water pressure at the plant for equipment washdown. The utility water system provides sufficient pressure for water use around the plant. **Figure 6-13** shows the booster pump for the utility water system.

Figure 6-13: **Tafuna WWTP – Booster Pump for Utility Water System**

6.1.8.5 Plant Drain Lift Station

The plant drain lift station (PDLS) receives drain wastewater from the control building, UV disinfection channel, sludge drying beds and screw press building (presumably). There is a submersible FLYGT pump in the PDLS, which discharges to the headworks through a 6-inch line. There is also a piping connecting the scum pit of the clarigesters to the plant drain lift station, but according to ASPA it is rarely used. The known design conditions of the PDLS are shown in **Table 6-6**.

Figure 6-14: **Tafuna WWTP – Plant Drain Lift Station**

Table 6-6: Tafuna WWTP – Support Facilities

Parameter	Design Value
Utility Water System	
Manufacturer/Model	Grundfos (CRN10-4H-G22-L-E-PQQE)
Pump Quantity	1
Rated Capacity (gpm)	52.8
Rated Power (HP)	3
Plant Drain Lift Station - Pumps	
Manufacturer/Model	Flygt, NP3102.181 MT
Quantity	1 Duty / 1 Standby
Type	Submersible
Rated Capacity (GPM)	550 gpm at 28' TDH
Rated Power (HP)	5 HP
Plant Drain Lift Station - Wet well	
Diameter (ft)	4
Depth (ft)	8

6.1.8.6 Operational Equipment

ASPA owns four vactor trucks, which are referred to as "honey wagons." These trucks are used to haul raw sewage to the septage receiving station in the headworks and sludge from the clarigesters from both plants to the sludge drying beds. One of the vactor trucks is brand new, while another truck does not work well. The operator reported that the availability of the vactor trucks is sufficient for current operations. ASPA hires a dump truck to haul thickened sludge from the drying beds to the landfill. ASPA also has a backhoe to remove dewatered sludge discharged from the sludge press and load it onto the dump truck.

6.1.8.7 Observed Deficiencies

Operations Building:

- The building is in poor condition and congested.

Electrical and Control Systems:

- In case of a power outage, the backup generator automatically turns on but shuts down after five minutes. According to ASPA's electrical team, the frequency of the generator dips down to 51 Hz when the third UV bank is turned on, and the generator struggles to run before shutting off. After that, the generator needs to be turned on manually. ASPA conducted a load test in May 15th, 2024. The load was 160 kW and 180 A, which the generator handled adequately.

- The incoming power supply is variable and sporadic. It is recommended to filter incoming power to protect downstream equipment.
- A new SCADA system is needed to record and archive process data.

Lab/Sampling:

- Hourly grab samples are collected manually to create a composite sample. The new draft permit for Tafuna WWTP requires 24-hour composite samples. Manually collecting hourly samples for 24 hours is not feasible.

Utility Water Systems:

- There is no redundant pump.
- The operator reported issues with pressure switches.

Plant Drain Lift Station:

- The lift station is located at a lower elevation at the treatment plant and has slotted cover with open grating. During heavy rain event, storm water flows into the lift station.

6.1.9 Overall Performance

The overall performance of the plant in meeting the effluent discharge limits based on the current permit is analyzed in this chapter. It is impossible to comply with the draft permit requirements, which include secondary level (85%) removal of TSS/BOD and stringent removal of nutrients with the existing primary level treatment process. Major changes in the infrastructure are needed to achieve compliance with the future permit that possess significant challenges, which are discussed further in the Secondary Treatment Feasibility Study (J-U-B Engineers, 2025).

Graphs of pollutants of concern from the current NPDES permit are included as follows:

- Effluent BOD_5 Concentration: **Figure 6-14**
- Effluent BOD_5 Loading: **Figure 6-15**
- BOD_5 Percent Removal: **Figure 6-16**
- Effluent TSS Concentration: **Figure 6-17**
- Effluent TSS Loading: **Figure 6-18**
- TSS Percent Removal: **Figure 6-19**
- Settleable Solids: **Figure 6-20**
- pH: **Figure 6-21**

Effluent quality has generally satisfied the permit limits, with the exception of four exceedance instances (7% of the reported data) of average monthly BOD_5 concentrations and one instance of reduced BOD_5 % removal (2% of the reported data) in the last five years from Oct. 2018 till Sep. 2023. It is recommended that ASPA closely monitor the concentration of BOD in the effluent. Addition of chemical coagulants may assist in BOD settling if the concentrations of BOD continue to exceed the effluent concentration for multiple instances in the future. For this, chemical mixing and dosing pumps and chemicals would be needed. However, the efficiency of chemicals to reduce BOD in primary treatment processes like clarigesters can vary a lot based on the wastewater compositions. Therefore, ASPA should consider this option only if BOD removal declines or continues to be an issue in the future.

Also included is the graph of pollutants with no compliance limit but required by the NPDES permit to report effluent levels for monitoring.

- Oil and Grease: **Figure 6-22**

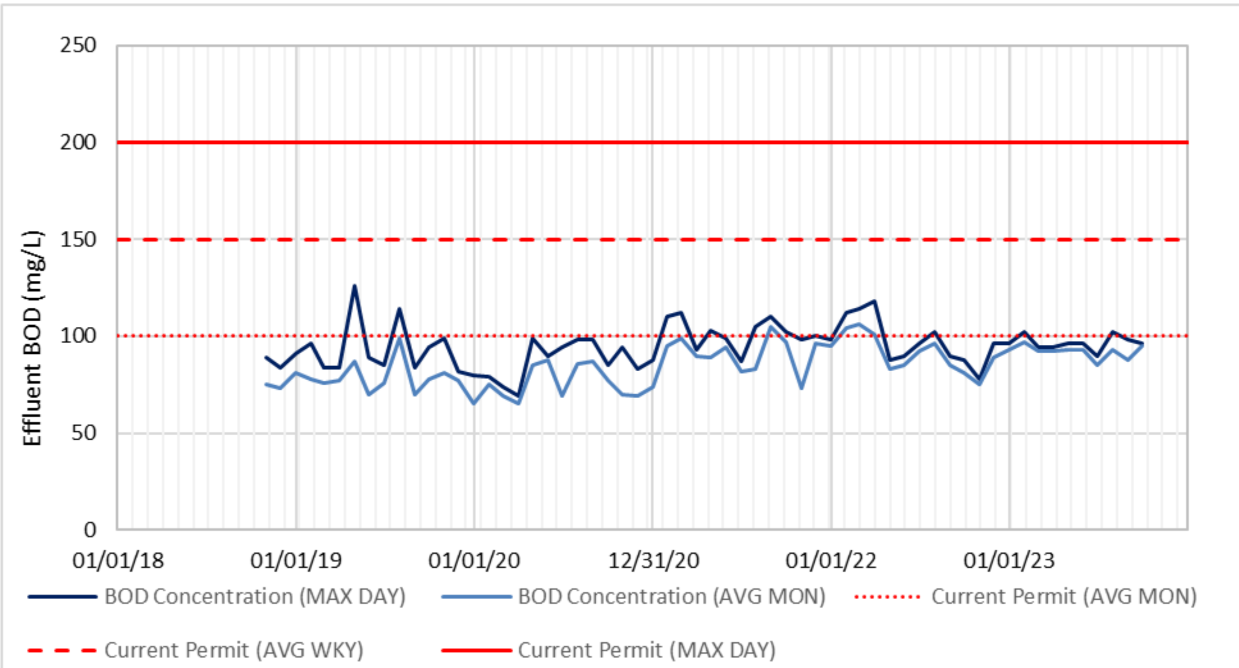


Figure 6-15: **Tafuna WWTP – Effluent BOD_5 Concentration**

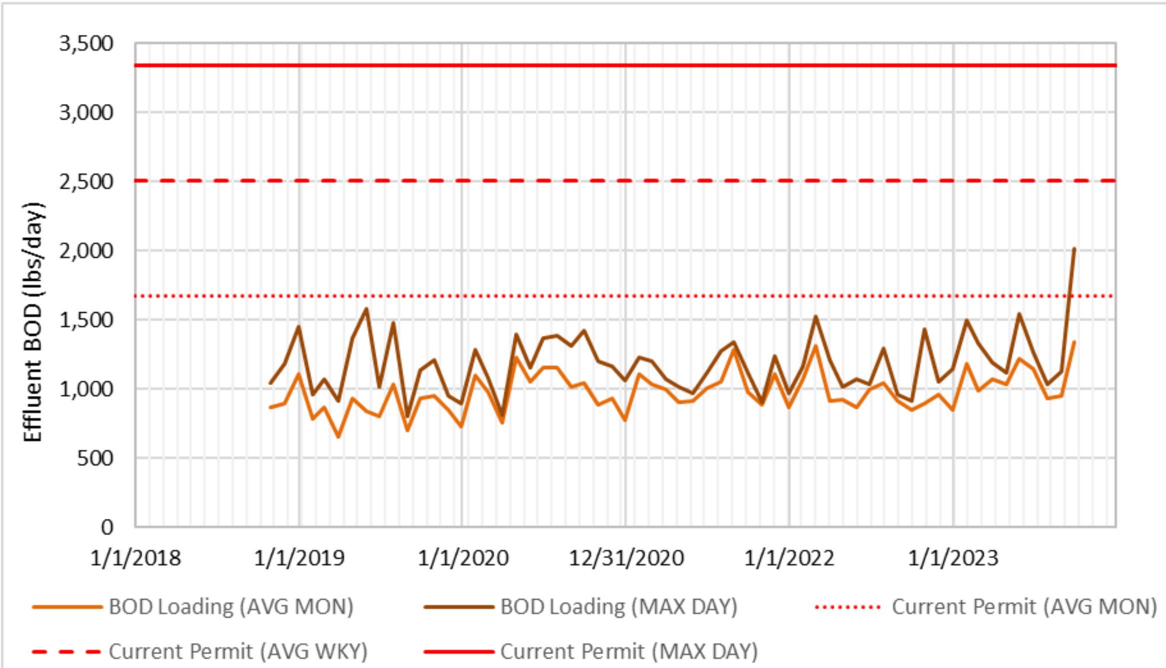


Figure 6-16: **Tafuna WWTP – Effluent *BOD₅* Loading**

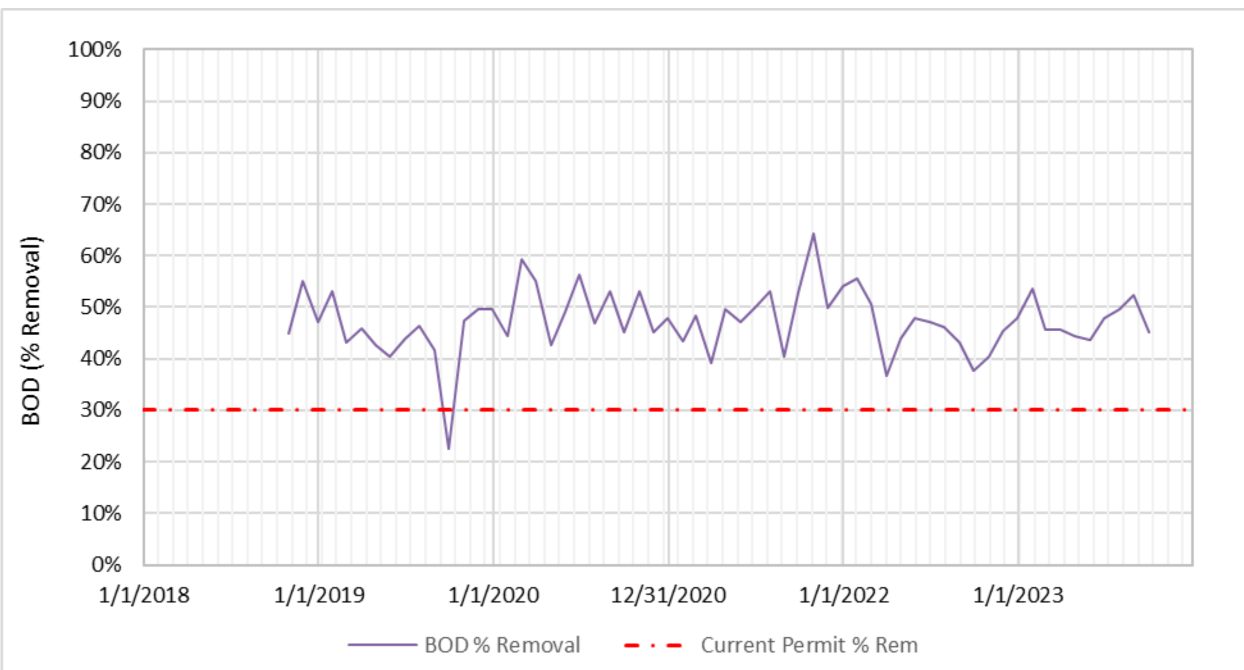


Figure 6-17: **Tafuna WWTP – BOD_5 % Removal**

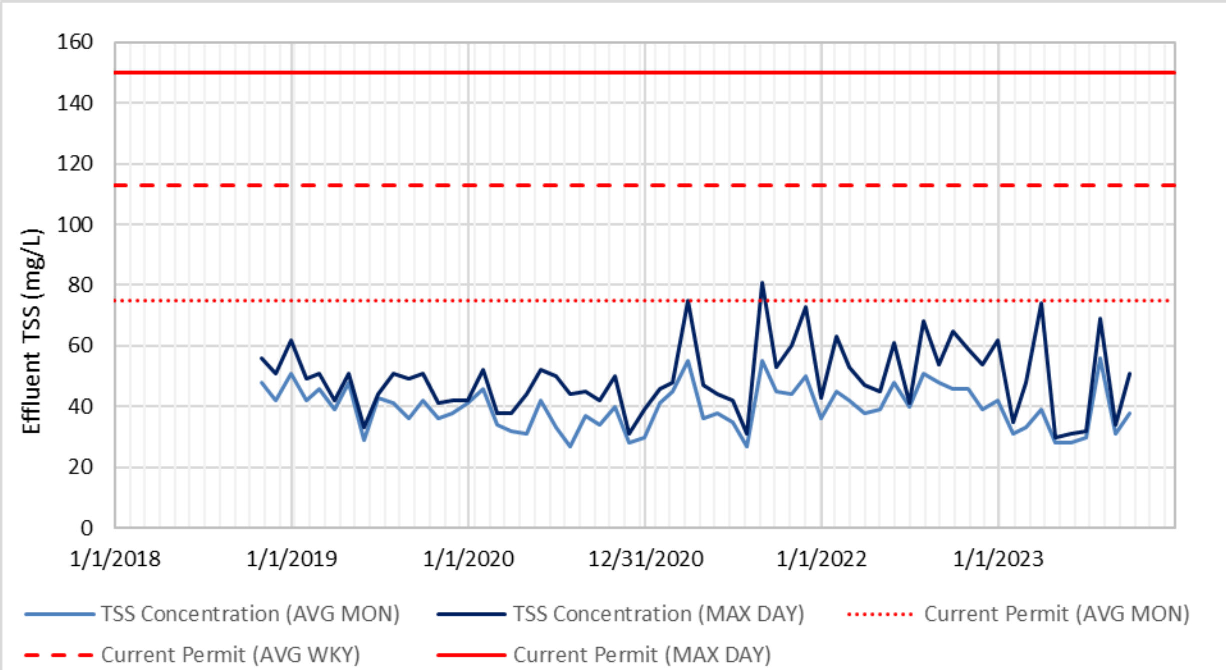


Figure 6-18: **Tafuna WWTP – Effluent TSS Concentration**

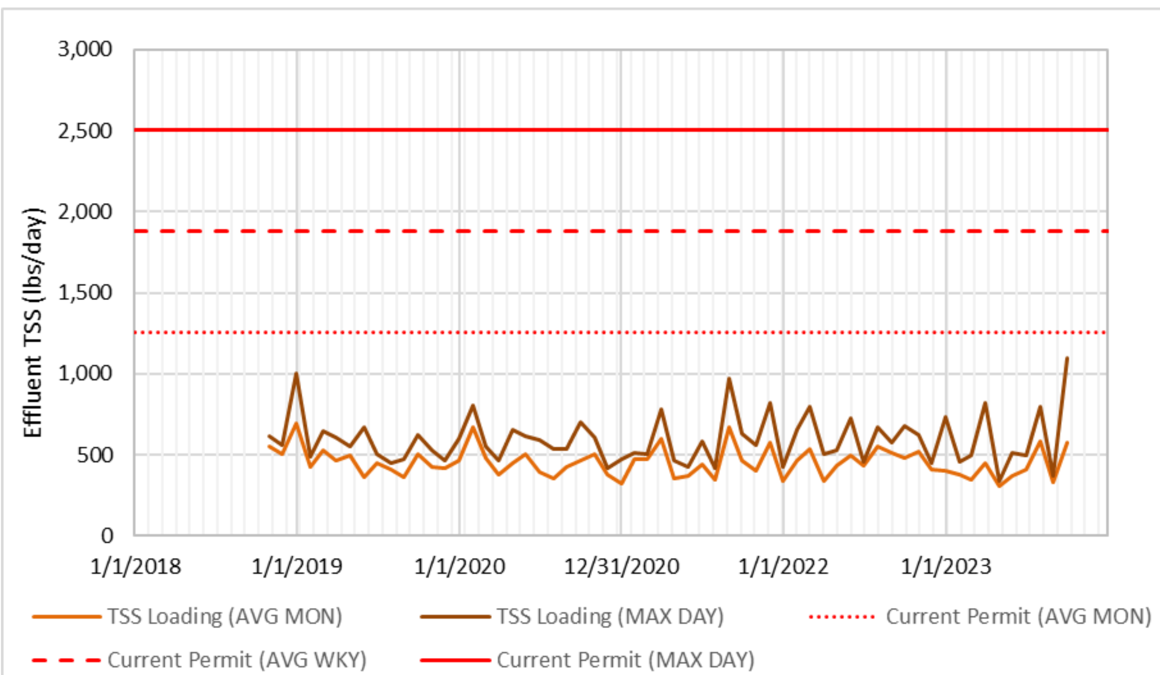


Figure 6-19: **Tafuna WWTP – Effluent TSS Loading**

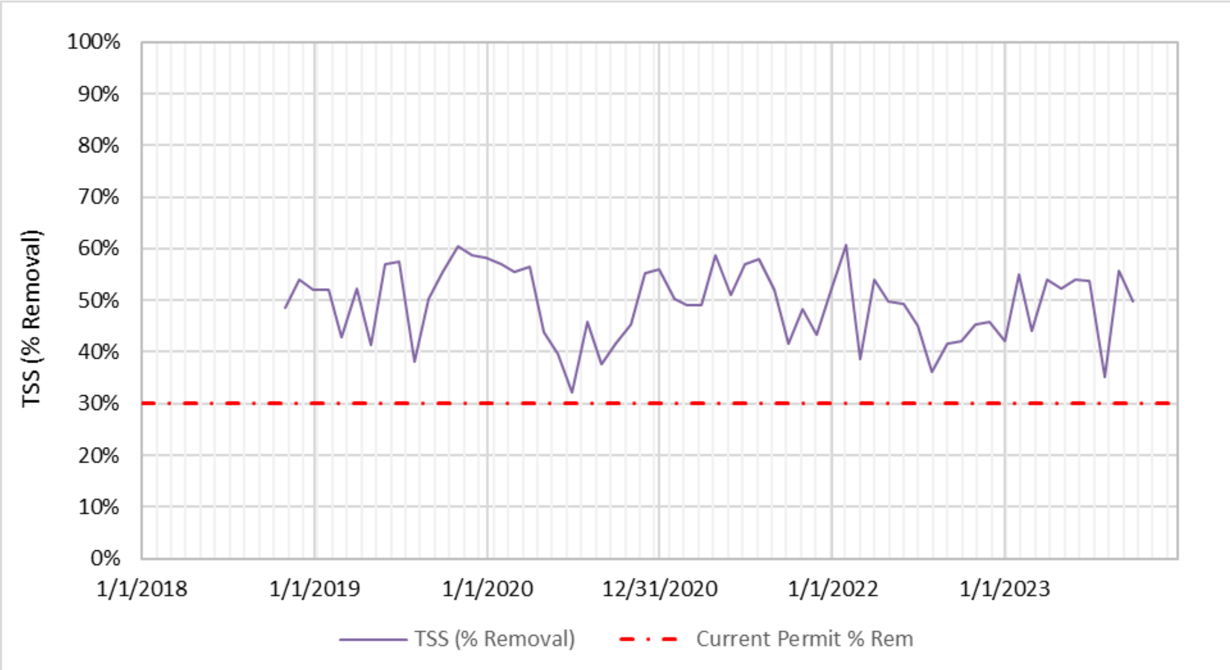


Figure 6-20: Tafuna WWTP – TSS % Removal

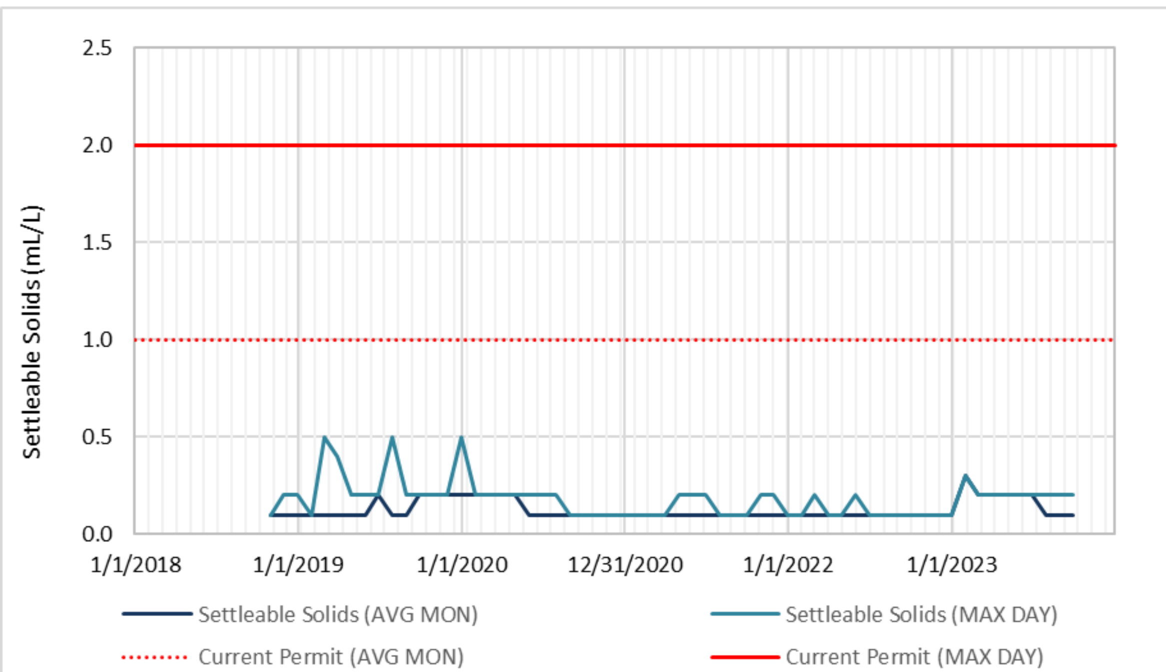


Figure 6-21: **Tafuna WWTP – Effluent Settleable Solids**

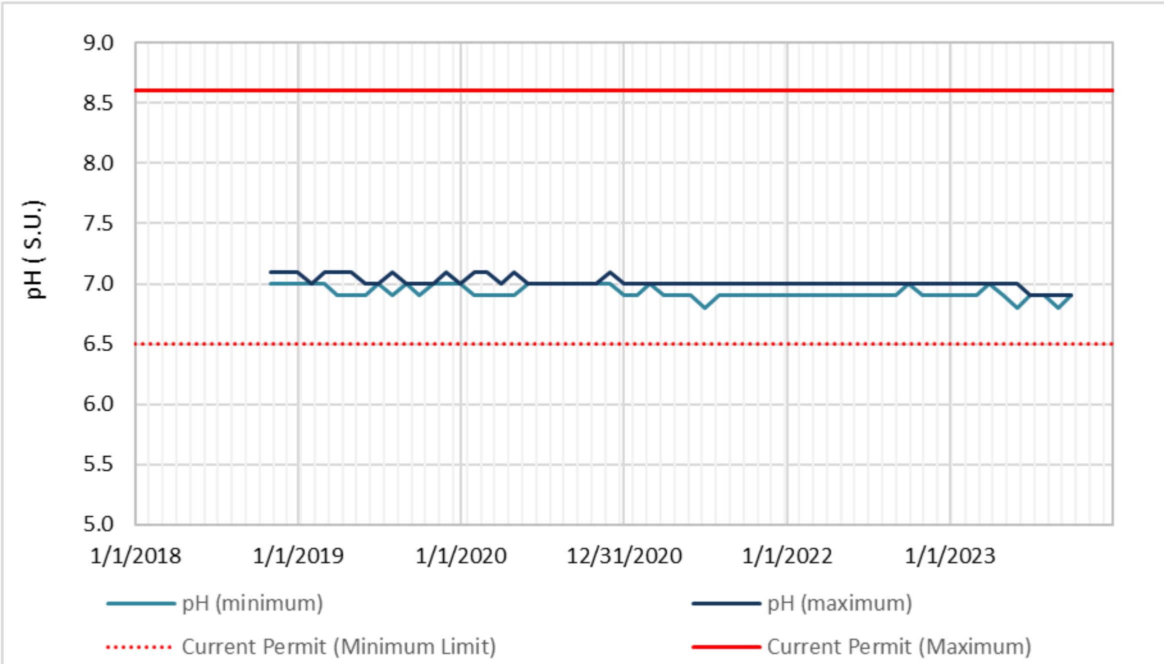


Figure 6-22: Tafuna WWTP – Effluent pH

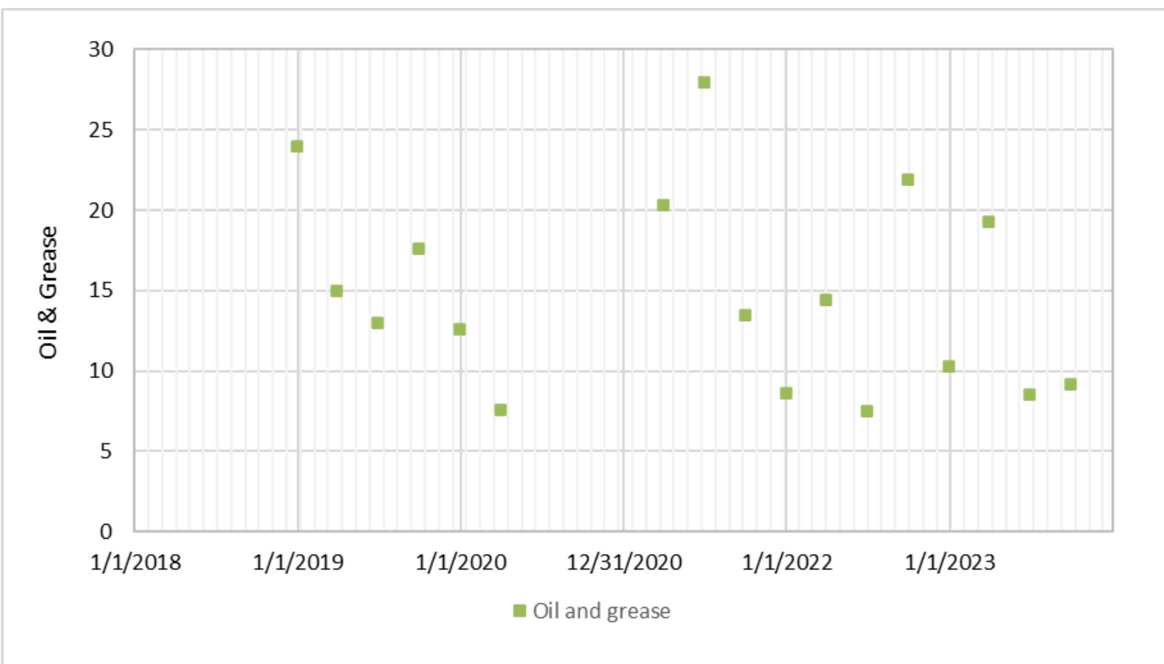


Figure 6-23: Tafuna WWTP – Effluent Oil & Grease

6.1.10 Overall Assessment

The capacities of major elements within each process based on the analysis in the preceding sections are shown in **Figure 6-23** for existing conditions and **Figure 6-24** for future conditions. The increased flow and loading in future conditions are caused of additional of population from extension of the collection system. Therefore, the growth would occur in spurts rather than slow and steady.

The figure includes a dashed black line at 85 percent firm capacity, which is a threshold value typically used to trigger facility planning and subsequent implementation of improvements to maintain adequate treatment capacity. Also included is a red shaded area, which indicates that a component is currently operating at or above 100 percent of the expected capacity. The firm capacity is calculated as the combined capacity of all units for some equipment which includes grit channels, automatic screen, wetwell size, mag meters, UV disinfection, outfall, screw press, and solids drying bed. For other key process equipment, including the influent pump station, clarigesters, scum pump, and plant drain lift station, firm capacity is calculated as the capacity of the combined capacity with the largest unit out of service.

All equipment has adequate capacity under current conditions. The grit channels, the influent pumps, and the pumps at the plant drain lift station exceed the 85% firm capacity limit under current flows. Hence, these units should be prioritized for future upgrades. The incoming future flow is anticipated to exceed the firm capacity of the grit channel and influent pump station in the next 20 years. Although the influent wet well, UV disinfection system, and screw press have sufficient capacity for future flows; the incoming flow capacities of these units are above the 85% firm capacity mark, as shown in the figure below. ASPA should observe the capacities of these processes in the coming years and reevaluate the need for expansion in the next facility plan. The current, future, and firm capacities and the assumptions made to calculate these capacities are documented in **Appendix D-1**.

Table 6-8 summarizes the condition, age, and redundancy provided by the existing infrastructure at the Tafuna WWTP. The typical design life or age is equipment-specific and usually 15- 20 years. In this report, the useful lifespan of the equipment is considered to be 20 years. The condition is based on operator feedback and observations during the January 2024 site visit and is evaluated based on the criteria listed in **Table 6-7**.

Table 6-7: Condition Evaluation Criteria

Ranking	Description
Good	Item is functioning properly; therefore, there is no immediate need for replacement.
Fair	Condition of item is fair; however, it is still functioning as intended. No immediate need for replacement, but it should be included in future maintenance/replacement project lists.
Poor	Condition of item is poor and is not functioning as intended or designed. Immediate replacement of item is necessary.

Additional units are needed for specific processes to meet future conditions, which are noted in **Table 6-8**. Potential improvements addressing the observed deficiencies noted in this section is analyzed in Chapter 8.

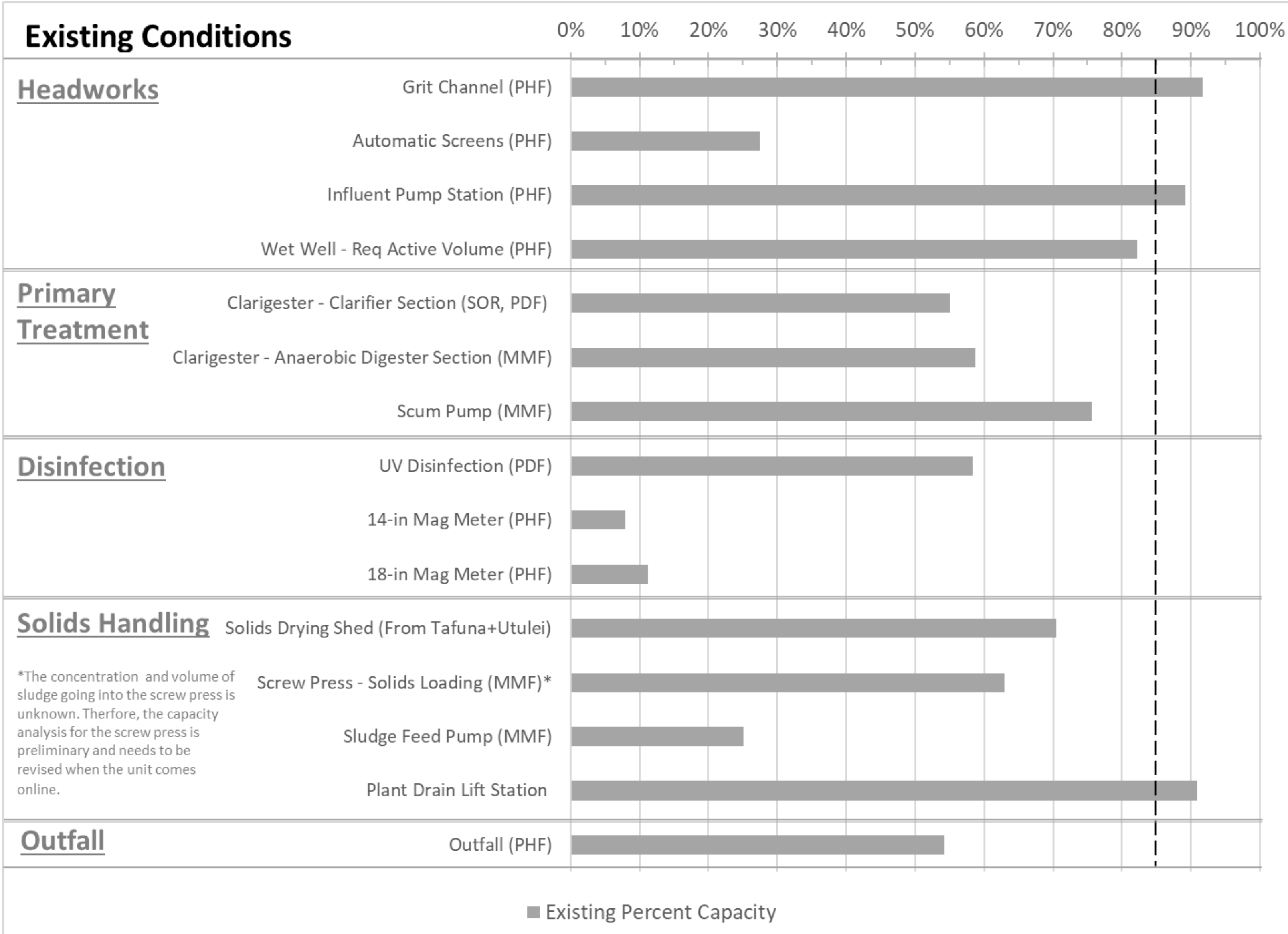


Figure 6-24: **Tafuna WWTP – Capacity at Existing Condition**

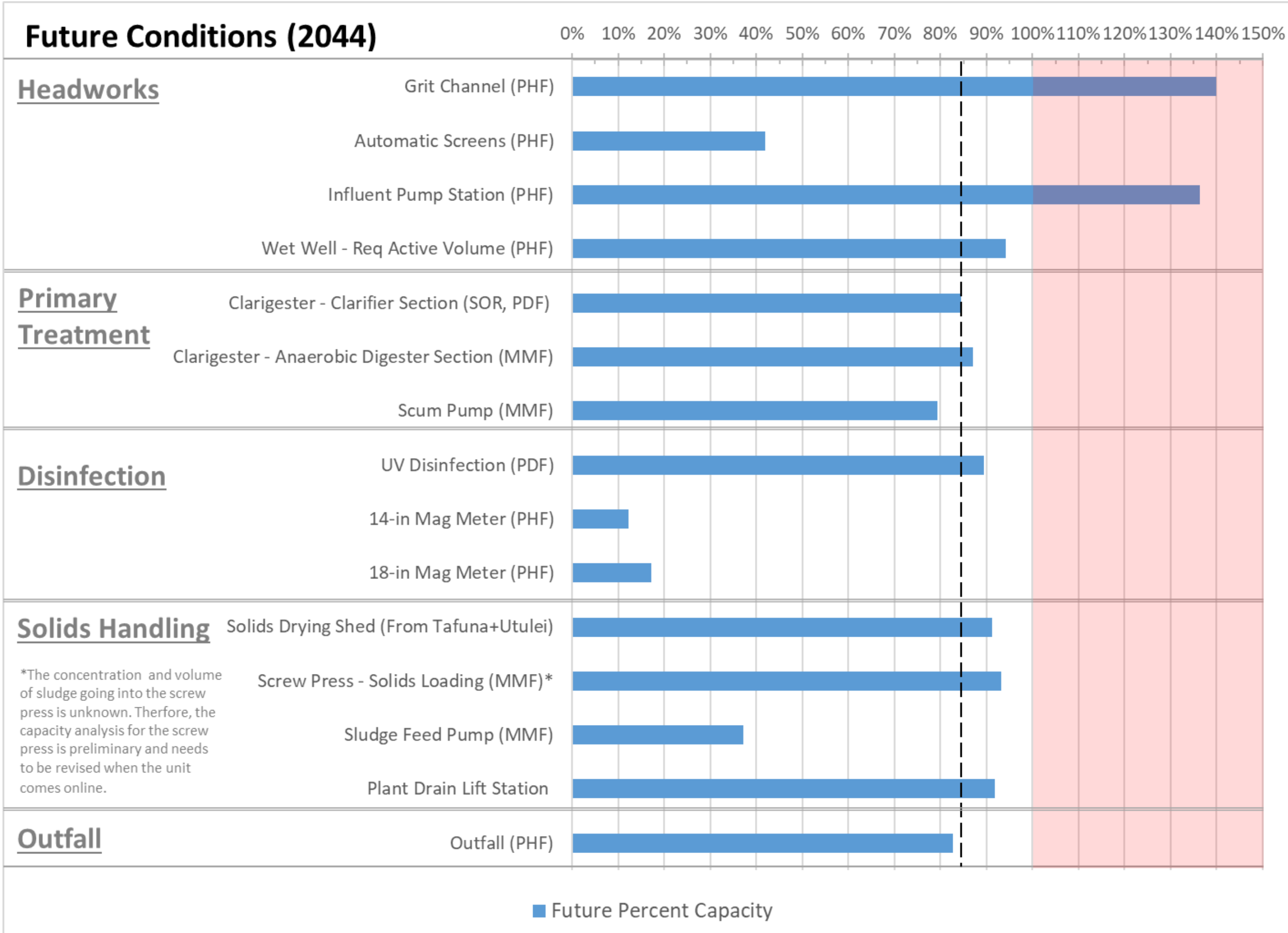


Figure 6-25: Tafuna WWTP – Capacity at Future Condition

Table 6-8: Tafuna WWTP – Assessment Table

Item	# of Unit	Redundancy	Age/Year	Equipment Condition	Electrical Condition	Structural Condition	Assessment
Grit Channel	2	no	30+	Fair	Fair	Good	Need Additional Channels to meet future demands.
Automatic Screen	2	no	6+	Fair	Poor	Poor	Corrosion Manual mode only
Washpress	1	no	6+	Fair	Poor	Fair	Leave as is Corrosion
Influent Pump Station	4	yes	4+	Fair	Fair	Fair	Need additional pumps to meet future demands
Clarigester - Clarifier Section	3	yes	30+	Fair	Fair	Poor	Replace railings, walkways, and support grating
Clarigester- Anaerobic Digester Section	3	yes	30+	Fair	Fair	Fair	-
Scum Pump	3	no	2+	Fair	Fair	Fair	
14-in Magmeter - Effluent flow meter	1	no	9+	Fair	Good	Fair	Exposed piping before and after the flow meter is corroded
18-in Magmeter - Effluent flow meter	1	no	9+	Fair	Good	Fair	Exposed piping before and after the flow meter is corroded
UV-Disinfection	1	no	9+	Poor	Fair	Poor	No redundant channel or other backup disinfection system Corrosion
Sludge Drying Shed	4	yes	30+ & 4+	Fair	N/A	Fair	When the screw press is operational, some of the sludge drying sheds can be used as a redundant system.

Screw Press	1	yes	N/A	-	-	-	Screw press is not operational yet. There is only one screw press, designed to handle solids from Tafuna WWTP only. Sludge drying bed will continue dewatering sludge from Utulei WWTP.
Plant Drain Lift Station	1	yes	2+	Fair	Fair	Fair	
Utility Water System-Pumps	1	no	<1	Good	Fair	Fair	Add redundant pump
Outfall	1	-	11+	Fair	N/A	Fair	Reevaluate diffuser size and configuration.

6.2 Utulei WWTP – Existing System

6.2.1 Facility Overview

The Utulei WWTP receives wastewater from villages in the eastern region of Tutuila Island in American Samoa. The WWTP is located in the village of Utulei near the Pago Pago Harbor. The existing treatment plant was initially constructed in 1977 and major processes equipment were added in 1990s, along with Tafuna WWTP. The treatment process has been expanded in subsequent years to increase capacity and improve effluent wastewater quality. The treatment process and equipment in the Utulei WWTP are similar to the ones in the Tafuna WWTP. The major process units in the treatment plant are:

- Headworks: Influent Pump Station and Manual Grit Removal
- Primary Treatment: Clarigester
- Disinfection: UV Disinfection
- Effluent Flow Measurement
- Outfall/ Effluent Disposal

The major difference between the two WWTPs is that no solids handling is done at Utulei. **Figure 6-25** shows an aerial image of the facility with the site map. **Figure 6-26** shows the existing process schematic in its current configuration. **Figure 6-27** shows the hydraulic profile of the existing WWTP based on elevations reported in previous studies (Westech, 1992; Coe & Van Loo, 2016).

Subsequent sections present a general description, capacity assessment, and observed deficiencies of each process. In determining probable capacity, one must consider the limitations and requirements of analysis, which are outlined in **Section 6.1.1**.

Figure 6-26: Utulei WWTP - Site Map

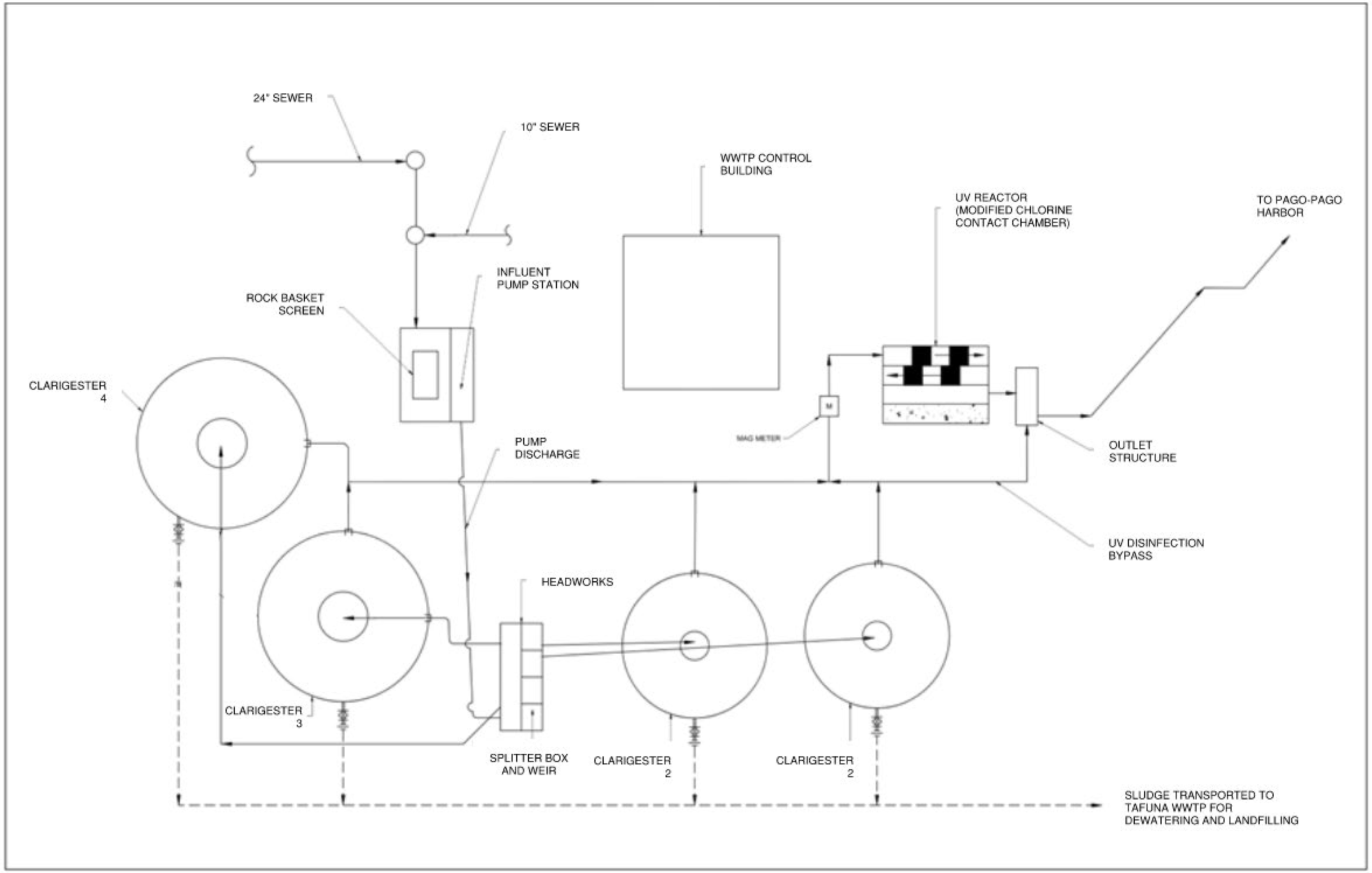
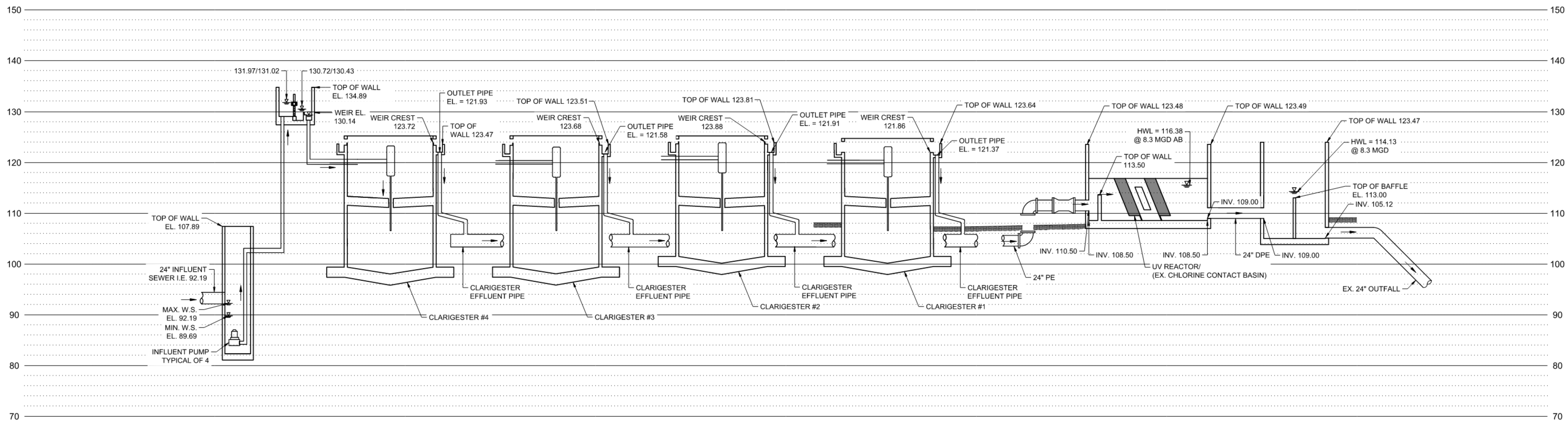


Figure 6-27: **Utulei WWTP - Process Flow Diagram**



NOTE: THIS HYDRAULIC PROFILE IS BASED ON ELEVATIONS REPORTED IN PREVIOUS STUDIES (WESTECH, 1992; COE & VAN LOO, 2016)

Figure 6-28: **Utulei WWTP - Hydraulic Profile**

6.2.2 Headworks

6.2.2.1 Description

The Utulei WWTP receives sewage only from the Utulei collection system, and there is no septage receiving station. The first treatment process in the headworks is the influent pump station. Raw sewage passes through a basket screen where large particles, such as rocks, are trapped. The operator manually takes the basket screens out of the wet well and then handpicks the large particles out of the basket screen. The wastewater then flows into the influent pump station, which has four submersible centrifugal pumps. **Figure 6-28** shows the influent pump station in Utulei WWTP. During the site visit, pump #3 was taken offline for maintenance. The pump size and operating conditions are summarized in **Table 6-9**. The sewage is then pumped from the wet well to the elevated splitter box with weirs, in which incoming flow is split into four streams.

There are two drum scrubbers by Pure Air Filtration that are used for odor control in an attempt to address odor complaints. However, the operator shared that changing the media from the drum is very difficult, and ASPA still receives odor complaints for the Utulei WWTP.

There is no grit removal channel or automatic mechanical grit removal system. Instead, every month, approximately one cubic yard of grit is manually removed with buckets from the splitter box. Grit removal from the splitter box is dangerous and takes a lot of work. The lift station is turned off for 1-1.5 hours to remove grit from the splitter box by hand using a bucket and pulley system, which causes the raw sewage to back up in the collection system upstream of the lift station. This practice could lead to sewer overflows from the manholes, odor issues, and even damage to the infrastructure in the collection system.

There is no influent flow meter at the headworks, and the actual flow coming into the plant is not measured. The effluent flow meter is used to measure the plant flow. The condition and capacity of the effluent flow meter are discussed in **Section 6.2.4**.

Figure 6-29: Utulei WWTP – Influent Pump Station

6.2.2.2 Design Criteria

Table 6-9 summarizes the design conditions of the equipment in the headworks.

Table 6-9: Utulei WWTP - Headworks Operating Conditions

Parameter	Design Value
Influent Pump Station	
Manufacturer	Flygt (Model: 3171)
Quantity	3 Duty / 1 Standby
Type	Submersible Centrifuge
Rated Capacity (gpm), each	1,364
Horsepower (HP)	34
Odor Control	
Quantity	2
Manufacturer	Pure Air (Model: DS-1000)
Design Airflow Rate	750 ACFM
Motor	1.5 HP
Electrical	230/460 V, 3 PH, 60 Hz
Date of Manufacture	April 2022
Media Volume:	
Sulphasorb XL	26 CU.FT.
CPS12 Blend	13 CU.FT.

6.2.2.3 Observed Deficiencies

The following deficiencies were noted during facility tours and discussions with operations staff:

- There is no mechanical screen or grit removal system, which means the operator must manually remove solids from the rock baskets and elevated splitter box every month.
- There are no spare parts for the influent pumps.
- There is no flow meter to measure the actual influent flow coming into the plant accurately.
- Wet wipes are a big problem at the lift stations and the plant.
- The exposed electrical and metallic areas of the equipment at the headworks are corroded. Some metal is coated in wax.
- There is no influent refrigerated composite sampler. Typically, WWTPs use a composite sampler to automatically sample the flow at programmed intervals. See also Chapter 3 and **Section 6.1.8.5**.
- There is no WWTP SCADA system to monitor process areas remotely, alarm when processes are not functioning as designed, and record data, such as influent and effluent flow. See also **Section 6.1.8.5**.

6.2.3 Clarigester

6.2.3.1 Description

Primary treatment at the Utulei WWTP is achieved with four Clarigesters manufactured by Ovivo. The operational mechanisms of the clarigesters in the Utulei WWTP are similar to those in the Tafuna WWTP. A clarigester is a cylindrical two-story tank with a common mechanical drive for both compartments. The upper compartment is for clarification, and the lower compartment is for digestion. The screened sewage enters the clarifiers from the central influent well, and then the clarified sewage overflows the weir at the tank periphery. The settleable solids sink in the digester compartment, where the solids undergo anaerobic digestion. The extent of anaerobic digestion is not monitored. The settled solids from the digester compartment of the clarigester are hauled to the dewatering area at the Tafuna WWTP with vactor trucks. **Figure 6-28** shows two of the clarigesters.

The scum floating at the top of the clarifier compartment and the supernatant from the digester compartment are passed to the scum and supernatant pit. The scum pump located in this pit can pump either scum or supernatant to the clarifier or the digester compartment by operating the three-way valve connected to the two discharge lines.

Clarigesters 1 and 2 were constructed in 1977, whereas clarigesters 3 and 4 were constructed in 1994. All the sump pumps were replaced in 2022. The clarigesters are cleaned every two years. The following retrofits have been done for the clarigesters in recent years:

- All Clarigesters: Skimmer blades, scum troughs, and influent feed wells were replaced in all clarigesters in 2011.
- Clarigester 1: Rehabilitated with a new drive, skimmer, and shaft in 2011. The skimmer arm was replaced in October 2023.
- Clarigester 2: Internal moving parts need to be replaced.
- Clarigester 3: The shaft/skimmer arm was replaced a few years ago. RFQ was issued on 09/18/2024 to replace all internal moving parts of the clarifier and the digester.
- Clarigester 4: The shaft/skimmer arm was replaced in September 2023

Figure 6-30: Utulei WWTP – Elevated Splitter Box and Clarigesters

6.2.3.2 Design Conditions

Table 6-10 summarizes the design conditions of the clarigesters.

Table 6-10: Utulei WWTP - Clarigester Design Conditions

Parameter	Design Value
Clarigester	
Quantity	4
Type	Center Feed, Peripheral Weir Clarifier on Anaerobic Digester
Manufacturer	Ovivo (Model: Dorr-Oliver Clarigester)
Clarigester – Clarifier Section	
Diameter (ft): Clarigester 1 & 2 Clarigester 3 & 4	 35 40
Sidewater Depth (ft): Clarigester 1 & 2 Clarigester 3 & 4	 6.5 9
Volume (gal): Clarigester 1 & 2 Clarigester 3 & 4	 46,754 84,554
Clarigester – Anaerobic Digester Section	
Diameter (ft): Clarigester 1 & 2 Clarigester 3 & 4	 35 40
Height (ft):	12
Volume (gal): Clarigester 1 & 2, each Clarigester 3 & 4, each	 86,315 112,739
Scum Pump	
Manufacturer	Flygt
Quantity	1 per clarigester (4 total)
Capacity (GPM)	75
TDH (FT)	32
Power (HP/V/KW)	2.7 / 230 / 1.4

6.2.3.3 Observed Deficiencies

The following deficiencies were noted during the facility tour and discussions with operations staff.

- The operator reported frequent blockage of the 3-inch 3-way valve and pump. The scum pits need to be rehabilitated with new piping and pumps.
- The railings, walkways, and support grating around the clarifier are currently wood and are replaced every two years or so. The railings, walkways and support grating are generally dilapidated and in poor condition. Alluminum parts have also shown signs of corrosion.
- The operators noted that wet solids from the clarigester cannot pass the paint filter test and, therefore, cannot be landfilled directly from the clarigester.

6.2.4 Flow Measurement

6.2.4.1 Description

Wastewater flow is measured with one McCrometer electromagnetic flowmeter, also known as a magmeter, upstream of the UV disinfection system. The 24-inch magmeter measures the combined flow coming from Clarigester 1,2, 3, and 4 and is shown in **Figure 6-32**. The flow meter-rated capacity and the expected flow in the respective pipeline are summarized in **Table 6-10**. The expected flow during the average day and peak hour conditions falls within the flow meters' rated capacity. The plant operator manually records the volume readings from the flow totalizer and subtracts them from the volume readings from the previous day to calculate the daily wastewater flow through each pipe. Since the flow is recorded on a daily basis, peak hour flow is not captured.

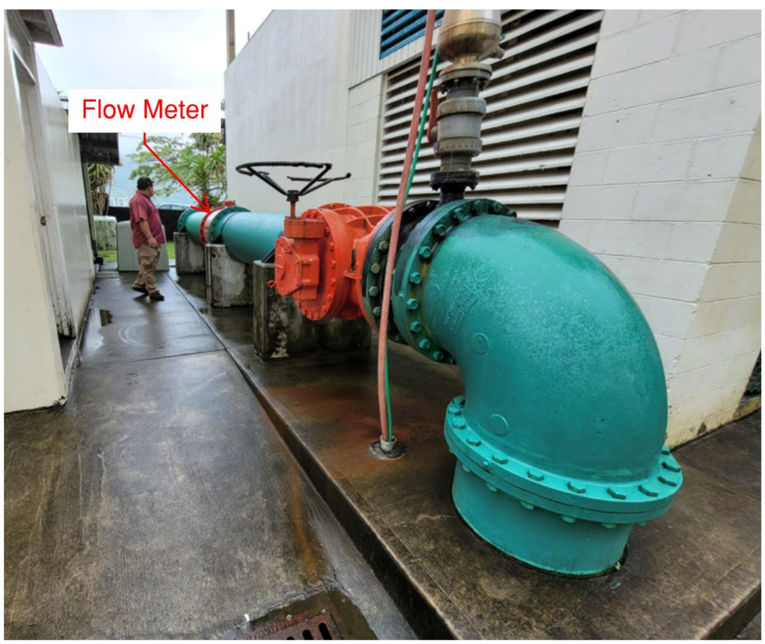


Figure 6-31: Utulei WWTP – Effluent Flow Meter

6.2.4.2 Design Criteria

Table 6-11 summarizes the design conditions of the effluent flow meter.

Table 6-11: Utulei WWTP - Flow-Meter Design Conditions

Parameter	Value
Flow Measurement	
Manufacturer	McCrometer (Model: Ultra Mag UM06-24)
Rated Capacity (GPM)	269 – 43,040
Expected Current Flow in the Pipe (GPM)[1]	1,420 – 3,615

[1] Expected Flow is calculated from the total measured flow during average day and peak hour conditions.

6.2.4.3 Observed Deficiencies

The following deficiencies were noted during the facility tour and discussions with operations staff:

- The effluent flow meter is the only flow measurement at the WWTP. Additional measurements of the plant influent should be added. See **Section 6.2.2.3**.
- The piping is exposed in this area and is showing signs of external corrosion.

6.2.5 Disinfection

6.2.5.1 Description

Following primary treatment, the effluent undergoes ultraviolet radiation (UV) disinfection for virus and pathogen inactivation. The UV system is manufactured by Trojan and was installed in 2017. The previous chlorine contact chamber was retrofitted to house the UV disinfection system. The system operates under gravity flow and is contained in an above-ground concrete channel, as shown in **Figure 6-31**. It consists of a single channel looped in a U-shape with four banks and space allocated for a future 5th bank. Each bank has 18 bulbs, which are automatically cleaned every 2 hours. The operating conditions of the UV system are summarized in **Table 6-12**. UV system cleaning maintenance practice in Utulei is similar to the Tafuna WWTP, which involves annual system bypass and labor-intensive manual cleaning.

Figure 6-32: Utulei WWTP - UV Disinfection Unit

6.2.5.2 Design Criteria

Table 6-12 summarizes the design conditions of UV disinfection units.

Table 6-12: Utulei WWTP - Disinfection Operating Conditions

Parameter	Design Value
UV-Disinfection	
Manufacturer	Trojan (Model: TrojanUVSigna)
No. of Channels	1
Banks per channel	4
Lamps per bank	18
Capacity, each channel (MGD)	8.3 MGD
Disinfection Goal, no./mL	4,700 Entercocci / 100 ml
Design Minimum UVT, %	40.6% @ 253.7nm (minimum)

6.2.5.3 Observed Deficiencies

The following deficiencies were noted during facility tours and discussions with operations staff:

- Wastewater disinfection is achieved with the existing single-train UV disinfection system. There is no redundant UV train or backup chlorination system, making it difficult to clean and provide maintenance on the existing train.

- Enterococci concentration in the effluent wastewater has exceeded permit limit 16 % of the time in the last five years from October 2018 till September 2023. Since there is no redundant disinfection system, these exceedances could have occurred during UV channel maintenance or cleanup.
- Floatables/grease get caught upstream of the lamps and must be removed manually with a net. Installing a downward opening gate that allows wastewater to follow under it in front of the UV banks may reduce the amount of floatables collecting around the UV banks.
- The UV disinfection process consumes a large amount of energy. The operator has expressed concern regarding the electrical cost of operating this system.
- The operator mentioned that the UV system requires frequent maintenance, which is challenging for three operating staff members to keep up with while running both WWTPs.

6.2.6 Outlet Box and Outfall

6.2.6.1 Description

After UV disinfection, the effluent wastewater flows into an outlet structure on site. An emergency bypass line with valves could divert flow from the headworks to the outlet structure. The outlet structure was in good condition during the site visit in January 2024. The effluent is then discharged to the Outer Pago Pago Harbor in the South Pacific Ocean via a 24-inch diameter pipeline that extends approximately 1,050 feet from the treatment plant (GDC, 2012). Approximately 700 feet of the outfall is buried in the coral reef flat. The inshore section of the outfall is ductile iron, and the offshore section is HDPE. The treated effluent is released through six diffusers across approximately 35 feet of the outfall length (GDC, 2012). **Figure 6-32** shows the location of the outfall and diffuser.

Based on the UDKHDEN model using data from March 2003, ASPA estimated the initial dilution of 127:1 and critical initial dilution of 91:1. In 2019, ASPA modified the diffusers by replacing three out of six existing side diffusers with 6-in HDPE blind flanges with 5.5-in diameter concentric holes across approximately 35 feet of the outfall length diffusers and replacing the blind flange at the end port with a 12-in (with internal diameter of 11-in) HDPE port (Crux Diving, eTrac, 2019). EPA evaluated compliance with section 301(h) regulations based only on the critical dilution of 91:1 (US EPA Final Decision, 2019, Page 13). However, in the modified NPDES permit by EPA released on June 7th, 2021, EPA used a dilution factor of 121:1 to calculate the effluent limits of four parameters (TN, TP, ammonia, and WET) and the previous dilution factor of 91:1 for any other parameters except those for which no dilution was credited.

Figure 6-33: **Utulei WWTP - Outfall and Diffuser Approximate Location (Based on NPDES Permit, 2019)**

6.2.6.2 Observed Deficiencies

- There is no effluent refrigerated composite sampler. Typically, WWTPs use a composite sampler to automatically collect samples for flow proportioned sampling. See also Chapter 3.

6.2.7 Solids Dewatering and Disposal

6.2.7.1 Description

The settled solids from the anaerobic digester compartment of the clarigesters are hauled in vactor trucks to the dewatering area of the Tafuna WWTP. There is no solids dewatering facility at the Utulei WWTP. The sludge from clarigesters 2 and 3 are pumped from the same draw point shown in **Figure 6-33**. **Section 6.1.7** discusses the design conditions and observed deficiencies of the dewatering and disposal facility at Tafuna WWTP.

Figure 6-34: Utulei WWTP – Sludge draw points from the Clarigester 2 and 3

6.2.8 Support Facilities

6.2.8.1 Operations Building

The Utulei operation building is leaking very badly and needs urgent repairs and upgrades, and to be remodeled. In addition, there is an urgent need to include a modern laboratory and operation room with SCADA.

6.2.8.2 Electrical and Control Systems

The plant has 3-phase power. There is a 250-kW backup diesel generator on-site which was manufactured by Cummins. The generator can handle the electrical needs of the plant. There is no automatic transfer switch at the Utulei WWTP, so the generator needs to be manually started in case of power outages. Although ASPA's electrical team successfully conducted a load test on the generator for approximately 15 minutes, the plant operator has stated that the generator cannot supply enough power to operate the plant during outages. The air and fuel filters on the generator were replaced in early 2024. The generator is located in a building with an open door/entryway, which has led to noise complaints.

There is no Supervisory Control and Data Acquisitions (SCADA) system in the plant. SCADA is a centralized digital network that gathers, analyzes, compiles and controls various process units.

6.2.8.3 Lab/Sampling

Weekly influent and effluent wastewater samples are collected and tested for parameters required by their permit, which are described in Chapter 4. The influent samples are collected at the influent pump station wet well, and the effluent sample is collected at the outlet box. Influent and effluent grab samples are collected every hour for 24 hours to create the composite samples at each of the sampling locations.

Only samples required by the permit are tested on a regular basis. The Utulei WWTP has an in-house laboratory where BOD_5, TSS, pH, salinity, and turbidity are tested. AS-EPA laboratory tests for the presence of Enterococci. Oil and grease samples are shipped every quarter to Hawaii for testing. Wastewater samples for WET testing are shipped to California. Samples for nutrient tests like TN, TP, TKN, ammonia, etc., are shipped to the Eurofins Laboratory in Monrovia, California.

6.2.8.4 Utility Water System

The Utility Water System, which includes two Grundfos pumps, was installed in 2019 to provide utility water for equipment cleaning and other uses around the plant. However, the system did not provide adequate pressure, so the operators manually power-wash the UV lamps. During the site visit of January 2024, the Grundfos pumps were not operational. **Figure 6-33** shows the utility water system.

Figure 6-35: Utulei WWTP - Pumps at Utility Water System

6.2.8.5 Plant Drain Lift Station

There is no dedicated Plant Drain Lift Station at the Utulei WWTP. Wastewater generated onsite is conveyed to the influent lift station.

6.2.8.6 Observed Deficiencies

Operations Building:

- The Utulei operations building is leaking very badly and needs urgent repairs and upgrades, and to be remodeled. There is an urgent need to include a modern laboratory and operation room with SCADA, when its ready to come online.

Electrical and Control Systems:

- Operators expressed the desire to add sound attenuation to the generator. They also expressed the desire for a better building around the generator.

- There is no automatic transfer switch for the generator. The generator needs to be turned on manually in case of a power outage.
- The incoming power supply is variable and sporadic.
- A new SCADA system is needed to record and archive process data.

Lab/Sampling:

- Hourly grab samples are collected manually to create a composite sample. Manually collecting samples for 24 hours, even at night, is challenging.

Utility Water System:

- The utility water system does not provide adequate water pressure for the automatic spray cleaning to wash the UV system. It was not functioning during the January 2024 site visit.

6.2.9 Overall Performance

The overall performance of the plant in meeting the effluent discharge limits based on the current permit is analyzed in this chapter. Graphs of pollutants of concern from the current NPDES permit are included as follows:

- Effluent BOD_5 Concentration: **Figure 6-35**
- Effluent BOD_5 Loading: **Figure 6-36**
- BOD_5 Percent Removal: **Figure 6-37**
- Effluent TSS Concentration:
- **Figure 6-38**
- Effluent TSS Loading: **Figure 6-39**
- TSS Percent Removal: **Figure 6-40**
- Effluent Settleable Solids: **Figure 6-41**
- Effluent pH: **Figure 6-42**
- Effluent Oil & Grease: **Figure 6-43**
- Effluent Nitrogen: **Figure 6-44**
- Effluent Phosphorus: **Figure 6-45**
- Ammonia Ratio: **Figure 6-46**
- Effluent Enterococci: **Figure 6-47**

The current effluent discharge limits for Utulei WWTP are more stringent compared to Tafuna WWTP. Few instances of exceedance were observed in the last five years from Oct. 2018 till Sep. 2023, which includes: two exceedance instances (8% of the reported data) of average monthly concentration of total phosphorus, five exceedance instances (12.8% of the reported data) and four exceedance instances (10.3% of the reported data) of the average monthly and maximum daily oil & grease respectively, and seven exceedance instances (16% of the reported data) and four exceedance instances (9% of the reported data) of average monthly and maximum daily enterococci respectively.

Also included in the following pages is the graph of pollutants with no compliance limit but are required by the NPDES permit to report effluent levels for monitoring.

- Effluent Ammonia: **Figure 6-48**
- Effluent Temperature: **Figure 6-49: Utulei WWTP – Effluent Temperature**

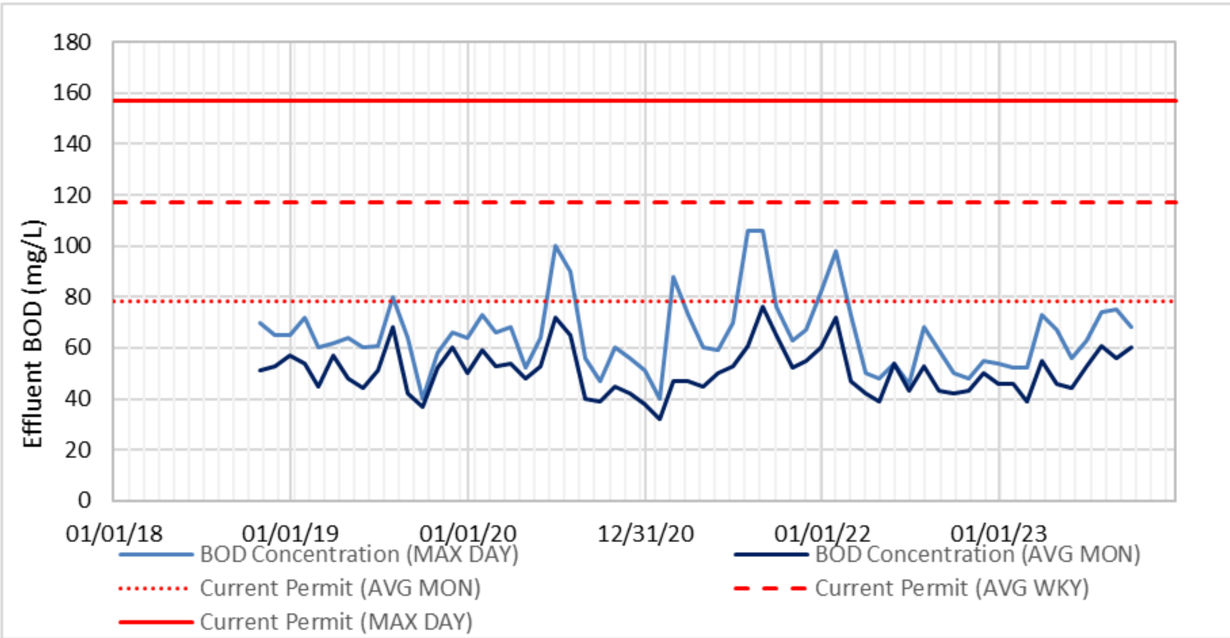


Figure 6-36: Utulei WWTP – Effluent BOD_5 Concentration

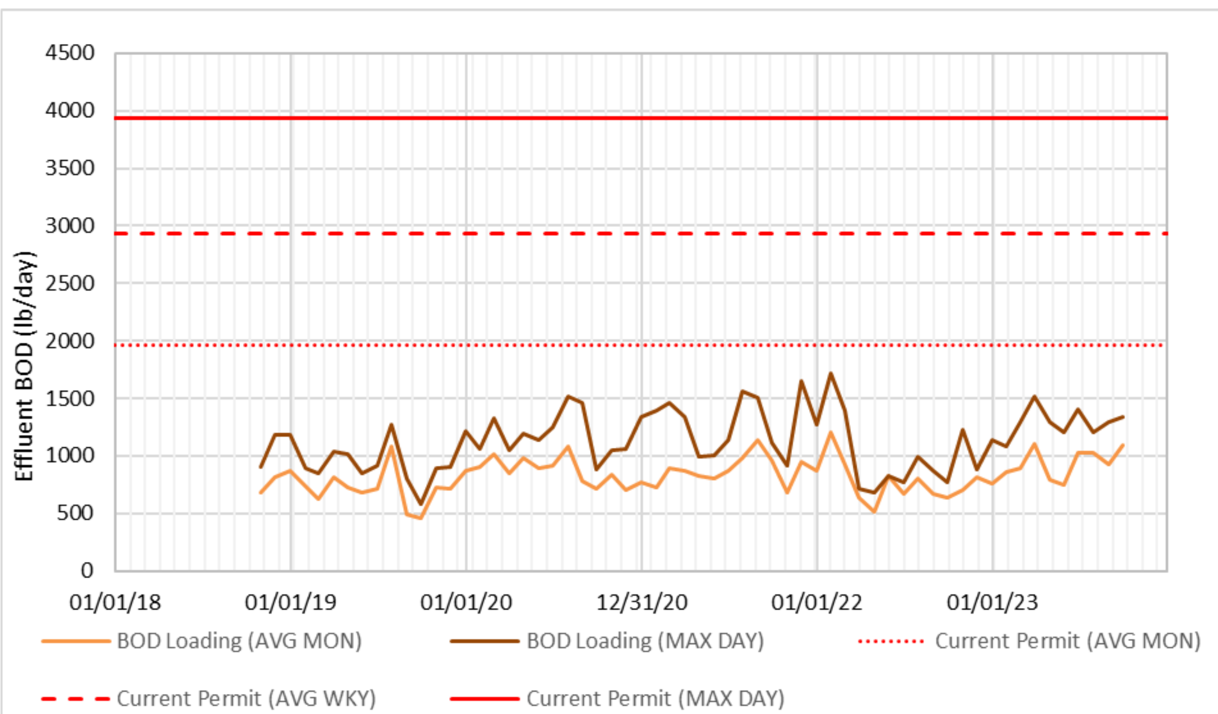


Figure 6-37: Utulei WWTP – Effluent BOD_5 Loading

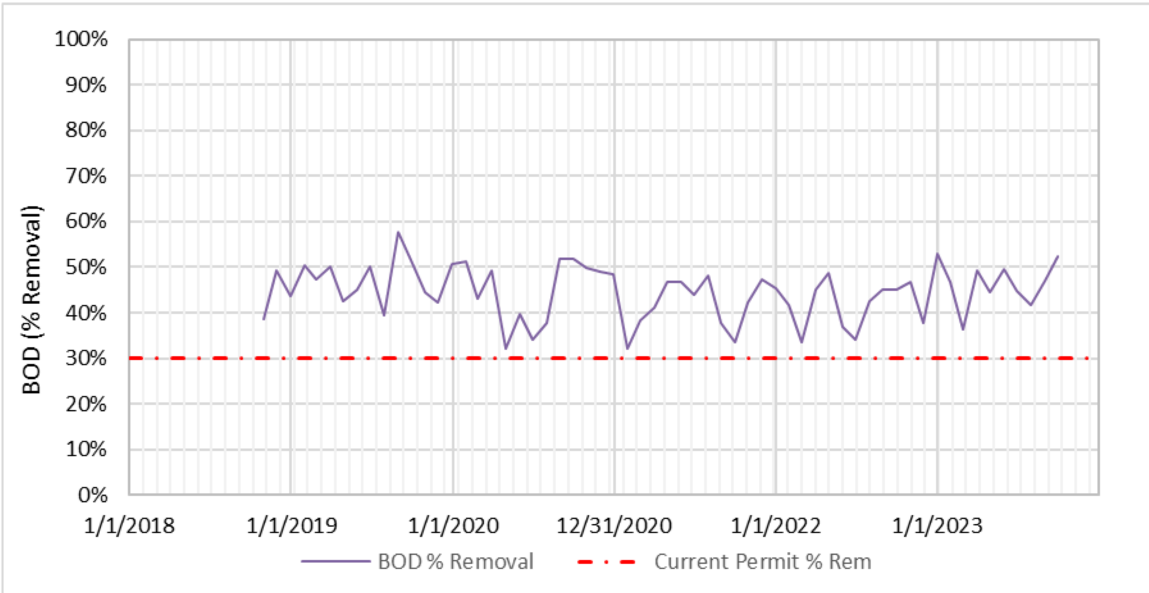


Figure 6-38: Utulei WWTP – BOD_5 % Removal

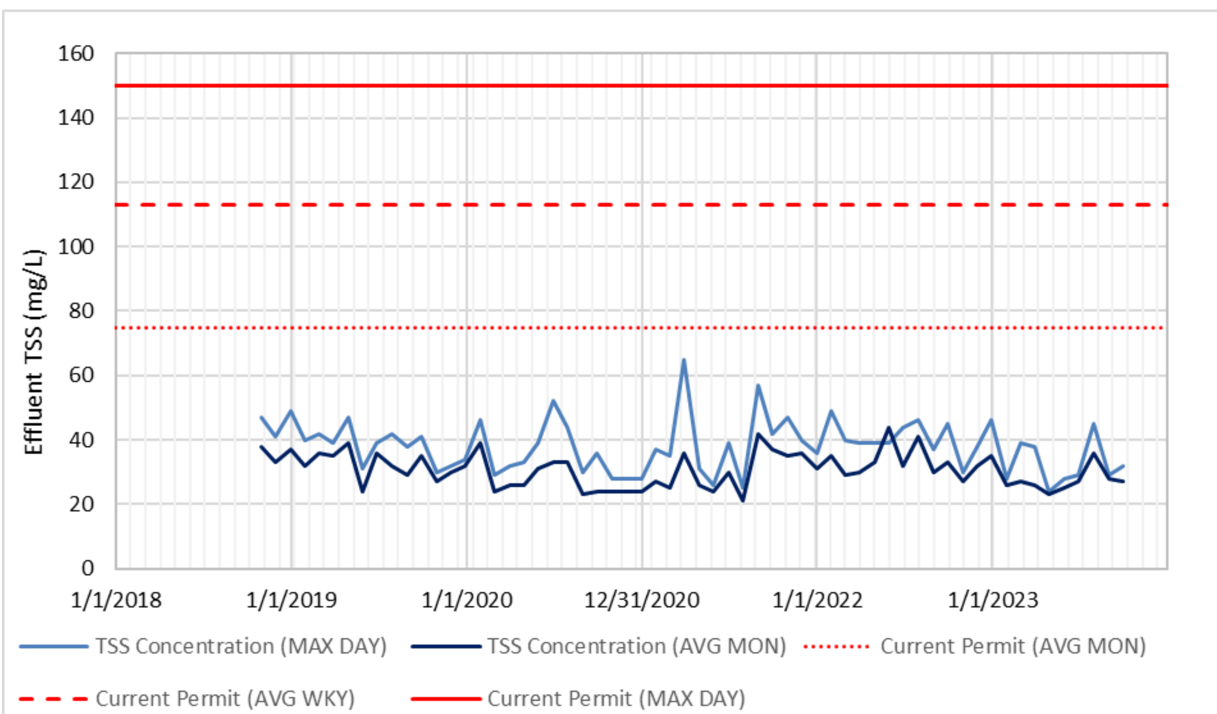


Figure 6-39: Utulei WWTP – TSS Concentration

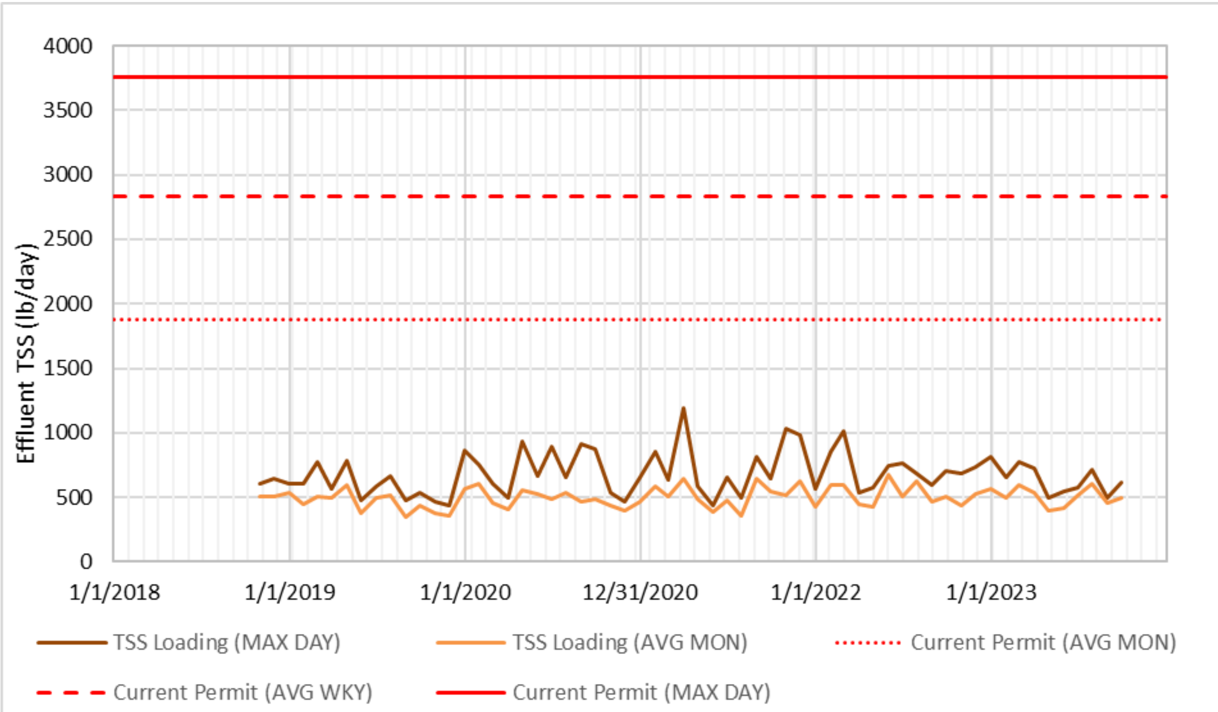


Figure 6-40: Utulei WWTP – TSS Loading

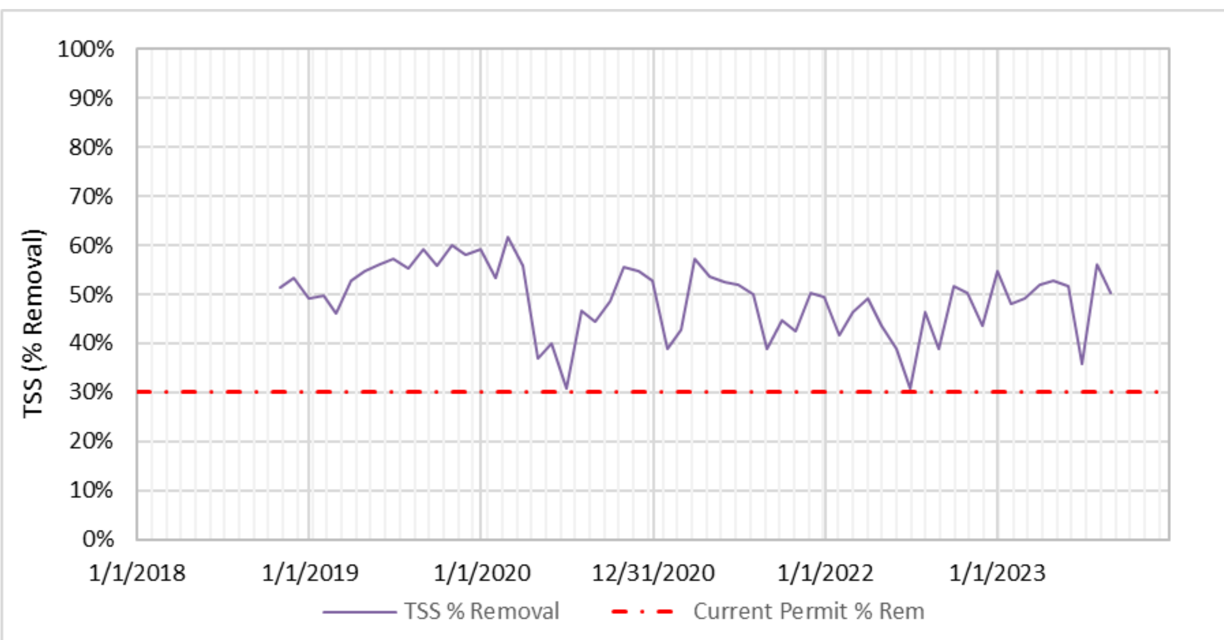


Figure 6-41: Utulei WWTP – TSS % Removal

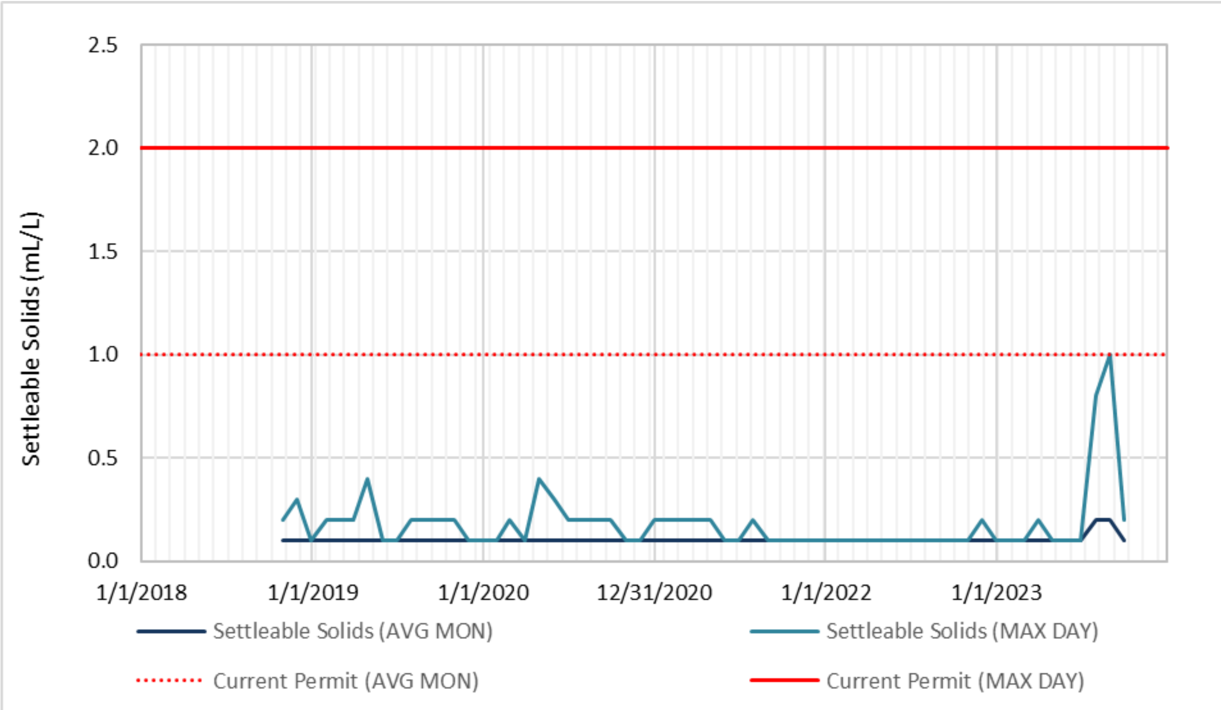


Figure 6-42: Utulei WWTP – Settleable Solids (mL/L)

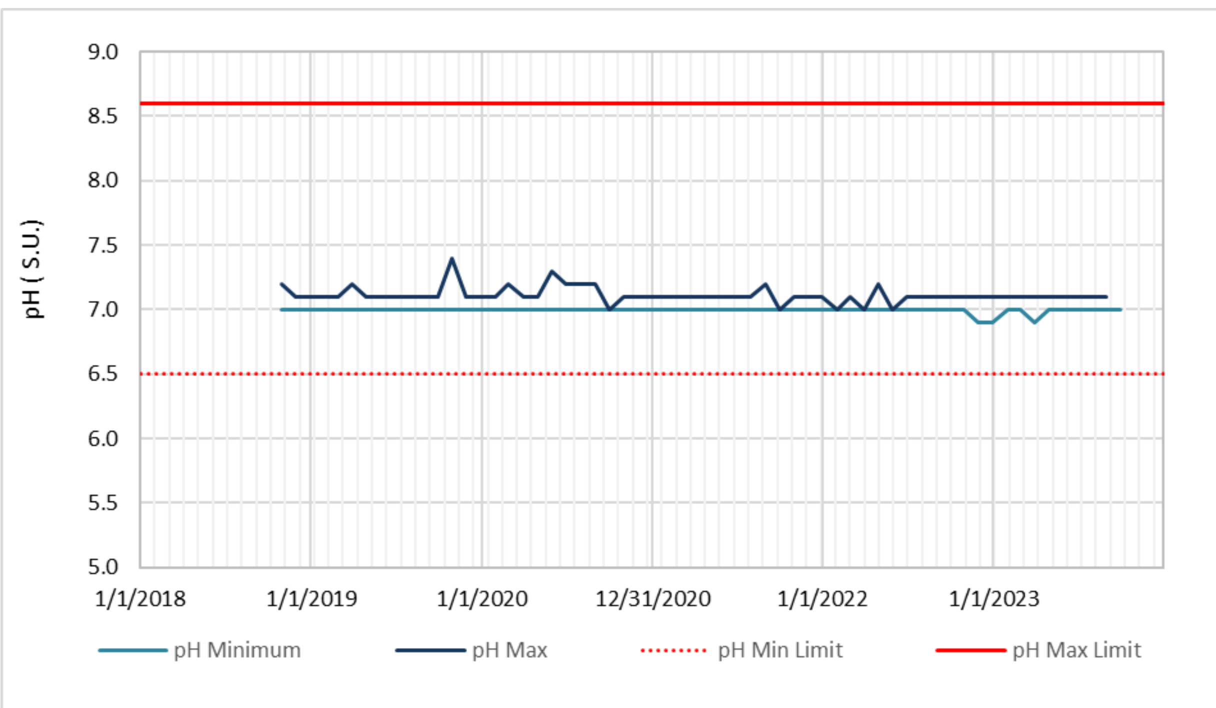


Figure 6-43: Utulei WWTP – Effluent pH

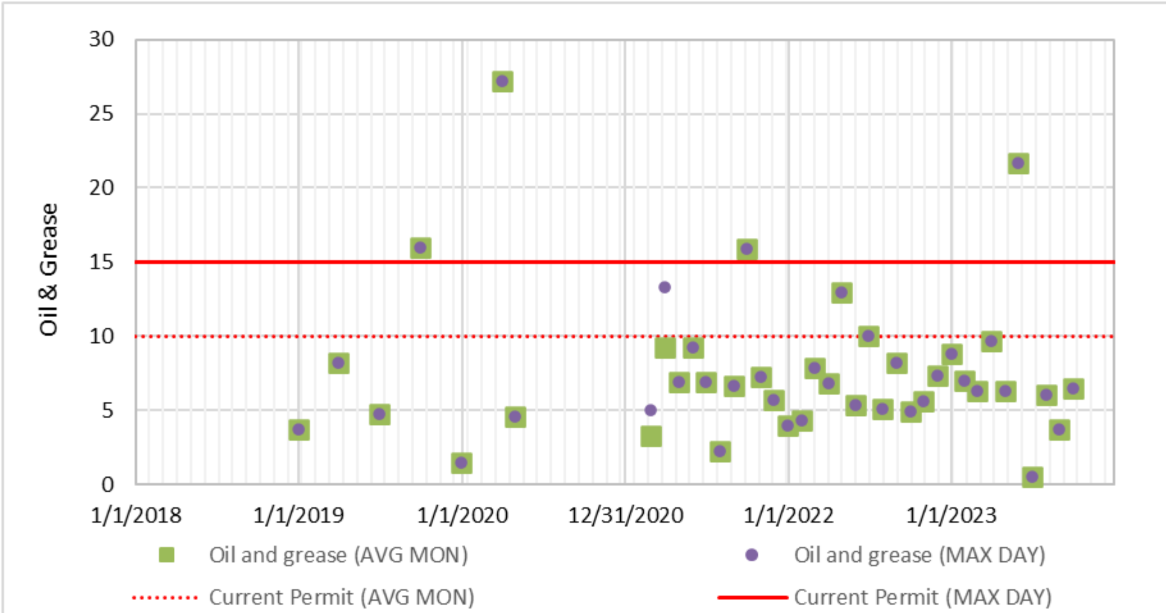


Figure 6-44: Utulei WWTP – Oil & Grease

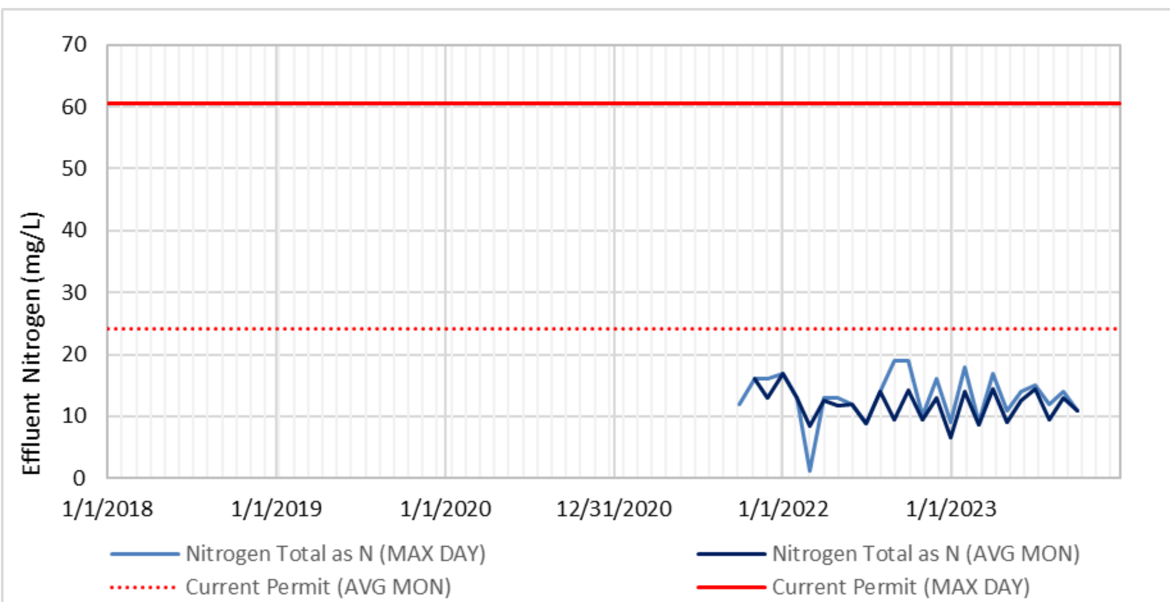


Figure 6-45: Utulei WWTP – Effluent Nitrogen

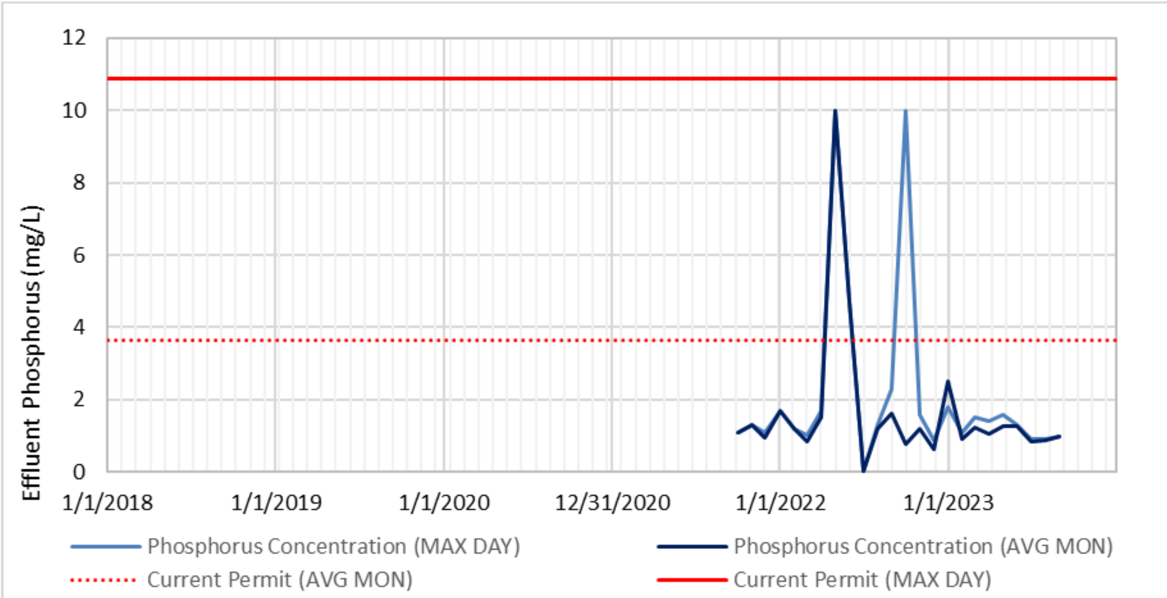


Figure 6-46: Utulei WWTP – Effluent Phosphorus

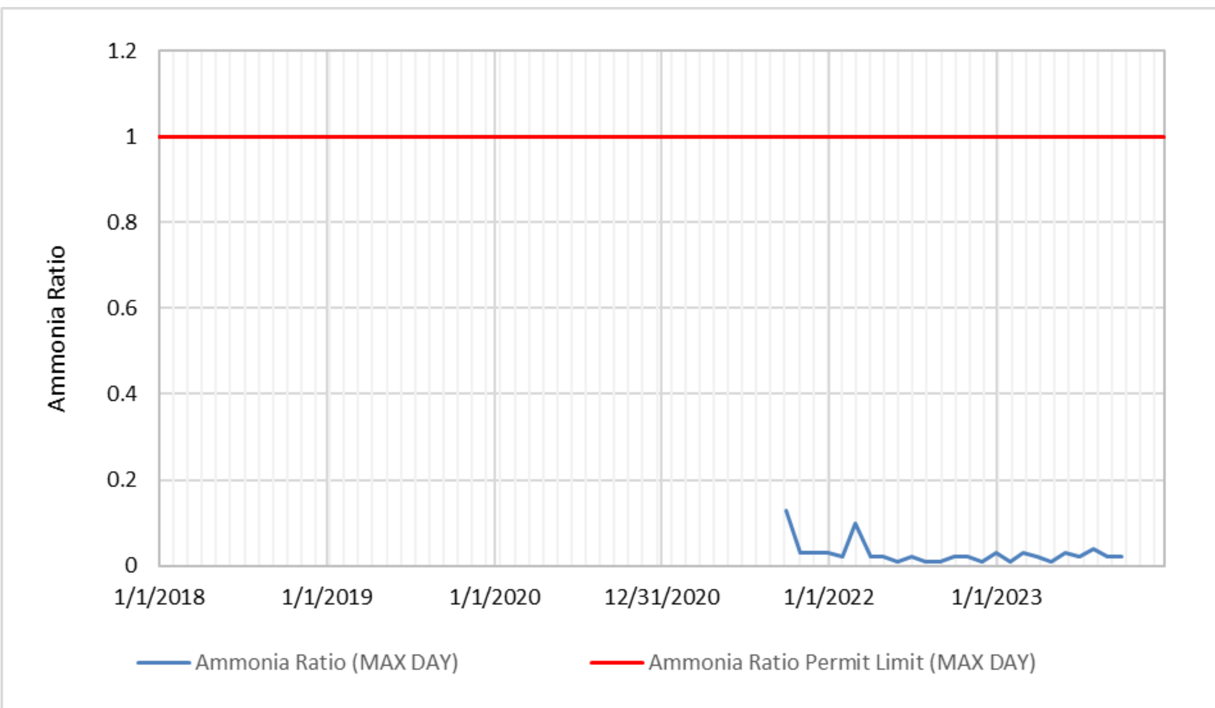


Figure 6-47: Utulei WWTP – Ammonia Ratio

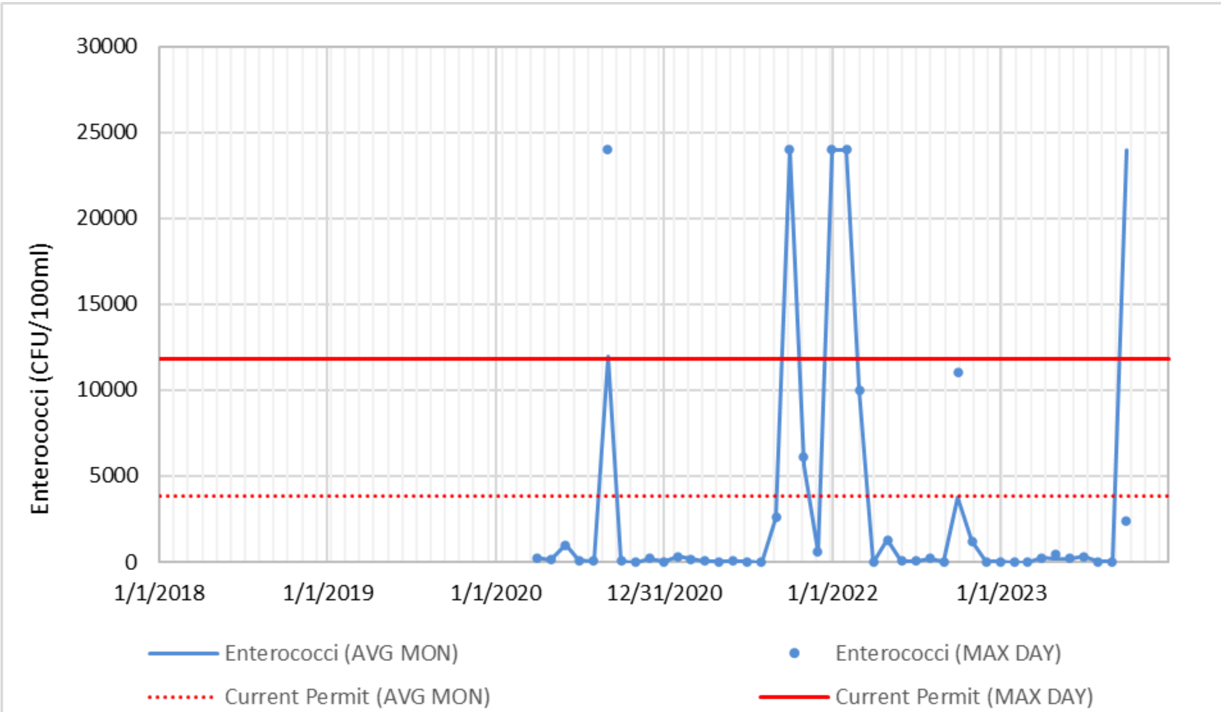


Figure 6-48: Utulei WWTP – Enterococci

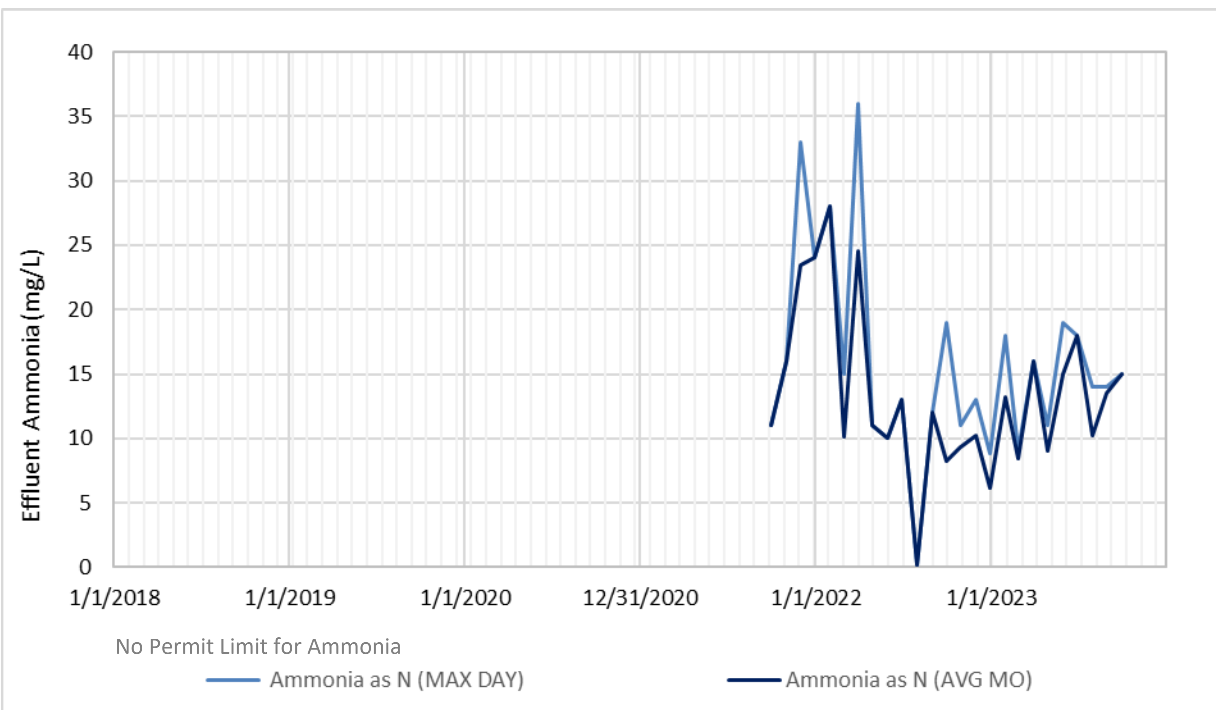


Figure 6-49: Utulei WWTP – Effluent Ammonia

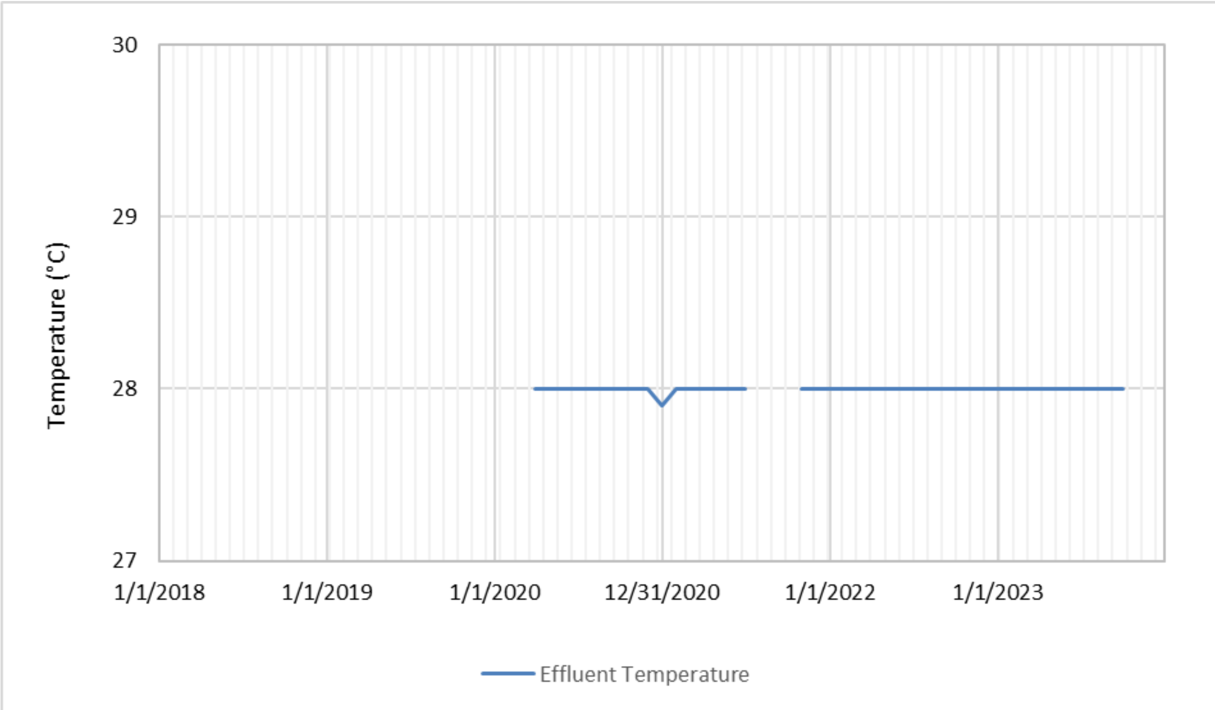


Figure 6-50: Utulei WWTP – Effluent Temperature

6.2.10 Overall Assessment

Similar to the assessment done for Tafuna WWTP, the capacities of major elements within each process based on the analysis in the preceding sections are shown in **Figure 6-50** for existing conditions and **Figure 6-51** for future conditions. Unlike Tafuna WWTP, the collection system expansion will not bring in significantly large flow and loading into the treatment plant in the future. Utulei's collection system is dominated by I/I flows.

The figure includes a dashed black line at 85 percent capacity, which is a threshold value typically used to trigger facility planning and subsequent implementation of improvements to maintain adequate treatment capacity. Also included is a red shaded area, which indicates that a component is currently operating at or above 100 percent of expected capacity. The firm capacity is calculated as the combined capacity of all units for some equipment, which includes the 24-in magmeter, UV disinfection, and outfall. For the influent pump station, clarigester, and scum pump, the firm capacity is calculated as the capacity of the pump system with the largest unit of each system out of service.

Table 6-12 summarizes the condition, age, and redundancy provided by the existing infrastructure at the Utulei WWTP. The typical design life or age is equipment-specific and usually 15- 20 years. In this report, the useful lifespan of the equipment is considered to be 20 years. The condition is based on operator feedback and observations during the January 2024 site visit and is evaluated based on the criteria listed in **Table 6-7**.

All equipment has adequate capacity under current and future conditions. The incoming flow to the influent pumps exceeds the 85% firm capacity limit under current flows. Hence, these pump upgrades should be prioritized in the future. Although the influent pump station and clarifier section of the clarigesters have sufficient capacity for future flows, the incoming flow capacities of these units are above the 85% firm capacity mark, as shown in the figure below. ASPA should observe the capacities of these processes in the coming years and reevaluate the need for expansion in the next facility plan. The current, future, and firm capacities and the assumptions made to calculate these capacities are documented in **Appendix D-1**.

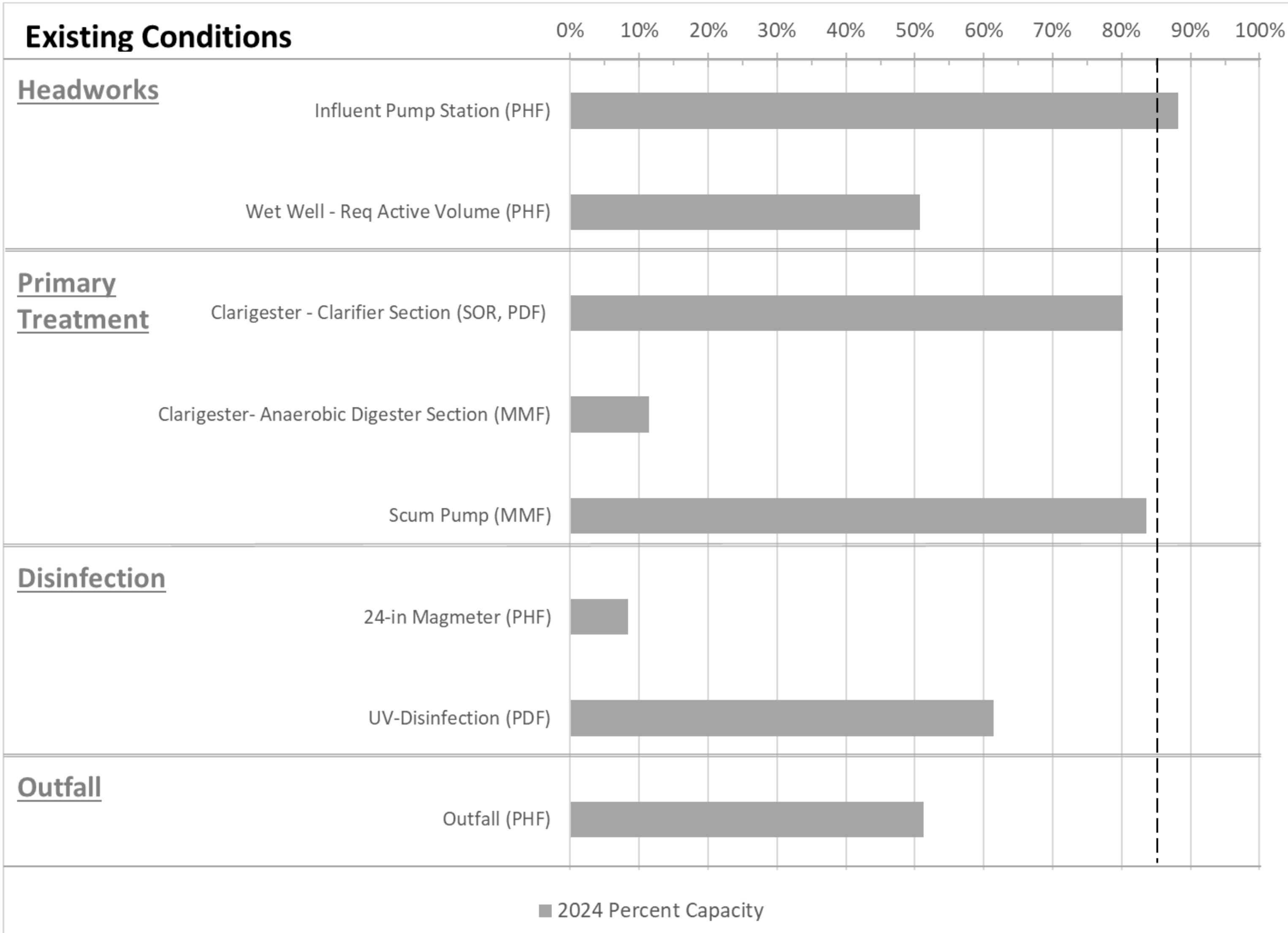


Figure 6-51: Utulei WWTP – Capacity at Existing Conditions

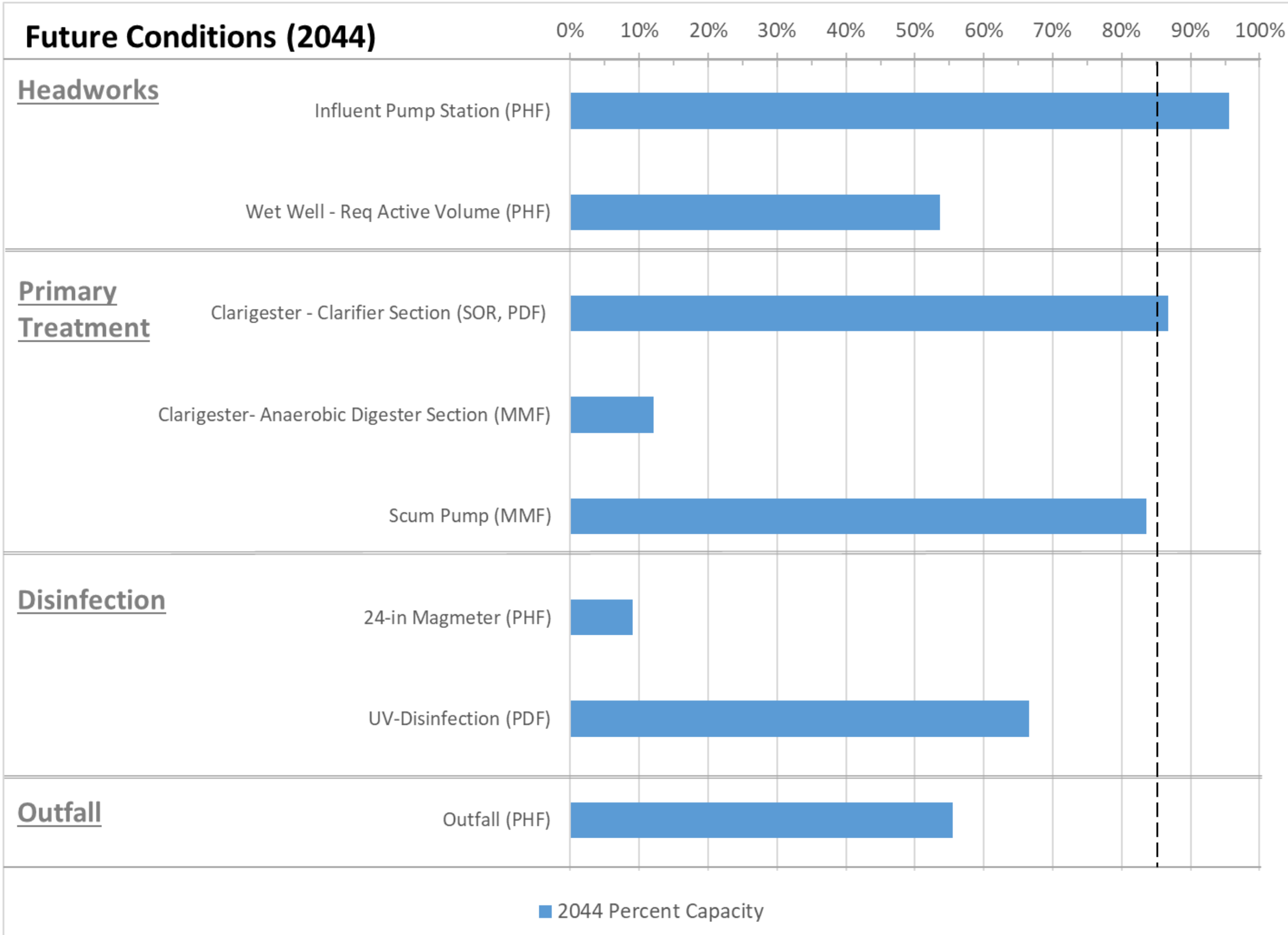


Figure 6-52: Utulei WWTP – Capacity at Future Conditions

Table 6-13: Utulei WWTP – Assessment Table

Item	# of Unit	Redundancy	Age/ Year	Equipment Condition	Electrical Condition	Structural Condition	Assessment
Influent Pumps	4	yes	14+	Fair	Fair	Fair	Need spare parts for pump Need flow meter Need refrigerated composite sampler Need additional pumps to meet future demands Need SCADA system
Odor Control	1	no	2+	Poor	Fair	Fair	ASPA still receives odor complaints.
Clarigester - Clarifier Section	4	yes	30+	Fair	Fair	Poor	Replace railing, walkways, and support grating.
Clarigester- Anaerobic Digester Section	4	yes	30+	Fair	Fair	Fair	
Scum Pump	4	no	2+	Fair	Fair	Fair	Frequent blockage of the valve and piping in scum pit.
24-in Magmeter - Effluent flow meter	1	no	9+	Fair	Good	Fair	Continuously record hourly flow.
UV-Disinfection	1	no	9+	Poor	Fair	Poor	Need backup disinfection system and redundant channel.
Utility Water System - Pumps	2	yes	5+	Poor	Poor	Fair	Upsize Pump
Outfall	1	-	11+	Fair	N/A	Fair	Reevaluate diffuser size.

6.3 Aunu'u – Existing System

Currently, the only wastewater treatment on Aunu'u is being done with an onsite septic system for the school's wastewater. The rest of the wastewater on Aunu'u receives no treatment prior to being conveyed to the lift station and then pumped into the ocean via the outfall. There is no NPDES permit for wastewater discharge in the Aunu'u island. The existing Aunu'u wastewater system was not evaluated as a part of this facility planning effort.

6.4 References

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CHAPTER 7

EXISTING COLLECTION SYSTEM EVALUATION

System Evaluation and Capacity Assurance Plan (SECAP)

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Chapter 7 Collection System Evaluation

7.1 Background

American Samoa Power Authority (ASPA) owns and operates three sanitary sewer collection systems: the Tafuna collection system, the Utulei collection system, and the Aunu'u collection system. The exact date that each of these systems were constructed is unknown, however the Tafuna Wastewater Treatment Plant (WWTP) was built in 1971 and the Utulei WWTP was built in 1963. Original construction dates for the Aunu'u system were not available at the time this report was written.

These collection systems serve approximately 45,000 people that live on the Tutuila and Aunu'u islands. The Tafuna and Utulei collection systems are located on the island of Tutuila, while the Aunu'u collection system is located on the island of Aunu'u. Each of the three collection systems includes multiple lift stations and is served by a separate wastewater treatment plant, with the exception of there being no treatment within the Aunu'u system. The study boundary for each system is depicted in **Figure 7-1**.

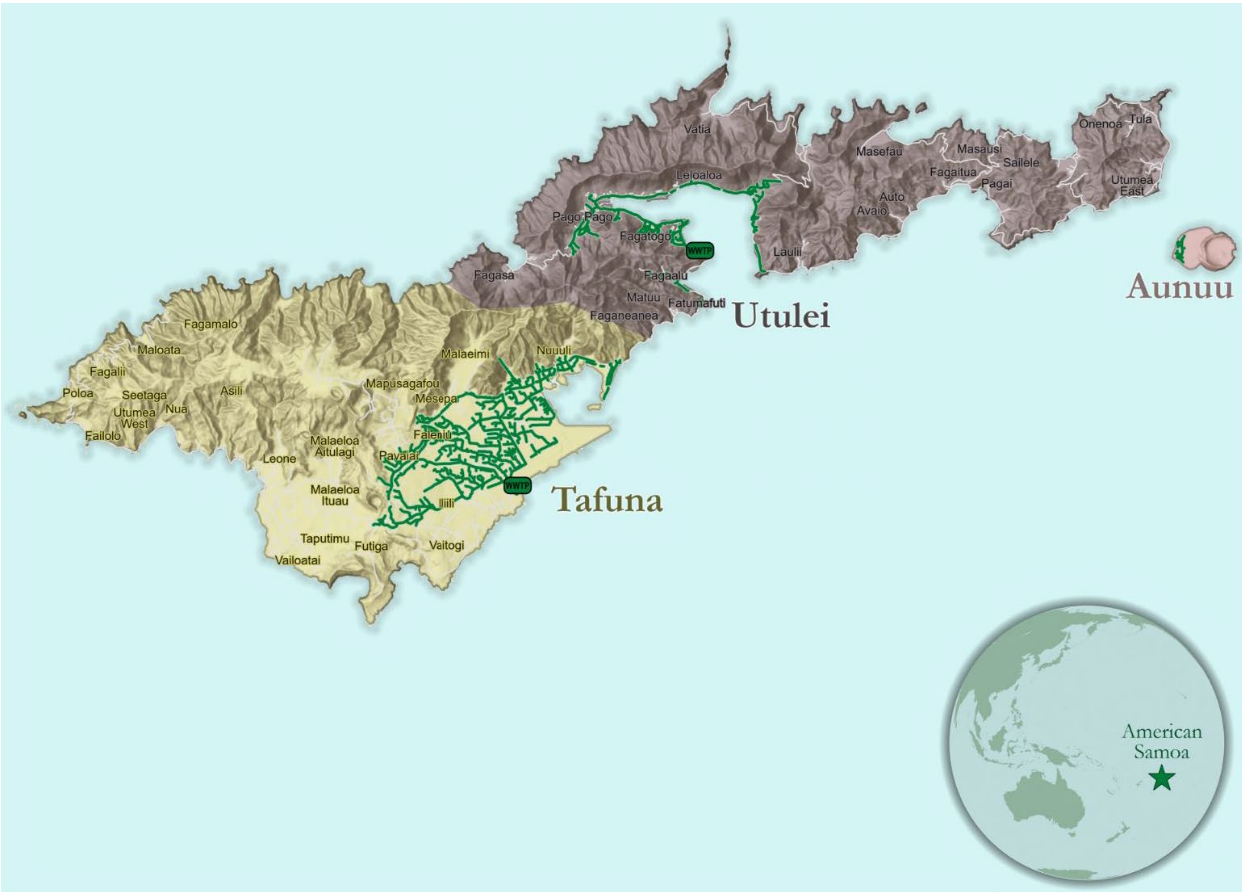

Figure 7-1: Existing Study Boundaries

This evaluation serves as the System Evaluation and Capacity Assurance Plan (SECAP) and assesses the performance of each of the three collection systems under both existing and future conditions. The future conditions, which account for anticipated growth within the collection systems for their respective time periods, consist of a 10-year, 20-year, and buildout (75-year) scenarios. The performance of each collection system was evaluated using a combination of hydraulic modeling and engineering calculations. Hydraulic modeling was completed using Aquanuity's AquaTwin Sewer hydraulic modeling software, which utilizes a geographic information system (GIS) interface.

The following sections provide a detailed description of the collection system evaluations, along with recommended collection system improvements for each of the three collection systems.

7.2 Data and Collection System Management Plan

7.2.1 GIS Data Management

ASPA maintains current GIS mapping for the entire sanitary sewer system, including gravity mains, force mains, manholes, and lift stations. Following the completion of collection system improvements, whether replacing existing infrastructure or installing new infrastructure, ASPA updates the GIS data using the as-built drawings to ensure that all changes and updates are accurately documented and reflected in the GIS data. ASPA provided their GIS data sets associated with the sewer collection systems for use in the hydraulic model. The primary GIS data used within the hydraulic model includes the gravity mains, force mains, manholes, and lift stations.

7.2.2 Collection System Asset Management

Asset management may be generally grouped into four categories: *Operative – Reactive*, *Inspection – Condition Based*, *Proactive*, and *Predictive* (Ugarelli et al, 2010). A brief summary of each category is listed below.

- *Operative – Reactive*: Also termed "fail and fix," this approach effectively results in operating an asset through its complete, useful life. However, doing so limits a utility's ability to fund maintenance since projects arise on an emergency basis only. Costs may be low in some years, while extremely high in other years.
- *Inspection – Condition Based*: This approach is often dubbed "find and fix" as it relies on inspecting lines, assessing the structural condition, and scheduling the line for replacement. In practice, this approach identifies lines that are approaching failure (typically with an expected remaining life of one to ten years) or have unnecessarily high maintenance costs. Utilities are better able to fund maintenance projects through yearly budgets, provided the inspection window covers several years of potential work. A consistent approach to prioritizing lines is critical to the success of this approach to asset management as decisions made in one year must be equivalent to assessments of other lines in subsequent years.
- *Proactive*: Moving farther out on the spectrum, this approach involves replacing or rehabilitating a main line before there is a likelihood of failure. Through regular inspections and condition assessments, the utility can monitor the rate of degradation of the line and schedule replacement or rehabilitation prior to an elevated risk of failure.
- *Predictive*: Under this scenario, a utility combines condition assessment, potential rehabilitation costs, expected maintenance costs with and without rehabilitation, risk of failure, and economic

impacts to minimize the life cycle cost of the utility. As the name implies, the approach includes a predictive component for utility degradation versus increased maintenance, as well as a probabilistic element for failure and the related impacts to ratepayers, the environment, level of service, etc.

Historically, ASPA has applied the *Operative – Reactive* and *Inspection – Condition Based* approach within the collection system. It is recommended that ASPA work toward implementing the *Proactive* approach to minimize the risk of asset failure.

Each asset management approach deals with the central issue of line deterioration and remaining service life. The likelihood of failure is generally reciprocal to the level of service when compared to a new installation with several stages.

- Within the first 20 years, it is expected that maintenance activities on mainlines will be relatively minor (e.g., routine cleaning and inspection).
- In the following 20 years, maintenance activities will generally increase but are necessary to maintain a desired level of service in the mainline. More frequent cleaning is required in addition to root cutting and possible point repairs to replace disconnected services, alignment problems, or other structural deficiencies.
- As these costs escalate and urbanized areas mature, it may become cost effective to undertake a rehabilitation of the mainline using cured-in-place pipe (CIPP), sliplining, pipe bursting or other trenchless technologies.

Each of these rehabilitation steps resets the deterioration curve but does not re-establish the level of service equal to a newly constructed line. Consequently, these maintenance and rehabilitation activities will reach a point of diminishing return and require complete replacement of the mainline. These repeated cycles of deterioration and rehabilitation are illustrated conceptually in **Figure 7-2**. A key conclusion of these theoretical curves is that through continued maintenance, point repairs, and rehabilitation, the useful life of a mainline may be greatly extended, which in turn extends the benefits gained from the original capital investment. These same principles are applicable to many utilities (drinking water systems, wastewater treatment, wastewater collection systems, etc.).

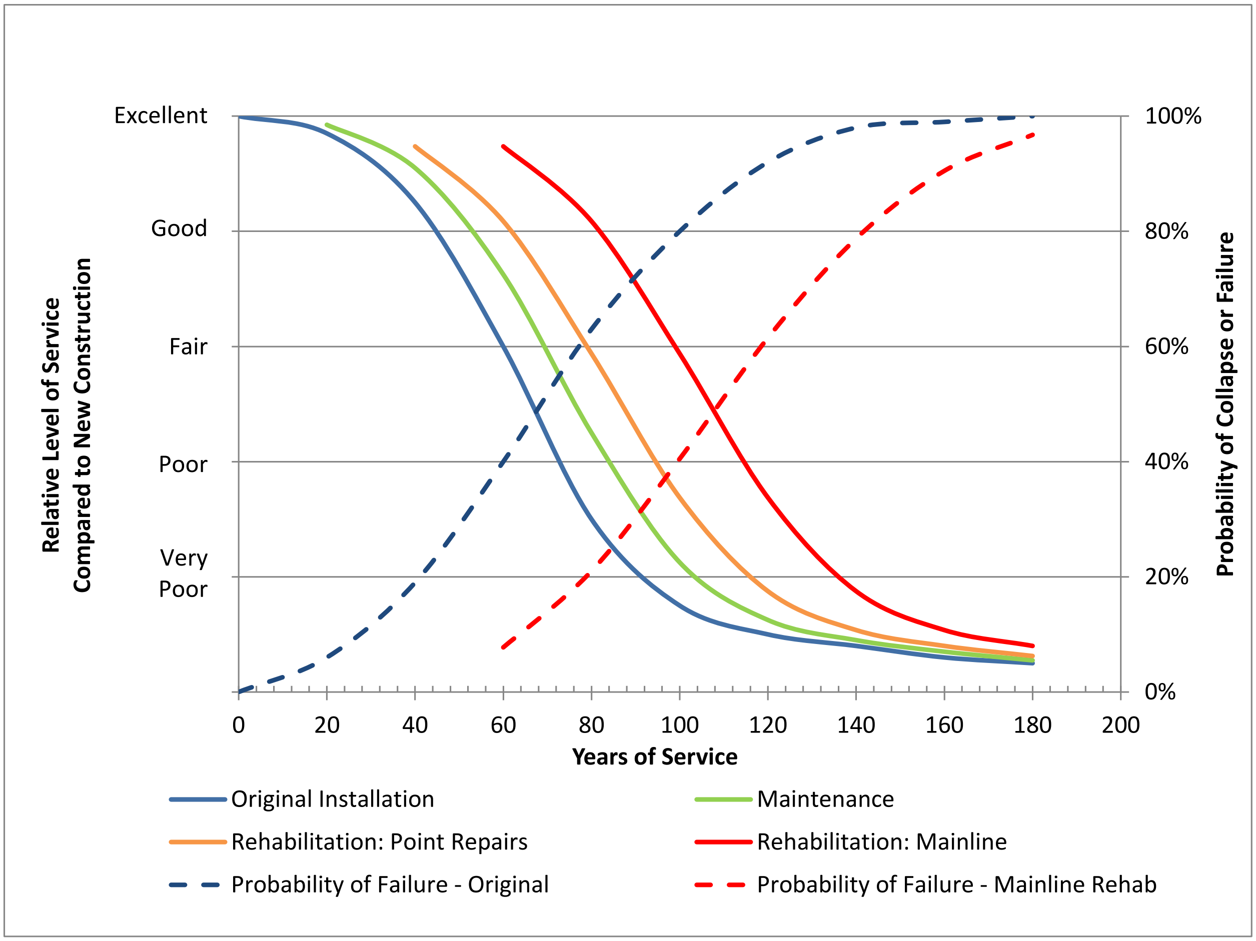

Figure 7-2: Theorized Deterioration Cycles of a Mainline with Multiple Rehabilitation Steps

The likelihood of failure of an asset can be defined through a condition assessment. In addition to the regular visual inspections of the lift stations and manholes, ASPA performs closed circuit television (CCTV) inspections when problem areas within the collection systems are identified. Issues that are identified during inspections are prioritized for repair or replacement based on the severity of the issue. Any defects or issues that have the potential for catastrophic failure, or that may result in an overflow, are evaluated and scheduled for immediate repair. When a defect or issue is not identified as needing immediate repair, it is added to the repair schedule, as deemed appropriate. This Collection System Evaluation does not include a condition assessment of the collection system pipes. However, the Collection System Management Plan (CSMP), which is included in Appendix C-1, provides recommendations for ASPA to implement a CCTV inspection program to regularly assess and monitor the condition of the collection system pipes.

7.3 Tafuna Collection System

7.3.1 Existing System Summary

The Tafuna collection system is the largest of ASPA's three collection systems and is located in the southeastern area of the island of Tutuila. The collection system includes pipelines (gravity and forcemains), manholes, and lift stations, and serves an estimated population of 19,854. The existing Tafuna collection system that was used in this study is shown in **Figure 7-3**. An 11x17 version of the figure is also provided in **Appendix E-3**.

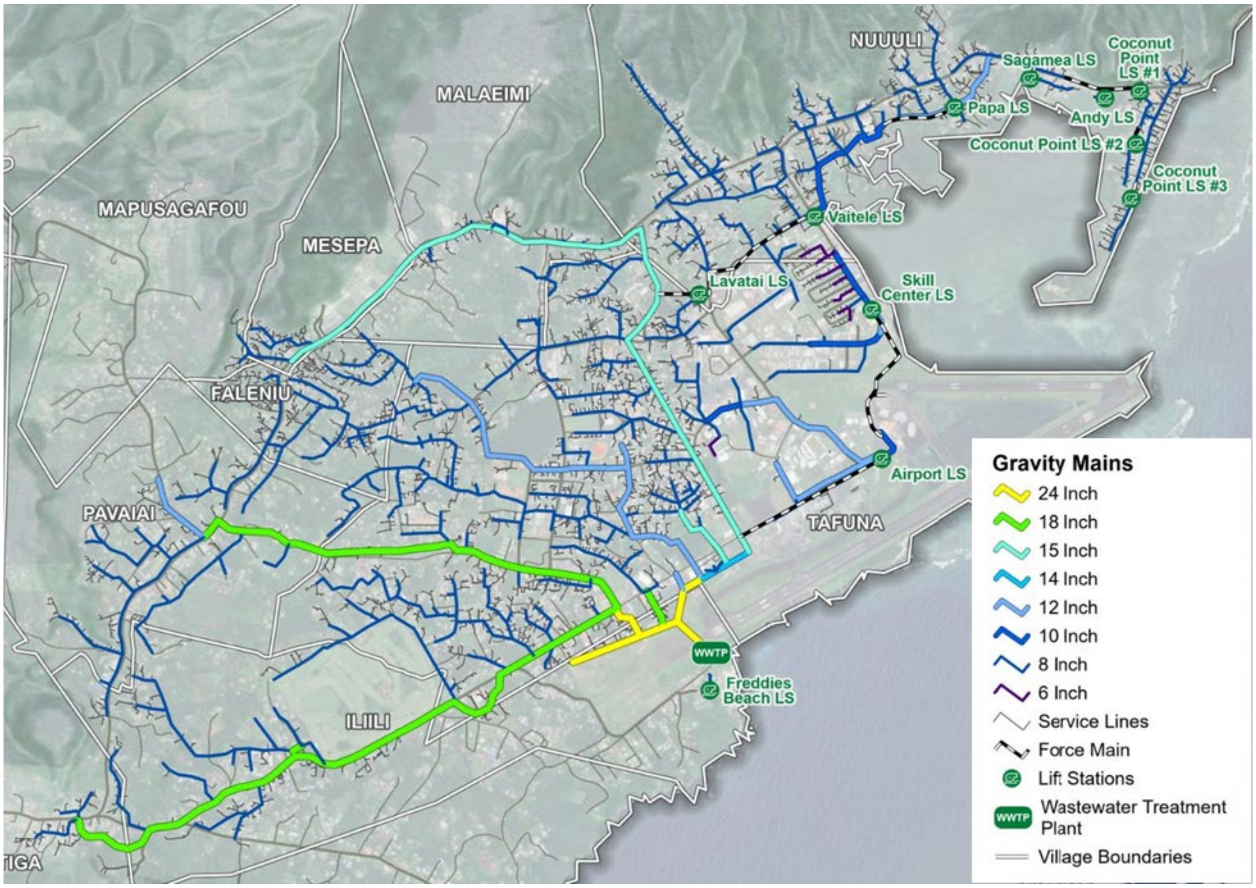

Figure 7-3: Existing Tafuna Collection System

7.3.1.1 Sewer lines

Within the Tafuna collection system, there are approximately 46 miles of gravity mains, which range in size from 6-inch to 24-inch diameter pipe. Based on GIS data, CAD data, and as-built data provided by ASPA, approximately 95% of Tafuna's gravity mains consist of polyvinyl chloride (PVC) pipe, with the remainder being either asbestos cement (AC) pipe or unknown material. The collection system gravity main material is displayed in **Figure 7-4** and summarized in **Table 7-1**. **Figure 7-5** and **Table 7-2** provides a summary of known pipe age. The average age of the Tafuna collection system based on known pipe installation data is approximately 42.2 years old. In addition to the gravity mains, there are approximately, 1,108 manholes and 2.7 miles of force mains, which consist of 1.5-inch, 6-inch, and 8-inch diameter pipes.

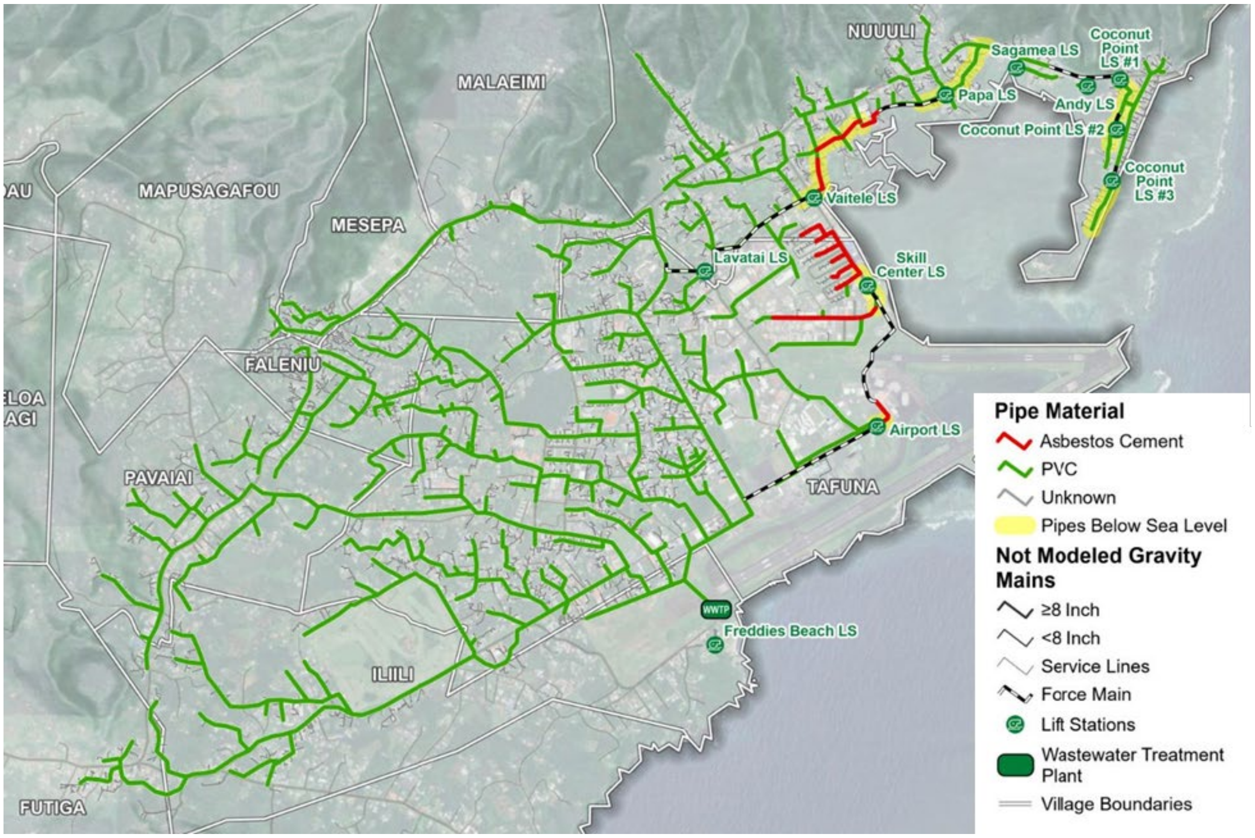

Figure 7-4:Tafuna Collection System Gravity Main Material

Table 7-1: Tafuna Collection System Gravity Main Material

Pipe Material	Length (mi)	Percent of Total Length
AC	1.74	4%
PVC	43.81	95%
Unknown	0.46	1%

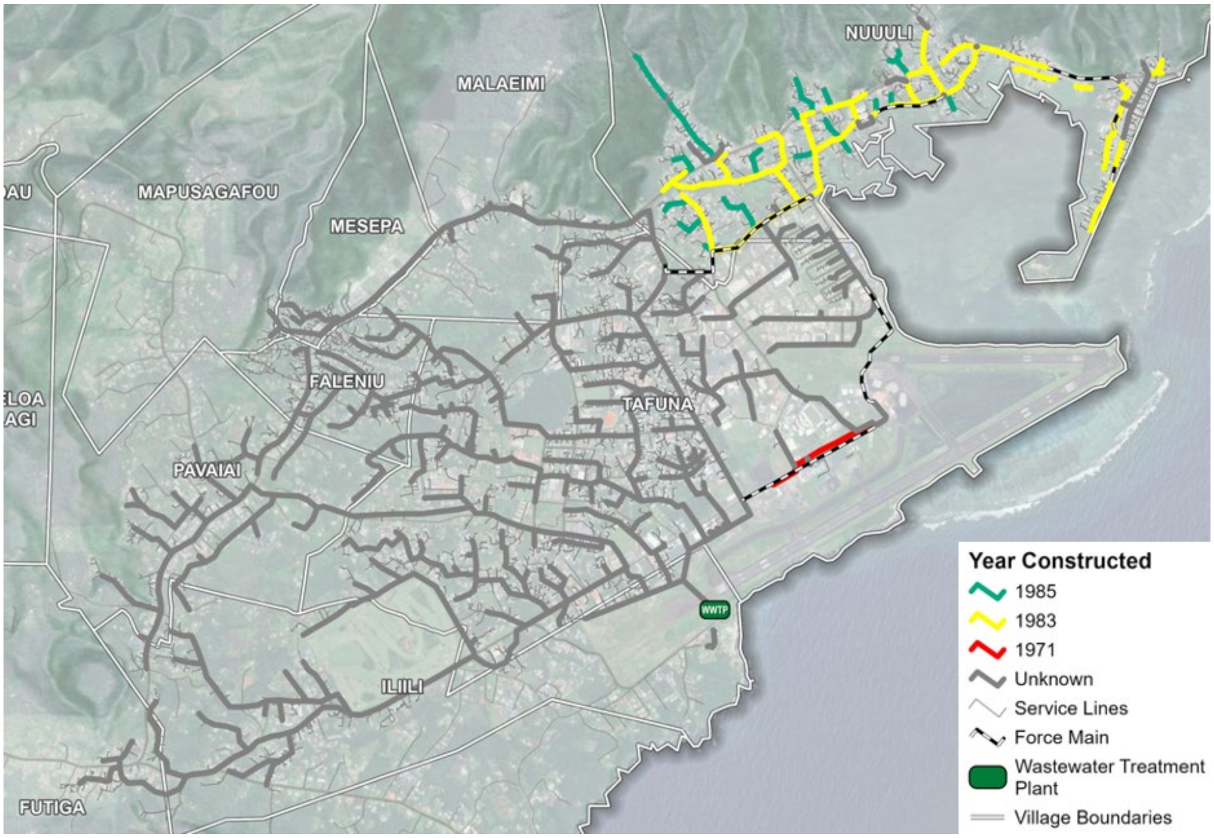

Figure 7-5:Tafuna Collection System Gravity Main Year Constructed

Table 7-2: Tafuna Pipe Age

Year Installed	Length (mi)	Pipe Age (yrs)
1971	0.46	54
1983	4.94	42
1985	1.96	40
Unknown	38.64	-

7.3.1.2 Lift Stations

The Tafuna collection system includes 11 lift stations. A summary of the lift stations is included in **Table 7-3**. For a summary of lift station capacity, see **Section 7.3.2.7.2**.

Table 7-3: Tafuna Collection System Lift Stations – Design Criteria

Lift Station Name	Year Constructed/ Last Major Rehabilitation	Wet Well			Pumps					
		Dia. (ft)	Depth (ft)	Total Vol. (gall-ons)	No. of Pumps	Make, Model, & Type	HP	TD H (ft)	Max. Pumping Capacity (gpm)	Comments
Coconut Point #3	Unknown	5	15	2,203	2	Hydromatic hpg200; Grinder	2	23	19	
Coconut Point #2	Unknown	5	15	2,203	2	Hydromatic hpg200; Grinder	2	21	22	
Coconut Point #1	Unknown	6	20	4,203	2	Hydromatic s3hx200jc; Non-Clog	2	21	140	
Andy's	Unknown	3	8	423	2	Hydromatic hpg 200; Grinder	2	40	18	Only 1 pump installed
Sagamea	Unknown	3	12	635	2	Hydromatic hpg200; Grinder	2	42	36	
Papa Stream	Unknown	8	25	9400	2	Flygt 3127; Non-Clog	7.5	36	390	
Vaitele	Unknown	15	20	26,438	3	Flygt; Non-Clog	Un-known	103	600	Only 2 pumps installed
Lavatai	Unknown	6	15	3,173	2	Flygt 3102; Non-Clog	6.5	42	155	Only 1 pump installed
Skill Center	Unknown	5	15	2,203	2	Flygt 3102; Grinder	5	24	225	
Airport	Unknown	10	14	8,225	2	Flygt 3153; Non-Clog	20	80	570	
Freddie's Beach	Unknown	5 x 5	10	1,870	2	Flygt 3085; Non-Clog	2.4	21	18	

J-U-B conducted site visits to each of the 11 lift stations in the Tafuna collection system. Observed conditions and deficiencies are summarized in and detailed descriptions for each lift station are listed below in **Table 7-5**. Observed deficiencies at the lift stations were used to identify potential improvement projects, which are discussed in detail in **Chapter 8**. **Appendix E-1** contains the original site visit information sheets for each lift station. **Table 7-4** below provides explanation to the ranking/descriptors used.

Table 7-4: Lift Station Ranking System

Ranking	Description
Good	Item is functioning properly; therefore, there is no immediate need for replacement.
Fair	Condition of item is fair; however, it is still functioning as intended. No immediate need for replacement, but it should be included in future maintenance/replacement project lists.
Poor	Condition of item is poor and is not functioning as intended or designed. Immediate replacement of item is necessary.

Table 7-5: Tafuna Collection System Lift Stations – Observed Conditions & Deficiencies

Observed Conditions & Deficiencies[1]										
Lift Station Name	Wet Well				Valve & Meter Vaults			Electrical Equipment		
	Piping	Pump	Guide Rails & Chains	Structure & Hatch	Piping	Valves	Structure & Hatch	Control Panel & Wiring	Level Sensors & Alarms	Electrical Box
Coconut Point #3	Good	1st pump working 2nd pump not working	Good	Good	Good	N/A	Good Some infiltration	Poor, Old & corroded Needs replacing	Level floats work No alarm	Poor & corroded
Coconut Point #2	Good	Both Pumps work	Good	Good Hatch is corroded	Good	N/A	Fair Lots of infiltration	Poor, Old & corroded Needs replacing	Level floats work No alarms	Poor & corroded
Coconut Point #1	Poor Needs to be replaced	1st pump works fair 2nd pump not working	Poor & corroded	Fair	Fair	Fair	Fair Some corrosion	Poor, Old & corroded Needs replacing	Level floats work No alarms	Poor & corroded
Andy's	Good	Good	Good	Good	Good	N/A	Fair Lots of infiltration	Poor, Old & corroded Needs replacing	Level floats work No alarms	Poor & corroded
Sagamea	Good	Good	Good	Manhole good Hatch is corroded, poor	Good	N/A	Fair Lots of infiltration	Poor, Old & corroded Needs replacing	Level floats work No alarms	Fair Some corrosion
Papa Stream	Fair Lots of corrosion	Good	Fair	Good	Fair	Fair	Valve Vault fair Meter Vault good	Good	Fair & functioning	Good
Vaitele	Fair Lots of corrosion	Good	Fair	Fair Lots of corrosion	Good	Good	Valve Vault good Meter Vault good	Poor, Old & corroded Needs replacing	Fair & functioning	Poor & corroded
Lavatai	Poor, Old Lots of corrosion	1st pump fair 2nd pump not working	Good	Fair Lots of corrosion	Poor, Old & corroded	Fair but corroded	Valve Vault good Meter Vault good	Poor, Old & unreliable	Fair & functioning	Fair but corroded
Skill Center	Fair	Good	Good	Fair Some infiltration	Poor & corroded	Poor & corroded	Valve Vault fair Meter Vault good	Poor, Old & needs replacing	Level sensors work Alarm does not work	Good
Airport	Fair	Good & working	Fair	Good Some corrosion	Fair	Fair	Valve Vault fair Meter Vault good	Good	Fair & functioning	Good Some corrosion
Freddie's Beach	Fair	Good	Good	Good	Poor & corroded	Poor & corroded	Valve Vault fair Meter Vault good	Poor & needs replacing	Fair & functioning	Poor & corroded

1. The text denotes deficiencies and areas that need improvement.

7.3.1.2.1 Coconut Point #3

The Coconut Point #3 lift station consists of two grinder pumps, however only one pump is working. The lift station collects sewer from homes at the end of Coconut Point and pumps to a manhole that gravity flows to the Coconut Point #1 lift station. The wet well and discharge piping are in good condition with minimal corrosion and infiltration. The pump float levels are functioning; however, the lift station does not have a high-water alarm. The electrical components are old with many components discontinued. Because of the failing electrical system, it has been observed that the pumps will not turn off automatically. The electrical box is very corroded and needs to be replaced. **Figure 7-6** shows a photo of Coconut Point Lift Station #3.

Figure 7-6: Coconut Point #3 Lift Station

7.3.1.2.2 Coconut Point #2

The Coconut Point #2 lift station consists of 2 grinder pumps that are functioning but old. The lift station collects flows from residents and businesses at about the middle of Coconut Point, and then pumps to a manhole that gravity flows to the Coconut Point #1 lift station. The lift station wet well and discharge piping are in good condition with minimal corrosion and infiltration. The valve vault with the flow meter and piping is in good condition but has lots of groundwater infiltration. The lift station float levels are functioning; however, the lift station does not have a high-water alarm. The electrical components are old with many components discontinued. The electrical box is very corroded and needs to be replaced. **Figure 7-7** shows a photo of Coconut Point Lift Station #2.

Figure 7-7: Coconut Point #2 Lift Station

7.3.1.2.3 Coconut Point #1

Coconut Point #1 lift station consists of 2 grinder pumps, however only 1 pump is working due to electrical problems. The lift station collects all the flow from Coconut Point area and pumps to manhole PS-MH-34. The wet well structure is in fair condition with some corrosion; the discharge piping and guide rails are old and corroded. The condition of the valve vault structure is fair with some corrosion and infiltration; the piping and valves are fair with some corrosion. The lift station float levels are functioning; however, the lift station does not have a high-water alarm. The electrical components are old with many components discontinued. The electrical box is very corroded and needs to be replaced. **Figure 7-8** shows a photo of Coconut Point Lift Station #1.

Figure 7-8: Coconut Point #1 Lift Station

7.3.1.2.4 Andy's

Andy's lift station consists of 2 grinder pumps, however only 1 pump is installed and operating. The lift station collects flows from nearby residential homes and pumps directly into the force main from Coconut Point #1 towards Papa Lift Station. The wet well structure is in good condition. The discharge piping and guide rails are in good condition. The manhole structure for the flow meter is in good condition but has lots of groundwater infiltration. The level floats are functioning, but there is no high-water alarm. The electrical components are old with many components discontinued. The electrical box is very corroded and needs to be replaced. **Figure 7-9** shows a photo of Andy's Lift Station.

Figure 7-9: **Andy's Lift Station**

7.3.1.2.5 Sagamea

The Sagamea lift station consists of 2 grinder pumps in good condition. The lift station collects flow from nearby residential homes and is pumped to a manhole that gravity flows to the Papa Lift Station. The wet well structure is in good condition with minimal corrosion. The manhole for the flow meter is in good condition but has lots of groundwater infiltration. The discharge piping and guide rails are both in good condition. The level floats are functioning but have no high-water alarm. The electrical components are old with many discontinued parts. Because of the old electrical components, it has been observed that the pumps will either not turn on or not turn off automatically. The electrical control box is in fair condition with minimal corrosion. **Figure 7-10** shows a photo of Sagamea Lift Station.

Figure 7-10: Sagamea Lift Station

7.3.1.2.6 Papa Stream

The Papa Stream Lift Station consists of 2 non-clog pumps. The lift station collects flow from nearby residential homes, Coconut Point #1 Lift Station, Andy's Lift Station, and Sagamea Lift Station. The flow is pumped to a manhole that gravity flows to the Vaitele lift station. The wet well is in good condition with minimal corrosion. The discharge piping and guide rails are in fair condition with lots of corrosion. The valve vault structure and piping are in fair condition with some corrosion. The flow meter vault is in good condition. The float levels are functioning but have no high-water alarm. The electrical controls are in good condition with new electrical controls and VFD controls. **Figure 7-11** shows a photo of Papa Stream Lift Station.

Figure 7-11: Papa Stream Lift Station

7.3.1.2.7 Vaitele

The Vaitele Lift Station consists of 3 non-clog pumps, however only two pumps are installed. The Lift Station collects flow from nearby resident homes and lift stations, and pumps to a 15-inch sewer main. The lift station can manage the dry weather flows with the two pumps. The wet well structure is in fair condition with lots of corrosion. The lift station has a bar screen on the inlet pipe that is cleaned regularly, manually. The discharge piping and guide rails are in fair condition with lots of corrosion. The valve vault and meter vault structures are in good condition. The float levels are functioning, and the high-water alarm does work. The electrical components are old and discontinued. The electrical box is old and corroded. The electrical service to the lift station is unreliable and the lift station loses power often. **Figure 7-12** shows a photo of Vaitele Lift Station.

Figure 7-12: Vaitele Lift Station

7.3.1.2.8 Lavatai

The Lavatai Lift Station consists of 2 non-clog pumps, but only 1 pump is functioning. The Lift Station collects flow from nearby residential homes and pumps to the 8-inch force main from Vaitele. The wet well structure is in fair condition with some corrosion, the valve vault and meter vault are in good condition. The discharge piping in both the lift station and the valve vault are in poor condition with lots of corrosion. The float levels are functioning but there is no high-water alarm. The electrical components are old and unreliable with discontinued parts. The electrical box is in okay condition with some corrosion. **Figure 7-13** shows a photo of Lavatai Lift Station

Figure 7-13: Lavatai Lift Station

7.3.1.2.9 Skill Center

The Skill Center Lift Station consists of 2 grinder pumps. The Lift Station collects flow from the Skill Center and nearby residential homes and pumps to a manhole upstream of the Airport Lift Station. The wet well structure is in fair condition with lots of infiltration and corroding concrete. The discharge piping in the lift station is in fair condition with some corrosion. The valve vault structure is in fair condition and the meter vault structure is in good condition. The piping for the valve vault is in poor condition with lots of corrosion and valves that will not close. The float levels are functioning, but the high-water alarm does not work properly. The electrical components are old and unreliable with discontinued parts. The electrical box is in good condition. **Figure 7-14** shows a photo of Skill Center Lift Station.

Figure 7-14: Skills Center Lift Station

7.3.1.2.10 Airport

The Airport Lift Station consists of 2 non-clog pumps. The Lift Station collects flows from the airport and nearby industrial zone and pumps it to a manhole in front of the stadium to the west. The wet well structure is in good condition with some corrosion. The valve vault structure is in fair condition; and the meter vault structure is in good condition. The discharge piping for both the lift station and the valve vault is in fair condition with lots of corrosion. The level floats and high-water alarm are working. The electrical components, VFD controls, and boxes are in good condition. The boxes are starting to see some corrosion. **Figure 7-15** shows a photo of Airport Lift Station.

Figure 7-15: Airport Lift Station

7.3.1.2.11 Freddie's Beach

Freddie's Beach Lift Station consists of one non-clog pump. The lift station collects flow from nearby residential homes and pumps to the Tafuna Wastewater Treatment Plant. The lift station or wet well structure is in fair condition with some corrosion. The discharge piping for the lift station is in good condition with minimal corrosion. The valve vault is in fair condition; and the meter vault is in good condition. The piping for the valve vault is in poor condition with lots of corrosion. The level floats are working for the Lift Station, but it does not have a high-water alarm. The electrical components are very old with discontinued parts, and because of the old electrical components, the pumps do not turn on or off as they should. The control box is also old and very corroded. **Figure 7-16** shows a photo of Freddie's Beach Lift Station.

Figure 7-16: Freddie's Beach Lift Station

7.3.2 Existing Model

7.3.2.1 General

Until this study, ASPA has not used a hydraulic model to evaluate the performance and capacity of the Tafuna collection system. In the past, the performance and capacity of the collection system have been assessed based on the visual and CCTV inspections that are regularly performed by ASPA staff. As part of this study, ASPA tasked J-U-B Engineers, Inc. (J-U-B) with developing a hydraulic model for the system. The model was developed using Aquanuity's AquaTwin Sewer hydraulic modeling software and based on GIS data (manhole rim and invert elevations) provided by ASPA. A survey was undertaken of the system to determine the rim and invert elevations for key manholes on gravity mains that are included in the model and that did not already have elevations listed in the ASPA system data. The data source for each manhole is listed in **Appendix E-5** with the model results.

The existing model's primary purposes include the following:

- Provide a snapshot of current system flows.
- Calibrate unit flows for use in future model scenarios based on flow data that is currently available.
- Calibrate infiltration amounts and inflow responses based on flow data that is currently available.
- Identify existing capacity issues.

The existing model is comprised of two layers – the System Layer and the Flow Generation Layer. Each layer includes multiple parameters and corresponding assumptions that characterize the area and system being modeled. The assumptions are based on ASPA's GIS data, survey data, analysis of lift station flows, characteristics learned from the physical system, data from similar studies done in the region, and general and historical knowledge obtained from ASPA staff. Key modeling assumptions used to analyze ASPA's sewer collection system in the Existing Model are documented in **Appendix E-2**.

7.3.2.2 Existing Model System Layer

The system layer for the existing model scenario is comprised of gravity mains, force mains, manholes, and lift stations in the Tafuna collection system. The existing Tafuna collection system, along with the study area boundary that was used in this study, are shown in **Figure 7-3**. It is representative of the collection system as of December 2023.

7.3.2.3 GIS Data

ASPA's GIS data was used as the main source of information for the manhole rim and invert elevations, pipe sizes, and pipe lengths. A review of the GIS data was completed to identify any missing or questionable rim elevations, invert elevations, or pipe sizes for trunk lines 10 inches and larger. Missing or questionable data was reviewed with ASPA, resulting in the review of ASPA's CAD data, record drawings, field checks, and field survey where possible. J-U-B subcontracted with PIOA Consulting & Engineering, LLC. (PIOA) to collect survey data at specified manholes where a data gap existed. If data was unavailable, assumptions such as interpolating an invert elevation between two known points were made. All manholes and pipes in the model include the source for both rim and invert elevations.

The American Samoa 1962 StatePlane Amer. Samoa FIPS 5300 (US Feet) coordinate system was used for all of the GIS data. The vertical datum used for the GIS and model layers are based on the elevations provided by ASPA.

7.3.2.4 Lift Stations

Lift stations and force mains were added to the existing model using GIS data and information obtained from ASPA staff.

Table 7-6 lists the operating lift stations in the Tafuna collection system and the corresponding pumping rate and notes if a variable frequency drive (VFD) is in use. Some of the lift stations were modeled as "ideal pumps" (i.e., the flow rate at the discharge matches the influent flow, resulting in no modeled storage in the wet well). The lift stations that are listed as having VFD equipment were modeled as "ideal pumps" within the model. When a lift station is modeled as an "ideal pump" and the modeled pumping rate is higher than the lift station's capacity, the lift station does not act as a bottleneck but allows passage of the full peak flow. In this situation, the collection system pipes, and force mains become the bottlenecks within the modeled system.

Table 7-6: Tafuna Collection System Lift Stations - Existing Model

Lift Station Name	Max. Pumping Rate (gpm)	Lift Station Equipped with VFD?	Modeled as Ideal Pump?
Coconut Point #3	19	No	No
Coconut Point #2	22	No	No
Coconut Point #1	140	No	No
Andy	18	No	No
Sagamea	36	No	No
Papa Stream	390	Yes	Yes
Vaitele	600	No	No
Lavatai	155	Yes	Yes
Skill Center	225	No	No
Airport	570	Yes	Yes
Freddie's Beach	18	No	No

7.3.2.5 Existing Model Flow Generation Layer

The flow generation layer for the existing model is comprised of sanitary flow, infiltration, and inflow. The dry weather flow (DWF) is defined as the combination of the sanitary sewer flow and infiltration. While the wet weather flow (WWF) is defined as the DWF plus inflow. The quantity of each flow type and the associated diurnal flow pattern for each land use type are described in this section. The flow layer is representative of the flows in August 2021 at the WWTP and October 2022 at the Papa Stream and Airport lift stations based on availability of recorded flow data.

In order to pinpoint areas with higher infiltration and inflow, the area served by the Tafuna system was split into 3 wastewater basins. These basins were determined by which lift stations had available flow data and by which lift stations had VFDs installed with the pumps. Due to these constraints, the Tafuna system was broken down into the following basins: Wastewater Treatment Plant, Papa Stream, and Airport basins. The area each of these basin's cover can be found in **Figure E-3-3.**

7.3.2.5.1 Existing Land Use

Detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Tafuna area. For this study's purpose in the Tafuna area, it is assumed that there are two types of land use and flows: residential and non-residential. There are no known significant industrial users that contribute to the Tafuna system. **Figure 2-2** in **Chapter 2** shows the spatial distribution of land use as applied in the Existing Model.

Table 7-7 below shows the three basins with available flow data and the corresponding percentage of land use based on area. The WWTP sewer basin includes the entire Tafuna area minus the area upstream of the Papa Stream and Airport Lift Stations.

Table 7-7: Existing Tafuna Area Percent Land Use

Sewer Basin	Residential	Non-residential
Wastewater Treatment Plant	89%	11%
Papa Stream	89%	11%
Airport	95%	5%

7.3.2.5.2 Service Areas

Service areas were created to help determine and route where sewer flows are collected by the existing sewer system and where areas previously developed, but not serviced, would be collected in the future. The service areas were created by splitting each village into small drainage basins based on the current layout of the sewer system and area topography.

The developed and sewered area within each service area was divided by the developed and sewered area of the village it was bound by. This resulted in a percentage that represented the estimated sewered area of each service area within each village. To estimate the population of the service area this percentage was multiplied by the estimated sewered population for the village it is located in. The estimated sewered population per village can be found in **Chapter 3 Section 3.1.4.** This population was used to estimate the flow produced by each service area. This method assumes that the density of each village is unique and is constant throughout the village. By utilizing service areas, the flow is injected at the correct spot in the modeled collection system resulting in as accurate as possible model without being provided more detailed sewer connection numbers, locations, and land use data.

7.3.2.5.3 Sanitary Sewer Flows

Average sanitary flows for the Existing Model were developed by determining the total average flow for the WWTP, Papa Stream, and Airport sewer basins. The estimated sewered population and typical average wastewater flows are used to assign the initial residential flows.

Average non-residential flows from each sewer basin were divided by the total serviced non-residential area upstream of the three sewer basins to determine an average unit flow per acre. The non-residential area typically includes the building and the property directly surrounding the building. The residential and non-residential unit flows were then adjusted to match flows recorded by the permanent flow meters during periods without rain. This process is the dry weather model calibration and is used to identify unique unit flows based on the estimated sewered population, non-residential area, and all other model assumptions. For additional discussion on model calibration see **Section 7.3.2.4**.

The residential and non-residential unit flows determined by the dry weather calibration efforts are 52 gallons per capita per day (gpcd) and 250 gallons per acre per day (gpad) respectively. These unit flows represent the sanitary sewer portion of the average daily DWF measured at the metered locations and were developed through the dry weather model calibration process. To further improve the accuracy of the residential and non-residential flows, it is recommended that ASPA resolve the number of residences and GIS mapping through field verification activities.

7.3.2.5.4 Infiltration and Inflow

Infiltration is groundwater or seawater entering the sewer through cracks, holes, joint failures, settled service connections, or other defects in the system. This can be from a high groundwater table, sewers located beneath sea level, or rainfall induced groundwater. Infiltration estimates for Tafuna were based on flow monitoring data collected at the WWTP, Papa Stream Lift Station, and the Airport Lift Station during the summer months of 2022. The estimated infiltration inputs to the model were then adjusted during model calibration**. Figure E-3-3** in **Appendix E-3** shows the estimated peak seasonal infiltration and relative development density for each basin.

Within the Tafuna collection system there are approximately 1.5 miles of modeled gravity sewer installed at an elevation beneath sea level. Not all of the system pipes in the GIS mapping have elevation data, so it is likely that there are additional pipes beneath sea level that we cannot confirm within the scope of this report.

Inflow is the flow of storm water directly into the sewer during and after a rainfall event due to a direct connection to the sewer from storm drains, roof drains, parking lots, manhole lids, etc. Inflow in a system can be observed and estimated by correlating sewer flow meter data flow spikes with recorded rain events. Due to the frequency of rain events and the amount of impervious area in American Samoa it is possible that a portion of the infiltration is due to inflow by increased groundwater. Quantifying the total peak inflow in American Samoa is challenging due to the tropical climate and magnitude of a single rainfall event. See **Figure 7-17** for a visual of the three types of flow: sanitary sewer, infiltration, and inflow.

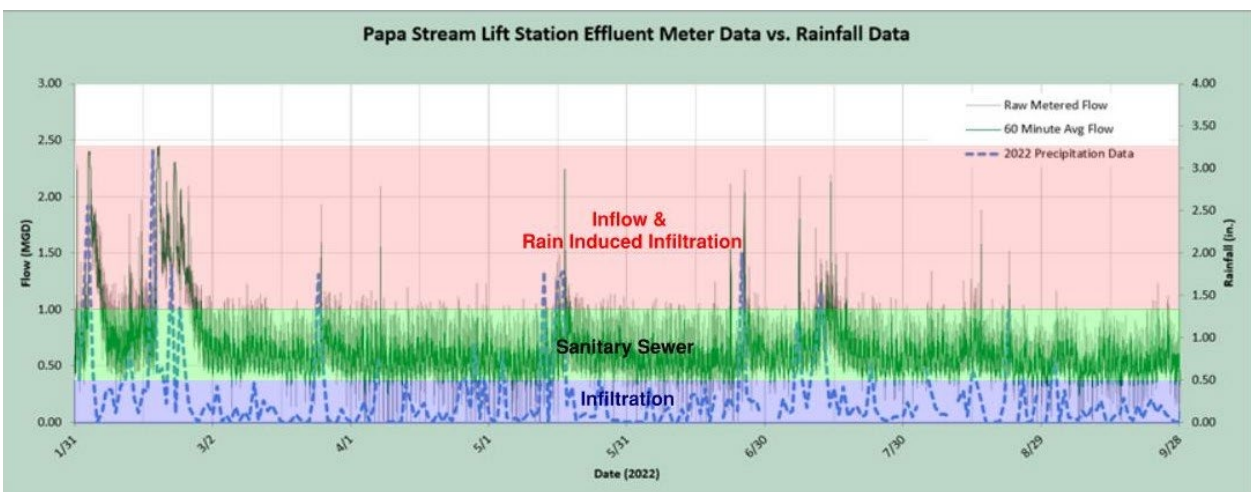

Figure 7-17: Papa Stream Lift Station Infiltration and Inflow Diagram

An estimate of infiltration and inflow for each sewer basin was developed from the available WWTP influent and lift station flow records, as well as rainfall data for storm events during January 2020, January-February 2022, and October 2022. **Table 7-8** provides a summary of the existing infiltration and inflow for the Tafuna area. For additional information on infiltration and inflow calculations, see **Section 7.3.2.6**. The

DWF and WWF in **Table 7-8** are similar to the flows reported in Chapter 3, but not exact. The differences are well within the margin of error based on the quality of the flow data, and the two different approaches.

Table 7-8: Tafuna Area Existing Infiltration and Inflow

Sewer Basin	Est. Basin Population	Infiltration Rate (GPAD)	Max. Basin Infiltration (MGD)[1]	Avg. DWF (GPCD)	Inflow Rate (GPAD)	Avg. Basin Inflow (MGD)[2]	Avg. WWF (GPCD)
Airport Lift Station	176	112	0.04	279	256	0.08	734
Papa Stream Lift Station	2,075	2,256	0.44	264	3,427	0.67	587
Tafuna WWTP	17,603	0	0.00	52	255	0.52	82
Total	**19,854**		**0.48**	**74**		**1.27**	**138**

[1] The Maximum Basin Infiltration is added to the model as a constant base flow.

[2] The Average Basin Inflow is added to the model as an average flow that follows a diurnal curve matching the peak wet weather flow captured by the available meter data.

The United States Environmental Protection Agency (USEPA) defines excessive infiltration as having an average DWF greater than 120 GPCD and excessive inflow as having an average WWF greater than 275 GPCD. As seen in the table above the total average DWF for Tafuna does not qualify as excessive infiltration or inflow, however the Airport and Papa Stream Lift Station Basins exceed the USEPA limits for excessive infiltration and inflow. This is likely due to the overall elevation of the basins and the pipe age and material. For example, the Airport and Papa Stream Lift Station Basins are both low in elevation and have several miles of gravity pipe beneath sea level and constructed of asbestos cement whereas the Tafuna WWTP Basin is higher in elevation and has no pipes beneath sea level and the pipe material is PVC. It is also possible that the September 2009 earthquake and tsunami may have caused unknown infiltration damage to some of the underground utilities near the shoreline.

Typically, infiltration is a constant flow throughout each day while inflow is added to the system based on storm intensity. For this model, a diurnal curve for the storm event was created to multiply the average basin inflow rates from above to match the peak wet weather flow seen in the meter data. Infiltration on American Samoa is a chronic issue that reduces the everyday capacity of the entire collection system. By having a reduced capacity due to infiltration means that there is less capacity in the system to carry inflow before having a potential SSO. Because of the location of the basins that have a high I/I rate it is likely that these flows have a high salinity content which can degrade wastewater infrastructure at a quicker than expected rate. Infiltration also gets carried to the WWTP thus decreasing the daily capacity at the WWTP as well as incurring additional cost to treat water and requiring higher discharge permits.

During large storm events, inflow within the system creates peak flows that are not able to pass through several segments of the gravity or pressure system resulting in sanitary sewer overflows (SSO). It is important for ASPA to find and correct the major sources of infiltration to regain system capacity as well as finding and minimizing sources of inflow to lower the peak flows seen throughout the system. Doing this would lower number of projects in the Capital Improvement Plan and result in a system that does not experience SSO's.

7.3.2.5.5 Peaking Factors

The existing model utilized two types of peaking factors to convert average usage data into hourly data.

Hourly peaking factors for the average sanitary flows were applied in the form of diurnal curves. Diurnal curves or hourly flow patterns (the typical 24-hour shape of the flow) were developed for each unique land use designation used in the model. The diurnal curves were developed from historical modeling efforts and by researching typical diurnal curves for tropical islands. These curves were then updated during calibration with the lift station flow data obtained for the year 2022. The year 2022 was chosen for calibration, due to the fact that the year 2022 had the most overlapping flow data between each lift station. Diurnal curves used in the model can be found in **Appendix E-2**.

Daily peaking factors adjust how much of the average flow is allocated to each hour of every day. The majority of the Tafuna area is characterized by residential flows which can be seen in the dry weather WWTP flow data. During model calibration it was noticed that inflow also has a high impact on the collection system. Whenever a large rainfall event (> 2.0 inches) occurs, peak flows increase exponentially.

The Existing Model utilized these hourly diurnal curves to adjust the average unit flow to match the average weekday and average weekend flows captured by the flow meters. The diurnal curves were also used to capture both weekday and weekend maximum peak possibilities. These factors are specific to each land use type and were adjusted during calibration of the model.

7.3.2.5.6 Flow Allocation

The average unit flows were used to calculate a total average flow per service area based on the estimated sewered population and non-residential area serviced within each service area. Each service area was assigned an injection point to the existing collection system. These injection points are simply an existing manhole in the system to which the flow produced by the service area was injected.

Pipes that do not serve enough area to generate flows larger than an 8" pipe can carry are not modeled. Because not every pipe in the collection system is modeled, flows from service areas that were not adjacent to modeled pipes were injected in the first modeled junction along their flow route to the WWTP. **Figure E-3-2** shows each service area and a line from the center of the service area to the injection point signifying where the flow produced by the service area will enter the modeled system. The flows were then allocated into the Existing Model at the identified injection point using the correct diurnal curve based on the flow type.

7.3.2.6 Existing Model Calibration

Calibration is the process of modifying the hourly diurnal curve and average unit flow values in order to match model flows to actual flows in the system at the meter locations. Data for actual flows, typically temporary flow monitoring (in this case lift station meter data), have limitations that prevent 'perfect' calibration between model output and real flows. Some of the factors affecting calibration include the level of uncertainty of the flow meter data, flow data from different time periods, and effluent versus influent meter data. Considering these limitations, a good model calibration results in model flows within ± 10 percent of actual flows.

7.3.2.6.1 Dry Weather Calibration

Daily sewer flows are continually monitored at the WWTP by ASPA staff and were provided for the dates between July 2019 and August 2021. Flow meter data for the majority of calendar year 2022 was obtained from several lift stations and two of them were chosen to represent the flows upstream of the Papa Stream and Airport Lift Stations. This data captured the peak seasonal flows that typically occur between October and May due to the long, wet summer season.

As discussed in **Section 7.3.2.3.5**, sanitary flows vary from weekday to weekend. As such, the model was calibrated to meet the average weekend and weekday flows. Individual days were plotted to show the uncertainty and variability of flow at any given point in the system, these plots can be found in **Appendix E-4**. Large service areas showed less variability in flow than smaller service areas due to the number of customers upstream. An average diurnal flow curve was determined for each site from the available flow meter data. Days with rain events were removed, base infiltration was added, and the model was calibrated to the average curves. After an iterative process through modifying the base infiltration for each basin the total peak seasonal infiltration in the Tafuna collection system was determined to be approximately 0.48 mgd.

An example calibration graph for one of the sites is shown in **Figure 7-18**. All individual calibration graphs for dry weather flows can be found in **Appendix E-4**.

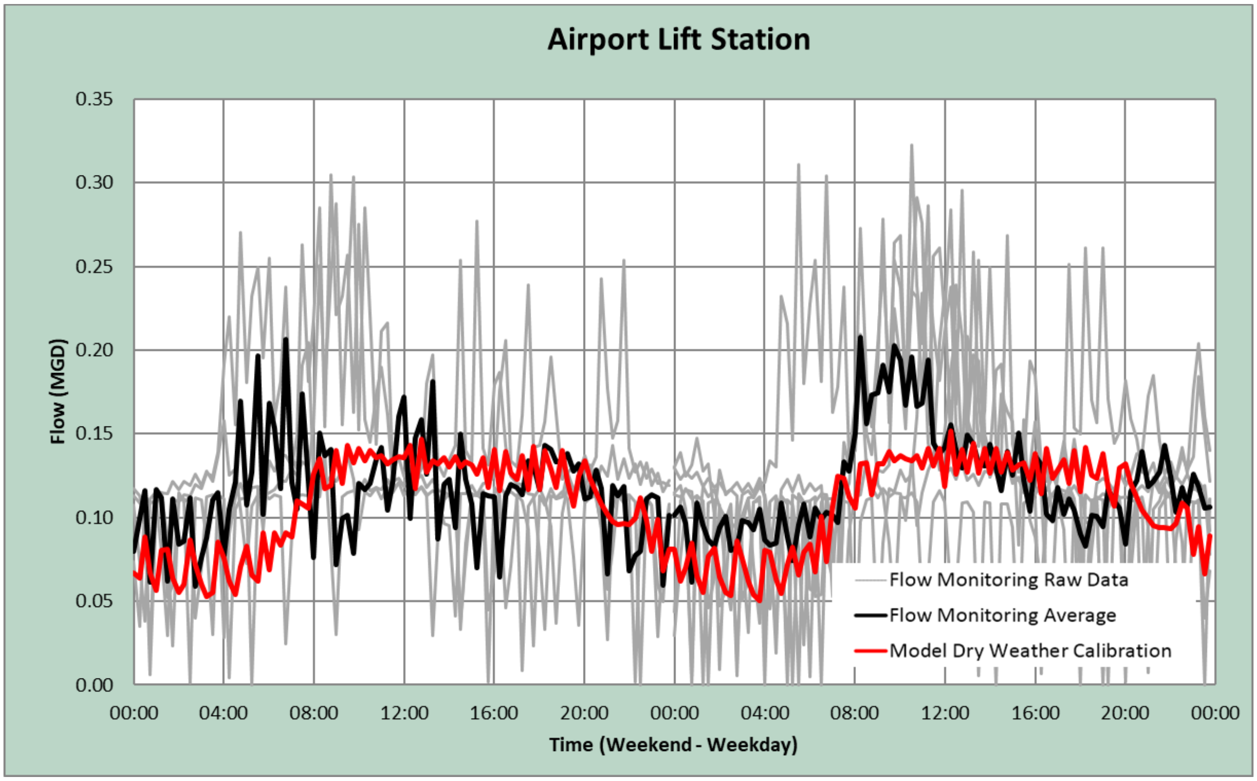

Figure 7-18: Dry Weather Calibration Example

7.3.2.6.2 Wet Weather Calibration

During the process of wet weather calibration, precipitation data for the area was analyzed and overlayed onto the available meter data. Data from storm events identified on January 22, 2020, February 17, 2022, and October 26-27, 2022, and flow data collected at the WWTP, Papa Stream and Airport Lift Stations were used for the wet weather calibration. **Figure 7-19** shows flow data for the Airport Lift Station with 2022 precipitation data, which was obtained from the NOAA Atlas 14 Point Precipitation Frequency Estimates (NOAA, 2024). As shown in the figure, the highest precipitation in 2022 occurred during the October 26-27 storm event. Inflow was added to the average flows determined during the dry weather calibration to estimate the inflow resulting from the storm. The peak hourly flow (PHF) produced by the Tafuna calibrated model is 5.67 million gallons per day (MGD). This is comparable to the PHF of 5.50 MGD listed in **Section 3.1.2.4** of **Chapter 3**.

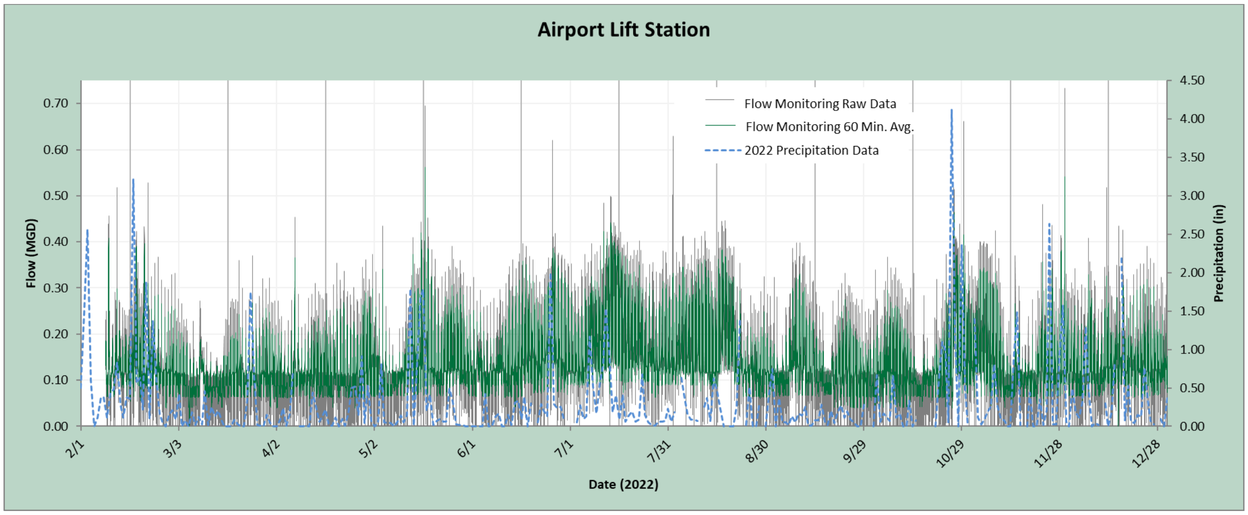

Figure 7-19: Flow Data for the Airport Lift Station with 2022 Precipitation Data

The October 2022 storm resulted in a peak storm depth of 4.12 inches. A calibration graph showing the measured and the calibrated modeled storm inflow at each location is included in **Appendix E-4**.

The combined weighted calibration error for all sites was 5% for peak flows. This calibration provides confidence that the model will provide representative results for future model scenarios and alternative evaluations.

7.3.2.7 Existing Model Analysis

The Existing Model includes base infiltration and a simulated rainfall event from an observed storm, using the calibrated system response parameters described previously, resulting in a worst-case scenario. **Figures E-3-4** and **E-3-5** show Depth over Diameter and Reserve Capacity for the Existing Model, illustrating any capacity issues. Depth over diameter is the ratio of the flow depth in the pipe over the diameter of the pipe and is used to identify how full the pipe is and includes any backwater conditions that may be present due to downstream restrictions. Reserve capacity identifies the remaining capacity of a pipe, without taking into account any downstream restrictions.

The reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments; therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity ("over capacity") does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other "over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any occurs. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to modeled pipes. **Appendix E-5** contains complete model results from the Existing Model analysis. All Existing Model results and figures include the design storm event from October 2022.

7.3.2.7.1 Existing Model Bottlenecks

The Existing Model analysis shows four locations in the system with surcharging (d/D > 1.0):

- Upstream of the Vaitele Lift Station and upstream of the Papa Lift Station as a result of the two lift stations being over capacity due to high I/I flow. The model also shows water spilling out of the following manholes during the peak wet weather event: VS-MH-48, VS-MH-51,PS-MH-25, and PS-MH-30. These manholes are at lower elevations than other surrounding manholes and are near several homes that have experienced backups. These backups have led to the installation of overflow pipes from home service lines so that the water spills out of the system before it reaches the homes.
- Surcharging throughout Coconut Point as a result of gravity pipes and lift stations being over capacity due to high I/I flow and inadequate pipe slopes. Through coordinating with ASPA staff, it was determined that the high I/I rate assigned to the Coconut Point area is higher than operators have observed. Additional meter data is needed to calibrate the model further and verify the flows within Coconut Point.
- Near the airport as the result of pipes segments with flat slopes and a reduction in reported pipe size. This section of pipe also has to carry the I/I being collected from the Airport and Papa Stream Lift Station Basins. While the pipes in this area do surcharge under wet weather conditions, there is no surcharging under dry weather conditions.

There are a few additional lines in the system that are near or over capacity. These are “flat” pipes that have very low slopes and show little or no reserve capacity. However, each “flat” pipe has significant reserve capacity both upstream and downstream. These isolated “flat” pipes do not result in any surcharging and are not considered bottlenecks.

It is important to note that the high I/I rates seen in the Airport and Papa Stream Lift Station Basins are a main contributor to the bottlenecks listed above. It is recommended that ASPA focuses on the condition-based projects first to eliminate as much of the I/I as possible. By lessening the I/I flow it is possible that these capacity projects could be reduced or eliminated while also removing the potential of a future SSO at locations currently known to overflow.

7.3.2.7.2 Existing Lift Stations

Table 7-9 contains a summary of each lift station and its remaining capacity. From the existing model it is observed that the listed existing peak flows are not representative of the actual peak flows seen in the system. This is due to existing upstream bottlenecks and undersized pumps restricting the amount of flow reaching the following lift stations: Vaitele, Papa Stream, and Coconut Point #1. These bottlenecks also cause several SSO’s leading to a loss of water from the system. **Table 8-1** lists the peak flow each lift station needs to accommodate future flows after improvements have been made and is more representative of the lift station capacity shortfalls. Several lift stations have an existing peak inflow that is higher than the current design capacity.

Table 7-9: Tafuna Area Existing Model Lift Station Summary

Lift Station Name	Design Capacity (gpm)	Existing Peak Flow[1] (gpm)	Remaining Capacity (gpm)
Coconut Point #3	19	95	**-76**
Coconut Point #2	22	96	**-74**
Coconut Point #1	140	155	**-15**
Andy's	18	6	12
Sagamea	36	11	25
Papa Stream	390	1,008	**-618**
Vaitele	600	518	82
Lavatai	155	22	133
Skill Center	225	172	53
Airport	570	561	9
Freddie's Beach	18	11	7

[1]Peak flow listed is 10% higher than model flows to provide a safety factor for lift station capacity.

CIP improvement projects are planned to improve the following lift stations that show capacity limitations under Existing Model conditions:

- Coconut Point #3
- Coconut Point #2
- Coconut Point #1
- Papa Stream
- Vaitele

7.3.3 10-year Model

7.3.3.1 General

The 10-year Model represents everything within the Tafuna area that is currently served and the areas that are anticipated to connect to the collection system within the next 10 years. See **Figure E-3-6** for the areas that are anticipated to develop in the future. The 10-year Model is a tool to estimate available collection system capacity, taking into account anticipated future development or redevelopment with the understanding that these flows may not be realized for several years into the future. The 10-year Model's primary purposes include:

- Evaluation of the remaining capacity in the system beyond the next 10 years.
- Identify potential capacity issues that may arise as development occurs over the next 10 years.

7.3.3.2 10-year Model System Layer

The 10-year Model uses the same system layer as the Exiting Model, which is described in **Section 7.3.2.2**.

7.3.3.3 10-year Model Flow Generation Layer

The Existing Model Flow Generation Layer is used as the base for the 10-year Model Flow Generation Layer. New flows added to the 10-year Model come from the areas that are anticipated to connect to the sewer within the next 10 years. These areas include:

- 75% of the full buildout within the Vaitogi village and the southern edge of the Iliili village that is not currently connected to the system.
- 50% of the full buildout within the Leone, Malaeloa Aitulagi, Malaeloa Ituau, Taputimu, Vailoatai, and Futiga villages.
- 50% of the full buildout within the Mapusagafou, Pavaiai, Aasu, and Aoloau villages.

7.3.3.3.1 Land Use and Unit Flows

As described in **Section 7.3.2.5.1**, detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Tafuna area. This study assumes that land use within the existing Tafuna area is limited to residential and non-residential areas. Land use designations for the 10-year Model were limited to residential flows and were assigned based on the population listed in the 2020 US Census. Residential unit flows were assigned to the future growth areas based on the current population, and as described in **Section 7.3.2.5.3**.

7.3.3.3.2 Flow Allocation

Each anticipated growth area where the collection system is anticipated to expand, was modeled by injecting flow to a manhole identified by previous studies or through coordination with ASPA. A map showing where future flows are to be injected is shown in **Figure E-3-6**.

7.3.3.3.3 Infiltration and Inflow

The infiltration and inflow used in the Existing Model was used as the base for the 10-year Model. Additional infiltration and inflow were added to the 10-year Model based on the expanded area. Future infiltration and inflow rates are expected to be lower than the rates used in the Existing Model due to better pipe material, improved installation technologies, and replacement of damaged pipe with new pipe. Generally, the future growth areas in Tafuna are at a higher elevation and there will likely be less piping installed beneath sea level. **Table 7-10** provides a summary of the 10-year infiltration and inflow for the Tafuna area.

Table 7-10: Tafuna Area 10-year Infiltration and Inflow

Description	Max. Total Infiltration (MGD)	Total Avg. Inflow (MGD)
Existing	0.48	1.27
Additional 10-year	0.07	0.14
Total 10-year	0.55	1.41

7.3.3.4 10-year Model Analysis

The 10-year Model analysis shows the results with anticipated future developments over the next 10 years without the addition of any relief lines or correction of existing system deficiencies. This helps identify priorities for Capital Improvement Projects in subsequent sections.

Figures E-3-7 and **E-3-8** show Depth over Diameter and Reserve Capacity, respectively, for the 10-year Model, illustrating any capacity issues. The reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments; therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity ("over capacity") does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other "over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any do occur. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to those pipe segments that are modeled. **Appendix E-5** contains model results from the 10-year Model analysis. All 10-year Model results and figures include the design storm event.

7.3.3.4.1 10-year Model Bottlenecks

Due to the location of the 10-year growth areas and where they connect to the existing system, the only changes to the d/D and reserve capacity within the existing system happen on the 18-inch Iliili gravity main and the 18-inch Pavaiai gravity main.

The 10-year Model analysis shows 1 additional area to the existing 4 areas where surcharging (d/D > 1.0) occurs. This additional area of concern is on the 24-inch line underneath the airport runway leading to the WWTP. The upstream manhole of this section of pipe is buried and accurate survey data was not able to be acquired prior to this report. This led to an assumed invert elevation at this point and additional work is needed to find, uncover, and survey this manhole to confirm the invert elevations. The capacity of each pipe is sensitive to the slope of the pipe and confirmation of the invert and pipe slope of the 24-inch pipe are needed to determine if surcharging will occur or if there is adequate capacity. See **Chapter 8** for additional details for each potential improvement.

7.3.3.4.2 10-year Model Lift Stations

Again, due to the location of the 10-year growth areas and where they connect to the existing system, the only changes to the d/D and reserve capacity within the existing system happen on the 18-inch Iliili gravity main and the 18-inch Pavaiai gravity main. These additional flows at the 10-year time frame do not affect any of the lift station capacities as previously listed in **Section 7.3.2.5.2**.

There are no additional lift station CIP projects needed due to the additional 10-year flows.

7.3.4 20-year Model

7.3.4.1 General

The 20-year Model represents everything within the Tafuna area that is currently served and the areas that are anticipated to expand the collection system into within the next 20 years. See **Figure E-3-6** for the areas that are anticipated to develop in the future. The 20-year Model is a tool to estimate available collection system capacity, taking into account anticipated future development or redevelopment with the understanding that these flows may not be realized for several years into the future. The 20-year Model's primary purposes include:

- Evaluation of the remaining capacity in the system beyond the next 20 years.
- Identify potential capacity issues that may arise as development occurs over the next 20 years.

7.3.4.2 20-year Model System Layer

The 20-year Model uses the same system layer as the Exiting Model, which is described in **Section 7.3.2.2**.

7.3.4.3 20-year Model Flow Generation Layer

The 10-year Model Flow Generation Layer is used as the base for the 20-year Model Flow Generation Layer. New flows added to the 20-year Model come from the areas that are anticipated to connect to the sewer within the next 20 years. These areas include:

- 100% of the full buildout within the Vaitogi village and the southern edge of the Iliili village that is not currently connected to the system.
- 100% of the full buildout within the Leone, Malaeloa Aitulagi, Malaeloa Ituau, Taputimu, Vailoatai, and Futiga villages.
- 100% of the full buildout within the Mapusagafou, Pavaiai, Aasu, and Aoloau villages.

7.3.4.3.1 Land Use and Unit Flows

As described in **Section 7.3.2.5.1**, detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Tafuna area. This study assumes that land use within the existing Tafuna area is limited to residential and non-residential areas. Land use designations for the 20-year Model were limited to residential flows and were assigned based on the assumption that the entire village population listed in the 2020 US Census connects to the sewer. Residential unit flows were assigned to the future growth areas based on the current population, and as described in **Section 7.3.2.5.3**.

7.3.4.3.2 Flow Allocation

Each anticipated growth area where the collection system is anticipated to expand, was modeled by injecting flow to a manhole identified by previous studies or through coordination with ASPA. A map showing where future flows are to be injected is shown in **Figure E-3-6**.

7.3.4.3.3 Infiltration and Inflow

The infiltration and inflow used in the 10-year Model was used as the base for the 20-year Model. Additional infiltration and inflow were added to the 20-year Model based on the expanded area. Future infiltration and inflow rates are expected to be lower than the rates used in the Existing Model due to better pipe material and installation technologies. Generally, the future growth areas in Tafuna are at a higher elevation and there will likely be less piping installed beneath sea level. **Table 7-11** provides a summary of the 20-year infiltration and inflow for the Tafuna area.

Table 7-11: Tafuna Area 20-year Infiltration and Inflow

Description	Max. Total Infiltration (MGD)	Total Avg. Inflow (MGD)
10-year	0.55	1.41
Additional 20-year	0.05	0.11
Total 20-year	0.60	1.52

7.3.4.4 20-year Model Analysis

The 20-year Model analysis shows the results with anticipated future developments over the next 20 years without the addition of any relief lines or correction of existing system deficiencies. This helps identify priorities for Capital Improvement Projects in subsequent sections.

Figures E-3-9 and **E-3-10** show Depth over Diameter and Reserve Capacity, respectively, for the 20-year Model, illustrating any capacity issues. As discussed in previous sections, the reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments, therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity (“over capacity”) does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other “over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any do occur. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to modeled trunk lines.

Appendix E-5 contains model results from the 20-year Model analysis. All 20-year Model results and figures include the design storm event.

7.3.4.4.1 20-year Model Bottlenecks

Due to the location of the 20-year growth areas and where they connect to the existing system, the only changes to the d/D and reserve capacity within the existing system happen on the 18-inch Iliili gravity main and the 18-inch Pavaiai gravity main. The 20-year Model analysis shows no additional capacity concerns to the five previous areas listed in the 10-year Model where surcharging (d/D > 1.0) occurs. The 24-inch line underneath the airport runway leading to the WWTP experiences an even greater level of surcharging than what is seen in the 10-year Model. See **Chapter 8** for additional details for each potential improvement.

7.3.4.4.2 20-year Model Lift Stations

Again, due to the location of the 20-year growth areas and where they will likely connect to the existing system, the only changes to the d/D and reserve capacity within the existing system happen on the 18-inch Iliili gravity main and the 18-inch Pavaiai gravity main. These additional flows at the 20-year time frame do not affect any of the lift station capacities as previously listed in **Section 7.3.2.5.2**.

There are no additional lift station CIP projects needed due to the additional 20-year flows.

7.3.5 Buildout Model (75-year)

7.3.5.1 General

The Buildout Model represents everything within the Tafuna area that is currently developed and infill of all villages that are only partially served. See **Figure E-3-6** for the areas that are anticipated to develop in the future. The Buildout Model is a tool to estimate available collection system capacity, taking into account anticipated future development or redevelopment with the understanding that these flows may not be realized for several years into the future. The Buildout Model's primary purposes include:

- Evaluation of the remaining capacity in the system after including the entire population of the villages anticipated to be connected to the system.
- Identify potential capacity issues that may arise as collection system growth occurs over the next 75-years.

7.3.5.2 Buildout Model System Layer

The Buildout Model uses the same system layer as the Exiting Model, which is described in **Section 7.3.2.2**.

7.3.5.3 Buildout Trunk Lines

Projecting future trunk lines to the villages not currently served by the existing collection system is not within the scope of this report. No future lines were included in the model or in the report.

7.3.5.4 Buildout Lift Stations

Identifying locations for future lift stations to service villages not currently served by the existing collection system is not within the scope of this report. No future lift stations were included in the model or in the report.

7.3.5.5 Buildout Diversions

There are no existing diversions within the Tafuna collection system and no future diversions are anticipated.

7.3.5.6 Buildout Model Flow Generation Layer

The 20-year Model Flow Generation Layer is used as the base for the Buildout Model Flow Generation Layer. New flows added to the Buildout Model come from the areas that are anticipated to connect to the sewer within the next 75 years. These areas include:

- Infill of all villages that the existing collection system currently partially serves. This includes the small communities that are located northeast of Coconut Point.

7.3.5.6.1 Land Use and Unit Flows

As described in **Section 7.3.2.5.1**, detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Tafuna area. This study assumes that land use within the existing Tafuna area is limited to residential and non-residential areas. Land use designations for the Buildout Model were limited to residential flows and were assigned based on the assumption that the entire village population listed in the 2020 US Census connects to the sewer. Residential unit flows were assigned to the future growth areas based on the current population, and as described in **Section 7.3.2.5.3**.

7.3.5.6.2 Flow Allocation

The infill of the existing system utilized the service areas and corresponding injection points used for the Existing Model.

7.3.5.6.3 Infiltration and Inflow

The infiltration and inflow used in the 20-year Model was used as the base for the buildout Model. Additional infiltration and inflow were added to the Buildout Model based on the added infill area. Future infiltration and inflow rates are expected to be lower than the rates used in the Existing Model due to better pipe material and installation technologies. Generally, the future growth areas in Tafuna are at a higher elevation and there will likely be less piping installed beneath sea level. **Table 7-12** provides a summary of the buildout infiltration and inflow for the Tafuna area.

Table 7-12: Tafuna Area Buildout Infiltration and Inflow

Description	Max. Total Infiltration (MGD)	Total Avg. Inflow (MGD)
20-year	0.60	1.52
Additional Buildout	0.01	0.02
Total Buildout	0.61	1.54

7.3.5.7 Buildout Model Analysis

The Buildout Model analysis shows the results with all anticipated future collection system growth over the next 75 years without the addition of any relief lines or correction of existing system deficiencies. This helps identify priorities for Capital Improvement Projects in subsequent sections.

Figures E-3-11 and **E-3-12** show Depth over Diameter and Reserve Capacity, respectively, for the Buildout Model, illustrating any capacity issues. As discussed in previous sections, the reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments; therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity ("over capacity") does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other "over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any do occur. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to modeled trunk lines. **Appendix E-5** contains model results from the Buildout Model analysis. All Buildout Model results and figures include the design storm event.

7.3.5.7.1 Buildout Model Bottlenecks

Due to the small and dispersed location of the buildout areas, minor changes are noticed on the d/D and reserve capacity within the existing system. The Buildout Model analysis shows no major additional capacity concerns to the five previous areas listed in the 10-year and 20-year Models where surcharging (d/D > 1.0) occurs. The 24-inch line underneath the airport runway leading to the WWTP experiences an even greater level of surcharging than what is seen in the 20-year Model. See **Chapter 8** for additional details on each potential bottleneck and the improvements needed.

There are also several additional lines scattered throughout the system that are near or over capacity. These are "flat" pipes that have very low slopes and show little or no reserve capacity. However, each "flat" pipe has significant reserve capacity both upstream and downstream. These isolated "flat" pipes do not result in any surcharging and are not considered potential bottlenecks.

7.3.5.7.2 Buildout Model Lift Stations

Because of the minor changes due to infill at the buildout stage and the existing backwater upstream of many of the existing lift stations, there are only minor changes to the d/D and reserve capacity. The additional flows at the buildout time frame do not have a noticeable effect on any of the lift station capacities as previously listed in **Section 7.3.2.5.2**.

There are no additional lift station CIP projects needed due to the additional buildout flows. **Chapter 8** and 9 discuss the potential improvements and evaluate the capacity of the pipes upstream of the lift stations that are over capacity once the lift stations are improved to have adequate capacity to convey peak flows.

7.4 Utulei Area

7.4.1 Existing System Summary

The Utulei collection system is the second largest of ASPA's three collection systems and is located near the center of the island of Tutuila, encircling the Pago Pago Harbor. The collection system includes pipelines (gravity and forcemains), manholes, and lift stations, and serves an estimated population of 7,675. The existing Utulei collection system that is used in this study, are shown in **Figure 7-20**.

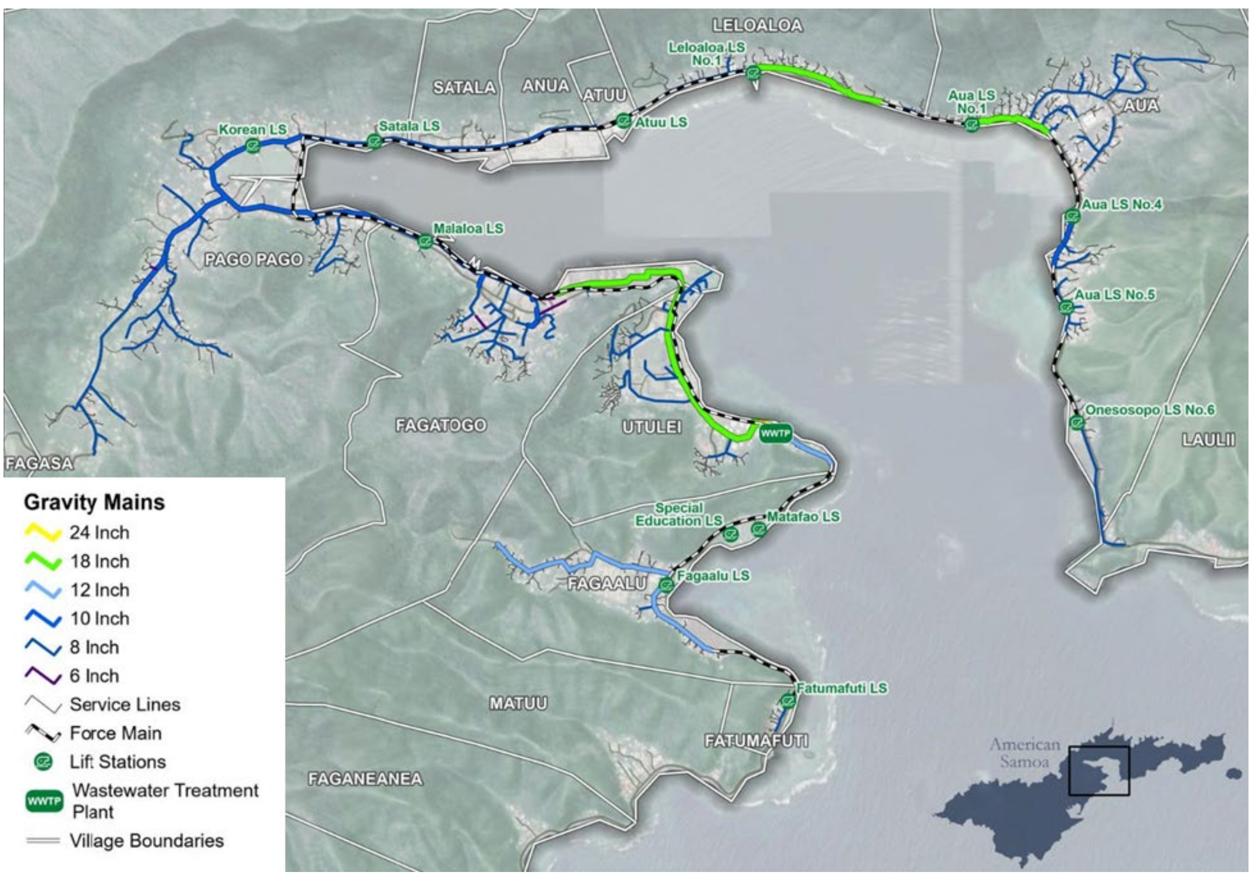

Figure 7-20: Existing Utulei Collection System

7.4.1.1 Sewerlines

Within the Utulei collection system, there are approximately 15 miles of gravity mains, which range in size from 6-inch to 24-inch diameter pipe. Based on GIS data, CAD data, and as-built data provided by ASPA, approximately 60% of Utulei's gravity mains consist of PVC pipe and 29% consist of AC pipe. The collection system gravity main material is displayed in **Figure 7-21** and summarized in **Table 7-13**. **Figure 7-22** and **Table 7-14** provides a summary of known pipe age. The average age of the Utulei collection system based on known pipe installation data is approximately 29.9 years old. In addition to the gravity mains, there are approximately, 547 manholes and 5.2 miles of force mains.

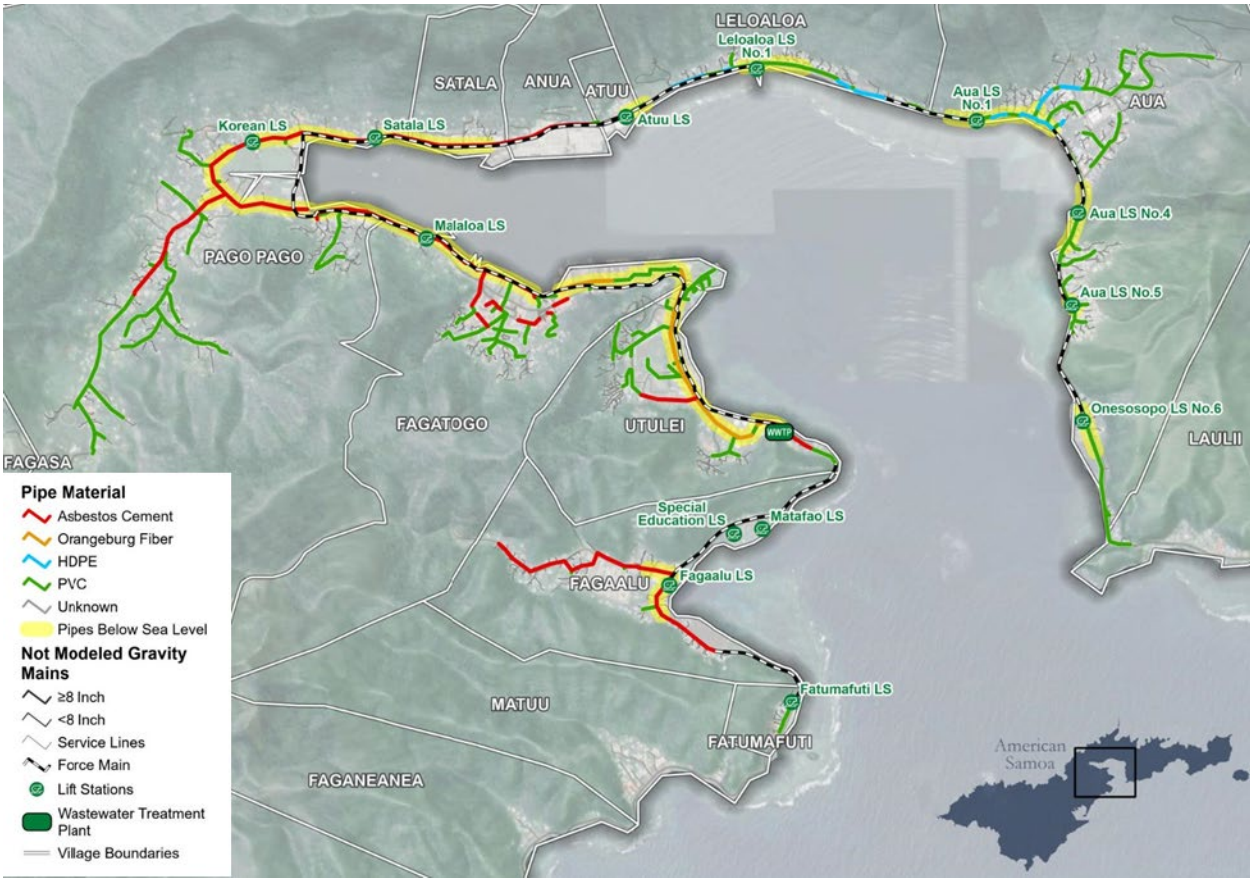

Figure 7-21: Utulei Collection System Gravity Main Material

Table 7-13: Utulei Collection System Gravity Main Material

Pipe Material	Length (mi)	Percent of Total Length
AC	4.43	29%
Orangeburg Fiber	0.84	6%
HDPE	0.59	4%
PVC	9.09	60%
Unknown	0.16	1%

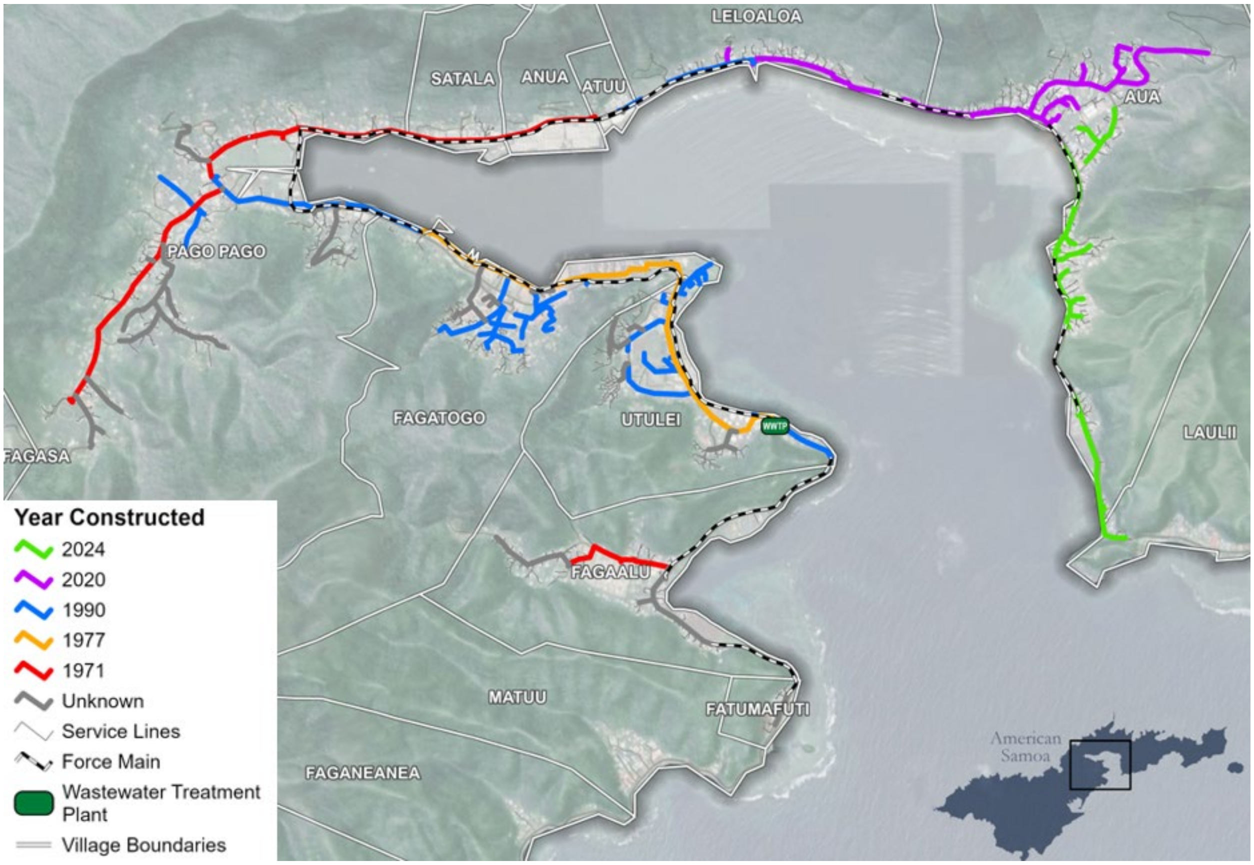

Figure 7-22: Utulei Collection System Gravity Main Year Constructed

Table 7-14: Utulei Pipe Age

Year Installed	Length (mi)	Pipe Age (yrs)
1971	2.48	54
1977	1.54	48
1990	3.83	35
2020	2.42	5
2024	1.64	1
Unknown	3.20	-

7.4.1.2 Lift Stations

The Utulei collection system includes 13 lift stations. A summary of the lift stations is included in **Table 7-15**. For a summary of lift station capacity, see **Section 7.4.2.5.2**.

Table 7-15: Utulei Collection System Lift Stations – Design Criteria

Lift Station Name	Year Constructed/ Last Major Rehabilitation	Wet Well			Pumps				
		Dia. (ft)	Depth (ft)	Total Vol. (gallons)	No. of Pumps	Make, Model, & Type	HP	TDH (ft)	Max. Pumping Capacity (gpm)
Onesopo	2023	6	20	4,230	2	Gellert; Grinder	2.7	39	96
Aua #5	2023	8	25	9,400	2	Flygt 3085	5	Unknown	320
Aua #4	2023	8	25	9,400	2	Flygt 3085	5	Unknown	505
Aua #1	2019	10	24	14,100	3	Flygt 3127; Non-clog	10	38	677
Leloaloa	2019	10	24	14,100	3	Flygt 3171; Non-clog	35	104	600
Atu'u	Unknown	5	20	2,938	2	Flygt 3085; Non-clog	3	39	96
Satala	Unknown	5	20	2,938	2	Flygt 3085; Non-clog	2.4	17	285
Korean	Unknown	5	20	2,938	2	Flygt 3102; Non-clog	5	18	380
Malaloa	Unknown	16	23	34,593	3	Flygt 3301; Non-clog	70	80	2,000
Fatumafuti	Unknown	8	12	4,512	2	Flygt 3085	3	22	310
Faga'alu	Unknown	6	13	2,750	2	Flygt 3127; Non-Clog	10	48	310
Matafao	Unknown	5	10	1,469	1	Flygt 3085; Non-Clog	2.4	31	75
Matafao Special Education	Unknown	6	12	2,538	1	Flygt 3085; Non-Clog	2.4	31	75

J-U-B conducted site visits to each of the 13 lift stations in the Utulei collection system. Observed conditions and deficiencies are summarized and detailed descriptions for each lift station are listed below in **Table 7-17**. Observed deficiencies at the lift stations were used to identify potential improvement projects, which are discussed in detail in **Chapter 8**. **Appendix E-1** contains the original site visit information sheets for each lift station. **Table 7-16** below provides explanation to the ranking/descriptors used.

Table 7-16: Lift Station Ranking System

Ranking	Description
Good	Item is functioning properly; therefore, there is no immediate need for replacement.
Fair	Condition of item is fair; however, it is still functioning as intended. No immediate need for replacement, but it should be included in future maintenance/replacement project lists.
Poor	Condition of item is poor and is not functioning as intended or designed. Immediate replacement of item is necessary.

Table 7-17: Utulei Collection System Lift Stations – Observed Conditions & Deficiencies[1]

Lift Station Name	Wet Well				Valve & Meter Vaults			Electrical Equipment		
	Piping	Pump	Guide Rails & Chains	Structure & Hatch	Piping	Valves	Structure & Hatch	Control Panel & Wiring	Level Sensors & Alarms	Electrical Box
Onesosopo	Good	Good	Good	Good	Good	Good	Good	Good	Good & functioning	Good
Aua #5	Good	Good	Good	Good	Good	Good	Good	Good	Good & functioning	Good
Aua #4	Good	Good	Good	Good	Good	Good	Good	Good	Good & functioning	Good
Aua #1	Good	Good	Good	Good	Good	Good	Good	Good	Good & functioning	Good Minor corrosion
Leloaloa	Good	Good	Good	Good	Good	Good	Good	Good	Good & functioning	Good
Atu'u	Fair	Fair	Fair	Fair Lots of infiltration	Poor	Poor	Fair Lots of infiltration	Poor All manual controlled	Fair & functioning	Poor
Satala	Fair	Good	Good	Fair Lots of infiltration	Poor Needs replacing	Poor Needs replacing	Fair Needs new hatches	Poor Needs replacing	Fair & functioning	Good
Korean	Fair Some corrosion	Good	Fair Some corrosion	Fair Some corrosion & infiltration	Good	Good	Fair Some concrete degradation	Good	Fair & functioning	Good
Malaloa	Fair Lots of corrosion	Good	Fair Lots of corrosion	Fair	Poor Lots of corrosion	Poor Lots of corrosion	Fair Some corrosion	Good	Fair & functioning	Good
Fatumafuti	Good	Good	Good	Good	Good	Good	Good	Good	Fair & functioning	Fair Some corrosion
Faga'alu	Unknown	Poor & undersized	Fair	Fair but undersized	Unknown	Unknown	Fair	Good	Fair & functioning	Fair Some corrosion
Matafao	Fair	Fair Needs replacing	Fair	Fair Concrete is eroding	Good	Good	Good	Poor Needs replacing	Fair & functioning	Poor & corroded
Matafao Special Education	Good	Good	Good	Good	Good	Good	Good	Poor Needs replacing	Fair & functioning	Poor & corroded

1. The text denotes deficiencies and areas that need improvement.

7.4.1.2.1 Onesosopo

Onesosopo Lift Station consists of 2 grinder pumps that collect flow from nearby residential homes and pump towards Aua #5 Lift Station. The lift station is newly built in 2023. All components of the lift station are working per plans. **Figure 7-23** shows a photo of Onesosopo Lift Station.

Figure 7-23: Onesosopo Lift Station

7.4.1.2.2 Aua #5

The Aua #5 Lift Station consists of 2 pumps that collect flow from nearby residential homes and Onesosopo Lift Station. Flow is pumped to a manhole that gravity flows towards Aua #4 Lift Station. The lift station is newly built in 2023. All components of the lift station are operating properly. **Figure 7-24** shows a photo of Aua #5 Lift Station.

Figure 7-24: Aua #5 Lift Station

7.4.1.2.3 Aua #4

The Aua #4 Lift Station consists of 2 pumps that collect flow from nearby residential homes and from Aua #5 Lift Station. Flow is pumped to a manhole that gravity flows towards Aua #1 Lift Station. The Lift Station is newly built in 2023. All components of the lift station are operating properly. **Figure 7-25** shows a photo of Aua #4 Lift Station.

Figure 7-25: Aua #4 Lift Station

7.4.1.2.4 Aua #1

The Aua #1 Lift Station consists of 3 non-clog pumps. The Lift Station collects flows from the nearby residential homes and from Aua #4 Lift Station. The structures for the lift station, valves, meter, and pig launch are in good condition with minimal corrosion. The discharge piping and valves for the lift station are also in good condition. Electrical panel and VFDs are working properly. The electrical boxes are in good condition with minimal corrosion. **Figure 7-26** shows a photo of Aua #1 Lift Station.

Figure 7-26: Aua #1 Lift Station

7.4.1.2.5 Leloaloa

The Leloaloa Lift Station consists of 3 grinder pumps. The Lift Station collects frow from the residential homes and from Aua #1 lift station. This lift station utilizes a 2.1 mile long force main to carry flows to the Malaloa Lift Station. This is the longest force main on the island. The structures for the lift station, valves, meter, and pig launch are in good condition with minimal corrosion. The discharge piping and valves are also in good condition. The electrical panel and VFD controls are both in good condition and operating properly. The electrical box is good with minimal corrosion. **Figure 7-27** shows a photo of Leloaloa Lift Station.

Figure 7-27: Leloaloa Lift Station

7.4.1.2.6 Atu'u

The Atu'u Lift Station consists of 2 non-clog pumps. The Lift Station collects flow from residential homes and businesses. The flow is pumped to manhole SPS-MH-14 and gravity flows to Satala Lift Station. The wet well structure for the lift station is in fair condition with lots of infiltration. The valve vault is in fair condition with lots of infiltration. The flow meter vault is in good condition with lots of infiltration. The piping in both the wet well and valve vault is poor and heavily corroded. The pumps are not automated and must be turned on manually. The electrical components are very old and unreliable. **Figure 7-28** shows a photo of Atu'u Lift Station.

Figure 7-28: Atu'u Lift Station

7.4.1.2.7 Satala

The Satala Lift Station consists of 2 non-clog pumps. The Lift Station collects from residential homes and businesses, flow from the Atu'u Lift Station, and infiltration. The flow is pumped to a manhole downstream towards the Korean Lift Station. The lift station wet well and discharge piping are in fair condition with lots of corrosion and infiltration. The valve vault is in fair condition with corrosion and old hatches. The piping in the valve vault is very corroded and old. The electrical components are old, but not as old as some other lift stations. The Lift Station does have new VFDs. **Figure 7-29** shows a photo of Satala Lift Station.

Figure 7-29: Satala Lift Station

7.4.1.2.8 Korean

The Korean Lift Station consists of 2 non-clog pumps. The Lift Station collects flow from residential homes and flow from the Satala Lift Station. The flow is lifted to a manhole 50-feet away and gravity flows to the Malaloa Lift Station. The lift station wet well is in fair condition with some corrosion and infiltration and old hatches. The discharge piping in the lift station is fair with some corrosion. The valve vault is in fair condition with a lot of corrosion. The flow meter manhole is in good condition. The pipe and valves in the valve vault are in good condition and operate properly. The electrical panel is in good condition with minor corrosion. The VFDs are also in good condition except the screen on one of the VFDs, which needs to be replaced. **Figure 7-30** shows a photo of Korean Lift Station.

Figure 7-30: Korean Lift Station

7.4.1.2.9 Malaloa

The Malaloa Lift Station is the largest lift station in the Utulei collection system and consists of 3 non-clog pumps. The lift station collects all the flow from the east side of the system which includes Aua, Pago Pago, and Fagatogo then pumps the flow to the 24-inch gravity main upstream of the Utulei WWTP. The lift station wet well is in fair condition with some corrosion and flaking of an old liner, but no infiltration. The discharge piping is old and very corroded inside the lift station as well as the guide rails. The valve vault is in fair condition but has lots of corrosion. The piping in the vault is very old, corroded, and difficult to operate. The electrical controls are in good condition, but the parts are starting to become discontinued. The VFDs are in good condition and operating properly. **Figure 7-31** shows a photo of the Malaloa Lift Station.

Figure 7-31: Malaloa Lift Station

7.4.1.2.10 Fatumafuti

The Fatumafuti Lift Station consists of 2 pumps. The Lift Station collects flow from residential homes and pumps to the 12-inch gravity main upstream of the Faga'alu Lift Station. The lift station wet well structure is in good condition with minimal corrosion. The discharge pipes are also in good condition with minimal corrosion. The valve vault is in good condition with minimal corrosion on the vault floor. The piping in the valve vault is in good condition. The electrical panel and equipment are in good condition and operate properly. **Figure 7-32** shows a photo of Fatumafuti Lift Station.

Figure 7-32: Fatumafuti Lift Station

7.4.1.2.11 Faga'alu

The Faga'alu Lift Station consists of 2 non-clog pumps. The lift station collects flow from the nearby collection system and from the Fatumafuti Lift Station. Flow is pumped to the 12-inch gravity main upstream of the Utulei WWTP. This lift station is undersized, both in pump capacity and wet well capacity. During any storm event, the wet well fills up and backs up into the collection system. This causes major sewer overflows. It works fine during normal operations and no storm events. The lift station and valve vault were both filled with water and the pumps, piping, and valves were not visible during inspection. The electrical panel and VFDs are in good condition. **Figure 7-33** shows a photo of Faga'alu Lift Station.

Figure 7-33: Faga'alu Lift Station

7.4.1.2.12 Matafao

The Matafao Lift Station consists of a single non-clog pump. The lift station collects flow from the elementary school and nearby homes and pumps it into the force main from the Faga'alu Lift Station. The lift station wet well is in fair condition with lots of concrete erosion and corrosion. The discharge piping is also old and very corroded. The valve vault is in fair condition with some corrosion. The piping in the valve vault is also fair but has minimal corrosion. The electrical panel for the lift station is old and unreliable. It's been observed that the control panel will not automatically turn the pump off. **Figure 7-34** shows a photo of Matafao Lift Station.

Figure 7-34: Matafao Lift Station

7.4.1.2.13 Matafao Special Education

The Matafao Special Education Lift Station consists of a single pump. The lift station collects flows from the special education school and nearby building and pumps it into the force main from the Faga'alu Lift Station. The lift station wet well and discharge piping are in good condition with minimal corrosion. The valve manhole and piping are both in good condition with some corrosion. The main issue with this lift station is the electrical control. The controls are old and corroded. It has been observed that the controls will not turn the pumps on automatically and need to be turned on manually. **Figure 7-35** shows a photo of the Matafao Special Education Lift Station.

Figure 7-35: Matafao Special Education Lift Station

7.4.2 Existing Model

7.4.2.1 General

Until this study, ASPA has not used a hydraulic model to evaluate the performance and capacity of the Utulei collection system. In the past, the performance and capacity of the collection system have been assessed based on the visual and CCTV inspections that are regularly performed by ASPA staff. As part of this study, ASPA tasked J-U-B with developing a hydraulic model for the system. The model was developed using Aquanuity's AquaTwin Sewer hydraulic modeling software and based on GIS data (manhole rim and invert elevations) provided by ASPA. A survey of the system was undertaken to determine the rim and invert elevations for key manholes on gravity mains that are included in the model and that did not already have elevations listed in the ASPA system data. The data source for each manhole is listed in **Appendix E-5** with the model results.

The existing model's primary purposes include the following:

- Provide a snapshot of current system flows.
- Calibrate unit flows for use in future model scenarios based on flow data that is currently available.
- Calibrate infiltration amounts and inflow responses based on flow data that is currently available.
- Identify existing capacity issues.

The existing model is comprised of two layers – the System Layer and the Flow Generation Layer. Each layer includes multiple parameters and corresponding assumptions that characterize the area and the system being modeled. The assumptions are based on ASPA's GIS data, survey data, analyzed lift station flows, characteristics learned from the physical system, similar studies done in the region, and general and historical knowledge obtained from ASPA staff. Key modeling assumptions used to analyze ASPA's sewer collection system in the Existing Model are documented in **Appendix E-2**.

7.4.2.2 Existing Model System Layer

The system layer for the existing model scenario is comprised of gravity mains, force mains, manholes, and lift stations in the Utulei collection system. The existing Utulei collection system, along with the study area boundary that was used in this study, are shown in **Table 7-18**. It is representative of the collection system as of July 2024.

7.4.2.2.1 GIS Data

ASPA's GIS data was used as the main source of information for the manhole rim and invert elevations, pipe sizes, and pipe lengths. A review of the GIS data was completed to identify any missing or questionable rim elevations, invert elevations, or pipe sizes for trunk lines 10 inches and larger. Missing or questionable data was reviewed with ASPA, resulting in the review of ASPA's CAD data, record drawings, field checks, and field survey where possible. J-U-B subcontracted with PIOA Consulting & Engineering, LLC. (PIOA) to collect survey data at specified manholes where a data gap existed. If data was unavailable, assumptions such as interpolating an invert elevation between two known points were made. All manholes and pipes in the model include the source for both rim and invert elevations.

The American Samoa 1962 StatePlane Amer. Samoa FIPS 5300 (US Feet) coordinate system was used for all of the GIS data. The vertical datum used for the GIS and model layers are based on the elevations provided by ASPA.

7.4.2.2.2 Lift Stations

Lift stations and force mains were added to the existing model using GIS data and information obtained from ASPA staff. **Table 7-18** lists the lift stations in the Utulei collection system and the corresponding pumping rate and states if a VFD is in use. Some of the lift stations were modeled as “ideal pumps” (i.e., the flow rate at the discharge matches the influent flow, resulting in no storage in the wet well). The lift stations that are listed as having VFD equipment were modeled as “ideal pumps” within the model. When a lift station is modeled as an “ideal pump” and the modeled pumping rate is higher than the lift station’s capacity, the lift station does not act as a bottleneck but allows passage of the full peak flow. In this situation, the collection system pipes, and force mains become the bottlenecks within the modeled system.

Table 7-18: Utulei Collection System Lift Stations - Existing Model

Lift Station Name	Max. Pumping Rate (gpm)	Lift Station Equipped with VFD?	Modeled as Ideal Pump?
Onesosopo	96	No	No
Aua #5	320	Yes	Yes
Aua #4	505	Yes	Yes
Aua #1	677	Yes	Yes
Leloaloa	600	Yes	Yes
Atu’u	96	No	No
Satala	285	Yes	Yes
Korean	280	Yes	Yes
Malaloa	2,000	Yes	Yes
Fatumafuti	310	No	No
Faga’alu	310	Yes	Yes
Matafao	75	No	No
Matafao Special Education	75	No	No

7.4.2.3 Existing Model Flow Generation Layer

The flow generation layer for the existing model is comprised of sanitary flow, infiltration, and inflow. The quantity of each flow type and the associated diurnal flow pattern for each land use type are described in this section. The flow layer is representative of the flows in August 2021 at the WWTP and October 2022 at the Malaloa Lift Station based on availability of recorded flow data.

In order to pinpoint areas with higher infiltration and inflow, the area served by the Utulei system was split into 2 wastewater basins. These basins were determined by which lift stations had available flow data and by which lift stations had VFDs installed with the pumps. Due to these constraints the Utulei system was broken down into the following basins: Wastewater Treatment Plant and Malaloa basins. The area each of these basin's cover can be found in **Figure E-3-15**.

7.4.2.3.1 Existing Land Use

Detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Utulei area. For this study's purpose in the Utulei area, it is assumed that there are two types of land use and flows: residential and non-residential. There are no known significant industrial users that contribute to the Utulei system. **Figure 2-3** in **Chapter 2** shows the spatial distribution of land use as applied in the Existing Model.

Table 7-19 below shows the three basins with available flow data and the corresponding percentage of land use based on area. The WWTP sewer basin includes the entire Utulei area minus the area upstream of the Malaloa Lift Station.

Table 7-19: Existing Utulei Area Percent Land Use

Sewer Basin	Residential	Non-residential
Wastewater Treatment Plant	50%	50%
Malaloa	80%	20%

7.4.2.3.2 Service Areas

Service areas were created to help determine and route where sewer flows are collected by the existing sewer system and where areas previously developed, but not serviced, would be collected in the future. The service areas were created by splitting each village into small drainage basins based on the current layout of the sewer system and area topography.

The developed and sewered area within each service area was divided by the developed and sewered area of the village it was bound by. This resulted in a percentage that represented the estimated sewered area of each service area within each village. To estimate the population of the service area this percentage was multiplied by the estimated sewered population for the village it is located in. The estimated sewered population per village can be found in **Chapter 3 Section 3.1.4.** This population was used to estimate the flow produced by each service area. This method assumes that the density of each village is unique and is constant throughout the village. By utilizing service areas, the flow is injected at the correct spot in the modeled collection system resulting in as accurate as possible model without being provided more detailed sewer connection numbers, locations, and land use data.

7.4.2.3.3 Sanitary Sewer Flows

Average sanitary flows for the Existing Model were developed by determining the total average flow for the WWTP and the Malaloa sewer basins. The estimated sewered population listed in **Chapter 3 Section 3.1.4** and typical average wastewater flows are used to assign the initial residential flows. Typically, parcel data or a home count would be used to determine a unit flow per household. However, ASPA does not maintain parcel data in this area and counting homes is challenging due to the amount of connected roof tops. Therefore, the following method was used.

Average non-residential flows from each sewer basin were divided by the total serviced non-residential area upstream of the three sewer basins to determine an average unit flow per acre. The non-residential area typically includes the building and the property directly surrounding the building. The residential and non-residential unit flows were then adjusted to match flows recorded by the permanent flow meters during periods without rain. This process is the dry weather model calibration and is used to identify unique unit flows based on the estimated sewered population, non-residential area, and all other model assumptions. For additional discussion on model calibration see **Section 7.4.2.4**.

The residential and non-residential unit flows determined by the dry weather calibration efforts are 52 gallons per capita per day (gpcd) and 250 gallons per acre per day (gpad) respectively. These unit flows represent the sanitary sewer portion of the average daily DWF measured at the metered locations and were developed through the dry weather model calibration process. To further improve the accuracy of the residential and non-residential flows, it is recommended that ASPA resolve the number of residences and GIS mapping through field verification activities.

7.4.2.3.4 Infiltration and Inflow

Infiltration is groundwater or seawater entering the sewer through cracks, holes, joint failures, settled service connections, or other defects in the system. This can be from a high groundwater table, sewers located beneath sea level, or rainfall induced groundwater. Infiltration estimates for Utulei were based on flow monitoring data collected at the WWTP and Malaloa Lift Station during the late spring and early summer months of 2022. The estimated infiltration inputs to the model were then adjusted during model calibration**.** **Figure E-3-15** shows the estimated peak seasonal infiltration and relative development density for each basin.

Within the Utulei collection system there are approximately 4.3 miles of modeled gravity sewer installed at an elevation beneath sea level. Not all of the system pipes that were modeled have elevation data, so it is likely that there are additional pipes beneath sea level that we cannot confirm within the scope of this report.

Inflow is the flow of storm water directly into the sewer during and after a rainfall event due to a direct connection to the sewer from storm drains, roof drains, parking lots, manhole lids, etc. Inflow in a system can be observed and estimated by correlating sewer flow meter data flow spikes with recorded rain events. Due to the frequency of rain events and the amount of impervious area in American Samoa it is possible that a portion of the infiltration is due to inflow by increased groundwater. Quantifying the total peak inflow in American Samoa is challenging due to the tropical climate and magnitude of a single rainfall event. See **Figure 7-36** for a visual of the three types of flow: sanitary sewer, infiltration, and inflow.

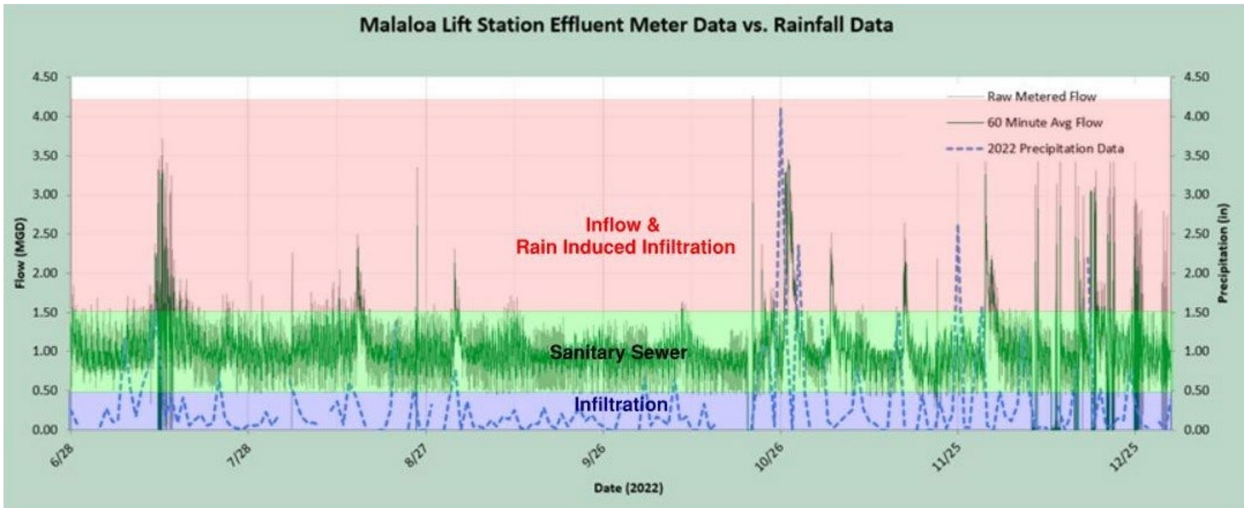

Figure 7-36: Malaloa Lift Station Infiltration and Inflow Diagram

An estimate of infiltration and inflow for each sewer basin was developed from the available WWTP influent and lift station flow records, as well as rainfall data for storm events during February 2019 and October 2022. **Table 7-20** provides a summary of the existing infiltration and inflow for the Utulei area. For additional information on infiltration and inflow calculations, see **Section 7.4.2.4**.

Table 7-20: Utulei Area Existing Infiltration and Inflow

Sewer Basin	Est. Basin Population	Infiltration Rate (GPAD)	Max. Basin Infiltration (MGD)[1]	Avg. DWF (GPCD)	Inflow Rate (GPAD)	Avg. Basin Inflow (MGD)[2]	Avg. WWF (GPCD)
Malaloa Lift Station	6,453	307	0.16	77	962	0.50	154
Utulei WWTP	1,222	6,432	1.17	1,009	0	0	1,009
Total	**7,675**		**1.33**	**225**		**0.50**	**290**

[1] The Maximum Basin Infiltration is added to the model as a constant base flow.

[2] The Average Basin Inflow is added to the model as an average flow that follows a diurnal curve matching the peak wet weather flow captured by the available meter data.

As seen in the table above the total average DWF for Utulei qualifies as excessive infiltration and inflow under the limits set by the USEPA as discussed in **Section 7.3.2.5.4**. This is likely due to the fact that the majority of the gravity main in Utulei is located below sea level and the use of asbestos cement and orangeburg pipe material. It is also possible that the September 2009 earthquake and tsunami may have caused unknown infiltration damage to some of the underground utilities near the shoreline.

Typically, infiltration is a constant flow throughout each day while inflow is added to the system based on storm intensity. For this model, a diurnal curve for the storm event was created to multiply the average basin inflow rates from above to match the peak wet weather flow seen in the meter data. Infiltration on American Samoa is a chronic issue that reduces the everyday capacity of the entire collection system. By having a reduced capacity due to infiltration means that there is less capacity in the system to carry inflow before having a potential SSO. Because the gravity mains throughout the Utulei system run parallel to the water line and are below sea level it is likely that these flows have a high salinity content which can degrade wastewater infrastructure at a quicker than expected rate. Infiltration also gets carried to the WWTP thus decreasing the daily capacity at the WWTP as well as incurring additional cost to treat water and requiring higher discharge permits.

During large storm events, inflow within the system creates peak flows that are not able to pass through several segments of the gravity or pressure system resulting in sanitary sewer overflows (SSO). It is important for ASPA to find and correct the major sources of infiltration to regain system capacity as well as finding and minimizing sources of inflow to lower the peak flows seen throughout the system. Doing this would lower number of projects in the Capital Improvement Plan and result in a system that does not experience SSO's.

7.4.2.3.5 Peaking Factors

The existing model utilized two types of peaking factors to convert average usage data into hourly data.

Hourly peaking factors for the average sanitary flows were applied in the form of diurnal curves. Diurnal curves or hourly flow patterns (the typical 24-hour shape of the flow) were developed for each unique land use designation used in the model. The diurnal curves were developed from historical modeling efforts and by researching typical diurnal curves for tropical islands. These curves were then updated during calibration with the lift station flow data obtained for the year 2022. The year 2022 was chosen for calibration, because the year 2022 had the most overlapping flow data between each lift station. Diurnal curves used in the model can be found in **Appendix E-2**.

Daily peaking factors adjust how much of the average flow is allocated to each hour of every day. Approximately 28% of the Utulei area is characterized by non-residential flows, which is reflected in the lower peak flows in the dry weather WWTP flow data. During model calibration it was noticed that inflow also has a high impact on the collection system. Whenever a large rainfall event (> 2.0 inches) occurs, peak flows increase exponentially.

The Existing Model utilized these hourly diurnal curves to adjust the average unit flow to match the average weekday and average weekend flows captured by the flow meters. The diurnal curves were also used to capture both weekday and weekend maximum peak possibilities. These factors are specific to each land use type and were adjusted during calibration of the model.

7.4.2.3.6 Flow Allocation

The average unit flows were used to calculate a total average flow per service area based on the estimated sewered population and non-residential area serviced within each service area. Each service area was assigned an injection point to the existing collection system. These injection points are simply an existing manhole in the system to which the flow produced by the service area was injected.

Pipes that do not serve enough area to generate flows larger than an 8" pipe can carry are not modeled. Because not every pipe in the collection system is modeled, flows from service areas that were not adjacent to modeled pipes were injected in the first modeled junction along their flow route to the WWTP.

Figure E-3-14 shows each service area and a line from the center of the service area to the injection point signifying where the flow produced by the service area will enter the modeled system. The flows were then allocated into the Existing Model at the identified injection point using the correct diurnal curve based on the flow type.

7.4.2.4 Existing Model Calibration

Calibration is the process of modifying the hourly diurnal curve and average unit flow values in order to match model flows to actual flows in the system at the meter locations. Data for actual flows, typically temporary flow monitoring (in this case lift station meter data), have limitations that prevent 'perfect' calibration between model output and real flows. Some of the factors affecting calibration include the level of uncertainty of the flow meter data, flow data from different time periods, and effluent versus influent meter data. Considering these limitations, a good model calibration results in model flows within ± 10 percent of actual flows.

7.4.2.4.1 Dry Weather Calibration

Daily sewer flows are continually monitored at the WWTP by ASPA staff and were provided for the dates between January 2019 and August 2021. Flow meter data for the majority of calendar year 2022 was obtained for the Malaloa Lift Station which represents the flows upstream of the lift station. This data captured the peak seasonal flows that typically occur between October and May due to the long, wet summer season.

As discussed in **Section 7.4.2.3.5**, sanitary flows vary from weekday to weekend. As such, the model was calibrated to meet the average weekend and weekday flows. Individual days were plotted to show the uncertainty and variability of flow at any given point in the system, these plots can be found in **Appendix E-4.** Large service areas showed less variability in flow than smaller service areas due to the number of customers upstream. An average diurnal flow curve was determined for each site from the available flow meter data. Days with rain events were removed, base infiltration was added, and the model was calibrated to the average curves. After an iterative process through modifying the base infiltration for each basin the total peak seasonal infiltration in the Utulei collection system was determined to be approximately 1.33 mgd.

An example calibration graph for one of the sites is shown in **Figure 7-37**. All individual calibration graphs for dry weather flows can be found in **Appendix E-4.**

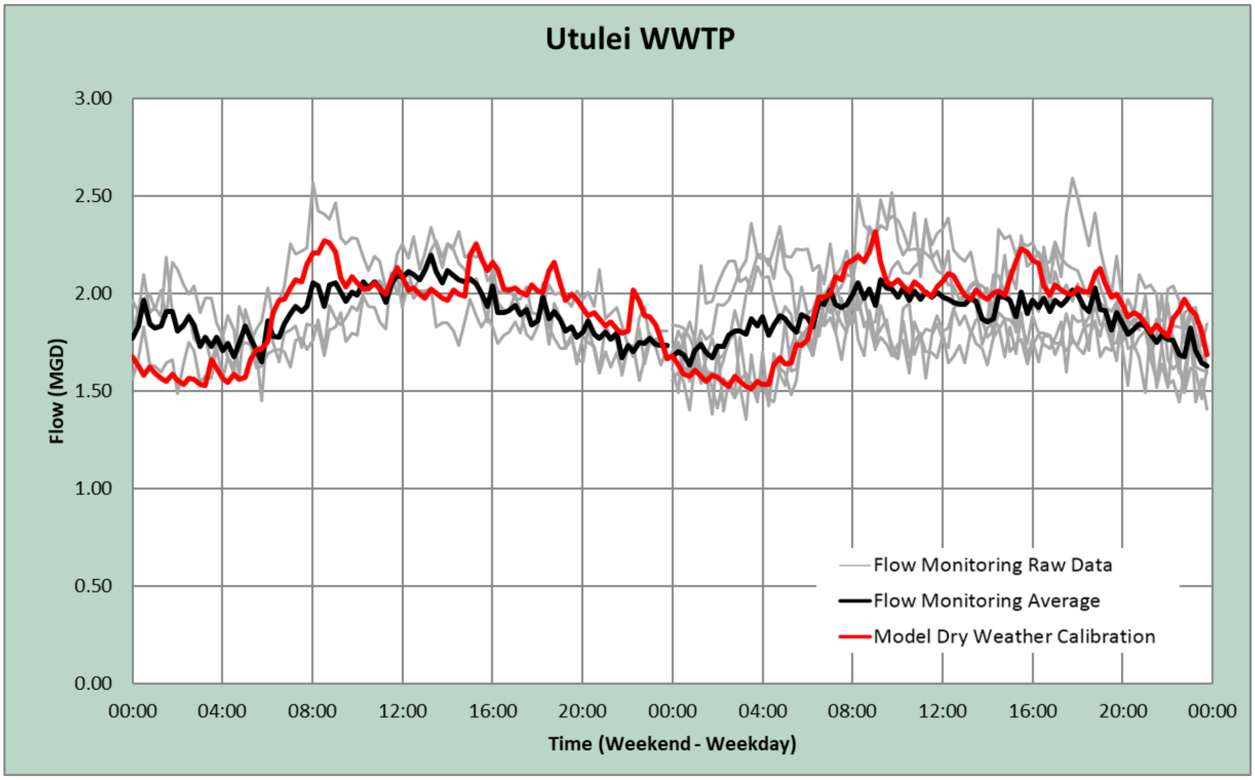

Figure 7-37: Dry Weather Calibration Example

7.4.2.4.2 Wet Weather Calibration

During the process of wet weather calibration, precipitation data for the area was analyzed and overlayed onto the available meter data. Data from storm events identified on February 23, 2019, and October 26-27, 2022, and flow data collected at the WWTP and Malaloa Lift Station were used for the wet weather calibration. **Figure 7-38** shows flow data for the Malaloa Lift Station with 2022 precipitation data, which was obtained from the NOAA Atlas 14 Point Precipitation Frequency Estimates (NOAA, 2024). As shown in the figure, the highest precipitation in 2022 occurred during the October 26-27 storm event. Inflow was added to the average flows determined during the dry weather calibration to estimate the inflow resulting from the storm. The PHF produced by the Tafuna calibrated model is 5.41 MGD. This is comparable to the PHF of 5.20 MGD listed in **Section 3.2.2.4** of **Chapter 3**.

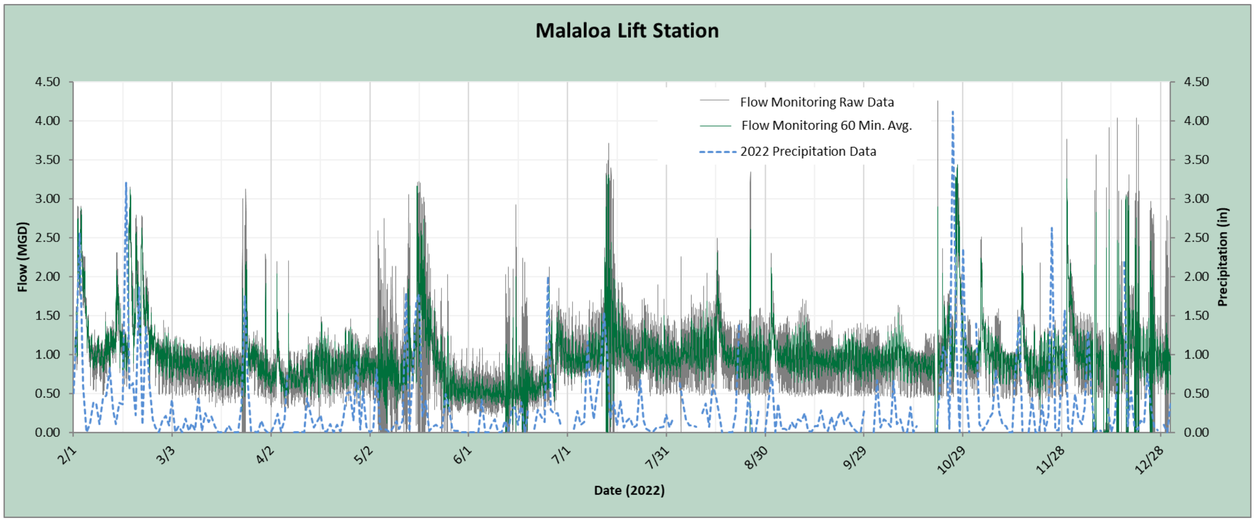

Figure 7-38: Flow Data for the Malaloa Lift Station with 2022 Precipitation Data

The October 2022 storm resulted in a peak storm depth of 4.12 inches. A calibration graph showing the measured and the calibrated modeled storm inflow at each location is included in **Appendix E-4**.

The combined weighted calibration error for all sites was 5% for peak flows. This calibration provides confidence that the model will provide representative results for future model scenarios and alternative evaluations.

7.4.2.5 Existing Model Analysis

The Existing Model includes base infiltration and a simulated rainfall event from an observed storm, using the calibrated system response parameters described previously, resulting in a worst-case scenario. **Figures E-3-16** and **E-3-17** show Depth over Diameter and Reserve Capacity for the Existing Model, illustrating any capacity issues.

The reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments, therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity ("over capacity") does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other "over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any do occur. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to modeled pipes. **Appendix E-5** contains complete model results from the Existing Model analysis. All Existing Model results and figures include the design storm event.

7.4.2.5.1 Existing Model Bottlenecks

The Existing Model analysis shows four locations in the system with surcharging (d/D > 1.0):

- Upstream of the Atu'u Lift Station as a result of the lift station being slightly overcapacity, due to high I/I flow.
- Upstream of the Onesosopo Lift Station. Due to the Aua collection system being recently constructed and no flow meter data specific to Aua, it is likely that the assumed I/I rates in the model determined from the Malaloa Lift Station Basin meter data are much higher than what has been observed by ASPA staff in the Aua and Onesosopo areas. It is anticipated that this area does not have any capacity issues and will not require a CIP project.
- Upstream of the Malaloa Lift Station as a result of the lift station being over capacity due to high I/I and to undersized piping leading to the lift station. The model shows water spilling out of the following manholes during the peak wet weather event: MPS-MH-94, MPS-MH-96, and MPS-MH-97. These manholes are at lower elevations than other surrounding manholes and are near one home that has experienced many backups. These backups have led to the installation of an overflow pipe from the home's service line so that the water spills out of the system before it reaches the home.
- Upstream of the Fatumafuti lift station as a result of an inadequate pipe slope going into the lift station.

Upstream of the Korean Lift Station and the Satala Lift Station, there are lines that are nearing capacity, which is a result of both pipe size and high I/I in the Malaloa Basin (see **Figure E-3-15**).

It is important to note that the high I/I rates seen throughout Utulei are a main contributor to the bottlenecks listed above. It is recommended that ASPA focuses on the condition-based projects first to eliminate as much of the I/I as possible. By lessening the I/I flow it is possible that these capacity projects could be eliminated while also removing the potential of a future SSO at locations currently known to overflow.

7.4.2.5.2 Existing Lift Stations

Table 7-21 contains a summary of each lift station and its remaining capacity. Several lift stations have an existing peak inflow that is higher than the current design capacity. **Table 8-2** list the peak flow each lift station needs to meet to accommodate future flows after improvements have been made.

Table 7-21: Utulei Area Existing Model Lift Station Summary

Lift Station Name	Design Capacity (gpm)	Existing Peak Flow[1] (gpm)	Remaining Capacity (gpm)
Onesosopo	96	124	**-28**
Aua #5	320	261	59
Aua #4	505	492	13
Aua #1	677	949	**-272**
Leloaloa	600	1,542	**-942**
Atu'u	96	96	0
Satala	285	446	**-161**
Korean	280	603	**-323**
Malaloa	2,000	2,641	**-641**
Fatumafuti	310	198	112
Faga'alu	310	659	**-349**
Matafao	75	17	58
Matafao Special Education	75	6	69

[1]Peak flow listed is 10% higher than model flows to provide a safety factor for lift station capacity.

Due to the limited amount of flow data, the base infiltration and peak inflow rates determined for the Malaloa basin were assigned to the entire area upstream of the Malaloa Lift Station. The collection system around Aua and Onesosopo are relatively new, and it is likely that they experience little infiltration and inflow, whereas the area between Malaloa and Leloaloa likely experiences high infiltration and inflow. It is possible that through additional flow metering in the bay area that the infiltration and inflow rates determined in this plan could be refined showing that the Leloaloa, Aua, and Onesopo lift stations do not have capacity deficiencies. Lower infiltration and inflow rates would need to be confirmed with additional flow meter data.

CIP improvement projects are planned to improve the following lift stations that show capacity limitations under Existing Model conditions:

- Aua #1
- Leloaloa
- Atu'u
- Satala
- Korean
- Malaloa
- Faga'alu

7.4.3 10-year Model

7.4.3.1 General

The 10-year Model represents everything within the Utulei area that is currently developed and the areas that are anticipated to connect to the collection system within the next 10 years. The 10-year Model is a tool to estimate available collection system capacity, taking into account anticipated future development or redevelopment with the understanding that these flows may not be realized for several years into the future. The 10-year Model's primary purposes include:

- Evaluation of the remaining capacity in the system beyond the next 10 years.
- Identify potential capacity issues that may arise as development occurs over the next 10 years.

7.4.3.2 10-year Model System Layer

The 10-year Model uses the same system layer as the Existing Model, which is described in **Section 7.4.2.2**.

7.4.3.3 10-year Model Flow Generation Layer

The Existing Model Flow Generation Layer is used as the base for the 10-year Model Flow Generation Layer. There are no future flows anticipated within the 10-year time frame.

7.4.3.4 10-year Model Analysis

There are no future flows anticipated within the 10-year time frame. Therefore, all the previous model results listed in **Section 7.4.2.5** do not change.

7.4.4 20-year Model

7.4.4.1 General

The 20-year Model represents everything within the Utulei area that is currently developed and the areas that are anticipated to develop within the next 20 years. The 20-year Model is a tool to estimate available collection system capacity, taking into account anticipated future development or redevelopment with the understanding that these flows may not be realized for several years into the future. The 20-year Model's primary purposes include:

- Evaluation of the remaining capacity in the system beyond the next 20 years.
- Identify potential capacity issues that may arise as development occurs over the next 20 years.

7.4.4.2 20-year Model System Layer

The 20-year Model uses the same system layer as the Existing Model, which is described in **Section 7.4.2.2**.

7.4.4.3 20-year Model Flow Generation Layer

The 10-year Model Flow Generation Layer is used as the base for the 20-year Model Flow Generation Layer. There are no future flows anticipated within the 20-year time frame.

7.4.4.4 20-year Model Analysis

There are no future flows anticipated within the 20-year time frame. Therefore, all the previous model results listed in **Section 7.4.2.5** do not change.

7.4.5 Buildout Model (75-year)

7.4.5.1 General

The Buildout Model represents everything within the Utulei area that is currently developed and infill of all villages that are only partially served. See **Figure E-3-18** for the areas that are anticipated to develop in the future. The Buildout Model is a tool to estimate available collection system capacity, taking into account anticipated future development or redevelopment with the understanding that these flows may not be realized for several years into the future. The Buildout Model's primary purposes include:

- Evaluation of the remaining capacity in the system after including the entire population of the villages anticipated to be connected to the system.
- Identify potential capacity issues that may arise as collection system growth occurs over the next 75-years.

7.4.5.2 Buildout Model System Layer

The Buildout Model uses the same system layer as the Existing Model, which is described in **Section 7.4.2.2**.

7.4.5.3 Buildout Trunk Lines

Projecting future trunk lines to the villages not currently served by the existing collection system is not within the scope of this report. No future lines were included in the model or in the report.

7.4.5.4 Buildout Lift Stations

Identifying locations for future lift stations to service villages not currently served by the existing collection system is not within the scope of this report. No future lift stations were included in the model or in the report.

7.4.5.5 Buildout Diversions

There are no existing diversions within the Tafuna collection system and no future diversions are anticipated.

7.4.5.6 Buildout Model Flow Generation Layer

The 20-year Model Flow Generation Layer is used as the base for the Buildout Model Flow Generation Layer. New flows added to the Buildout Model come from the areas that are anticipated to connect to the sewer within the next 75 years. These areas include:

- Infill of all villages that the existing collection system currently partially serves.

- Expansion of the existing collection system to serve the Matu'u and Faganeanea villages.

7.4.5.6.1 Land Use and Unit Flows

As described in **Section 7.4.2.3.1**, detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Utulei area. This study assumes that land use within the Utulei area is limited to residential and non-residential areas. Land use designations for the Buildout Model were limited to residential flows and were assigned based on the assumption that the entire village population listed in the 2020 US Census connects to the sewer. Residential unit flows were assigned to the future growth areas based on the current population, and as described in **Section 7.3.2.5.3**.

7.4.5.6.2 Flow Allocation

The infill of the existing system utilized the service areas and corresponding injection points used for the Existing Model.

Each anticipated growth area where the collection system is anticipated to expand, was modeled by injecting flow to a manhole identified by previous studies or through coordination with ASPA. A map showing where future flows are to be injected is shown in **Figure E-3-18**.

7.4.5.6.3 Infiltration and Inflow

The infiltration and inflow used in the Existing Model was used as the base for the Buildout Model. Additional infiltration and inflow were added to the Buildout Model based on the added infill and expansion areas. Future infiltration and inflow rates are expected to be lower than the rates used in the Existing Model due to better pipe material and installation technologies. **Table 7-22** provides a summary of the buildout infiltration and inflow for the Utulei area.

Table 7-22: Utulei Area Buildout Infiltration and Inflow

Description	Max. Total Infiltration (MGD)	Total Avg. Inflow (MGD)
Existing	1.33	0.50
Additional Buildout	0.01	0.02
Total Buildout	1.34	0.52

7.4.5.7 Buildout Model Analysis

The Buildout Model analysis shows the results with anticipated future developments over the next 75 years without the addition of any relief lines or correction of existing system deficiencies. This helps identify priorities for Capital Improvement Projects in subsequent sections.

Figures E-3-23 and **E-3-24** show Depth over Diameter and Reserve Capacity, respectively for the Buildout Model, illustrating any capacity issues. As discussed in previous sections, the reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments, therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity (“over capacity”) does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other “over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any do occur. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to modeled trunk lines. **Appendix E-5** contains model results from the Buildout Model analysis. All Buildout Model results and figures include the design storm event.

7.4.5.7.1 Buildout Model Bottlenecks

Due to the small and dispersed location of the buildout areas, minor changes are noticed on the d/D and reserve capacity within the existing system. The Buildout Model analysis shows no major additional capacity concerns to the four previous areas listed in the Existing Model where surcharging (d/D > 1.0) occurs. See **Chapter 8** for additional details on each potential bottleneck and the improvements needed.

There are also several additional lines scattered throughout the system that are near or over capacity. These are “flat” pipes that have very low slopes and show little or no reserve capacity. However, each “flat” pipe has significant reserve capacity both upstream and downstream. These isolated “flat” pipes do not result in any surcharging and are not considered potential bottlenecks.

7.4.5.7.2 Buildout Model Lift Stations

Because of the minor changes due to infill and collection system expansion at the buildout stage, there are only minor changes to the d/D and reserve capacity. The additional flows at the buildout time frame do not have a noticeable effect on any of the lift station capacities as previously listed in **Section 7.4.2.5.2**.

There are no additional lift station CIP projects needed due to the additional buildout flows. **Chapter 8** and 9 discuss the potential improvements and evaluate the capacity of the pipes upstream of the lift stations that are over capacity once the lift stations are improved to have adequate capacity to convey peak flows.

7.5 Aunu’u Area

7.5.1 Existing System Summary

The Aunu’u collection system is the smallest of ASPA’s three collection systems and is located in the western area of the island of Aunu’u. The existing Aunu’u collection system that was used in this study is shown in **Figure 7-39.**

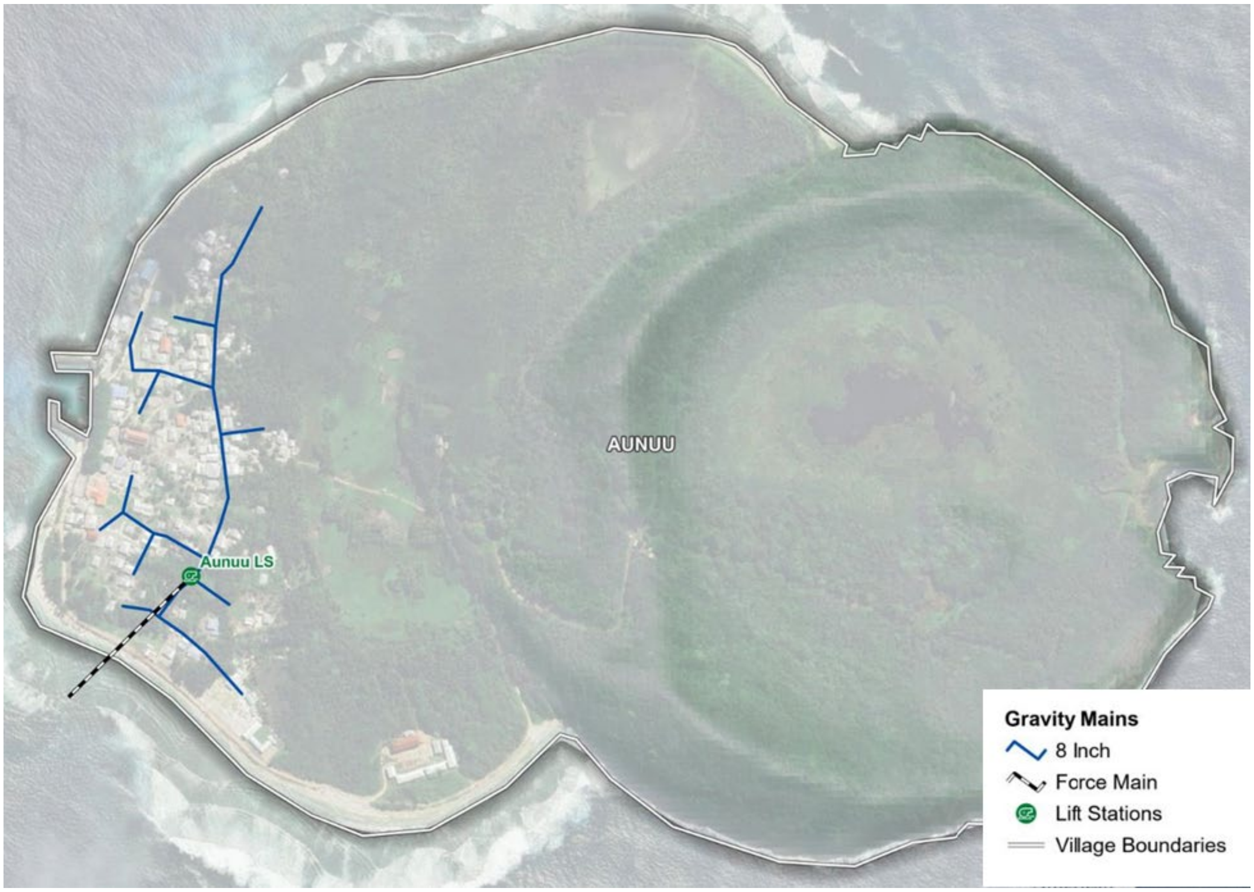

Figure 7-39: Existing Aunu'u Collection System

7.5.1.1 Sewerlines

Within the Aunu'u collection system, there is approximately one mile of gravity mains, most of which consist of 8-inch diameter pipe. Based on GIS data provided by ASPA, approximately 98% of Aunu'u's gravity mains consist of PVC pipe. The collection system gravity main material is displayed in **Figure 7-40** and summarized in **Table 7-23**. In addition to the gravity mains, there are approximately 31 manholes in the Aunu'u collection system.

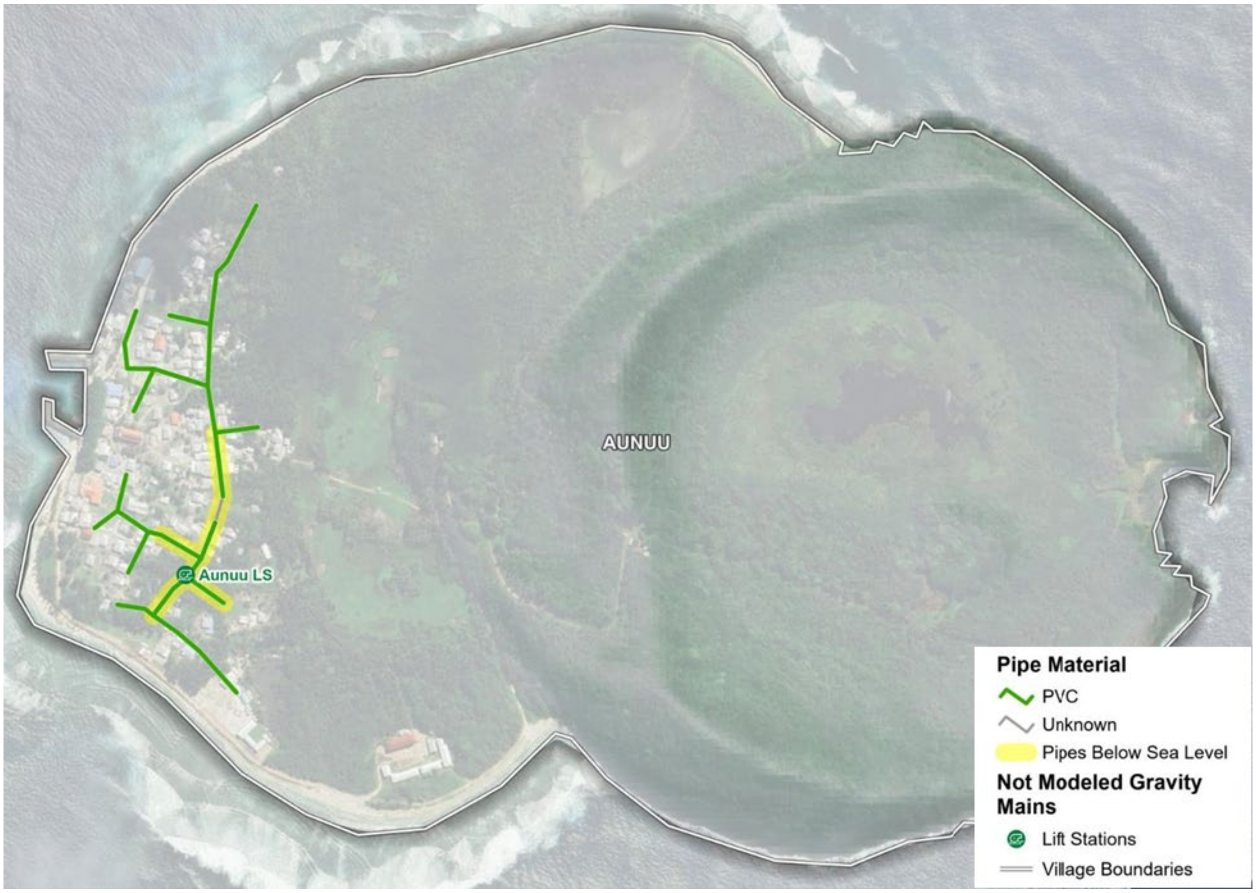

Figure 7-40: Aunu'u Collection System Gravity Main Material

Table 7-23: Aunu'u Collection System Gravity Main Material

Pipe Material	Length (mi)	Percent of Total Length
PVC	0.98	98%
Unknown	0.02	2%

7.5.1.2 Lift Stations

The Aunu'u collection system includes one lift station. A summary of the lift station is included in **Table 7-24**. For a summary of lift station capacity, see **Section 7.5.2.5.2**.

Table 7-24: Aunu'u Collection System Lift Station – Design Criteria

Lift Station Name	Year Constructed/ Last Major Rehabilitation	Wet Well			Pumps					
		Dia. (ft)	Depth (ft)	Total Vol. (gallons)	No. of Pumps	Make, Model, & Type	HP	TDH (ft)	Max. Pumping Capacity (gpm)	Comments
Aunu'u	Unknown	6	12	2,538	2	Flygt 3085	2.4	12	325	Only 1 pump installed currently

J-U-B conducted a site visit to the Aunu'u lift station. Observed conditions and deficiencies are summarized in and detailed descriptions for each lift station are listed below in **Table 7-26**. Observed deficiencies at the lift station were used to identify potential improvement projects, which are discussed in detail in **Chapter 8**. **Appendix E-1** contains the original site visit information sheet for the lift station. **Table 7-25** below provides explanation to the ranking/descriptors used.

Table 7-25: Lift Station Ranking System

Ranking	Description
Good	Item is functioning properly; therefore, there is no immediate need for replacement.
Fair	Condition of item is fair; however, it is still functioning as intended. No immediate need for replacement, but it should be included in future maintenance/replacement project lists.
Poor	Condition of item is poor and is not functioning as intended or designed. Immediate replacement of item is necessary.

Table 7-26: Aunu'u Collection System Lift Station – Observed Conditions & Deficiencies[1]

	Observed Conditions & Deficiencies									
Lift Station Name	**Wet Well**				**Valve & Meter Vaults**			**Electrical Equipment**		
	Piping	**Pump**	**Guide Rails & Chains**	**Structure & Hatch**	**Piping**	**Valves**	**Structure & Hatch**	**Control Panel & Wiring**	**Level Sensors & Alarms**	**Electrical Box**
Aunu'u	Fair	Good	Fair	Fair Some corrosion	Fair Some corrosion	Fair Some corrosion	Fair Some corrosion	Poor Needs replacing	Level sensors Fair No alarm	Fair Some corrosion

1. The text denotes deficiencies and areas that need improvement.

7.5.1.2.1 Aunu'u

The Aunu'u Lift Station consists of a single pump. This lift station collects wastewater from most of the homes and buildings on the island and discharges the flow to the ocean. The lift station wet well and discharge piping are in fair shape with some corrosion. The piping, valves, and vault for the valve vault are also in fair condition with some corrosion. The electrical controls are very unreliable and old. It has been observed that the lift station will not turn on, which then backs up flow into the collection system and homes. **Figure 7-41** shows a photo of Aunu'u Lift Station.

Figure 7-41: Aunu'u Lift Station

7.5.2 Existing Model

7.5.2.1 General

Until this study, ASPA has not used a hydraulic model to evaluate the performance and capacity of the Utulei collection system. In the past, the performance and capacity of the collection system have been assessed based on the visual and CCTV inspections that are regularly performed by ASPA staff. As part of this study, ASPA tasked J-U-B Engineers, Inc. (J-U-B) with developing a hydraulic model for the system. The model was developed using Aquanuity's AquaTwin Sewer hydraulic modeling software and based on GIS data (manhole rim and invert elevations) provided by ASPA. A survey was undertaken of the system to determine the rim and invert elevations for key manholes on gravity mains that are included in the model and that did not already have elevations listed in the ASPA system data. The data source for each manhole is listed in **Appendix E-5** with the model results.

The existing model's primary purposes include the following:

- Provide a snapshot of current system flows.
- Calibrate unit flows for use in future model scenarios based on flow data that is currently available.
- Calibrate infiltration amounts and inflow responses based on flow data that is currently available.
- Identify existing capacity issues.

The existing model is comprised of two layers – the System Layer and the Flow Generation Layer. Each layer includes multiple parameters and corresponding assumptions that characterize the area and system being modeled. The assumptions are based on ASPA's GIS data, survey data, characteristics learned from the physical system, similar studies done in the region, and general and historical knowledge obtained from ASPA staff. Key modeling assumptions used to analyze ASPA's sewer collection system in the Existing Model are documented in **Appendix E-2**.

7.5.2.2 Existing Model System Layer

The model will contain gravity mains, force mains, manholes, and lift stations in the Aunu'u collection system. The existing Aunu'u collection system, along with the study area boundary that was used in this study, are shown in **Figure 7-39**. It is representative of the collection system as of December 2023.

It should be noted that Aunu'u does not currently treat any of the water collected by the wastewater collection system and raw sewage is discharged directly to the ocean. A treatment plant is needed to complete this system.

7.5.2.2.1 GIS Data

ASPA's GIS data was used as the main source of information for the manhole rim and invert elevations, pipe sizes, and pipe lengths. A review of the GIS data was completed to identify any missing or questionable rim elevations, invert elevations, or pipe sizes. Missing or questionable data was reviewed with ASPA, resulting in the review of ASPA's CAD data, record drawings, field checks, and field survey where possible. J-U-B subcontracted with PIOA Consulting & Engineering, LLC. (PIOA) to collect survey data at specified manholes where a data gap existed. If data was unavailable, assumptions such as interpolating an invert elevation between two known points were made. All manholes and pipes in the model include the source for both rim and invert elevations.

The American Samoa 1962 StatePlane Amer. Samoa FIPS 5300 (US Feet) coordinate system was used for all of the GIS data. The vertical datum used for the GIS and model layers are based on the elevations provided by ASPA.

7.5.2.2.2 Lift Stations

The lift station and force mains were added to the existing model using GIS data and information obtained from ASPA staff. **Table 7-27** lists the lift station in the Aunu'u collection system.

Table 7-27: Aunu'u Collection System Lift Stations - Existing Model

Lift Station Name	Max. Pumping Rate (gpm)	Lift Station Equipped with VFD?	Modeled as Ideal Pump?
Aunu'u	325	No	No

7.5.2.3 Existing Model Flow Generation Layer

The flow generation layer for the existing model is comprised of sanitary flow, inflow, and infiltration. There were no available flows recorded in the Aunu'u system and the flow layer relied on the assumptions and unit flows determined by the modeling efforts at Tafuna and Utulei.

7.5.2.3.1 Existing Land Use

Detailed land use designations or zoning for each building or connection to the existing collection system is not available for the Aunu'u area. For this study's purpose in the Aunu'u area, it is assumed that there are two types of land use and flows: residential and non-residential. There are no known significant industrial users that contribute to the Tafuna system. **Figure 2-4** in **Chapter 2** shows the spatial distribution of land use as applied in the Existing Model.

Table 7-28 below shows the corresponding percentage of land use based on area.

Table 7-28: Existing Aunu'u Area Percent Land Use

Sewer Basin	Residential	Non-residential
Aunu'u	92%	8%

7.5.2.3.2 Service Areas

Service areas were created to help determine and route where sewer flows are collected by the existing sewer system and where areas previously developed, but not serviced, would be collected in the future. The service areas were created by splitting the Aunu'u village into smaller drainage basins based on the current layout of the sewer system and area topography.

The developed and sewered area within each service area was divided by the developed and sewered area of the village it was bound by. This resulted in a percentage that represented the estimated sewered area of each service area within each village. To estimate the population of the service area this percentage was multiplied by the estimated sewered population for the village it is located in. The estimated sewered population per village can be found in **Chapter 3 Section 3.1.4.** This population was used to estimate the flow produced by each service area. This method assumes that the density of each village is unique and is constant throughout the village. By utilizing service areas, the flow is injected at the correct spot in the modeled collection system resulting in as accurate as possible model without being provided more detailed sewer connection numbers, locations, and land use data.

7.5.2.3.3 Sanitary Sewer Flows

Average sanitary flows for the Existing Model were developed by determining the total average flow for Aunu'u. The estimated sewered population listed in **Chapter 3 Section 3.1.4** and typical average wastewater flows are used to assign the initial residential flows.

Average non-residential flows from each sewer basin were divided by the total serviced non-residential area upstream of the three sewer basins to determine an average unit flow per acre. The non-residential area typically includes the building and the property directly surrounding the building. The residential and non-residential unit flows were then adjusted to match flows recorded by the permanent flow meters during periods without rain. This process is the dry weather model calibration and is used to identify unique unit flows based on the estimated sewered population, non-residential area, and all other model assumptions. For additional discussion on model calibration, see **Section 7.5.2.4**.

The residential and non-residential unit flows determined by the dry weather calibration efforts are 52 gallons per capita per day (gpcd) and 250 gallons per acre per day (gpad) respectively. These unit flows represent the sanitary sewer portion of the flow measured at the metered locations and were developed through the dry weather model calibration process.

7.5.2.3.4 Infiltration and Inflow

Infiltration is groundwater or seawater entering the sewer through cracks, holes, joint failures, settled service connections, or other defects in the system. This can be from a high groundwater table, sewers located beneath sea level, or rainfall induced groundwater. Due to having no flow data from Aunu'u, infiltration estimates for were based on the average infiltration rate between Tafuna and Utulei. **Figure E-3-27** shows the estimated peak seasonal infiltration and relative density on Aunu'u.

Within the Aunu'u collection system there are approximately 0.3 miles of modeled gravity sewer installed at an elevation beneath sea level. Not all of the system pipes that were modeled have elevation data, so it is likely that there are additional pipes beneath sea level that we cannot confirm within the scope of this report.

Inflow is the flow of storm water directly into the sewer during and after a rainfall event due to a direct connection to the sewer from storm drains, roof drains, parking lots, manhole lids, etc. Inflow in a system can be observed and estimated by correlating sewer flow meter data flow spikes with recorded rain events. Due to the frequency of rain events and the amount of impervious area in American Samoa it is possible that a portion of the infiltration is due to inflow by increased groundwater. Quantifying the total peak inflow in American Samoa is challenging due to the tropical climate and magnitude of a single rainfall event.

Aunu'u does not have any recorded flows to compare rainfall data to and the estimate of inflow was developed using a combined average inflow rate from Tafuna and Utulei. **Table 7-29** provides a summary of the existing infiltration and inflow for the Aunu'u area. For additional information on infiltration and inflow calculations, see **Section 7.5.2.4**.

Table 7-29: Aunu'u Area Existing Infiltration and Inflow

Sewer Basin	Infiltration Rate (GPAD)	Max. Total Infiltration (MGD)	Inflow Rate (GPAD)	Max. Total Inflow (MGD)
Aunu'u	1,821	0.08	980	0.04

Typically, infiltration is a constant flow throughout each day while inflow is added to the system based on storm intensity. For this model a diurnal curve for the storm event was created to match the peak wet weather flow seen in the meter data. Infiltration on American Samoa is a chronic issue that reduces the capacity of the entire collection system. During large storm events, inflow within the system creates peak flows that test the capacity of this smaller system.

It is important for to find and correct the major sources of infiltration to regain system capacity as well as finding and minimizing sources of inflow to lower the peak flows seen throughout the system.

7.5.2.3.5 Peaking Factors

The existing model utilized the same diurnal curves created for the Tafuna and Utulei systems.

7.5.2.3.6 Flow Allocation

The average unit flows were used to calculate a total average flow per service area based on the estimated sewered population and non-residential area serviced within each service area. For Aunu'u it is assumed that the entire population of the smaller island is serviced. Each service area was assigned an injection point to the existing collection system. These injection points are simply an existing manhole in the system to which the flow produced by the service area was injected.

Pipes that do not serve enough area to generate flows larger than an 8" pipe can carry are not modeled. Because not every pipe in the collection system is modeled, flows from service areas that were not adjacent to modeled pipe were injected in the first modeled junction along their flow route to the WWTP. **Figure E-3-26** shows each service area and a line from the center of the service area to the injection point signifying where the flow produced by the service area will enter the modeled system. The flows were then allocated into the Existing Model at the identified injection point using the correct diurnal curve based on the flow type.

7.5.2.4 Existing Model Calibration

Calibration is the process of modifying the hourly diurnal curve and average unit flow values in order to match model flows to actual flows in the system at the meter locations. Due to having no flow data for the Aunu'u system, calibration relied on the calibrated Tafuna and Utulei models to determine reasonable unit flows to assign at Aunu'u.

7.5.2.5 Existing Model Analysis

The Existing Model includes a simulated rainfall event from a design storm, using the calibrated system response parameters described previously.

Figures E-3-28 and **E-3-29** show Depth over Diameter and Reserve Capacity, respectively, for the Existing Model, illustrating any capacity issues. The reserve capacity figure can be used to identify individual pipes that could be the root cause of surcharging or limited capacity. This figure does not include backwater effects from downstream pipe segments, therefore, it does not indicate whether or not surcharging will occur. A negative value for reserve capacity ("over capacity") does not indicate surcharging, only that the flow depth increases faster than the pipe slope as you go up-stream. Pipes with a negative reserve capacity have the possibility of surcharge if they have sufficient length or are in sequence with other "over capacity" pipe sections. However, this is not always the case.

The depth over diameter figure can be used to identify the extents of surcharging, if any do occur. This figure includes the effects of backwater from downstream pipe segments, so it shows how full a pipe may get under the design conditions noted previously. Results are limited to the modeled trunk lines. **Appendix E-5** contains complete model results from the Existing Model analysis. All Existing Model results and figures include the design storm event.

7.5.2.5.1 Existing Model Bottlenecks

The Existing Model analysis shows no locations in the system with surcharging (d/D > 1.0). The highest d/D in the Existing Model is 0.54. There are also no bottlenecks areas or areas with possible capacity issues.

7.5.2.5.2 Existing Lift Stations

Table 7-30 contains a summary of each lift station and its remaining capacity.

Table 7-30: Aunu'u Area Existing Model Lift Station Summary

Lift Station Name	Design Capacity (gpm)	Existing Peak Flow[1] (gpm)	Remaining Capacity (gpm)
Aunu'u	325	307	18

[1]Peak flow listed is 10% higher than model flows to provide a safety factor for lift station capacity.

No CIP improvement projects are planned to improve the Aunu'u Lift Station.

7.5.3 Future Model Analysis

The Aunu'u area is considered to have reached buildout conditions; therefore, future development in the area is not anticipated. Full buildout flows were used for the existing model analysis, which resulted in identical model results for existing and future conditions. The model information described in **Section 7.5.2** is applicable to both the existing and future models.

While there are some buildings that are not currently connected to the collection system, such as a church and an elementary school on the southern border of the island, connecting these buildings to the collection system is not anticipated to result in any system capacity issues. Based on model results, the highest d/D within the Aunu'u area is 0.54 and the lowest reserve capacity is 0.16 mgd, which demonstrate the system's ability to accommodate added flow if additional connections were made to the system in the future. As the collection system does not have any capacity concerns, future projects will be limited to replacement of infrastructure as it ages and reaches the end of its useful life.

7.6 References

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CHAPTER 8

Wastewater System Potential Project Improvements

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Chapter 8 Wastewater System Potential Project Improvements

This Chapter includes an overview of the potential improvements for the general wastewater system, the WWTPs, and collection systems and estimates construction costs for each improvement project. Chapter 9 includes both the costs and the phasing of the project improvements. The Secondary Treatment Feasibility Study covers upgrading the WWTP(s) for secondary, or biological, treatment and nutrient removal, so that is not covered in this Plan. A final permit for secondary treatment has not been issued for Tafuna and the long-term permit requirements for Utulei are not known; consequently, improvements associated with secondary treatment are not included in the Capital Improvement Plan. If secondary treatment is ultimately required, some of the recommendations herein for the WWTPs should be re-evaluated for timing and necessity. A prioritization of the projects is given in Chapter 9 as part of the Capital Improvement Plan.

The Wastewater Utility Plan is a planning tool to guide system improvements. All potential improvements are conceptual and are intended to be used for planning purposes only. Field verification of all data must be performed prior to preliminary and final design of any system improvements.

The wastewater system potential project improvements are subdivided into three sections that correspond to the previous chapters that evaluated each overarching component of the system. Section 8.1 discusses general potential projects based on deficiencies or issues noted in Chapter 5. Section 8.2 discusses wastewater treatment plant potential projects based on deficiencies or issues noted in Chapter 6. Section 8.3 discusses collection system potential projects based on deficiencies or issues noted in Chapter 7. Each section of Chapter 8 assigns a numerical number to the projects based on the order in which they are discussed. Chapter 9 uses this numerical number also and adds a three letter identifier as described in Chapter 9.

8.1 Potential General Wastewater Improvements

8.1.1 Introduction

The general improvements include projects that apply generally to ASPA's wastewater systems and to ASPA's Wastewater Division. These projects relate to condition, capacity, key infrastructure, and lift stations and impact both the collection systems and WWTPs.

8.1.2 General Improvement Projects

8.1.2.1 G.1 I/I Study

ASPA's wastewater collection systems are subject to high I/I due to their proximity to the ocean, collection system pipes at elevations below sea level, and aging infrastructure. Each of ASPA's lift stations is equipped with a flow meter, which is downstream of the pumps making it difficult to evaluate the real time flow, including I/I, into the lift stations. As discussed in the Collection System Management Plan (see Chapter 5 of Appendix C-1), ASPA should install temporary flow meters throughout the collection systems in areas upstream of lift stations to collect data specific to I/I. Installation of temporary flow meters will allow ASPA to collect flow data, identify and quantify I/I throughout the collection systems, and establish a plan to reduce I/I.

The temporary flow meters should be installed simultaneously so each meter collects data for the same time period, with the same weather and flow conditions. Meters should first be installed in the major basins to identify which basins are subject to high I/I. After identifying which of the major basins have high I/I, the major basins can be subdivided into smaller basins and additional meters can be installed within the smaller basins to identify areas where I/I is entering the system. Collecting I/I data will allow ASPA to make informed decisions regarding prioritized system maintenance and repair to reduce the amount of I/I in their system. There are a variety of flow metering techniques and technologies that ASPA can consider for gathering I/I data. These are as follows:

- Area Velocity Flow Meters. Many area velocity flow meters contain a pressure transducer and doppler radar sensor that are installed directly in the flow to collect depth and velocity data, which are used to calculate flow. Use of these meters would allow ASPA to quantify I/I through the observed base flow conditions. These work well if installed properly and if the pipes do not have too much sediment that could cover the doppler sensor.

- Laser Flow Meters. Laser flow meters are another option and are installed directly above the flow and use ultrasonic level and laser doppler velocity technology to collect depth and velocity data, which are used to calculate flow. Use of these meters would allow ASPA to quantify I/I through the observed base flow conditions. These meters work best if installed in manholes that have good channelization so that the cross-sectional area of the flow in the manhole is very similar to that of the incoming pipe.

- Level Flow Sensors. Simple level flow sensors are another option that can be installed just below the manhole rim and collect level data that can be used to identify I/I. These meters monitor fluctuations in flow levels, which is used identify the presence of I/I. While the level flow sensors do calculate approximate flows, the approximate flows are less accurate than those calculated by area velocity and laser flow meters. Therefore, the collected data cannot be used in detailed modeling and model calibration.

There are other variations of these technologies that can also be considered for metering. Training in the use of a given type of meter is important for anyone that will be involved with installing, maintaining, or analyzing the data for accurate flow measurement results.

The recommended I/I Study consists of installing 23 temporary flow meters (12 flow meters in Tafuna, 10 flow meters in Utulei, and one flow meter in Aunu'u) within the major collection system basins for a three-month period. The flow meters should be installed during the wet season so that effects of storm events on the collection systems can be captured and observed. The flow meters should be equipped with cellular modems to allow data to be stored on a cloud-based server and accessed online. However, prior to meter installation, the ability of the cellular modems to connect to American Samoa's Bluesky cellular network should be verified. Following meter installation, personnel from ASPA, or personnel with whom ASPA decides to contract, should be trained to perform flow meter maintenance. Assuming the flow meter cellular modems are able to connect to the Bluesky cellular network, data from each of the flow meters should be regularly monitored online via the cloud-based server. If the online data suggests any potential issues with the flow meters, the trained personnel should be informed so maintenance can be performed to mitigate the issues.

Approximately one month after the temporary flow meters are installed, each meter should be checked in the field to ensure it is functioning properly. Data from the flow meters should be downloaded and analyzed to identify the major basins that are subject to high I/I. Once the major basins with high I/I are identified, additional level flow sensors should be installed throughout these basins to identify specific areas within the basins where I/I enters the collection systems.

Following the metering period, all temporary flow meters should be removed, and the collected flow data should be processed and used to quantify I/I throughout the collection systems. The existing sewer model should be updated based on flow meter data to improve its accuracy, the results of which should be provided in an I/I study report with updated system capacity figures. Finally, the collection system CIP projects should be updated to reflect the findings of the study.

8.1.2.2 G.2 GIS and Asset Management

ASPA currently uses a mix of asset management tools, including GIS, paper, spreadsheets, and asset management software. As discussed in the Collection System Management Plan (see Chapter 5 of Appendix C-1), ASPA should acquire additional asset management tools, such as asset management software, to replace the spreadsheets and paper records that it currently uses for asset management. When selecting asset management software, ASPA should assess the advantages, disadvantages, features, capabilities, cost (e.g., one-time cost vs. annual subscription), etc., to determine the software that will best meet its needs.

ASPA should also further develop and expand its wastewater system GIS data to include and track all infrastructure and its related information (e.g., installation date, maintenance dates and repairs performed, pipe size, pipe material, pump horsepower, condition, etc.). As ASPA further develops its GIS data, it should consider using online/cloud-based services. Using online/cloud-based services would allow ASPA to access its GIS data from any computer and would also provide the option for ASPA's Wastewater Division staff to access the data on mobile devices, which would allow them to reference or update data while working in the field.

ASPA has a GIS technician who oversees and maintains GIS data. If ASPA chooses to use online/cloud-based services for GIS, the development of these services could be performed by ASPA's GIS technician, or by a third-party consultant. If a third-party consultant is used, ASPA's GIS technician could continue to oversee and maintain the GIS data after its development.

ASPA currently has a SCADA project underway, which encompasses portions of the GIS and asset management needs. This current project will serve as a starting point for ASPA's GIS and asset management improvements and should be coupled with the following project recommendations.

The recommended project consists of hiring a third-party consultant to set up ArcGIS Pro Online to map and track ASPA's wastewater collection system infrastructure and its related information. The project includes purchase and set up of an ArcGIS Pro Online account, an administrative user license, four mobile worker licenses, establishing and organizing data in schema, setting up ArcGIS Online to track wastewater system maintenance and repair for asset management, and training ASPA staff on use of ArcGIS Pro Online.

ArcGIS Pro Online is an effective asset management tool that will allow ASPA to track information related to the wastewater system infrastructure and its maintenance and repair history. The opinion of probable cost for GIS and Asset Management is limited to the tasks associated with ArcGIS Pro Online, as previously described. If ASPA desires to acquire asset management software outside of ArcGIS Pro Online for scheduling maintenance and repairs, tracking work orders, etc., additional software licensing and costs would be applicable. Depending on the desired functionality of the asset management software, annual fees may range from $10,000 to $100,000.

8.1.2.3 G.3 CCTV Inspections

As discussed in the Collection System Management Plan (see Chapter 5 of Appendix C-1), ASPA should develop a CCTV inspection program that regularly inspects the collection system pipes on a five-year rotational basis. The program should target a specified length of collection system pipes to be inspected each year based on what ASPA can reasonably inspect based on its resources, staffing, and equipment. Implementing this program will allow ASPA to maintain current and accurate pipe condition records, which will allow for pipe repair or replacement prior to failure or to reduce I/I. This information can be integrated with and recorded in GIS and in the Asset Management software, so the pipe condition records are easily accessible.

As part of the CCTV inspection program, ASPA should collect data related to the collection system pipes (e.g., pipe material, pipe size, pipe condition, maintenance and repairs performed, etc.) that can be used to update its GIS asset management data. The *Pipe Condition Assessment Using CCTV: Performance Specification Guideline* by the National Association of Sewer Service Companies (NASSCO) provides a guideline for CCTV inspections, including general specifications, that ASPA can reference when developing its CCTV inspection program (NASSCO, 2014).

Establishing a CCTV inspection program will allow ASPA to regularly inspect collection system pipes on a five-year rotation basis, which will allow for pipe repair or replacement prior to failure. This recommended project includes the purchase of additional CCTV inspection equipment (trailer with gas generator, cameras, computer software, etc.), fuel and equipment maintenance over the five-year rotational period, and CCTV inspection of the approximately 328,000 linear feet (62 miles) of collection system pipes. ASPA will likely need to hire additional personnel to aid with the CCTV inspections, the cost of which was not included in the cost estimate provided in Chapter 9.

8.1.2.4 G.4 Wastewater Construction Standards Update

ASPA would like to continue to develop and approve design and construction standards and specifications, as well as procedures and standards for inspections, to utilize within its Construction Division. To further develop its standards, ASPA could utilize its in-house engineering staff, or contract with an engineering consulting firm. ASPA currently uses the Ten States Standards and could consider adopting additional standards and specifications from other organizations, such as the American Public Works Association (APWA) and the Engineers Joint Contract Document Committee (EJCDC).

Established design and construction standards for the wastewater system is crucial for both wastewater construction and expansion projects. For this recommended project, it is assumed that an engineering consulting firm will be hired to review ASPA's existing wastewater standards and ASEPA requirements, review wastewater standards from other Pacific Islands and organizations (APWA, EJCDC, etc.), and develop wastewater standards for ASPA.

8.2 Potential Wastewater Treatment Plant Improvements

8.2.1 Introduction

This section evaluates the Tafuna and Utulei WWTPs' ability to satisfy current permit conditions with the observed deficiencies identified in Chapter 6 and projected flow changes over the next 20 years. Potential improvements are identified that are necessary to maintain reliable operations and effluent quality now and in the future. The WWTPs will face increasing pressure to maintain satisfactory operations as equipment ages and as new sewer connections are added to the existing collection systems of both plants. The costs of the potential project improvements detailed here are analyzed and presented in Chapter 9. The proposed improvement projects are categorized into four groups:

- Process optimization/Permit compliance: The improvement projects are placed under this category if these projects are required to provide sufficient treatment for permit compliance. The permit conditions are listed in Chapter 4.
- Condition of equipment: The projects under this category are required to maintain the optimum condition of the equipment so that desired treatment and operational needs are met. Improvement projects are recommended based on the condition of the equipment observed during the January 2024 site visit, the operator's feedback, or the equipment's operating age. Equipment older than 20 years is considered to be beyond its useful life.
- Capacity: The projects under this category are required to provide sufficient hydraulic and solids loading capacity for present and future flow conditions. Improvement projects are recommended if the existing loading to equipment is 85% of the firm capacity or if the future loading is above 100% of the firm capacity of that equipment.
- Redundancy: The projects under this category are needed to provide redundancy for the critical equipment treating wastewater. This will ensure operations and treatment are not disrupted in case one piece of equipment fails.

This section does not include recommendations for the facility to meet the draft Tafuna permit conditions, which require secondary treatment of wastewater or other potential future permit changes. The Secondary Treatment Feasibility Study (J-U-B Engineers, 2024) evaluates options for implementing secondary treatment and nutrient removal at both Tafuna and Utulei WWTPs. Lastly, the projects are organized by treatment plant and within each treatment plant by process area.

Chapter 9 includes figures showing the locations of the proposed capital improvement projects.

8.2.2 Tafuna WWTP Improvement Projects

8.2.2.1 Expected Conditions with No Action

If a No Action Alternative is pursued, the existing facility will generally continue performing well, meeting most of its permit limits, but may struggle to meet BOD_5 limits. Since much of the major equipment has been in service from 10 to 20 years, equipment repair and maintenance are expected to become an increasing part of the operations staff's work. The aging equipment will also be more prone to failure which will jeopardize the reliability of the facility. Some process areas, like headworks, will not be able to handle future flows in peak hour or peak day conditions. Therefore, the No-Action Alternative is seen as risky and is not recommended as a long-term solution since equipment failures could lead to process disruptions and non-compliance with permit conditions.

8.2.2.2 Headworks

8.2.2.2.1 Process Optimization/Permit Compliance

TWT.1: Install Influent WWTP Flow Meter

Currently, wastewater coming into the plant is calculated by adding the flow readings from the two effluent mag meters, which measure the wastewater flow from the clarigesters. The flow readings from these effluent flow meters do not capture the actual peak conditions coming into the headworks since some peak flows could be attenuated as wastewater goes through the headworks and clarigester. A new flow meter is recommended to be installed upstream of the screens to measure the influent flow. It is strongly recommended that flow readings be automatically recorded at least on an hourly basis through SCADA to better understand the peak flows, I/I contributions, and overall daily variation of influent wastewater.

A potential alternative could be to fix the existing ultrasonic sensor of the influent screen and calibrate it to measure the influent flow coming into the WWTP. However, there is no drop in elevation between the Parshall flume and the screens, so the screens have the potential to back flow up into the flumes rendering them unable to accurately measure the influent flow. Therefore, this approach to measuring influent flow would not work.

A second alternative considered is to install one mag meter between the screens and the wet well. The four pipes from the screens to the influent wet well would be replaced with one larger pipe, and the new magmeter would be located there. However, this alternative would be costly and require changes in the existing wet well, like reconfiguring pipes, closing pipe penetrations, etc., and would be difficult to construct while maintaining ongoing treatment. Therefore, this alternative was not further considered for influent flow measurement.

The third alternative considered is to use Flo-Dar flow sensors to measure wastewater flowing through the grit channels. One sensor will be mounted on each grit channel with brackets and will be connected to a single display. The probable location of these sensors is shown in **Figure 8-1**. These sensors can give inaccurate readings when they come in contact with water, so they should be protected from rain by installing a cover on the top of the sensors. The sensors would need to be periodically calibrated to give accurate flow readings. Additionally, the stagnant grit buildout at the bottom of the channel should be considered while designing this system. A small baffle plate (3-in or so) installed at the bottom of the channel before the flo-dar measurement zone could assist in the interference of grit buildout on flow measurement. This alternative can be easily retrofitted into the existing infrastructure with minimal changes. Therefore, installing Flo-Dar flow meters is recommended for influent flow monitoring.

Figure 8-1: Tafuna WWTP – Influent Flow Meter Location

8.2.2.2.2 Condition of Equipment

TWT.2: Corrosion Protection for Headworks

During the site visit in January 2024, it was evident that the majority of the Headworks equipment, including the screens and electrical panels, etc., was heavily corroded after only a few years of use. The moist and humid climate of American Samoa and the corrosive atmosphere associated with the headworks create the conditions for accelerated corrosion of ferric-based metals. Applying a protective coating on the metal surfaces, following proper surface preparation, should mitigate further corrosion of existing equipment. Epoxy-based coating systems are common in wastewater applications as they are resistant to these severe conditions. Using corrosion-resistant metals such as stainless steel could be an option to consider when equipment in the headworks needs replacement in the future.

Another potential consideration would be to cover electrical gear and panels with a Nema 4x Enclosure with a clear front wherever applicable. Some of the panels, for example the panels for the ultrasonic level sensor of the screen, already have these enclosures. The engineering effort is assumed to be minimal. The cost of this improvement includes coating and a cover for the electrical gear.

TWT.3: Miscellaneous Electrical Improvements of Screens

The operations staff shared that the ultrasonic sensor is not currently working because of power fluctuations. Therefore, the screens are currently operated manually instead of automatically. The manual run and HOA (Hand Off Auto) switch for the wash press at the headworks does not work. It is recommended that the sensor and switches be fixed so that the screens operate smoothly and automatically.

TWT.4: Install FRP grating Over the Grit Channels

It is recommended that FRP grating be installed over the grit channels to prevent external debris from falling into them and clogging the screens. Covering the channels is also a best practice for operational safety.

TWT.5: Provide Spare Pump and Parts for Influent Pump Station

There are four influent pumps, with three pumps in duty and one pump in standby configuration. Given the location of American Samoa in the Pacific Islands region, it takes longer to ship parts if any equipment breaks down. Therefore, it is recommended to store manufacturer-recommended spare parts and one pump on-site for quick maintenance. The spare parts include items that wear and tear quickly, which usually include bearings and seals. These spare parts and the pump should be stored in a climate-controlled room to prevent rusting or other damage.

8.2.2.2.3 Capacity

TWT.6: Upsize Influent Pumps

Based on the capacity analysis in Chapter 6, the existing pump system with one large pump out of service has sufficient capacity to pump the existing peak hour flow. However, this pump will not be able to pump future peak hour flows. An additional pumping capacity of approximately 2.24 mgd (1,557 gpm) is needed to pump wastewater during future peak-hour conditions. Therefore, the two smaller pumps (Pumps 1 & 2) should be upsized to match the larger pumps (Pumps 3 & 4) to provide sufficient capacity for future peak-hour flow conditions. The discharge piping of these two pumps will also need to be upsized to 10 inches. These larger pumps would fit into the existing wet well.

TWT.7: Install a Parallel Headworks Train

During future conditions, the grit removal channels can handle the projected peak day flow of 5.37 MGD but will not have sufficient capacity for the projected peak hour flow of 8.4 MGD. Therefore, it is recommended to construct a new headworks train with two new grit removal channels, a flow meter, and automatic screens as the new areas are added to Tafuna's sewer collection network. A parallel 24-inch sewer line will bring the influent wastewater to these new grit channels from the existing 24-inch line connecting the septage receiving station and existing grit channels. The concept-level layout of this recommendation is shown in **Figure 8-2**. It should be noted that the vortex grit removal chamber is more efficient at removing grit than the grit channel. However, the vortex grit removal chamber has moving mechanical parts and adds operational complexity, and we do not consider it a right fit for Tafuna WWTP.

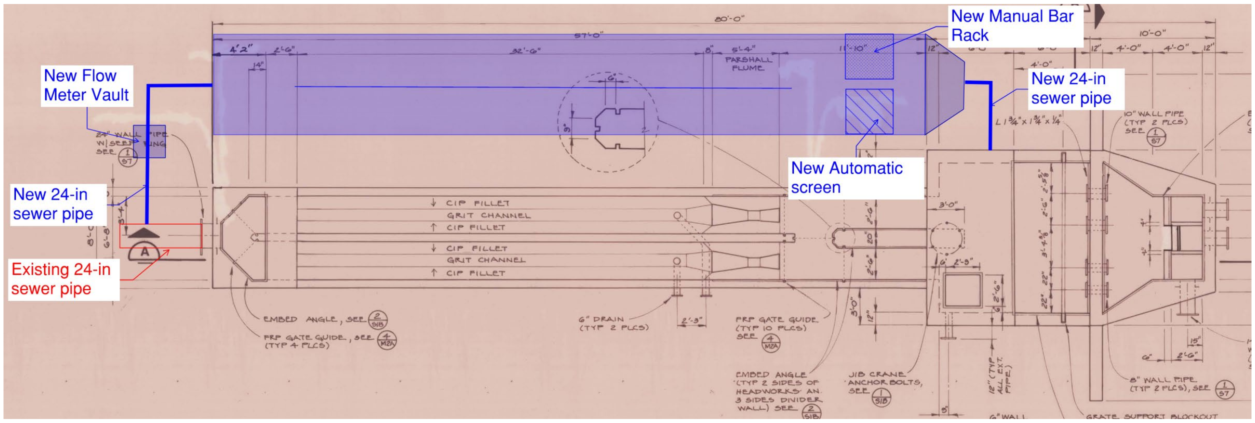

Figure 8-2: Tafuna WWTP – New Headworks Train

8.2.2.2.4 Redundancy

TWT.8: Install a New Bypass Pipe for Headworks

The two existing grit channels have a total capacity of 6 MGD, sufficient for the peak hour flow of 5.5 MGD. However, there is no redundancy as wastewater flow approaches future flow conditions and during channel maintenance and repair. Until a new parallel line is constructed, as mentioned in CIP # 7, a bypass line should be installed that will direct wastewater flow to the influent wet well whenever one of the channels or screens is undergoing maintenance or cleaning. A 20-inch PVC pipe is recommended, which can bypass flow from one of the two channels and provide redundancy to the system. A parallel headworks train, as described in CIP #7, should still be constructed to treat anticipated higher wastewater flow in the future.

8.2.2.3 Clarigester

8.2.2.3.1 Process Optimization/Permit Compliance

None proposed.

8.2.2.3.2 Condition of Equipment

TWT.9: Replace Piping in Scum Pits

The piping and fittings in the scum pit are 3 inches, and it reduces to 2 inches to connect to the discharge end of the sump pump. The operator reported frequent blockage of the three-way valve . The scum pit in each clarigester needs to be rehabilitated with new upsized piping   It is recommended that the existing piping be replaced with a 4-inch piping and valves.

TWT.10: Replace Drive for Clarigester #2 and #3

Based on the operator's feedback during the site visit, Clarigester #3 needs a new mechanical drive. It is recommended to use stainless steel (SST16) material for the drive to reduce corrosion. ASPA released an RFQ (Request For Quote) for replacing all the internal moving parts for clarigester #2 on 09/18/2024 and is planning to replace similar parts in Clarigester #3 in the near future. This CIP includes the cost of the replacement of internal parts for both Clarigester #2 and Clarigester #3. ASPA has acquired funding for this project through 2020-2023 (for clarigester #2) and 2023-2024 (for Clarigester #3) Grant Bill Funding.

TWT.11: Replace Grating of the Walkway and Railing of the Clarigesters

The handrails and grating on the floor of the walkways, the steps on the metal stairs of the walkway and the handrail around the clarigesters are currently made of wood. They are replaced every two years, and pose an occupational hazard. Steel and aluminum can corrode if exposed to salt water. Given the proximity to the ocean, stainless steel (316 SST) or FRP is a better option. For longevity and safety, it is recommended to use FRP grating with a stainless steel handrail. ASPA has acquired funding for this project through Grant Bill Funding.

8.2.2.3.3 Capacity

None proposed.

8.2.2.3.4 Redundancy

None proposed.

8.2.2.4 Flow Measurement

8.2.2.4.1 Process Optimization/Permit Compliance

TWT.12: Record Hourly Flow

Currently, flow readings are recorded manually every day from the effluent magmeters. It is recommended that the hourly flow rate (at a minimum) from the magmeters should be automatically recorded using a WWTP SCADA system. The cost of implementing this project is included in the SCADA upgrades project (see CIP #21). In conjunction with this, an influent flow meter should be installed which is discussed separately in improvement project CIP #1.

8.2.2.4.2 Condition of Equipment

TWT.13: Recoat Exposed Piping

The exposed segments of the 14-inch and 18-inch pipes, going from the clarigesters to the UV disinfection channel, are showing signs of corrosion. These pipes should be recoated using the color scheme approved by the ASPA for process pipes and a product that will withstand the corrosive weathering to help with pipe longevity.

8.2.2.4.3 Capacity

None proposed.

8.2.2.4.4 Redundancy

None proposed.

8.2.2.5 Disinfection

8.2.2.5.1 Process Optimization/Permit Compliance

TWT.14: Recalibrate UVT meter

During the site visit, JUB noticed that the UVT (87.71 %) and dose (899.74 mJ/cm2) of the UV units for Tafuna WWTP (flow of 1 mgd that day) were extremely high. The dose rate of the UV system is dependent on the UVT. The design UVT for the UV system at Tafuna WWTP is 19.3% (minimum). Based on UVT data provided by ASPA from July 2019 to July 2021, a logged UVT value from the UV system greater than 75% was noticed frequently, sometimes as often as daily, for multiple months. Trojan recommended recalibrating the UVT meter so that the system does not overdose UV to achieve disinfection. By using the appropriate UV dose, ASPA can save money by decreasing electrical consumption of the UV system. Engineering/consulting time for re-calibrating the UVT meter is included in the project cost.

8.2.2.5.2 Condition of Equipment

TWT.15: New UV Shed for Corrosion Protection

The metal shed building and the exposed metal surfaces of the UV system are heavily corroded. It is recommended to replace the existing metal shed with a corrosion-resistant reinforced fiberglass frame and an aluminum roof.

TWT.16: Miscellaneous Channel Improvements

Floatables/grease get caught upstream of the lamps and must be removed manually with a net. Installing a slide gate that allows wastewater to follow under it in front of the UV banks may reduce the amount of floatables around the UV banks. Additionally, the UV channel's existing telescoping valve is not working. Once the channel is isolated, this valve helps drain it to maintain and clean the UV banks. The telescoping valve needs to be repaired. Therefore, as a part of this upgrade, it is recommended to repair the existing telescoping valve and install a gate in front of the first UV bank.

8.2.2.5.3 Capacity

None proposed.

8.2.2.5.4 Redundancy

TWT.17: Provide Backup Power to the AC unit in the UV Control Room

Backup power from the generator is not supplied to the air conditioning (AC) in the UV control room. All electrical components should always have AC to prevent overheating during electrical power outages. The UV control room needs to be added to the generator. This project should be implemented in parallel with project #28: Generator Upgrades.

TWT.18: Backup Disinfection Design Study

Wastewater disinfection is achieved with the existing single-train UV disinfection system. There is no redundant UV train or backup chlorination system. A backup system is crucial to achieving disinfection in case of a power outage, failure, or maintenance of the existing UV system or channel. The easiest solution appears to be the addition of chlorine as 12.5% liquid, sodium hypochlorite as ASPA is familiar with operating and handling this disinfection process in their drinking water system. A shed would need to be built over the new chemical injection pump and the drum(s) of sodium hypochlorite. The system would need to be manually engaged by the operator when the UV system is down for maintenance or otherwise. The dose would need to be adjusted based on the combined effluent flowrate through both pipes leaving the clarigesters. However, many unknowns need to be considered before finalizing this approach. Additional coordination with EPA and ASEPA is required to determine if chlorinated water can leave the facility. Currently there is no total residual chlorine limit (TRC) for the facility. The receiving marine water has a TRC limit of 0.0075 mg/L (EPA, 2018). Depending on the effluent TRC limit and the available contact time, dechlorination may be required before discharging the treated wastewater into the ocean. Currently, the effluent sample is taken at the outlet box on the site. Only approximately 45 ft of pipe is between the discharge end of the UV channel and the outlet box, which will likely not provide sufficient contact time for chlorination. So, a chlorine contact chamber or pipe loop would be required to provide sufficient contact time. Chlorine could be dosed at the inlet end of the existing UV channel; however, the operators could not clean or maintain the channel if it is also being used as a chlorine contact loop. While there previously was an effluent disinfection system that used chlorine, the reasons for its abandonment for UV is unknown, as are the previous permit conditions. Therefore, a more detailed study that includes collaboration with regulatory agencies on permit limits for TRC is needed to finalize the appropriate redundant disinfection system. ASPA has acquired funding for this project through the 2020-2023 Grant Bill Funding.

8.2.2.6 Outlet Box and Outfall Line

8.2.2.6.1 Process Optimization/Permit Compliance

TWT.19: Outfall Modification Study

In 2019, ASPA modified the six existing side diffusers with 8-inch HDPE blind flanges with 6-inch concentric port diffusers across approximately 50 ft and replaced the 24” blind flange with a 12-inch (I.D. 11-inch) end-gate port as discussed in Chapter 6. Following this change, EPA reduced the critical initial dilution factor of the diffusers from 187:1 to 109:1 in the new draft permit, stating that the treated wastewater does not go through the 7-diffuser port openings (six diffusers and the end port) uniformly, but instead, most of the flow goes through the 11-inch end port. Therefore, it is recommended to re-evaluate the diffuser configuration and to consider reducing the end port orifice size to 6-inch, so water flows uniformly across the diffusers. The ideal diffuser configuration should be further studied and modeled to attain the maximum possible dilution factor. Additionally, this study should also evaluate the advantages and disadvantages of extending the outfall further into deeper waters and increasing the number of dilution ports. Dilution factor is one of the factors used by EPA to finalize the limit of contaminant loading in the wastewater effluent. If ASPA is able to achieve higher dilution factor by modifying the outfall or diffuser, then the allowable concentration of the contaminants in their NPDES permit could also increase.

8.2.2.6.2 Condition of Equipment

None proposed.

8.2.2.6.3 Capacity

None proposed.

8.2.2.6.4 Redundancy

None proposed.

8.2.2.7 Solids Dewatering and Disposal

8.2.2.7.1 Process Optimization/Permit Compliance

None proposed.

8.2.2.7.2 Condition of Equipment

TWT.20: Dewatering Infrastructure Improvements

The existing dewatering CMU shed only covers the screw press, pump, and the polymer mixing unit. The conveyor and the dewatered solids are not covered. Furthermore, the conveyor dumps the solids directly onto the ground. Consequently, during the frequent rain events, the rainwater falls onto the dried sludge, turning it into a muddy mess. The sludge slurry is difficult to handle and haul to the landfill. Therefore, extending the dewatering building to cover the open area and collecting the solids in a dumpster attached to a trailer is recommended. The cost for this project includes a new dumpster trailer and concrete foundation with a metal shed extending from the existing structure to cover the conveyor and solids.

The sludge from the clarigester is hauled using a HDPE pipe. The screw press can only connect to one clarigester at a time using the same connection pipe. It is recommended to install a 4-in DI pipe to connect all the clarigester at Tafuna WWTP to the screw press for smooth operation and safe management of sludge. The cost of this improvement includes check valves, plug valves, DI fittings, and DI pipe.

8.2.2.7.3 Capacity

None proposed.

8.2.2.7.4 Redundancy

None proposed.

8.2.2.8 Support Facilities

8.2.2.8.1 Process Optimization/Permit Compliance

TWT.21: Install New SCADA System

There is no centralized system to monitor the plant operation and process configuration digitally. Supervisory Control and Data Acquisition (SCADA) is a system that consists of both software and hardware components and allows remote and on-site gathering, controlling, monitoring, and analyzing processes in the WWTP. It is recommended to install a new SCADA system at the Tafuna WWTP, which would likely include a new programmable logic controller (PLC) and integrating software.

TWT.22: Install Refrigerated Composite Samplers

Hourly grab samples are collected manually to create a composite sample. The new draft permit for the Tafuna WWTP requires 24-hour composite samples. Manually collecting hourly samples for 24 hours is not feasible. Therefore, it is recommended to install two automatic composite samplers, one each for the influent and effluent sampling locations. Additionally, it is recommended to evaluate current sampling location as stated in #25 to ensure that samples are collected from a well-mixed point within the sampling site.

TWT.23: Coordinate Permit Conditions with EPA

Effluent discharge limits for 2,3,7,8-Tetrachlorodibenzodioxin (TCDD), 4,4'-DDT, and bis(2-ethylhexyl) are added in the Tafuna WWTP's draft NPDES discharge permit. There is limited data (a total of 2 samples) that was found on these chemicals. We recommend that ASPA test the concentration of these contaminants in the both the suspended and dissolved phase of the effluent and influent wastewater to better understand the source of the contaminants and also do more testing of the receiving water body. ASPA may also consider discussing a compliance schedule or monitoring only requirements for these new parameters in the permit with the EPA.

In addition, it is recommended that ASPA explore the option with EPA to reduce the sample draw frequency to create composite samples from hourly to once every couple of hours. Currently, grab samples are taken each hour to create composite samples. However, the frequency could be reduced to three to five grab samples daily instead of collecting grab samples hourly. Additionally, ASPA could also review 301(h) waiver request with ASEPA, potential compliance schedules with EPA and phased improvements to the Tafuna similar to a compliance schedule.

8.2.2.8.2 Condition of Equipment

TWT.24: Install Filter for Incoming Power

The incoming power supply is variable and sporadic. It is recommended to filter incoming power to protect downstream equipment. In addition to the incoming filter to condition the voltage, an active harmonic filter should be added to mitigate the harmonics created by the UV system ballasts.

TWT.25: Investigate Sampling and Testing Practices

Typically, the BOD5 and TSS influent concentrations are somewhat similar, but the influent TSS concentration in Tafuna WWTP is about half of BOD5. Additionally, the nitrogen concentration is closer to medium and high strength, whereas the BOD concentration is between low and medium strength. Additionally, the BOD and TSS per capita influent loads are unexpectedly low at the Tafuna WWTP when compared to values from Utulei WWTP. Since the influent samples are collected towards the end of the long grit channel, it is probable that some organic solids settled before the sampling point. This explains the low strength of BOD and TSS and the higher strength of nutrients since nutrients are usually soluble. Any contamination during sample collection, handling, and testing could also result in erroneous results. It is recommended that ASPA investigate the cause of this potential error and assess whether it is an issue with the sample collection methodology or laboratory testing protocols. Special attention should be given to ensure that the composite samples are collected throughout the day (manually or using an automatic sampler per project TWT.22) from a well-mixed point within the sampling location.

TWT.26: Raise the Grade of the Plant Drain Lift Station

The plant drain lift station is located at a low point on-site and has a slotted cover with open gratings. Consequently, stormwater flows into the lift station frequently during the rainfall on the island. It is recommended to add a manhole ring to raise the rim elevation of the lift station and replace the cover with a solid SST cover lid to prevent stormwater from getting into the lift station.

8.2.2.8.3 Capacity

TWT.27: Wastewater Operations Building Upgrades Study

J-U-B Engineers has not evaluated the proposed upgrades for the new operations building. ASPA provided the description and cost related to this improvement project and listed them in the FY24-25 Clean Water Act Infrastructure Projects (ASPA, 2024). ASPA will engage an architect/engineer to review the existing building structures and propose upgrades. Laboratory and operation rooms will continue to be needed to meet demand, and SCADA will need to be based in the main operation buildings. The cost of this CIP item here includes the cost of the study only.

TWT.28: Generator Upgrades

The existing generator is not large enough for the existing load or future load. Additionally, the UV control room and air conditioner need to be added to the new generator system. The new generator needs to be sized to power all connected loads at the facility (harmonic loads and the base 60Hz loads). This project should be implemented in conjunction with project #17. The cost estimate for this project includes the cost of a 300 kW generator. However, a detailed analysis of the electrical load should be done during design to finalize the adequate size of the generator.

8.2.2.8.4 Redundancy

TWT.29: Install Redundant Utility Water Pump

The utility water system consists of two 2,500-gallon storage tanks, a booster pump, and a hydrostatic pressure tank, and it provides pressurized potable water for equipment washdown. It is recommended to install a second pump for redundancy.

8.2.3 Utulei WWTP Improvement Projects

8.2.3.1 Expected Conditions with No Action

If a No Action Alternative is pursued, the existing facility will generally continue performing well, meeting most of its permit limits but may struggle to meet oil & grease, phosphorus, and enterococci limits. Since much of the major equipment has been in service for over 20 years, equipment repair and maintenance are expected to become an increasing part of the operations staff's work. The aging equipment will also be more prone to failure which will jeopardize the reliability of the facility. Some process areas, like headworks, will not be able to handle future flows in peak hour or peak day conditions. Therefore, the No-Action Alternative is seen as risky and is not recommended as a long-term solution since equipment failures could lead to process disruptions and non-compliance with permit conditions.

8.2.3.2 Headworks

8.2.3.2.1 Process Optimization/Permit Compliance

UWT.1: New Headworks Building with Screen and Grit Removal

Currently, there is no screen or grit removal system, so inert solids in the wastewater settle in the splitter box, clarigester, and other basins, which can pose operational and treatment challenges. Approximately one cubic yard of solids is manually removed with buckets from the splitter box every month, which is a dangerous and time-consuming practice. Additionally, grit and other inert materials in the wastewater increase wear on the downstream mechanical equipment and pipes, decreasing their useful life. Therefore, it is recommended to install an automatic screen and grit removal system at the headworks to reduce the amount of inert solids going into the downstream processes. A vertically oriented screen or multitrack bar screen could be used. Standalone Vortex grit removal chamber system, grit channel, or grit backet attachment to the screen could be used for removing grit. Huber Multi-Rake Automatic Bar Screen and S&L Pista grit removal system were used as the basis of design to calculate the capital cost for this project. However, various screen and grit removal system should be evaluated and selected during the design phase.

There is no channel upstream of the influent pump station, and wastewater comes into the plant through a 24-inch sewer line. There is no space to install new equipment around the influent pump station in the existing headworks. However, the existing shop building adjacent to the UV disinfection shed could be demolished to construct a new headworks building on-site. Even then, the area available is extremely limited and poses significant challenges in terms of operation and constructability. The influent sewer would need to be pumped to this proposed headworks building with a new 24-inch pipe, and after grit removal, the wastewater would need to be pumped up to the existing splitter box. Alternatively, the headworks could be constructed at a new site so construction is not limited by the foodprint available at the existing WWTP site. The size of a new building will be determined by the technology chosen for screens and grit removal. These presented options should be considered in more detail during the design phase.

To determine the cost of this CIP project, a new multistoried building is proposed to be constructed on-site with an automatic coarse screen, vortex grit removal system, an influent pump station, and an influent mag meter. A concept-level layout is shown in **Figure 8-3**.

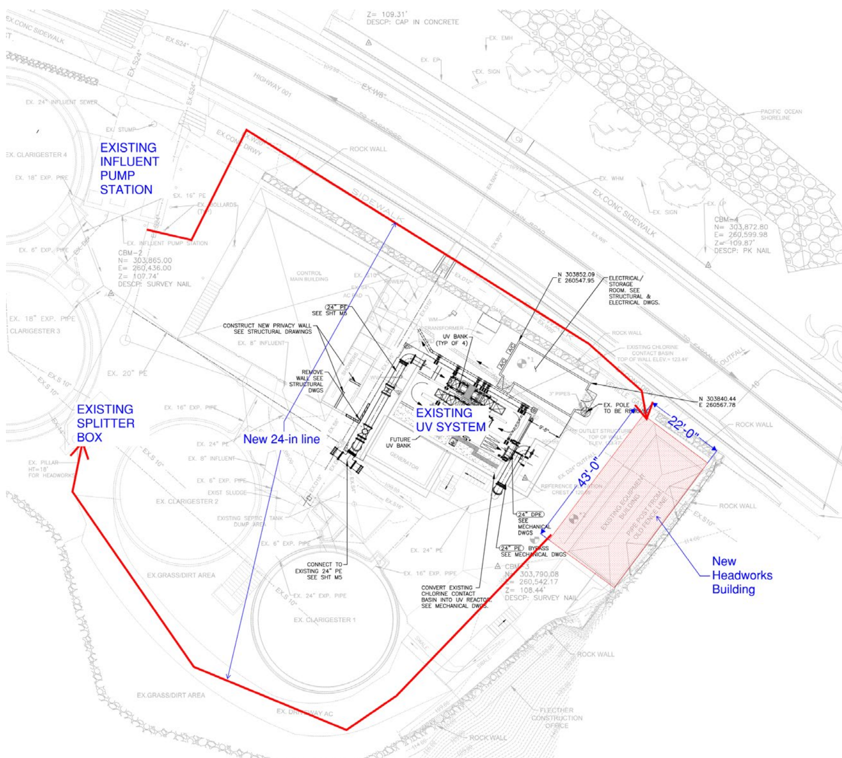

Figure 8-3: Utulei WWTP – New Headworks Building Layout

UWT.2: Install Automatic Wet Basket Screen

A basket screen located inside the influent pump station is used to manually remove large debris like rocks from the influent wastewater. There is no screen or grit removal equipment as described in project #1. This rock basket screen is lifted using a manual hand crank and then manually cleaned. The mesh size of the rock basket is unknown. It is recommended to replace the existing rock basket with an automatic basket screen when the existing rock basket screen starts showing signs of wear and tear. By doing so, the motor attached to the screen would lift the basket out of the wet well so that the operators would not need to lift it manually. However, they would still need to remove debris from the basket. This project is only recommended if ASPA cannot construct the new headworks as described in project #1.

UWT.3: Install Influent Flow Meter

Currently, wastewater coming into the plant is estimated based on the flow readings from the effluent magmeter, which measures the wastewater flow from the clarigesters. The flow readings from the effluent flow meter do not capture the actual peak conditions coming into the plant since some peak flows could be attenuated as wastewater is conveyed through the clarigesters. There is no space upstream of the influent pump station to install a flow meter without reconfiguring the gravity line and force mains coming into the wet well. Therefore, it is recommended to install a magmeter in the 14-inch line going from the influent lift station to the elevated splitter box. It is strongly recommended to automatically record flow readings at least on an hourly basis through SCADA to better understand the peak flows, I/I contributions, and overall daily variation of influent wastewater.

8.2.3.2.2 Condition of Equipment

UWT.4: Corrosion Protection for Headworks

Similar to the Tafuna WWTP, the exposed metal surfaces in the headworks at the Utulei WWTP, which include control panels for the influent pump station and odor control system, are corroded. Applying a protective coating on the metal surfaces, following proper surface preparation, should mitigate further corrosion of existing equipment. Epoxy-based coating systems are common in wastewater applications as they are resistant to these severe conditions. Using corrosion-resistant metals such as stainless steel could be an option to consider when equipment in the headworks needs replacement in future. Reapplication of coating may be required in approximately 10 years of application.

Another potential consideration would be to cover electrical gear and panels with a Nema 4x enclosure with a clear front wherever applicable. The engineering effort is assumed to be minimal. The cost of this improvement includes coating and a cover for the electrical gear.

UWT.5: Provide Spare Pump and Parts for Influent Pump Station

There are four influent pumps, with three pumps in duty and one pump in standby configuration. Given the remote location of American Samoa in the Pacific Islands region, it takes longer to ship parts if any equipment breaks down. Therefore, it is recommended to store spare parts and one pump on-site for quick maintenance. The spare parts include items that wear and tear quickly, which usually include bearings and seals. These spare parts and the pump should be stored in a climate-controlled room to prevent rusting or other damage.

8.2.3.2.3 Capacity

None proposed.

8.2.3.2.4 Redundancy

None proposed.

8.2.3.3 Clarigester

8.2.3.3.1 Process Optimization/Permit Compliance

None proposed.

8.2.3.3.2 Condition of Equipment

UWT.6: Replace Piping in Scum Pits

The piping and fittings in the scum pit are 3-inch, and it reduces to 2 inch to connect to the discharge end of the sump pump. Similar to the Tafuna WWTP, the operator reported frequent blockage of the three-way valve . The scum pit in each clarigester needs to be rehabilitated with new piping . It is recommended that the existing piping be replaced with a 4-inch piping and valves.

UWT.7: Replace Drive for Clarigester #2 and #3

It is recommended to use stainless steel (SST16) material for the drive to reduce corrosion. ASPA released an RFQ (Request For Quote) for replacing all the internal moving parts for clarigester #3 on 09/18/2024 and is planning to replace similar parts in Clarigester #2 in the near future. This CIP includes the cost of the replacement of internal parts for both Clarigester #2 and Clarigester #3. ASPA has acquired funding for this project through 2020-2023 (for clarigester #3) and 2023-2024 (for Clarigester #2) Grant Bill Funding.

UWT.8: Replace the Grating of the Walkway and Railings of the Clarigesters

Similar to the Tafuna WWTP, the handrails and grating on the floor of the walkways, the steps on the metal stairs of the walkway, and the handrail around the clarigesters are currently made of wood. Additionally, the walkway around Clarigester 2 is also made of wood at the Utulei WWTP. These wooden structures are replaced frequently, every two years, and also pose an occupational hazard. For longevity and safety, it is recommended to use FRP grating with stainless-steel handrails instead of wood. ASPA has acquired funding for this project through the Grant Bill Funding.

UWT.9: Study Cracks in the Clarigester

During a site visit in January 2025, JUB Engineers noticed cracks in the support beams and walls of the clarigester 2, as shown in **Figure 8-4**. No leakage was observed through these cracks. However, a structural engineer should evaluate the condition of all clarigester, assess the severity of these cracks, and make recommendations to preserve the functionality of the clarigester basins.

Figure 8-4: Utulei WWTP – Cracks in Clairgester 2

8.2.3.3.3 Capacity

None proposed.

8.2.3.3.4 Redundancy

None proposed.

8.2.3.4 Flow Measurement

8.2.3.4.1 Process Optimization/Permit Compliance

UWT.10: Record Hourly Flow

Currently, flow readings are recorded manually every day from the effluent magmeters. It is recommended that the hourly flow rate (at a minimum) from the magmeters be automatically recorded using a WWTP SCADA system. In conjunction with this, an influent flow meter should be installed. See improvement #3.

8.2.3.4.2 Condition of Equipment

UWT.11: Recoat Exposed Piping

The exposed segments of the 24-inch pipe from the clarigesters to the UV disinfection channel, show signs of corrosion. This pipe should be recoated using the color scheme approved by the District for process pipes and a product that will withstand the corrosive weathering to help with pipe longevity.

8.2.3.4.3 Capacity

None proposed.

8.2.3.4.4 Redundancy

None proposed.

8.2.3.5 Disinfection

8.2.3.5.1 Process Optimization/Permit Compliance

UWT.12: Recalibrate UVT meter

The design UVT for the UV system at Utulei WWTP is 40.6% (minimum). During the site visit, JUB noticed that the UVT (55.29%) and dose (15.65 mJ/cm2) of the UV units for Utulei WWTP (flow of 2.04 mgd that day) were reasonable. However, based on UVT data provided by ASPA for a few months from 2019 to 2021, a UVT value greater than 75% was noticed for a few days a month. The dose rate of the UV system is dependent on the UVT. Trojan recommended recalibrating the UVT meter so that the system does not overdose UV to achieve disinfection. By using the appropriate UV dose, ASPA can save operation costs by decreasing electrical consumption of the UV system. The UVT meters at Utulei WWTP and Tafuna WWTP (Project TWT.14) can be recalibrated together. The cost of this project only includes the consultant's time to troubleshoot and recalibrate the UVT meter at the Utulei WWTP and potential reprogramming.

8.2.3.5.2 Condition of Equipment

UWT.13: New UV Shed for Corrosion Protection

The metal shed building and the exposed metal surfaces of the UV system are heavily corroded. It is recommended to replace the existing metal shed with a corrosion-resistant reinforced fiberglass frame and an aluminum roof.

UWT.14: Miscellaneous Channel Improvements

Floatables/grease get caught upstream of the lamps and must be removed manually with a net. Installing a slide gate that allows wastewater to follow under it in front of the UV banks may reduce the amount of floatable around the UV banks.

8.2.3.5.3 Capacity

None proposed.

8.2.3.5.4 Redundancy

UWT.15: Backup Disinfection Study

Wastewater disinfection is achieved with the existing single-train UV disinfection system. There is no redundant UV train or backup chlorination system. A backup system is crucial to achieving disinfection in case of a power outage, failure, or maintenance of the existing UV system or channel. The easiest solution appears to be the addition of chlorine as 12.5% liquid, sodium hypochlorite as ASPA is familiar with operating and handling this disinfection process in their drinking water system. A shed would need to be built over the new chemical injection pump and the drum(s) of sodium hypochlorite. The system would need to be manually engaged by the operator when the UV system is down for maintenance or otherwise. The dose would need to be paced based on the combined effluent flowrate through both pipes leaving the clarigesters. However, many unknowns need to be considered before finalizing this approach. Additional coordination with EPA and ASEPA is required to determine if chlorinated water can leave the facility. Currently there is no total residual chlorine limit (TRC) for the facility. The receiving marine water has a TRC limit of 0.0075 mg/L (EPA, 2018). Depending on the effluent TRC limit and the available contact time, dechlorination may be required before discharging the treated wastewater into the ocean. Currently, the effluent sample is taken at the outlet box on the site. Only approximately 5 ft of pipe is between the discharge end of the UV channel and the outlet box, which will not provide sufficient contact time for chlorination. So, a chlorine contact chamber or pipe loop would be required to provide sufficient contact time. Chlorine could be dosed at the inlet end of the existing UV channel; however, while this provides a redundant disinfection system it doesn't provide a redundant disinfection loop or channel, so the operators would still not be able to clean or maintain the channel. While there previously was an effluent disinfection system that used chlorine, the reasons for its abandonment for the UV system are unknown, as are the previous permit conditions. Therefore, a more detailed study that includes collaboration with regulatory agencies on permit limits for TRC is needed to finalize the appropriate redundant disinfection system.

UWT.16: Provide Backup Power to the AC unit in the UV Control Room

Backup power from the generator is not supplied to the air conditioning (AC) in the UV control room. All electrical components should always have AC to prevent overheating during electrical power outages. The UV control room needs to be added to the generator, if the added load exceeds the existing capacity of the existing generator, then a small generator can be added just to address the backup power needs of the UV control room. This project should be implemented in parallel with project #25: Generator Upgrades.

8.2.3.6 Outlet Box and Outfall Line

8.2.3.6.1 Process Optimization/Permit Compliance

UWT.17: Outfall Modification Study

In 2019, ASPA modified the diffusers in the outfall of the Utulei WWTP by replacing three out of six existing side diffusers with 6-inch HDPE blind flanges with 5.5-inch diameter concentric holes across approximately 35 feet of the outfall length diffusers and replacing the blind flange at the end port with a 12-inch (I.D. 11-inch) HDPE port (Crux Diving, eTrac, 2019) as discussed in Chapter 6. The outfall for the Tafuna WWTP was also modified in a similar way, which resulted in a lower critical initial dilution factor in the next permit cycle because EPA's modeling software showed that most of the effluent would pass through the end port instead of uniformly flowing through each diffuser orifice. The critical dilution factor used in the Utulei WWTP's current permit is 121:1 for four parameters (TN, TP, ammonia, and WET) and 91:1 for any other parameters except those for which no dilution was credited. Although the modified permit was released after the ASPA made changes to the diffuser, it is still probable that the dilution factor can be reduced in the next permit cycle following the same rationale of uneven flow split among the ports used for reduction in Tafuna's dilution factor. Therefore, it is recommended to re-evaluate the diffuser configuration and to consider reducing the end port size to 6-inch, so water flows uniformly across the diffusers. The ideal diffuser configuration should be further studied and modeled to attain the maximum possible dilution factor. Additionally, this study should also evaluate the advantages and disadvantages of extending the outfall further into deeper waters and increasing the number of dilution ports. Dilution factor is one of the factors used by EPA to finalize the limit of contaminant loading in the wastewater effluent. If ASPA is able to achieve higher dilution factor by modifying the outfall or diffuser, then the allowable concentration of the contaminants in their NPDES permit could also increase.

8.2.3.6.2 Condition of Equipment

None proposed.

8.2.3.6.3 Capacity

None proposed.

8.2.3.6.4 Redundancy

None proposed.

8.2.3.7 Support Facilities

8.2.3.7.1 Process Optimization/Permit Compliance

UWT.18: Install New SCADA System

There is no centralized system to monitor the plant operation and process configuration digitally. Supervisory Control and Data Acquisition (SCADA) is a system that consists of both software and hardware components and allows remote and on-site gathering, controlling, monitoring, and analyzing processes in the WWTP. It is recommended to install a new SCADA system at the Utulei WWTP, which would likely include a new programmable logic controller (PLC) and integrating software.

UWT.19: Install Refrigerated Composite Samplers

Hourly grab samples are collected manually to create a composite sample. The current permit for the Utulei WWTP requires 24-hour composite samples. Manually collecting samples for 24 hours is not feasible. Therefore, it is recommended to install two automatic composite samplers, one each for the influent and effluent sampling locations.

UWT.20: Coordinate Permit Conditions with EPA

It is recommended that ASPA explore the option with EPA to reduce the sample draw frequency to create composite samples for TSS and BOD_5 testing from hourly to once every couple of hours. Currently, grab samples are taken each hour to create composite samples. However, the frequency could be reduced to every couple of hours instead of every hour.

Utulei's permit requires chronic testing (WET) with *S. purpuratus* and *D. excentricus* annually. The DMR data shows WET test results are reported quarterly. It is recommended perform WET test on an annual basis unless additional samples are required for compliance in addition to the effluent monitoring requirement in the permit.

8.2.3.7.2 Condition of Equipment

UWT.21: Install Filter for Incoming Power

The incoming power supply is variable and sporadic. It is recommended to filter incoming power to protect downstream equipment. In addition to the incoming filter to condition the voltage, an active harmonic filter should be added to mitigate the harmonics created by the VFDs and UV system ballasts.

UWT.22: Investigate Sampling and Testing Practices

Wastewater samples are shipped to Eurofins Laboratory in Monrovia, California, for nutrient testing. TKN and TN contain ammonia nitrogen, so it is not possible for the concentration of ammonia-N to be higher than that of TKN and TN. However, Eurofins Laboratory reported higher concentrations of ammonia-N than TKN and TN in the influent and effluent wastewater. Sampling or testing errors in ammonia-N or TKN analysis could cause erroneous results. If proper refrigeration and shipping protocol are not adhered to strictly, biological activity continue in wastewater and the concentration of nutrient decreases. It is suggested to ship the samples to a certified laboratory closer to the island, perhaps in Honolulu, rather than in California. It is recommended that ASPA investigate the cause of the error and assess whether it is an issue with the sample collection methodology, sample shipping, or laboratory testing protocols.

8.2.3.7.3 Capacity

UWT.23: Replace Pumps in Utility Water System

The utility water system does not provide adequate water pressure for the automatic spray cleaning (automatic wash) of the UV system to work and is not currently in use. The operator manually power washes the UV lamps. It is recommended to replace the existing pump with an appropriately sized pump that can deliver adequate pressure.

UWT.24: Wastewater Operations Building Upgrades and Remodeling Study

J-U-B Engineers has not evaluated the proposed upgrades for the new operations building. ASPA provided the description and cost related to this improvement project and listed them in the FY24-25 Clean Water Act Infrastructure Projects (ASPA, 2024). ASPA will engage an architect/engineer to review the existing building structures and propose upgrades. Laboratory and operation rooms will continue to be needed to meet demand, and SCADA will need to be based in the main operation buildings. The cost of this CIP item here includes the cost of the study only.

UWT.25: Generator Upgrades

The on-site generator provides power to equipment in case of power outages, which are frequent. In case of power outages, the operator has to manually turn on the generator. The existing manual transfer switch should be replaced with an automatic transfer switch. The automatic transfer switch will allow the generator to automatically start and supply power to the equipment in case of an outage. The existing generator is not large enough for the existing load or future load. The new generator needs to be sized to power all connected load at the facility (harmonic loads and the base 60Hz loads). The Utulei WWTP is located adjacent to the main street and is close to residential homes and businesses. The operator expressed the desire to add sound attenuation to the generator to reduce noise pollution. The new generator should be provided in a sound attenuated enclosure. ASPA has acquired funding for this project through the Grant Bill Funding.

8.2.3.7.4 Redundancy

None proposed.

8.2.4 Other Treatment Related Improvement Projects

8.2.4.1 Process Optimization/Permit Compliance

OWT.1: Aunu’u Wastewater System Treatment and Design Study

Sewage is pumped from an outfall into the near-shore reef area of Aunu'u. A health risk exists for swimmers within the area. Untreated sewage discharges cause reef and coral bleaching, pollution, and contamination of fish and other sea delicacy within the area (ASPA, 2024). Residents who swim and catch fish from here may be exposed to this risk (ASPA, 2024). Assessment of the existing Aunu’u wastewater discharge practice is beyond the scope of this study. J-U-B Engineers has not evaluated the existing or future design of the Aunu’u wastewater system. The description and cost related to this improvement project are provided by ASPA and are listed in the FY24-25 Clean Water Act Infrastructure Projects. The cost of this project includes the cost of a study that evaluates current wastewater treatment practices and recommends an appropriate treatment technology in Aunu’u. ASPA has acquired Grant Bill funding for this project.

OWT.2: Manua Islands Septic Tank Installation

Sewage on the Manua islands, including Ofu, is presumed to be treated only in cesspools. The Ofu Reef Project aims to protect Ofu Reef, a uniquely valuable coral reef. Macroalgae outbreaks have been observed in the reef, caused by elevated nutrient concentrations. A US Geological Survey (USGS) water sampling effort in 2020 found elevated inputs of nutrients consistent with untreated wastewater (nitrates, nitrites, and phosphates) in freshwater springs at Ofu Beach, particularly at the spring below Vaoto Lodge. ASPA is aware of these issues and is planning to replace the cesspool with septic tanks. In the next five years, ASPA plans to conduct a survey to assess the condition of the fifty cesspools in Manua Island. Based on their condition, ASPA will prioritize the replacement of the cesspool with a septic tank over the following three years. The project description and capital cost for this CIP are based on ASPA’s feedback.

8.2.4.2 Condition of Equipment

OWT.3: Tutuila On-Site Septic System Upgrade

Tutuila is the largest island in American Samoa. On-site septic tanks are often used in the areas of Tutuila Island that are not connected to the Tafuna or Utulei sewer collection systems. Tutuila Island is blanketed with poorly designed and failing wastewater septic tanks and leach fields, which are often located adjacent to streams and the ocean. These systems pollute groundwater and surface water (ASPA, 2024). Assessment of the existing on-site septic systems is beyond the scope of this study. J-U-B Engineers has not evaluated the existing conditions or proposed upgrades for the on-site system. The description and cost related to this improvement project are provided by ASPA and are listed in the FY24-25 Clean Water Act Infrastructure Projects. ASPA hopes to improve the on-site septic system by removing old residential leach fields and providing individual residences with engineered septic tanks and drain fields (ASPA, 2024). Where available land constraints preclude single-family facilities, groups of residences should be provided with individual septic tanks that feed effluent to "community" drain fields (ASPA, 2024). This project will focus on providing decentralized wastewater treatment solutions to existing deficient and failing on-site systems and will also incorporate "green" technology as appropriate to all aspects of the project (ASPA, 2024). The project costs include the construction cost of upgrading the on-site septic system in Tutuila.

8.2.4.3 Condition of Equipment

None Proposed.

8.2.4.4 Capacity

None Proposed.

8.2.4.5 Redundancy

None Proposed.

8.3 Potential Collection System Improvements

8.3.1 Introduction

This section evaluates the Tafuna, Utulei and Aunu'u collection systems' ability to satisfy current needs with the observed deficiencies identified in Chapter 7 and projected flow changes over the next 20 years. Potential improvements are identified that are necessary to maintain reliable operations now and in the future. The collection systems will face increasing pressure to maintain satisfactory operations as the infrastructure ages and as new sewer connections are added. The costs of the potential project improvements detailed here are analyzed and presented in Chapter 9. The proposed improvement projects are categorized into the following groups:

- **Condition** – Projects required to maintain or improve the integrity of the existing system, manage associated risks, and to address excessive I/I.
- **Capacity** – Projects required to remove bottlenecks in the system that propagate significant upstream surcharging. Each bottleneck has a section with a reserve capacity less than zero ("over capacity") and a d/D greater than one otherwise known as a full pipe.
- **Key Infrastructure** – Projects to serve growth in specific areas or otherwise accomplish ASPA's goals to preserve groundwater aquifer water quality and the marine environment.
- **Lift Station Projects** – Projects required to improve the condition and/or capacity of existing lift stations that have condition concerns and/or do not have adequate capacity.

Chapter 9 includes figures showing the locations of the proposed capital improvement projects.

8.3.1.1 Overview of Planned Improvements and Associated Constraints

The hydraulic model identified many areas within the Tafuna, Utulei and Aunu'u systems that back up, surcharge, and in some areas spill out of the top of manholes where the rim elevation is lower than other nearby manholes. As these potential projects were added to the hydraulic model, each bottleneck is removed allowing the system to route all flow to its respective treatment plant. Once all the flow produced within the system was fully captured, the number and size of the potential projects grew to meet the needs of the system. This assumed that the condition projects do not reduce the I/I rates identified in Chapter 7. This assumption is overly conservative and would produce a future system that is oversized.

To address this, the potential projects identified in this chapter were based on the idea that between the General Wastewater Improvements, those improvements discussed in **Section 8.1**, and the condition projects, those projects discussed in **Sections 8.3.2.1** and **Section 8.3.3.1** the I/I rates would decrease in the areas where high I/I is found. High I/I is found in the Airport, Papa Stream, Utulei, and Malaloa basins. Because of the current limited availability of flow data, it is unknown how much these improvement projects will actually reduce I/I, so for this report it is assumed that the areas with high I/I could be reduced by 50 percent. The potential projects listed for the collection system are defined with this assumed reduction of I/I taken into account.

This approach shows that by reducing I/I, the need for potential capacity related projects can also be reduced. It is recommended that ASPA focus on the General Wastewater Improvements and the condition-based projects first to eliminate as much of the I/I as possible. By lessening the I/I flow entering the systems it is possible that the capacity-based projects could be eliminated while also removing the potential of a future SSO at locations currently known to overflow.

8.3.2 Tafuna Collection System – Improvement Projects

Below is a summary of potential improvement projects within the Tafuna collection system following the structure defined in the introduction.

8.3.2.1 Condition Projects

Condition projects are required to restore and maintain the integrity of the existing system through damage repair, management of the associated risks, and to address excessive I/I. The average age of the Tafuna collection system based on known pipe installation data is approximately 42.2 years old. These projects include replacement or refurbishment of lengths of pipe currently constructed with asbestos cement or orangeburg fiber pipe material and sewers located beneath the sea level. It is likely that the pipes constructed with these materials are in poor condition and when coupled with being located beneath sea level are significant contributors to I/I. CCTV verification of the condition of these pipes is recommended prior to any pipe rehabilitation project. Pipe rehabilitation for the purpose of this utility plan, is defined as the cleaning and tv of the pipe to determine the condition of the pipe and then to perform a trenchless rehabilitation method to repair the pipe. There are several trenchless rehabilitation methods that can be used, and each method has its own purpose and range of costs. For this CIP the rehabilitation costs assume that a cured-in-place-pipe (CIPP) rehabilitation method will be used.

For condition projects related to the lift stations see **Section 8.3.2.4** below. Potential lift station operation and maintenance improvements were identified through site visits and discussions with ASPA staff.

TCS.1: Coconut Point Condition Assessment & Rehabilitation

Within the Coconut Point area there are approximately 2,500-feet of 8-inch gravity pipe constructed below sea level. The area upstream of the Papa Stream Lift Station, which includes the Coconut Point area, has a high rate of I/I and it is assumed that this 2,500-feet of pipe in Coconut Point is a significant contributor.

This project overlaps a portion of the capacity project identified in CIP #9, which will focus on upsizing approximately 950 feet of pipe, while this condition project focuses on rehabilitating the remaining 1,550 feet of pipe.

TCS.2: Papa Stream Lift Station Condition Assessment & Rehabilitation

Along the gravity main just upstream of the Papa Stream Lift Station there is approximately 1,850-feet of 12-inch and 150-feet of 8-inch gravity pipe constructed below sea level. Based on the calibrated hydraulic model the area upstream of the Papa Stream Lift Station has a high rate of I/I and it is assumed that this 2,000-feet of pipe is a significant contributor.

This project overlaps a portion of the capacity project identified in CIP #8, which will focus on upsizing all of the 12-inch and 8-inch pipe east of the lift station, while this project focuses on rehabilitating the remaining 550 feet of 12-inch gravity main west of the lift station.

TCS.3: Vaitele Lift Station Condition Assessment & Rehabilitation

Along the gravity main just upstream of the Vaitele Lift Station there is approximately 300 feet of 12-inch and 2,750 feet of 10-inch gravity main constructed below sea level. Approximately 2,450 feet of the 10-inch gravity main east of the lift station is constructed of either asbestos cement or orangeburg fiber pipe. It is assumed that this 3,050 feet of pipe is a significant contributor.

This project overlaps a portion of the capacity project identified in CIP #7, which will upsize approximately 50 feet of 12-inch and all 2,750 feet of the 10-inch pipe north and east of the lift station, while this project focuses on rehabilitating the remaining 250 feet of 12-inch gravity main west of the lift station.

TCS.4: Skill Center Lift Station Condition Assessment & Rehabilitation

The 12-inch and 10-inch gravity main just upstream of the Skill Center Lift Station was constructed with either asbestos cement or orangeburg fiber pipe of which a portion is beneath sea level. It is likely that these pipes are in poor condition and contribute to the I/I.

This project focuses on rehabilitating approximately 500 feet of 12-inch and 3,400 feet of 10-inch gravity main just upstream of the lift station.

TCS.5: Airport Lift Station Condition Assessment & Rehabilitation

Portions of the 12-inch and 10-inch gravity main just upstream of the Airport Lift Station were constructed with either asbestos cement or orangeburg fiber pipe of which a small portion is beneath sea level. It is likely that these pipes are in poor condition and contribute to the I/I.

This project focuses on rehabilitating approximately 50 feet of 12-inch and 650 feet of 10-inch gravity main just upstream of the lift station.

TCS.6: Overall Tafuna Inflow and Infiltration Inspection/Maintenance

This project includes inspecting the Tafuna wastewater collection system for potential I/I and fixing potential I/I using ASPA's Wastewater Construction Division. The project is not an I/I study and does not include any flow metering.

8.3.2.2 Capacity Projects

Capacity projects are required to relieve surcharging caused by bottlenecks in the system. Bottlenecks were identified through hydraulic modeling of the collection system. When the model is run under dry weather conditions there are little to no capacity issues. However, under peak wet weather conditions the system requires several projects to increase capacity. These projects are based on peak wet weather flows after a 50 percent reduction of I/I in the high I/I areas as noted previously. High I/I areas include the Papa Stream, Utulei, and Malaloa basins.

It is recommended that the capacity projects listed in this section are re-evaluated after the I/I study and rehabilitation to the system to reduce I/I have been completed, then sized and prioritized as needed.

TCS.7: Tafuna Gravity Main

Currently, the GIS data provided by ASPA indicates that the gravity main parallel to the airport runway and Route 014 is 14-inches in diameter while the line that turns to the north under Veterans Memorial Stadium is 15-inch. Currently, the 14-inch and 15-inch gravity mains are both over capacity and need to be upsized. This capacity issue is due to the flat slope of the 14-inch line as well as the reduction in pipe size. It is very possible that the 14-inch gravity main is a 15-inch, but it would still have capacity deficiencies.

This 15-inch gravity main carries the flow from portions of the Mesepa, Malaeimi, and Tafuna villages as well as the flow from the Vaitele Lift Station. Under the existing scenario in the hydraulic model the Vaitele, Papa Stream, and the three Coconut Point Lift Stations, and many of the gravity pipes, are bottlenecks that restrict the amount of flow and even lose flow due to the overtopping of manholes. Once all bottlenecks are removed, allowing flow to be routed through without restraint, this 15-inch gravity main becomes over capacity due to the extra loading.

The proposed improvements to the 14-inch and 15-inch gravity mains include confirming that the 14-inch is the actual pipe size and if it is, replacing approximately 1,050 feet of 14-inch pipe with 24-inch PVC pipe, replacing 350 feet of 15-inch pipe with 24-inch PVC pipe, replacing 4,250 feet of 15-inch pipe with 21-inch PVC pipe, and replacing 1,200 feet of 15-inch pipe with 18-inch PVC pipe. This project could be phased into two timeframes by constructing all 1,400 feet of 24-inch gravity main and approximately 1,650 feet of 21-inch gravity main to alleviate the portion of existing pipe that is over capacity and then to construct the remaining gravity main once the Vaitele, Papa Stream, and Coconut Point lift station bottlenecks are fixed.

TCS.8: Vaitele Gravity Main

The 10-inch gravity main upstream and east of the Vaitele Lift Station experiences backwater from the lift station as well as back up due to undersized pipes, which results in surcharging and a sanitary sewer overflow (SSO) at the manhole where the Papa Stream force main discharges to the Vaitele gravity main. The high I/I seen within the Papa Stream Lift Station basin is a large contributor to the backwater seen throughout the 10-inch gravity main and at the lift station.

The recommended improvement to relieve this bottleneck is to reduce the amount of infiltration and inflow that enters the system by doing the general projects listed in **Section 8.1** and the condition projects found in **Section 8.3.2.1**. Even with lower I/I flows, approximately 50 feet of 12-inch will need to be replaced with 18-inch PVC pipe, 2,050 feet of 10-inch pipe will need to be replaced with 18-inch PVC pipe, and 650 feet of 10-inch pipe will need to be replaced with 15-inch PVC pipe. See **CIP #3 and CIP #22** for discussion on the Vaitele Lift Station.

TCS.9: Papa Stream Gravity Main

The 12-inch gravity main upstream and east of the Papa Stream Lift Station experiences backwater from the lift station as well as backup due to undersized pipes, which results in surcharging and a SSO at a low manhole in the 8-inch section of pipe flowing northeast from the Coconut Point basin. The high I/I seen within the Papa Stream Lift Station basin is a large contributor to the backwater seen throughout the 12-inch and 8-inch pipes and at the lift station.

The recommended improvement to relieve this bottleneck is to reduce the amount of infiltration and inflow that enters the system by doing the general projects listed in **Section 8.1** and the condition projects found in **Section 8.3.2.1**. Even if the I/I flows can be reduced by 50% here, there is approximately 1,300 feet of 12-inch that will need to be replaced with 15-inch PVC pipe, 400 feet of 8-inch pipe to be replaced with 15-inch PVC pipe, and 1,050 feet of 8-inch pipe to be replaced with 12-inch PVC pipe. See **CIP #2 and CIP #21** for discussion on the Papa Stream Lift Station.

TCS.10: Coconut Point Gravity Main

The majority of the 8-inch pipes in the Coconut Point area experience backwater from the Coconut Point Lift Station No.1. The backup is also due to undersized pipes near the lift station, which results in surcharging and a SSO at the third manhole upstream from the lift station, which is a low point. There are several pipes in this area that have flat or even adverse (upward) slopes, which are also contributors to the surcharged state. The high I/I seen within the Papa Stream Lift Station basin is a large contributor to the backwater seen throughout the 8-inch pipes and at the Coconut Point Lift Station No.1.

The proposed improvement for Coconut Point is to reduce the amount of infiltration and inflow entering the system by doing the general projects listed in **Section 8.1** and the condition projects found in **Section 8.3.2.1**. Even with lower I/I flows there is approximately 550 feet of 8-inch pipe that will need to be replaced with 12-inch PVC pipe and 400 feet of 8-inch pipe to be replaced with 10-inch PVC pipe.

Even if infiltration and inflow are reduced and the improvements listed in this document have been completed there is still the issue of inverse and/or flat sloping pipes, which will contribute to a buildup of solids leading to high water in the pipes upstream. To correct this issue ASPA will either need to clean these pipes regularly or will need to replace the piping with corrected slopes.

8.3.2.3 Key Infrastructure Projects

Key infrastructure projects are not required due to capacity bottlenecks but fulfill one main purpose. They help ASPA accomplish its goal to conserve both groundwater aquifer water quality and the marine environment by extending the collection system through developed areas currently on septic systems in order to open up the undeveloped area beyond. See **Figure E-3-6** from **Appendix E-3** in **Chapter 7** for the future growth areas listed in this section. These areas are also mentioned in the ASPA provided Improvement Projects from the FY24-25 Clean Water Act Infrastructure plan (ASPA, 2024).

Projected costs to extend the collection system into these large areas are highly sensitive to the boundary of growth and the means to serve them. Suggesting master planned pipe alignments and lift station locations to serve areas that are currently not served is not within the scope of this Utility Plan. The costs and conceptual designs will need to be covered by independent studies outside of this Plan and have been included in **Chapter 9**.

TCS.11: Vaitogi Collection System

A large residential area with some light business located in the Vaitogi and Iliili villages need a piped wastewater collection system to protect groundwater aquifer areas where ASPA wells are located. Population densities in the Vaitogi area increase yearly and septic pits or sludge pits are common throughout the area.

A study of the Vaitogi Collection system has been completed and ASPA has issued a Request for Proposal (RFP) for its design. The project plan includes collecting wastewater from the Vaitogi Village area and piping it to the existing Tafuna/Fogagogo Wastewater Treatment Plant. This project is anticipated to serve 465 homes and an average wet weather flow of approximately 246,000 gallons per day (gpd) (see **Table 3-13** in **Chapter 3**). The project will include installation of a gravity main, lateral and service connections, and decommissioning of septic tanks and cesspools.

TCS.12: Leone Collection System

A large residential area with some light business needs a piped wastewater collection system to protect groundwater aquifer areas where ASPA wells are located. Population densities in the Leone area increase yearly and septic pits or sludge pits are common throughout the area.

A study of the Leone Collection System (Pryzm, 2024) has been completed and ASPA will issue an RFP for its design. The project plan includes collecting wastewater from the Leone, Malaeloa, Vailoatai, and Taputimu Villages and piping it to the existing 18-inch gravity sewer located near the eastern border of the Futiga Village. The project will include installation of a gravity main, lateral and service connections, and decommissioning of septic tanks and cesspools. This project is anticipated to serve 1,269 homes and an average wet weather flow of approximately 670,000 gpd (see **Table 3-13** in **Chapter 3**).

TCS.13: Malaeimi Sewer Extension

The Malaeimi catchment area is located in the central portion of the Malaeimi Village north of Route 001 and is one of the few potential underground water sources and wells located in the area. To avoid any contamination of this water source and well field, ASPA would like to connect all homes in this area to the sewer collection system.

ASPA will bid out this project for design and construction. The project will collect wastewater from this area and convey it through the existing Malaemi 16-inch gravity sewer line to the Tafuna/Fogagogo WWTP. The project will serve more than 50 homes (with 2-8 people per home). The project will include the installation of a gravity main, service laterals, and decommissioning of septic tanks and cesspools.

TCS.14: Upper Pavaiai Collection System

The upper Pavaiai area has recently been identified as an underground source for water. This area includes the upper reaches of the Pavaiai Village and the entire Mapusagafou Village. Two water wells were recently constructed within the area. To protect these wells from any underground contamination due to houses built above the well, there is a need to reticulate this area and connect it to the existing sewer system.

ASPA has issued an RFP for the study and design of the Upper Pavaiai Collection System. Upper Mapusaga and Pavaiai will have more than 120 homes (with 2-8 people per home).

TCS.15: Aoloau Collection System

In addition to the Upper Pavaiai Collection System, the Aoloau and Aasu Villages have been identified to connect to the existing collection system. This extension is to protect the groundwater and well in the Aoloau area from contamination and pollution, ASPA will construct a wastewater collection system to replace cesspools and septic tanks. Poorly constructed cesspools and septic tanks, which contribute to the contamination and pollution, will be decommissioned.

Design for the project will be completed in 2025. The project will include construction of gravity lines, force mains, a lift station, removal of cesspools and septic tanks, and connecting service lines to properties within the Aoloau collection system.

8.3.2.4 Lift Station Projects

These lift station projects provide an overview of the planned improvements and associated constraints. Potential lift station condition improvements were identified through site visits and discussions with ASPA staff. Lift station capacity constraints were identified through hydraulic modeling of the collection system. The peak WWF and remaining capacity shown in **Table 8-1** signifies the flow after the 50 percent reduction in I/I and completion of all CIP projects to eliminate surcharging. This is described in further detail above in **Section 8.3.1.1**. As seen in **Table 8-1** several of the CIP peak flows increased even though there was a reduction in I/I. This is due to the system being able to collect and route all sanitary sewer, infiltration, and inflow through the system without any overflows during a large storm event.

Table 8-1: Tafuna Area CIP Model Lift Station Summary Including 50% I/I Reduction and No Surcharging

Lift Station Name	Design Capacity (gpm)	CIP Peak Flow[1] (gpm)	Remaining Capacity (gpm)
Coconut Point #3	19	196	**-177**
Coconut Point #2	22	197	**-175**
Coconut Point #1	140	1,132	**-992**
Andy's	18	6	12
Sagamea	36	11	25
Papa Stream	390	2,108	**-1,718**
Vaitele	600	2,507	**-1,907**
Lavatai	155	22	133
Skill Center	225	248	**-23**
Airport	570	567	3
Freddie's Beach	18	11	7

[1]*Peak flow listed is 10% higher than model flows to provide a safety factor for lift station capacity.*

TCS.16: Overall Tafuna Lift Station Electrical/Control Upgrades

This project is part of a grant-funded project to refurbish the Tafuna lift stations that are in need of electrical upgrades with new control panels, standby pumps, and provisions for SCADA for connection to ASPA's SCADA system.

TCS.17: Coconut Point #3 Lift Station Upgrades

The Coconut Point #3 lift station design capacity is 19 gpm. The modeled peak flow, with reduced I/I, is 196 gpm. The lift station will require pump upgrades to increase its capacity, by approximately 177 gpm, to meet the peak flow. Through discussions with ASPA staff, it was determined that the high I/I rate assigned to the Coconut Point area may be too high and the model is showing a system that is over capacity when in actuality it is able to carry the wet weather flows. It is recommended that this project be prioritized as a Phase 3 or 4 project to be completed after ASPA has been given a chance to rehabilitate areas contributing to the high I/I.

The electrical controls and cabinets for the lift station need to be replaced as they are corroded and consist of old discontinued parts. The electrical connections to the available power on site need to be improved.

TCS.18: Coconut Point #2 Lift Station Upgrades

The Coconut Point #2 lift station design capacity is 22 gpm. The modeled peak flow, with reduced I/I, is 197 gpm. The lift station will require pump upgrades to increase its capacity by approximately 175 gpm to meet the peak flow. Through discussions with ASPA staff, it was determined that the high I/I rate assigned to the Coconut point area is likely too high and the model is showing a system that is over capacity when in actuality it is able to carry the wet weather flows. It is recommended that this project be prioritized as a Phase 3 or 4 project to be completed after ASPA has been given a chance to rehabilitate areas contributing to the high I/I.

Infiltration was observed entering the flow meter manhole. The recommended improvement would be to add a liner to the meter manhole and to ensure that the manhole drains back to the wet well. The electrical controls and cabinets are in poor condition with old, discontinued parts that need to be replaced. The hatch is corroded and needs to be replaced.

TCS.19: Coconut Point #1 Lift Station Upgrades

The Coconut Point #1 lift station design capacity is 140 gpm. The modeled peak flow, with reduced I/I, is 1,132 gpm. The lift station will require pump upgrades to increase its capacity, by approximately 992 gpm, to meet the peak flow. Through discussions with ASPA staff, it was determined that the high I/I rate assigned to the Coconut point area is likely too high and the model is showing a system that is over capacity when in actuality it is able to carry the wet weather flows. It is recommended that this project be prioritized as a Phase 3 or 4 project to be completed after ASPA has been given a chance to rehabilitate areas contributing to the high I/I.

The discharge piping and pump guide rails in the wet well are corroded and should be replaced. The electrical controls and cabinets are in poor condition with old, discontinued parts that need to be replaced.

TCS.20: Andy's Lift Station Upgrades

There are no capacity concerns with the Andy's Lift Station. The peak flow is lower than the lift station's design capacity.

Infiltration has been observed entering the flow meter manhole. The recommended improvement would be to add a liner to the meter manhole and to ensure that the manhole drains back to the wet well. The electrical controls and cabinets are in poor condition with old, discontinued parts that need to be replaced.

TCS.21: Sagamea Lift Station Upgrades

There are no capacity concerns with the Sagamea Lift Station. The peak flow is lower than the lift station's design capacity.

Infiltration has been observed entering the flow meter manhole. The recommended improvement would be to add a liner to the meter manhole and to ensure that the manhole drains back to the wet well. The electrical controls and cabinets are in poor condition and need to be replaced. The hatch to the wet well is corroded and needs to be replaced.

TCS.22: Papa Stream Lift Station Upgrades

The Papa Stream lift station design capacity is 390 gpm. The modeled peak flow, with reduced I/I, is 2,108 gpm. Additionally, the flow velocity within the force main is in excess of 5 feet per second (fps). The lift station will require pump upgrades to increase its capacity, by approximately 1,718 gpm, to meet the peak flow, and an upsized force main to reduce the flow velocity. The discharge piping and pump guide rails in the wet well are heavily corroded and should be replaced.

TCS.23: Vaitele Lift Station Upgrades

The Vaitele lift station design capacity is 600 gpm. The modeled peak flow, with reduced I/I, is 2,507 gpm. Additionally, the flow velocity within the force main is in excess of 5 fps. The lift station will require pump upgrades to increase its capacity, by approximately 1,907 gpm, to meet the peak flow, and an upsized force main to reduce the flow velocity.

Corrosion was observed on the piping in the wet well. It was observed that the electrical controls and cabinets are in poor condition and need to be replaced. ASPA staff also noted that the electrical connections need to be improved to have a reliable and constant power supply at this location. ASPA is currently planning improvements to this lift station, and has issued an RFP to upgrade/rebuild the lift station.

TCS.24: Lavatai Lift Station Upgrades

There are no capacity concerns with the Lavatai Lift Station. The peak flow is lower than the lift station's design capacity.

The discharge piping and valves in the wet well and valve vault should be replaced. They are corroded and in poor condition. The electrical controls and cabinets are in poor condition with old, discontinued parts, which need to be replaced.

TCS.25: Skill Center Lift Station Upgrades

The Skill Center Lift Station is nearing capacity at peak wet weather flows. It is recommended that ASPA observes the capacity of the lift station as they complete projects to address I/I and as the new industrial park/hospital are completed.

Infiltration has been observed entering into and corroding the wet well. The recommended improvement would be to add a liner to the wet well. Other needed improvements include replacing the discharge piping and valves in the valve vault, which are corroded and in poor condition. The electrical controls and cabinets are in poor condition with old, discontinued parts that need to be replaced.

TCS.26: Freddie's Beach Lift Station Upgrades

There are no capacity concerns with the Freddie's Beach Lift Station. The peak flow is lower than the lift station's design capacity.

The discharge piping and valves in the valve vault should be replaced. They are corroded and in poor condition. The electrical controls and cabinets are in poor condition with old, discontinued parts that need to be replaced.

8.3.3 Utulei Collection System – Improvement Projects

Below is a summary of potential improvement projects within the Utulei collection system following the structure defined in the Introduction.

8.3.3.1 Condition Projects

Condition projects are required to restore and maintain the integrity of the existing system through damage repair, management of the associated risks, and to address excessive I/I. The average age of the Utulei collection system based on known pipe installation data is approximately 29.9 years old. These projects include replacement or refurbishment of lengths of pipe currently constructed with asbestos cement or orangeburg fiber pipe material and sewers located beneath the sea level. It is likely that the pipes constructed with these materials are in poor condition and when coupled with being located beneath sea level are significant contributors to I/I. CCTV verification of the condition of these pipes is recommended prior to any pipe rehabilitation project.

For condition projects related to the lift stations see **Section 8.3.3.4** below. Potential lift station operational and maintenance improvements were identified through site visits and discussions with ASPA staff.

UCS.1: Leloaloa Lift Station Condition Assessment & Rehabilitation

Just upstream of the Leloaloa Lift Station there is approximately 850 feet of 18-inch gravity main and 250 feet of 8-inch gravity pipe constructed below sea level. These pipes are likely under additional stress and wear due to their close proximity to sea water. This project recommends the inspection and rehabilitation of these lines to address the overall condition of the pipes as well as finding any possible I/I that could be removed from the system.

UCS.2: Atu'u Lift Station Condition Assessment & Rehabilitation

Just upstream of the Atu'u Lift Station there is approximately 400-feet of 8-inch gravity pipe constructed below sea level. These pipes are likely under additional stress and wear due to their close proximity to sea water. This project recommends the inspection and rehabilitation of these lines to address the overall condition of the pipes as well as finding any possible I/I that could be removed from the system.

UCS.3: Satala Lift Station Condition Assessment & Rehabilitation

Just upstream of the Satala Lift Station there is approximately 3,550 feet of 10-inch gravity pipe constructed below sea level with asbestos cement. These pipes are likely under additional stress and wear due to their close proximity to sea water. Based on the calibrated hydraulic model, the area upstream of the Malaloa Lift Station has a high rate of I/I and it is assumed that this 3,550 feet of pipe is a significant contributor. This project includes the inspection and rehabilitation of these lines to address the overall condition of the pipes as well as finding any possible I/I that could be removed from the system.

UCS.4: Korean Center Lift Station Condition Assessment & Rehabilitation

Just upstream of the Korean Lift Station there is approximately 2,000 feet of 10-inch gravity pipe constructed below sea level with asbestos cement. These pipes are likely under additional stress and wear due to their close proximity to sea water. Based on the calibrated hydraulic model, the area upstream of the Malaloa Lift Station has a high rate of I/I and it is assumed that this 2,000 feet of pipe is a significant contributor. This project recommends the inspection and rehabilitation of these lines to address the overall condition of the pipes as well as finding any possible I/I that could be removed from the system.

UCS.5: Malaloa Lift Station Condition Assessment & Rehabilitation

Just upstream of the Malaloa Lift Station there is approximately 6,850 feet of 10-inch gravity pipe constructed below sea level with asbestos cement. These pipes are likely under additional stress and wear due to their close proximity to sea water. Based on the calibrated hydraulic model, the area upstream of the Malaloa Lift Station has a high rate of I/I and it is assumed that this 6,850 feet of pipe is a significant contributor.

This project overlaps a portion of the capacity project identified in Section 8.2.3.2.1 which will focus on upsizing approximately 3,450 feet of the 10-inch pipe upstream of the lift station while this project focuses on rehabilitating the remaining 3,400 feet of 10-inch gravity main upstream of the lift station.

UCS.6: Utulei WWTP Condition Assessment & Rehabilitation

Just upstream of the Utulei Wastewater Treatment Plant there is approximately 400 feet of 24-inch gravity main, 5,850 feet of 18-inch gravity main, and 500 feet of 12-inch gravity pipe with a large portion of the length constructed below sea level with asbestos cement. These pipes are likely under additional stress and wear due to their close proximity to sea water. Based on the calibrated hydraulic model, the area upstream of the Utulei Wastewater Treatment Plant has a high rate of I/I and it is assumed that this 6,750 feet of pipe is a significant contributor. This project recommends the inspection and rehabilitation of these lines to address the overall condition of the pipes as well as finding any possible I/I that could be removed from the system.

UCS.7: Fagaalu Lift Station Condition Assessment & Rehabilitation

Just upstream of the Fagaalu Lift Station there is approximately 3,150 feet of 12-inch gravity pipe with portions of the pipe constructed below sea level with asbestos cement. These pipes are likely under additional stress and wear due to their close proximity to sea water. Based on the calibrated hydraulic model the area upstream of the Utulei Wastewater Treatment Plant has a high rate of I/I and it is assumed that this 3,150 feet of pipe is a significant contributor.

This project recommends the inspection and rehabilitation of these lines to address the overall condition of the pipes as well as finding any possible I/I that could be removed from the system.

UCS.8: Overall Utulei Inflow and Infiltration Inspection/Maintenance

This project includes inspecting the Utulei wastewater collection system for potential I/I and fixing potential I/I using ASPA's Wastewater Construction Division. The project is not an I/I study and does not include any flow metering.

8.3.3.2 Capacity Projects

Capacity projects are required to relieve surcharging caused by bottlenecks in the system. Bottlenecks were identified through hydraulic modeling of the collection system. When the model is run under dry weather conditions there are little to no capacity issues. However, under peak wet weather conditions the system requires several projects to increase capacity. These projects are based on peak wet weather flows after a 50 percent reduction of I/I in the high I/I areas. High I/I areas include the Papa Stream, Utulei, and Malaloa basins.

It is recommended that the capacity projects listed in this section are re-evaluated after the I/I study and rehabilitation to the system to reduce I/I have been completed, then prioritized as needed.

UCS.9: Malaloa Gravity Main

The 10-inch gravity main running northwest from the Malaloa Lift Station to the Korean Lift Station is over capacity and in a surcharged state and experiences several SSOs at manholes between the road going to the Upper Pago Pago area and the Korean Lift Station. The capacity issue is due to pipe slopes lower than minimum slopes along the bay and high I/I rates within the Malaloa Lift Station basin.

The recommended improvement to relieve this bottleneck is to reduce the amount of infiltration and inflow that enters the system by utilizing the general projects listed in **Section 8.1** and the condition projects found in **Section 8.3.3.1.** Even with the 50 percent lower I/I flow there is approximately 2,050 feet of 10-inch pipe that will need to be replaced with 15-inch PVC pipe and 1,400 feet of 10-inch pipe to be replaced with 12-inch PVC pipe. See **CIP #16** for discussion on the Maloaloa Lift Station as well.

8.3.3.3 Key Infrastructure Projects

Key infrastructure projects are not required due to capacity bottlenecks but fulfill one main purpose. They help ASPA accomplish its goal to conserve both groundwater aquifer water quality and the marine environment by extending the collection system through developed areas currently on septic systems in order to open up the undeveloped area beyond. See **Figure E-3-6** from **Appendix E-3** in **Chapter 7** for the future growth areas listed in this section. These areas are also mentioned in the ASPA provided Improvement Projects from the FY24-25 Clean Water Act Infrastructure plan (ASPA, 2024).

Projected costs to extend the collection system into these large areas are highly sensitive to the boundary of growth and the means to serve them. Suggesting master planned pipe alignments and lift station locations to serve areas that are currently not served is not within the scope of this Utility Plan. The costs and conceptual designs will need to be covered by independent studies outside of this Plan and have been included in **Chapter 9**.

UCS.10: Matu'u to Faganeanea Collection System

This project will focus on designing the sewer collection system extension to connect the Matu'u and Faganeanea Villages to the Utulei sewer collection system. These two villages are located on the shoreline between the Tafuna and Utulei collection systems.

The design for the collection system extension to Matu'u and Faganeanea includes the installation of wastewater gravity mains to collect residential wastewater. This expansion will benefit the villages of

Matu'u and Faganeanea. This project will also help the maintain the quality of both groundwater aquifer water reserves and the marine environment by removing potential contaminant sources like the existing cesspools and septic systems.

UCS.11: Upper Pago Pago Bay Area Extension

Homes in the upper Pago Pago Bay area are not served with a piped wastewater collection system. The flows from these areas are modeled in the 75-year model and can be seen in **Figure E-3-18** of **Appendix E-3** in **Chapter 7**. ASPA will retain a wastewater consulting firm to produce a feasibility study that evaluates the capacity of the lower valley collection system to receive wastewater from this area. Pending the results of that effort, an engineering design for collecting wastewater from upper Pago Pago should be produced. The design would likely direct collected wastewater to the Malaloa Lift Station and the Utulei WWTP. After completion of final design drawings, construction phasing would follow in sequence.

8.3.3.4 Lift Station Projects

These lift station projects provide an overview of the planned improvements and associated constraints. Potential lift station condition improvements were identified through site visits and discussions with ASPA staff. Lift station capacity constraints were identified through hydraulic modeling of the collection system. The peak WWF and remaining capacity shown in **Table 8-2** signifies the flow after a 50 percent reduction in I/I and correction of all CIP projects so that no surcharging is allowed. This is described in further detail above in **Section 8.3.1.1**. As seen in **Table 8-2** several of the CIP peak flows increased even though there was a reduction in I/I. This is due to the system being able to collect and route all sanitary sewer, infiltration, and inflow through the system without any overflows during a large storm event.

Table 8-2: Utulei Area CIP Model Lift Station Summary Including 50% I/I Reduction and No Surcharing

Lift Station Name	Design Capacity (gpm)	CIP Peak Flow[1] (gpm)	Remaining Capacity (gpm)
Onesosopo	96	124	**-28**
Aua #5	320	267	53
Aua #4	505	386	119
Aua #1	677	639	38
Leloaloa	600	944	**-344**
Atu'u	96	32	64
Satala	285	234	51
Korean	280	333	**-53**
Malaloa	2,000	1,914	86
Fatumafuti	310	68	242
Faga'alu	310	407	**-97**
Matafao	75	17	58
Matafao Special	75	6	69

[1]Peak flow listed is 10% higher than model flows to provide a safety factor for lift station capacity

The recently constructed Onesosopo lift station does not have a reported design capacity, however, it is not anticipated to need condition or capacity improvements due to being newly constructed.

The Leloaloa Lift Station design capacity is 600 gpm. The modeled peak flow, with reduced I/I is 944 gpm. However, ASPA staff have noted that this lift station has the needed capacity to route wet weather flows to the Malaloa Lift Station. The discrepancy between the modeled peak flow and ASPA staff observes is likely due to using the I/I rate calculated from the Malaloa Lift Station for all of the East Side Villages. Because the collection system in these villages was built in the last few years it is likely that they do not experience as high of an I/I rate as the older system between Malaloa and Atu'u. Installing temporary flow meters throughout the East Side villages will help clarify the I/I and actual peak flows in this area of the system. At this time there are no capacity upgrades needed to this lift station.

UCS.12: Overall Utulei Lift Station Electrical/Control Upgrades

This project is part of a grant-funded project to refurbish the Utulei lift stations that are in need of electrical upgrades with new control panels, standby pumps, and provisions for SCADA for connection to ASPA's SCADA system.

UCS.13: Atu'u Lift Station Upgrades

There are no capacity concerns with the Atu'u Lift Station. The peak flow is lower than the lift station's design capacity.

Infiltration into the wet well, valve vault, and meter manhole should be addressed by adding a liner. Also, drains should be installed in the valve vault and meter manhole and route them to the wet well. Replace the discharge piping and valves in the valve vault, which are corroded and in poor condition. The electrical controls and cabinets are in poor condition with old, discontinued parts that need to be replaced. Install new level control equipment in the wet well to automate when the pumps turn on and off.

UCS.14: Satala Lift Station Upgrades

There are no capacity concerns with the Skill Center Lift Station. The peak flow is lower than the lift station's design capacity.

Address corrosion and infiltration in the wet well and valve vault with liners, coatings, and new hatches. Replace piping and valves in the valve vault. Electrical controls and cabinets are in poor condition with old parts that need to be replaced.

UCS.15: Korean Lift Station Upgrades

The Korean Lift Station design point is 280 gpm. The modeled peak flow, with reduced I/I, is 333 gpm. The lift station will require pump upgrades to increase its capacity, approximately 53 gpm, to meet the peak flow.

Implement measures to prevent further corrosion to piping in the wet well and valve vault. Replace old, corroded hatches on both the wet well and valve vault. Replace the screen on the VFD equipment. Address sewer surface overflow at the discharge manhole near the lift station.

UCS.16: Malaloa Lift Station Upgrades

The Malaloa Lift Station has a design capacity of 2,000 gpm. The modeled peak flow, with reduced I/I, is 1,914 gpm. The peak flow is near the design capacity of the lift station. The Malaloa lift station is a critical lift station in the Utulei system that conveys all the system's flows to the Utulei Wastewater Treatment Plant. Therefore, it is recommended the lift station pumps be upsized to provide additional flow contingency.

Address corrosion in both the wet well and valve vault with either a new liner or coatings. Replace piping and valves in both the wet well and valve vault. Replace pump guide rails in the wet well and hatches on both the wet well and valve vault due to heavy corrosion. Electrical equipment and controls have old and discontinued parts that need to be replaced.

UCS.17: Faga'alu Lift Station Upgrades

The Faga'alu Lift Station design capacity is 310 gpm. The modeled peak flow, with reduced I/I, is 407 gpm. The lift station is capable to handle average daily flows, however, it regularly overflows during storm events. Additionally, the flow velocity within the force main is in excess of 5 fps. The lift station will require minor pump upgrades to increase its capacity to meet the peak flow and an upsized force main to reduce the flow velocity, if improvements to reduce I/I are implemented.

If improvements to reduce I/I are not implemented, it is highly recommended this lift station be analyzed and re-designed to prevent further sewer surface overflows during storm events. Upsizing the pumps and increasing the wet well capacity is recommended, in addition to upsizing the force main.

UCS.18: Matafao Lift Station Upgrades

There are no capacity concerns with the Matafao Lift Station. The peak flow is lower than the lift station's design capacity.

The pump for the lift station is nearing the end of its life cycle and will need to be replaced soon. Address corroding concrete with a coating or liner. The electrical controls are in poor condition with old, discontinued parts that do not automatically turn off the pumps. These controls need to be replaced.

8.3.4 Aunu'u Collection System – Improvement Projects

Below is a summary of potential improvement projects within the Aunu'u collection system following the structure defined in the introduction.

8.3.4.1 Condition Projects

Condition projects are required to restore and maintain the integrity of the existing system through damage repair, management of the associated risks, and to address excessive I/I. These projects include replacement or refurbishment of lengths of pipe currently constructed with asbestos cement or orangeburg fiber pipe material and sewers located beneath the sea level. It is likely that the pipes constructed with these materials are in poor condition and when coupled with being located beneath sea level are significant contributors to I/I. CCTV verification of the condition of these pipes is recommended prior to any pipe rehabilitation project.

For condition projects related to the lift stations see **Section 8.3.4.4** below. Potential lift station operational and maintenance improvements were identified through site visits and discussions with ASPA staff.

8.3.4.2 Capacity Projects

Capacity projects are required to relieve surcharging caused by bottlenecks in the system. Bottlenecks were identified through hydraulic modeling of the collection system. These are based on peak wet weather flows, which represent worst-case scenarios.

Currently there are no capacity projects identified within the Aunu'u gravity collection system.

8.3.4.3 Key Infrastructure Projects

Key infrastructure projects are not required due to capacity bottlenecks but fulfill one main purpose. They help ASPA accomplish its goal to conserve both groundwater aquifer water quality and the marine environment by extending the collection system through developed areas currently on septic systems in order to open up the undeveloped area beyond. See **Figure E-3-18** from **Appendix E-3** in **Chapter 7** for the future growth areas listed in this section. These areas are also mentioned in the ASPA provided Improvement Projects from the FY24-25 Clean Water Act Infrastructure plan (ASPA, 2024).

Currently there are no Key Infrastructure projects identified within the Aunu'u collection system. See **Section 8.2.4.1.1** to reference the Aunu'u Wastewater Treatment and Design Study project.

8.3.4.4 Lift Station Projects

The lift station projects provide an overview of the planned improvements and associated constraints. Potential lift station condition improvements were identified through site visits and discussions with ASPA staff. Lift Station capacity constraints were identified through hydraulic modeling of the collection system and are based on peak wet weather flows representing worst-case scenarios (see **Chapter 7, Section 7.5.2.5.2**).

ACS.1: Aunu'u Lift Station Upgrades

The Aunu'u Lift Station is nearing capacity; however, the sanitary flows and infiltration for the Aunu'u area were based on general assumptions from the Tafuna and Utulei areas. ASPA should monitor the lift station's performance and capacity, and implement improvements, as required.

To reverse the corrosion of the piping and valves, regularly paint the piping and valves. The electrical controls are old with discontinued parts that need to be replaced and upgraded. Connection to the available power on site needs to be improved to ensure the pumps turn on.

8.4 References

ASPA. 2024. FY24-25 Clean Water Act Infrastructure. Provided by ASPA on June 26th, 2024.

EPA. 2018. American Samoa Water Quality Standards 2018 Revision. Provided by ASPA on June 26th, 2024.

NASSCO (National Association of Sewer Service Companies). October 2014. *Pipe Condition Assessment Using CCTV: Performance Specification Guideline.*

Pryzm Consulting LLC (Pryzm). 2024. Leone – Vaitogi Feasibility Study. Prepared for American Samoa Power Authority; March 2024. Accessed March 5, 2024.

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J-U-B ENGINEERS, INC.

CHAPTER 9

CAPITAL IMPROVEMENT PLAN

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Chapter 9 Capital Improvement Plan

The purpose of the Capital Improvement Plan (CIP) is to provide ASPA with a prioritized list of capital improvement projects that address existing wastewater system deficiencies, account for future growth and system expansion, and replace aging infrastructure as it reaches the end of its useful life. As the CIP was developed, the following challenges identified by ASPA were considered:

- High infiltration and inflow (I/I)
- Sanitary sewer overflows
- Sludge drying and disposal
- Degradation of wastewater infrastructure due to salt spray and tropical climate
- High electrical bills due to old and discontinued electrical equipment
- Remote location of American Samoa
- High operation and maintenance costs that exceed available budget

Most of this project's equipment and construction materials need to be shipped from overseas to American Samoa, which results in higher construction costs than the mainland U.S. The construction costs were calculated based on material, equipment, services, and labor typically found in the United States, mostly in Utah and Idaho, and then was multiplied by a factor of 2.0 to estimate the likely cost of these construction items in American Samoa. Project cost summary sheets (schedules of value) for several utility projects were reviewed, which aided in developing cost estimates for piping, manholes, surface repair, etc. Overall, utility costs were approximately 1.3 to 1.5 times higher than work on the mainland U.S. ASPA's recent screw press purchase provided a comparison point for equipment. The screw press price was approximately 2.5 times that of a similar unit purchased on the mainland in the same timeframe. An Area Cost Factor (ACF) for government projects of 2.54 was established by the U.S. Department of Defense in a May 2024 newsletter, with 1.00 being the U.S. Average (US-ACOE, 2024). Based on these data points, a cost factor of 2.0 seems appropriate for American Samoa. If these projects are implemented, the project scope and probable costs should be reviewed during the initial design phase with likely constructors to establish budgetary costs.

The costs presented in this chapter are in 2025 dollars and should be inflated appropriately to the mid-point of construction for budgeting purposes. The prepared costs are AACE Class 4 estimates for feasibility study level screening, so there could be variability in cost estimates within the range of -15 to -30% on the low end and +20 to +50% on the high end. Costs associated with special funding requirements such as Davis-Bacon prevailing wages and Build America, Buy America (BABA) are not included. Further refinement of the cost opinions will be required during subsequent preliminary engineering and design phases. It is important to note that undertaking individual projects one at a time could increase the total cost presented in this chapter whereas overlapping related or similar type of projects could reduce total capital cost.

To prioritize the projects in the CIP, a risk assessment for each project was completed, which addressed both the likelihood of failure and the consequence of failure of the infrastructure associated with the project. **Table 9-1** outlines the likelihood of failure and **Table 9-2** outlines the consequence of failure.

Table 9-1: Capital Improvement Project Risk Assessment Criteria-Likelihood of Failure

Likelihood of Failure	Description	Probability	Discussion
5	Almost certain	> 90%	Component, equipment, or portions of the process have exceeded the likely lifetime; major maintenance is frequent (at least quarterly); process is currently overloaded.
4	Likely	65-90%	Component, equipment, or portions of the process are at or very near the likely lifetime; major maintenance occurs yearly; process is nearly overloaded.
3	Possible	35 - 65%	Regular maintenance, often major, is required yearly or longer to maintain operation.
2	Unlikely	10 - 35%	Maintenance is infrequent and generally minor in scope.
1	Rare	< 10%	Very little maintenance is required to maintain acceptable operation.

Table 9-2: Capital Improvement Project Risk Assessment Criteria-Consequence of Failure

Consequence of Failure	Description	Permit Violations	Cost Impact	Safety Concern	Capacity Limitation	Process Impact
5	Significant	Expected	High and unknown	Life and health	Loading exceeds capacity	Impacts multiple processes significantly and/or impacts overall capacity.
4	Extensive	Very likely	High	Health	Loading is at capacity	Impacts one or two processes significantly with moderate impact to capacity.
3	Moderate	Possible	Medium to High	Health	Loading > 85% of capacity	Impacts the process and compromises capacity.
2	Negligible	Not likely	Low	Minimal	Loading > 50% of capacity	Impacts the process and results in more maintenance / operator attention.
1	Not significant	None	Very low	None expected	Loading < 50% of capacity	Negligible.

The "Likelihood of Failure" with a ranking of 1 to 5 is multiplied by the "Consequence of Failure" with a weighting of 1 through 5. This results in a weighted ranking risk assessment number. **Table 9-3** establishes the overall risk assessment criteria used to assess and prioritize each capital improvement project. The underlying assumptions associated with the risk assessment should be regularly reviewed and the scoring should be updated to reflect ongoing operations, which may result in the need to reprioritize improvements.

Table 9-3: Capital Improvement Project Risk Assessment Criteria

		Consequence of Failure				
		Not significant	Negligible	Moderate	Extensive	Significant
Likelihood of Failure		1	2	3	4	5
Almost certain	5	5	10	15	20	25
Likely	4	4	8	12	16	20
Possible	3	3	6	9	12	15
Unlikely	2	2	4	6	8	10
Rare	1	1	2	3	4	5

Projects are assessed as follows:

- Improvements with risk scores of 21-25, those in red, are considered a top priority to maintain suitable operations and should be completed within years 0 to 5.
- Improvements with risk scores of 16-20, those in orange, should be programmed as needed within years 5 to 10.
- Improvements with risk scores of 11-15, those in yellow, should receive normal maintenance and should be budgeted with minor improvements as necessary within years 10 to 20.
- Improvements with risk scores of 6-10, those in green, should receive normal maintenance, with operational issues addressed as they arise within years 20+.
- Improvements with risk scores of 1-5, those in grey, should receive normal maintenance.

In addition to the capital improvement projects outlined in this chapter, ASPA is performing the following work:

- Regular inspection and cleaning of grease traps
- Raising buried manholes
- Adding auto dialers to lift stations to alert staff of emergencies
- Repairing/replacing pipes known to have high infiltration and inflow
- Adding a new screw press to the Utulei WWTP

As noted in **Chapter 8**, the wastewater system potential project improvements are subdivided into three sections that correspond to the previous chapters that evaluated each overarching component of the system. Section 9.1 discusses general capital improvement plan (CIP) projects as described in **Chapter 8**. Section 9.2 discusses wastewater treatment plant potential projects as described in **Chapter 8**. Section 9.3 discusses collection system potential projects as described in **Chapter 8**. Each section of **Chapter 8** assigns a numerical number to the projects based on the order in which they are discussed. **Chapter 9** uses this numerical number also and adds a three-letter identifier as follows:

- General projects have a “G” identifier for “general”.
- Wastewater Treatment projects:
    - Tafuna projects have a “TWT” identifier for “Tafuna Wastwater Treatment.”
    - Utulei projects have a “UWT” identifier for “Utulei Wastwater Treatment.”
- Collection System projects:
    - Tafuna projects have a “TCS” identifier for “Tafuna Collection System.”
    - Utulei projects have a “UCS” identifier for “Utulei Collection System.”

9.1 General Wastewater Capital Improvement Plan

9.1.1 Overview

The general improvements include projects that apply generally to ASPA’s wastewater systems and to ASPA’s Wastewater Division. These projects relate to condition, capacity, key infrastructure, and lift stations and impact both the collection system and WWTPs. This section estimates the capital costs of the improvement projects described in **Chapter 8** for the General Wastewater Improvements. Included in the construction cost are the following: contractor mobilization and administration (10%), yard piping (25%, if applicable to the specific project), site civil (10%, if applicable to the specific project), electrical and instrumentation (35%, if applicable to the specific project), bonding (4%), and contractor overhead and profit (10%). Along with the construction costs, these total capital costs also include the following additional costs: construction contingency (30%), AIS compliance (10%), design engineering and construction management services (20%), and legal and administration services (1%). The percent contingency (30%) is based on AACE Class 4 feasibility study level screening.

9.1.2 General Improvement Projects

A total of four improvement projects were identified in **Chapter 8** to address concerns related to address general concerns with the wastewater system. The engineer’s opinion of the probable total capital cost for all the proposed general projects is $2.3 million.

The prioritization of General Wastewater CIP projects is shown in **Table 9-4**. Because these projects are related to information gathering and processing, and not infrastructure improvements, the ranking process that was previously described was not used for these projects. However, the General Wastewater CIP projects are recommended to be included in the Phase 1 (0-5 year) timeframe as they will provide valuable information that will aid ASPA in identifying where improvements are needed, which will allow ASPA to spend funds more efficiently. The summary of the capital costs of these improvement projects by phase based on the priority is listed in **Table 9-5**. Detailed project cost estimates can be found in **Appendix G-1**.

Table 9-4: General - Project Prioritization

No.	Description
G.1	I/I Study
G.2	GIS & Asset Management
G.3	CCTV Inspections
G.4	Wastewater Construction Standards Update

Table 9-5: General – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years	As Needed with Growth
G.1	I/I Study	$805,000	$805,000				
G.2	GIS & Asset Management	$21,000	$21,000				
G.3	CCTV Inspections[1]	$1,332,000	$1,332,000				
G.4	Wastewater Construction Standards Update	$121,000	$121,000				
	TOTAL (2025 Dollars)	**$2,279,000**	**$2,279,000**	**$0**	**$0**	**$0**	**$0**

1. Project includes operation and maintenance costs that do not represent capital costs, but are included for financial planning.

9.2 WWTP Capital Improvement Plan

9.2.1 Overview

This section estimates the capital costs of the improvement projects described in **Chapter 8** for Tafuna and Utulei WWTP. Included in the construction cost are the following: contractor mobilization and administration (10%), yard piping (25%, if applicable to the specific project), site civil (10%, if applicable to the specific project), electrical and instrumentation (35%, if applicable to the specific project), bonding (4%), and contractor overhead and profit (10%). Along with the construction costs, these total capital costs also include the following additional costs: construction contingency (30%), AIS compliance (10%), design engineering and construction management services (20%), and legal and administration services (1%). The percent contingency (30%) is based on AACE Class 4 feasibility study level screening.

9.2.2 Tafuna WWTP Improvement Projects

A total of twenty-eight improvement projects were identified in **Chapter 8** to address concerns related to process optimization, capacity, condition and age, and risk and redundancy in the Tafuna WWTP. The engineer's opinion of the probable total capital cost for all the proposed projects for Tafuna WWTP is $9.7 million, and for the projects that need funding is $5.9 million. **Figure 9-1** shows an aerial view of the CIP projects inside the WWTP. The relative risk assessment and prioritization of CIP projects for the Tafuna WWTP are shown in **Table 9-6** organized by project ranking from the most important to least important based on relative risk. The summary of the capital costs of these improvement projects by phase based on the priority is listed in **Table 9-7.** The engineer's opinion of the construction costs for each improvement project is included in **Appendix G-2.**

Table 9-6 - Tafuna WWTP – Project Prioritization-by Project Ranking

No.	Description	Likelihood of Failure	Consequence of Failure	Product
TWT.3	Miscellaneous Electrical Improvements of Screens	5	5	25
TWT.8	Install a New Bypass Pipe for Headworks	5	5	25
TWT.10	Replace Drive for Clarigester #2 and #3	5	5	25
TWT.11	Replace Grating of the Walkway and Railing of the Clarigester	5	5	25
TWT.12	Record Hourly Flow	5	5	25
TWT.15	New UV Shed for Corrosion Protection	5	5	25
TWT.17	Provide Backup Power to the AC unit in the UV Control Room	5	5	25
TWT.18	Backup Disinfection Design Study	5	5	25
TWT.20	Dewatering Infrastructure Improvements	5	5	25
TWT.21	Install New SCADA System	5	5	25

No.	Description	Likelihood of Failure	Consequence of Failure	Product
TWT.23	Coordinate Permit Conditions with EPA	5	5	25
TWT.26	Raise the Grade of Plant Drain Lift Station	5	5	25
TWT.28	Generator Upgrades	5	5	25
TWT.29	Install Redundant Utility Water Pump	5	5	25
TWT.1	Install Influent WWTP Flow Meter	4	4	16
TWT.2	Corrosion Protection for Headworks	5	4	20
TWT.9	Replace Piping in Scum Pits	4	4	16
TWT.13	Recoat Exposed Piping	4	4	16
TWT.14	Recalibrate UVT meter	4	4	16
TWT.16	Miscellaneous Channel Improvements	4	5	20
TWT.19	Outfall Modification Study	4	5	20
TWT.25	Investigate Sampling and Testing Practices	4	5	20
TWT.27	Wastewater Operations Building Upgrades and Remodeling Study	5	4	20
TWT.4	Install FRP grating Over the Grit Channels	3	5	15
TWT.5	Provide Spare Pump and Parts for Influent Pump Station	3	5	15
TWT.6	Upsize Influent Pumps	3	4	12
TWT.7	Install a Parallel Headworks Train	3	5	15
TWT.22	Install Refrigerated Composite Samplers	3	5	15
TWT.24	Install Filter for Incoming Power	3	3	9

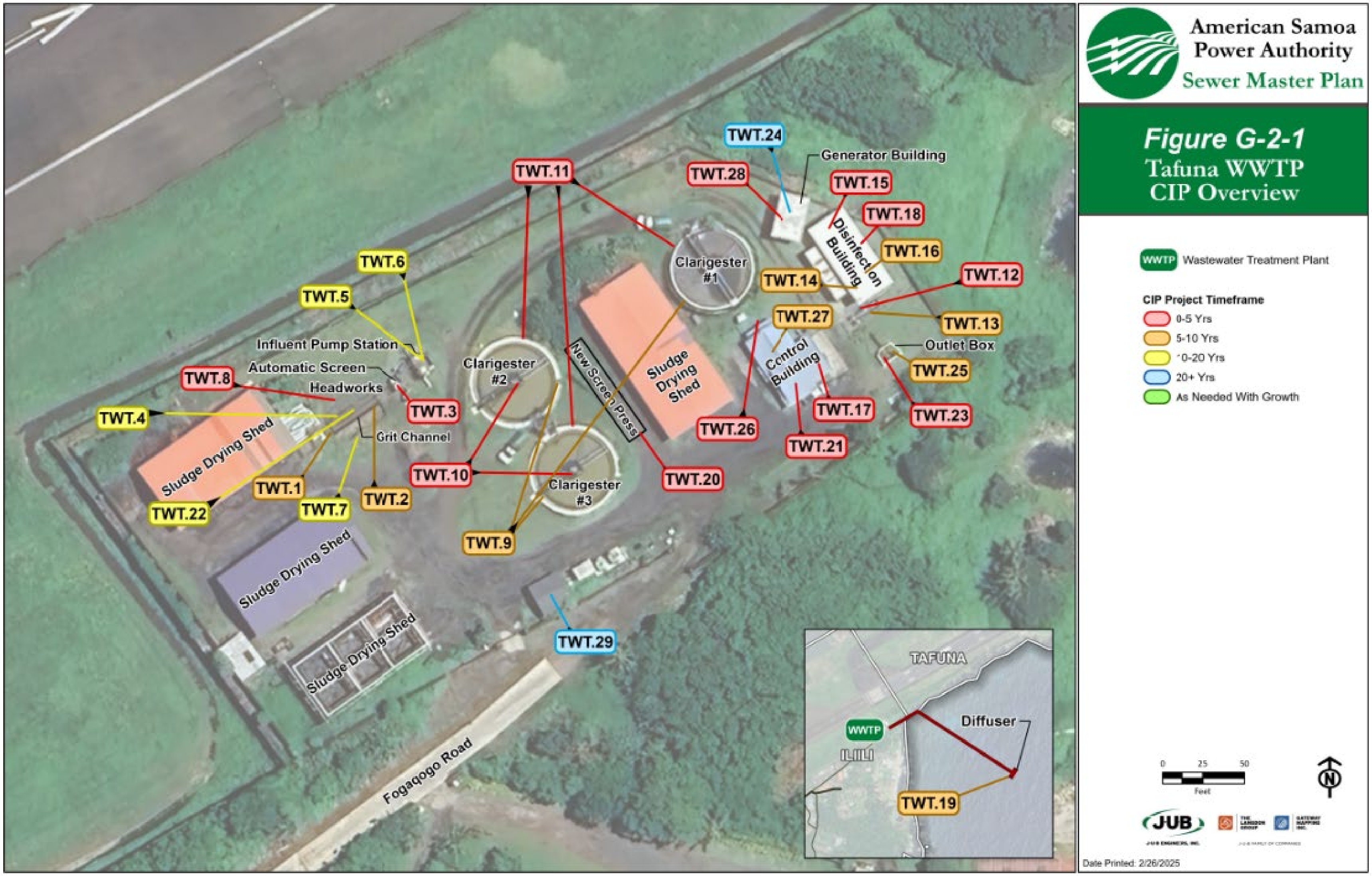

Figure 9-1: Tafuna WWTP - CIP Overview

Table 9-7: Tafuna WWTP – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years
TWT.1	Install Influent WWTP Flow Meter	$182,000		$182,000		
TWT.2	Corrosion Protection for Headworks	$56,140		$56,140		
TWT.3	Miscellaneous Electrical Improvements of Screens	$610,000	$610,000			
TWT.4	Install FRP grating Over the Grit Channels	$43,360			$43,360	
TWT.5	Provide Spare Pump and Parts for Influent Pump Station	$103,000			$103,000	
TWT.6	Upsize Influent Pumps	$345,000			$345,000	
TWT.7	Install a Parallel Headworks Train	$2,062,000			$2,062,000	
TWT.8	Install a New Bypass Pipe	$132,000	$132,000			
TWT.9	Replace Piping in Scum Pits	$84,000		$84,000		
TWT.10	Replace Drive for Clarigester #2 and #3[1]	$1,433,000	$1,433,000			
TWT.11	Replace Grating of the Walkway and Railing of the Clarigester[1]	$693,000	$693,000			
TWT.12	Record Hourly Flow	$0	$0			
TWT.13	Recoat Exposed Piping	$106,000		$106,000		
TWT.14	Recalibrate UVT meter	$40,000		$40,000		
TWT.15	New UV Shed for Corrosion Protection[1]	$654,000	$654,000			
TWT.16	Miscellaneous Channel Improvements	$70,000		$70,000		

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years
TWT.17	Provide Backup Power to the AC unit in the UV Control Room	$225,000	$225,000			
TWT.18	Backup Disinfection Design Study[1]	$212,000	$212,000			
TWT.19	Outfall Modification Study	$202,000		$202,000		
TWT.20	Dewatering Infrastructure Improvements	$289,000		$289,000		
TWT.21	Install New SCADA System[1]	$700,000	$700,000			
TWT.22	Install Refrigerated Composite Samplers	$101,000			$101,000	
TWT.23	Coordinate Permit Conditions with EPA	$101,000	$101,000			
TWT.24	Install Filter for Incoming Power	$397,000				$397,000
TWT.25	Investigate Sampling and Testing Practices	$101,000		$101,000		
TWT.26	Raise the Grade of the Plant Drain Lift Station	$9,100	$9,100			
TWT.27	Wastewater Operations Building Upgrades and Remodeling Study	$101,000		$101,000		
TWT.28	Generator Upgrades	$591,000	$591,000			
TWT.29	Install Redundant Utility Water Pump[1]	$109,000	$109,000			
	TOTAL (2025 Dollars)-All Projects	**$9,751,600**	**$5,758,100**	**$942,140**	**$2,654,360**	**$397,000**
	TOTAL (2025 Dollars)-Non-Funded Projects	**$5,950,600**	**$1,957,100**	**$942,140**	**$2,654,360**	**$397,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time.

9.2.3 Utulei WWTP Improvement Projects

A total of twenty-five improvement projects were identified in **Chapter 8** to address concerns related to process optimization, capacity, condition and age, and redundancy in the Utulei WWTP. The engineer's opinion of the probable total capital cost for all the proposed projects for Utulei WWTP is $22.0 million and for the projects that needs funding is $18.4 million. **Figure 9-2** shows an aerial view of the CIP projects inside the WWTP. The relative risk assessment and prioritization of CIP projects for the Utulei WWTP are shown in **Table 9-8** organized by project ranking from the most important to least important based on relative risk. The summary of the capital costs of these improvement projects by phase based on the priority is listed **Table 9-9.** The engineer's opinion of the construction costs for each improvement project is included in **Appendix G-2**.

Table 9-8: Utulei WWTP – Project Prioritization-by Project Rank

No.	Description	Likelihood of Failure	Consequence of Failure	Product
UWT.7	Replace Drive for Clarigester #2 and #3	5	5	25
UWT.8	Replace Walkway and Railing of the Clarigester	5	5	25
UWT.9	Study Cracks in the Clarigester	5	5	25
UWT.10	Record Hourly Flow	5	5	25
UWT.15	Backup Disinfection Design Study	5	5	25
UWT.16	Provide Backup Power to the AC unit in the UV Control Room	5	5	25
UWT.17	Outfall Modification Study	5	5	25
UWT.18	Install New SCADA System	5	5	25
UWT.20	Coordinate Permit Conditions with EPA	5	5	25
UWT.25	Generator Upgrades	5	5	25
UWT.3	Install Influent Flow Meter	4	5	20
UWT.4	Corrosion Protection for Headworks	5	4	20
UWT.12	Recalibrate UVT meter	4	5	20
UWT.13	New UV Shed for Corrosion Protection	4	5	20
UWT.14	Miscellaneous Channel Improvements	5	4	20
UWT.22	Investigate Sampling and Testing Practices	4	5	20
UWT.23	Replace Pumps in Utility Water System	5	4	20
UWT.5	Provide Spare Pump and Parts for Influent Pump Station	3	5	15

No.	Description	Likelihood of Failure	Consequence of Failure	Product
UWT.6	Replace Piping in Scum Pits	4	4	16
UWT.11	Recoat Exposed Piping	4	4	16
UWT.19	Install Refrigerated Composite Samplers	3	5	15
UWT.24	Wastewater Operations Building Upgrades and Remodeling Study	5	3	15
UWT.1	New Headworks Building with Screen and Grit Removal	2	4	8
UWT.2	Install Automatic Wet Basket Screen	3	3	9
UWT.21	Install Filter for Incoming Power	3	3	9

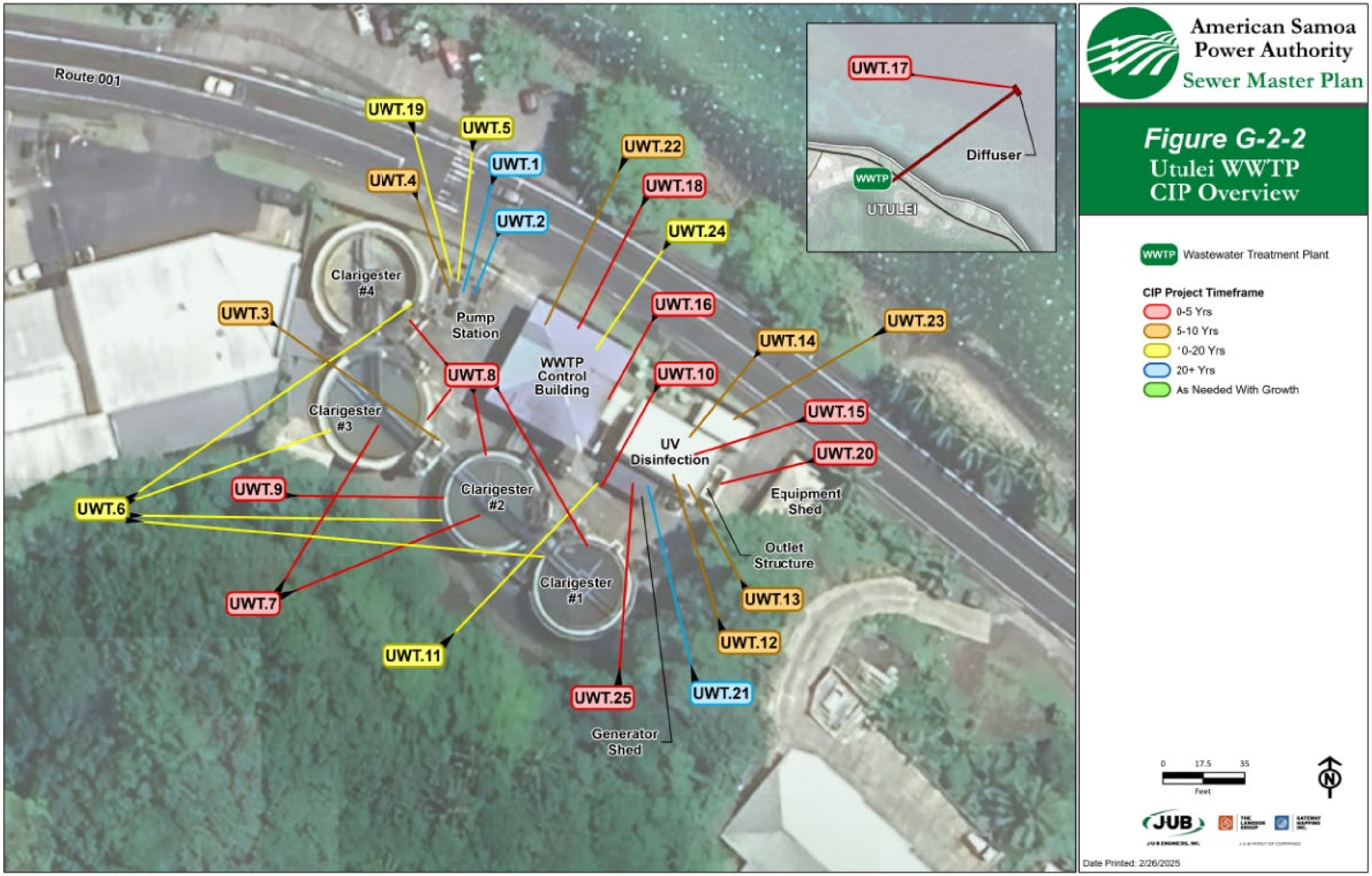

Figure 9-2: Utulei WWTP - CIP Overview

Table 9-9: Utulei WWTP – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years
UWT.1	New Headworks Building with Screen and Grit Removal	$15,498,000				$15,498,000
UWT.2	Install Automatic Wet Basket Screen	$166,000				$166,000
UWT.3	Install Influent Flow Meter	$152,000		$152,000		
UWT.4	Corrosion Protection for Headworks	$46,400		$46,400		
UWT.5	Provide Spare Pump and Parts for Influent Pump Station	$103,000			$103,000	
UWT.6	Replace Piping in Scum Pits	$132,000		$132,000		
UWT.7	Replace Drive for Clarigester #2 and #3[1]	$1,433,000	$1,433,000			
UWT.8	Replace Walkway and Railing of the Clarigester[1]	$703,000	$703,000			
UWT.9	Study Cracks in the Clarigester	$51,000	$51,000			
UWT.10	Record Hourly Flow	$0	$0			
UWT.11	Recoat Exposed Piping	$64,000		$64,000		
UWT.12	Recalibrate UVT meter	$18,000		$18,000		
UWT.13	New UV Shed for Corrosion Protection	$486,000		$486,000		
UWT.14	Miscellaneous Channel Improvements	$81,000		$81,000		

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years
UWT.15	Backup Disinfection Design Study	$212,000	$212,000			
UWT.16	Provide Backup Power to the AC unit in the UV Control Room	$225,000	$225,000			
UWT.17	Outfall Modification Study	$202,000	$202,000			
UWT.18	Install New SCADA System[1]	$700,000	$700,000			
UWT.19	Install Refrigerated Composite Samplers	$101,000			$101,000	
UWT.20	Coordinate Permit Conditions with EPA	$101,000	$101,000			
UWT.21	Install Filter for Incoming Power	$397,000				$397,000
UWT.22	Investigate Sampling and Testing Practices	$81,000		$81,000		
UWT.23	Replace Pumps in Utility Water System	$234,000		$234,000		
UWT.24	Wastewater Operations Building Upgrades and Remodeling Study	$101,000			$101,000	
UWT.25	Generator Upgrades[1]	$754,000	$754,000			
	TOTAL (2025 Dollars)-All Projects	**$22,041,400**	**$4,381,000**	**$1,294,400**	**$305,000**	**$16,061,000**
	TOTAL (2025 Dollars)-Projects without Funding	**$18,451,400**	**$791,000**	**$1,294,400**	**$305,000**	**$16,061,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time.

9.2.4 Other Treatment Related Improvement Projects

ASPA identified three projects to improve wastewater treatment or handling outside the collection system of Tafuna WWTP and Utulei WWTP. J-U-B Engineers have not evaluated or estimated the cost of these proposed projects. The relative risk assessment and prioritization of CIP projects is shown in **Table 9-10**. The costs of these projects were provided by ASPA and are summarized in **Table 9-11**.

Table 9-10: Other WWTP – Project Prioritization by Project Number and by Project Rank

No.	Description	Likelihood of Failure	Consequence of Failure	Product
OWT.1	Aunu'u Wastewater System Treatment and Design Study	5	5	25
OWT.2	Manua Islands Septic Tank Installation	5	5	25
OWT.3	Tutuila On-Site Septic System Upgrade	5	4	20

Table 9-11: Other Treatment Related – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years
OWT. 1	Aunu'u Wastewater System Treatment and Design Study[1,2]	$500,000	$500,000			
OWT. 2	Manua Islands Septic Tank Installation[1]	$1,250,000	$1,250,000			
OWT. 3	Tutuila On-Site Septic System Upgrade[1]	$2,500,000		$2,500,000		
	TOTAL (2025 Dollars) - All Projects	**$4,250,000**	**$1,750,000**	**$2,500,000**	**-**	**-**
	TOTAL (2025 Dollars)- Non-Funded Projects	**$3,750,000**	**$1,250,000**	**$2,500,000**		

1. The costs and description for these projects were provided by ASPA.
2. This project is already funded under ASPA's Bill Grant Funds as listed in FY24-25 Clean Water Act Infrastructure Project Ranking which was provided by ASPA through email on 6/26/2024.

9.3 Collection System Capital Improvement Plan

9.3.1 Overview

The collection system improvements include projects to satisfy the current needs and the projected flow changes over the next 20 years. The improvement projects are categorized into the following groups: condition, capacity, key infrastructure and lift stations. This section estimates the capital costs of the improvement projects described in **Chapter 8** for the General Wastewater Improvements. Included in the construction cost are the following: contractor mobilization and administration (10%), yard piping (25%, if applicable to the specific project), site civil (10%, if applicable to the specific project), electrical and instrumentation (35%, if applicable to the specific project), bonding (4%), and contractor overhead and profit (10%). Along with the construction costs, these total capital costs also include the following additional costs: construction contingency (30%), AIS compliance (10%), design engineering and construction management services (20%), and legal and administration services (1%). The percent contingency (30%) is based on AACE Class 4 feasibility study level screening.

Figures G-3-1, **Figure G-3-2**, and **Figure G-3-3** in **Appendix G-3** and **Figure 9-3, Figure 9-4, and Figure 9-5** provide overviews of the CIP projects for the Tafuna, Utulei, and Aunu'u collection systems, respectively.

As noted in **Chapters 7 and 8**, it is recommended that ASPA focus on the General Wastewater Improvements and the condition-based projects first to eliminate as much of the I/I as possible. By lessening the I/I flow entering the systems it is possible that the capacity-based projects could be eliminated, or reduced in scope, while also removing the potential of future SSOs at locations currently known to overflow.

9.3.2 Tafuna Collection System Improvement Projects

A total of 26 improvement projects were identified in **Chapter 8** to address concerns related to condition, capacity, key infrastructure and the lift stations in the Tafuna collection system. The engineer's opinion of probable total capital cost for all the identified projects for the Tafuna collection system is $313.9 million. The relative risk assessment and prioritization of CIP projects for the Tafuna collection system are shown in **Table 9-12** organized by project ranking from the most important to least important based on relative risk. The summary of the capital costs of these improvement projects by phase based on the priority is listed in **Table 9-13**. The engineer's opinion of the construction costs for each improvement project is included in **Appendix G-3**.

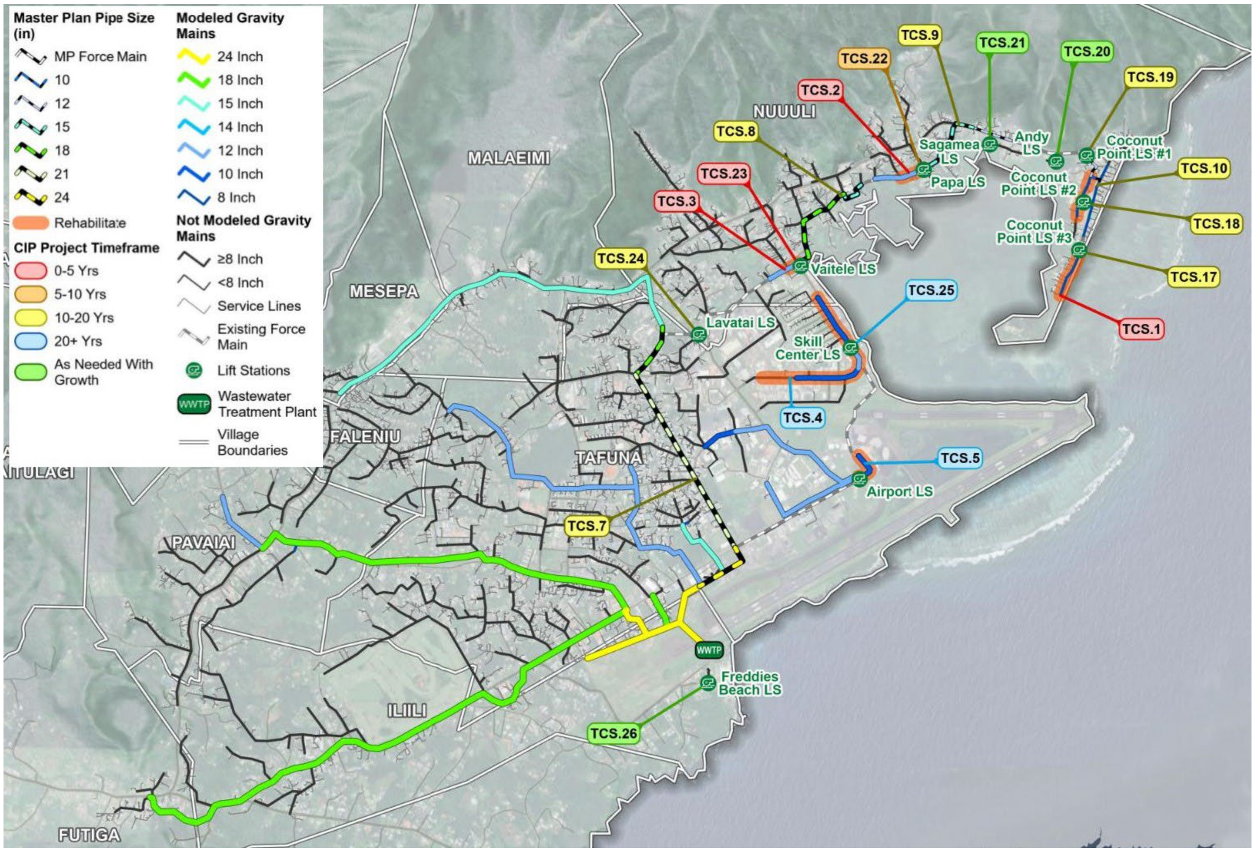

Figure 9-3 - Tafuna CIP Overview

Table 9-12: Tafuna Collection System – Project Prioritization-by Project Ranking

No.	Description	Likelihood of Failure	Consequence of Failure	Risk Assessment Score
TCS.16	Overall Tafuna Lift Station Electrical/Control Upgrades	5	5	25
TCS.2	Papa Stream Lift Station Condition Assessment & Rehabilitation	5	5	25
TCS.3	Vaitele Lift Station Condition Assessment & Rehabilitation	5	5	25
TCS.23	Vaitele Lift Station Upgrades	5	5	25
TCS.1	Coconut Point Condition Assessment & Rehabilitation	5	5	25
TCS.13	Malaeimi Sewer Extension Expansion	5	5	25
TCS.14	Upper Pavaiai Collection System Expansion	5	5	25
TCS.6	Overall Tafuna Inflow and Infiltration Inspection/Maintenance	5	5	25
TCS.22	Papa Stream Lift Station Upgrades	4	5	20
TCS.9	Papa Stream Gravity Main Upsize	5	3	15
TCS.7	Tafuna Gravity Main Upsize	5	3	15
TCS.8	Vaitele Gravity Main Upsize	5	3	15
TCS.10	Coconut Point Gravity Main Upsize	5	3	15
TCS.19	Coconut Point #1 Lift Station Upgrades	3	5	15
TCS.17	Coconut Point #3 Lift Station Upgrades	3	4	12
TCS.18	Coconut Point #2 Lift Station Upgrades	3	4	12
TCS.24	Lavatai Lift Station Upgrades	3	4	12
TCS.25	Skill Center Lift Station Upgrades	3	3	9
TCS.4	Skill Center Lift Station Condition Assessment & Rehabilitation	4	2	8
TCS.5	Airport Lift Station Condition Assessment & Rehabilitation	3	2	6
TCS.20	Andy's Lift Station Upgrades	2	2	4
TCS.21	Sagamea Lift Station Upgrades	2	2	4
TCS.26	Freddie's Beach Lift Station Upgrades	2	2	4
TCS.11	Vaitogi Collection System Expansion	1	1	1
TCS.12	Leone Collection System Expansion	1	1	1
TCS.15	Aoloau Collection System Expansion	1	1	1

Table 9-13: Tafuna Collection System – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years	As Needed with Growth
TCS.1	Coconut Point Condition Assessment & Rehabilitation	$392,000	$392,000				
TCS.2	Papa Stream LS Condition Assessment & Rehabilitation	$190,000	$190,000				
TCS.3	Vaitele LS Condition Assessment & Rehabilitation[1]	$104,000	$104,000				
TCS.4	Skill Center LS Condition Assessment & Rehabilitation	$1,015,000				$1,015,000	
TCS.5	Airport LS Condition Assessment & Rehabilitation	$213,000				$213,000	
TCS.6	Overall Tafuna Inflow and Infiltration Inspection/Maintenance[1]	N/A	N/A				
TCS.7	Tafuna Gravity Main Upsize	$8,464,000			$8,464,000		
TCS.8	Vaitele Gravity Main Upsize	$3,473,000			$3,473,000		
TCS.9	Papa Stream Gravity Main Upsize	$3,315,000			$3,315,000		
TCS.10	Coconut Point Gravity Main Upsize	$1,315,000			$1,315,000		
TCS.11	Vaitogi Collection System Expansion[1]	$5,765,000		$5,765,000			
TCS.12	Leone Collection System Expansion[2]	$269,400,000					$269,400,000
TCS.13	Malaeimi Sewer Extension Expansion[1]	$4,500,000	$4,500,000				
TCS.14	Upper Pavaiai Collection System Expansion[1]	$5,000,000	$4,159,000 $841,000[1]				
TCS.15	Aoloau Collection System Expansion	$3,500,000					$3,500,000
TCS.16	Overall Tafuna Lift Station Electrical/Control Upgrades[1]	N/A	N/A				
TCS.17	Coconut Point #3 Lift Station Upgrades	$370,000			$370,000		
TCS.18	Coconut Point #2 Lift Station Upgrades	$387,000			$387,000		
TCS.19	Coconut Point #1 Lift Station Upgrades	$1,251,000			$1,251,000		

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years	As Needed with Growth
TCS.20	Andy's Lift Station Upgrades	$28,000					$28,000
TCS.21	Sagamea Lift Station Upgrades	$62,000					$62,000
TCS.22	Papa Stream Lift Station Upgrades	$1,521,000		$1,521,000			
TCS.23	Vaitele Lift Station Upgrades[1]	$3,152,000	$3,152,000				
TCS.24	Lavatai Lift Station Upgrades	$194,000			$194,000		
TCS.25	Skill Center Lift Station Upgrades	$162,000				$162,000	
TCS.26	Freddie's Beach Lift Station Upgrades	$104,000					$104,000
	TOTAL (2025 Dollars)-All Projects	**$313,877,000**	**$13,338,000**	**$7,286,000**	**$18,769,000**	**$1,390,000**	**$273,094,000**
	TOTAL (2025 Dollars)-Non-Funded Projects	**$299,515,000**	**$4,741,000**	**$1,521,000**	**$18,769,000**	**$1,390,000**	**$273,094,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time. The cost shown here is the engineer's opinion of probable cost and is not included in the total cost of improvements for Tafuna Collection System.
2. Estimate prepared by Przym Consulting, LLC.

9.3.3 Utulei Collection System Improvement Projects

A total of 18 improvement projects were identified in **Chapter 8** to address concerns related to condition, capacity, key infrastructure and the lift stations in the Utulei collection system. The engineer's opinion of the probable total capital cost for all the proposed projects for the Utulei collection system is $19.9 million. The relative risk assessment and prioritization of CIP projects for the Utulei collection system are shown in **Table 9-14** organized by project ranking from the most important to least important based on relative risk. The summary of the capital costs of these improvement projects by phase based on the priority is listed in **Table 9-15**. The engineer's opinion of the construction costs for each improvement project is included in **Appendix G-3**.

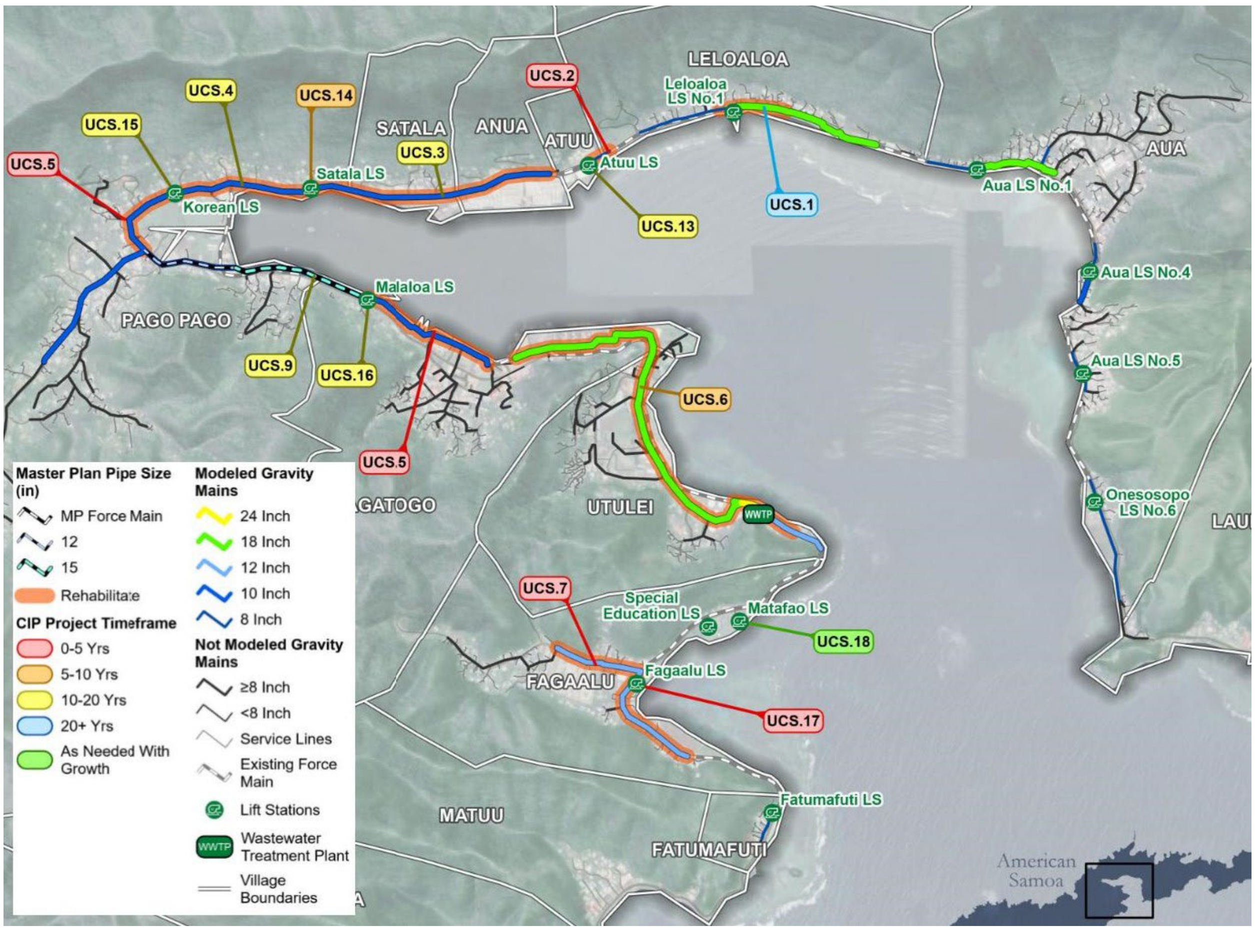

Figure 9-4 - Utulei CIP Overview

Table 9-14: Utulei Collection System – Project Prioritization-by Project Rank

No.	Description	Likelihood of Failure	Consequence of Failure	Risk Assessment Score
UCS.5	Malaloa LS Condition Assessment & Rehabilitation	5	5	25
UCS.2	Atu'u LS Condition Assessment & Rehabilitation	5	5	25
UCS.12	Overall Utulei Lift Station Electrical/Control Upgrades	5	5	25
USC.8	Overall Utulei Inflow and Infiltration Inspection/Maintenance	5	5	25
UCS.11	Upper Pago Pago Bay Area Extension	5	5	25
UCS.17	Faga'alu Lift Station Upgrades	5	5	25
UCS.14	Satala Lift Station Upgrades	4	5	20
UCS.6	Utulei WWTP Condition Assessment & Rehabilitation	5	4	20
UCS.9	Malaloa Gravity Main Upsize	5	3	15
UCS.16	Malaloa Lift Station Upgrades	3	5	15
UCS.15	Korean Lift Station Upgrades	3	5	15
UCS.10	Matu'u to Faganeanea Collection System Extension	3	5	15
UCS.3	Satala LS Condition Assessment & Rehabilitation	4	3	12
UCS.4	Korean LS Condition Assessment & Rehabilitation	4	3	12
UCS.7	Faga'alu LS Condition Assessment & Rehabilitation	3	4	12
UCS.13	Atu'u Lift Station Upgrades	3	4	12
UCS.1	Leloaloa LS Condition Assessment & Rehabilitation	3	3	9
UCS.18	Matafao Lift Station Upgrades	3	1	3

Table 9-15: Utulei Collection System – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years	As Needed with Growth
UCS.1	Leloaloa LS Condition Assessment & Rehabilitation	$393,000				$393,000	
UCS.2	Atu'u LS Condition Assessment & Rehabilitation	$135,000	$135,000				
UCS.3	Satala LS Condition Assessment & Rehabilitation	$921,000			$921,000		
UCS.4	Korean LS Condition Assessment & Rehabilitation	$528,000			$528,000		
UCS.5	Malaloa LS Condition Assessment & Rehabilitation	$889,000	$889,000				
UCS.6	Utulei WWTP Condition Assessment & Rehabilitation	$2,507,000		$2,507,000			
UCS.7	Faga'alu LS Condition Assessment & Rehabilitation	$876,000	$876,000				
UCS.8	Overall Utulei Inflow and Infiltration Inspection/Maintenance[1]	N/A	N/A				
UCS.9	Malaloa Gravity Main Upsize	$4,771,000			$4,771,000		
UCS.10	Matu'u to Faganeanea Collection System Extension	$600,000			$600,000*		
UCS.11	Upper Pago Pago Bay Area Extension	$3,500,000	$3,500,000*				
UCS.12	Overall Utulei Lift Station Electrical/Control Upgrades[1]	N/A	N/A				
UCS.13	Atu'u Lift Station Upgrades	$194,000			$194,000		
UCS.14	Satala Lift Station Upgrades	$685,000		$685,000			
UCS.15	Korean Lift Station Upgrades	$179,000			$179,000		
UCS.16	Malaloa Lift Station Upgrades	$1,416,000			$1,416,000		
UCS.17	Faga'alu Lift Station Upgrades	$1,966,000	$1,966,000				
UCS.18	Matafao Lift Station Upgrades	$388,000					$388,000
	TOTAL (2025 Dollars)-All Projects	**$19,948,000**	**$7,366,000**	**$3,192,000**	**$8,609,000**	**$393,000**	**$388,000**
	TOTAL (2025 Dollars)-Non-Funded Projects	**$15,848,000**	**$3,866,000**	**$3,192,000**	**$8,009,000**	**$393,000**	**$388,000**

1. These projects are already funded under ASPA's Grant Funds, as shared by ASPA through email on 1/14/2025. Each grant usually last 7 years and must be completed by the end of the 7th year. Some of these projects may not have been implemented at this point in time. The cost shown here is the engineer's opinion of probable cost and is not included in the total cost of improvements for Utulei Collection System.

9.3.4 Aunu'u Collection System Improvement Projects

A single improvement project was identified in **Chapter 8** to address concerns related to the lift station in the Aunu'u collection system. The engineer's opinion of the probable total capital cost for the proposed project for the Aunu'u collection system is $292,000. The relative risk assessment and prioritization of the CIP project for the Aunu'u collection system is shown in **Table 9-16**. The summary of the capital cost of the improvement project by phase based on the priority is listed in **Table 9-17**. The engineer's opinion of the construction costs for each improvement project is included in **Appendix G-3**.

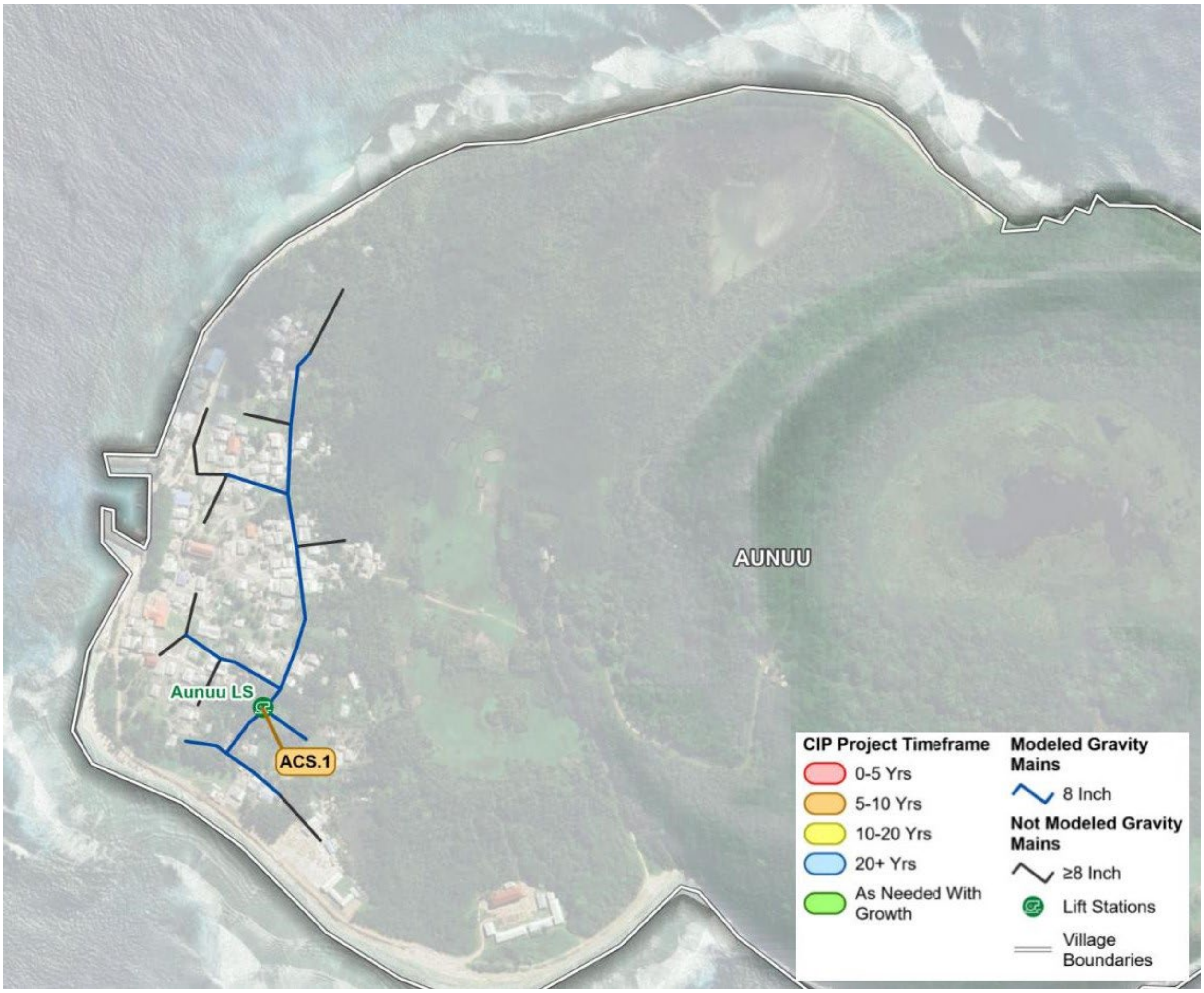

Figure 9-5 - Aunu'u CIP Overview

Table 9-16: Aunu'u Collection System – Project Prioritization-by Project Number

No.	Description	Likelihood of Failure	Consequence of Failure	Risk Assessment Score
Lift Station Projects				
ACS.1	Aunu'u Lift Station Improvements	4	4	16

Table 9-17: Aunu'u Collection System – Summary of CIP Costs and Project Phasing

No.	Description	Capital Cost (2025 Dollars)	Phase 1: 0-5 Years	Phase 2: 5-10 Years	Phase 3: 10-20 Years	Phase 4: 20+ Years	As Needed with Growth
ACS.1	Aunu'u Lift Station Improvements	$292,000		$292,000			
	TOTAL (2025 Dollars)	**$292,000**	**$0**	**$292,000**	**$0**	**$0**	**$0**

9.4 References

ASPA. 2024. FY24-25 Clean Water Ace Infrastructure. Provided by ASPA on June 26th, 2024.

US Army Corps of Engineers. 2024. DOD Area Cost Factors (ACF) PAX Newsletter No 3.2.1. 29 March 2024.

CHAPTER 10

FINANCIAL ASSESSMENT

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H: Financial Model

Chapter 10 Financial Assessment

10.1 Introduction

The purpose of this chapter is to provide a financial assessment and recommendations to implement the capital improvement plan. The recommendations in this chapter are provided to ensure the long-term financial sustainability of the wastewater utility operated by ASPA. This chapter will begin with an overview of the general methodology utilized to analyze the financial sustainability of the wastewater utility. This will be followed by a review of each portion of the analysis. This chapter will conclude with findings and recommendations. **Appendix H** includes a full financial model. Note: The yellow highlighted items in **Appendix H** are to be addressed with EFG Consulting and ASPA in the future as rates are finalized.

10.2 General Methodology

The first step in analyzing the implementation of a long-term capital plan is to analyze the current operation and maintenance of the system. This includes a 10-year projection of current operating costs. Prior to adding capital, the user rate is adjusted to find break-even while meeting specific financial metrics. The proposed capital improvement projects are then added. Several scenarios are then run to include grant and debt to fund the capital improvement plan while continuing to modify the rate to meet the financial metrics. Conclusions and recommendations are then provided. The overall goal of this analysis is to identify the required funding levels to ensure the system can operate long into the future while keeping user rates as low as possible.

10.3 Operating Expenses

The first step is to provide a basic foundation for the operating costs needed to operate and maintain the current system. This analysis assumed a 3% inflation rate on the operating expenses. The following operating expenses were projected for the next 10 years. The amounts provided are the 2025 budget including the GL account number.

- $2,204,000 - Personnel (5100)
- $1,551,000 - Material & Supplies (5200)
- $221,290 - Contractual Services (5300) – note: capital expenditures were pulled from this line item.
- $19,000 - Travel (5400)
- $1,513,500 - All Others (5500)
- $690,500 - Equipment (5600)
- New Operation and Maintenance from STFS

Total operating expenses were budgeted at $6.2M for these items in 2025 for current operations. Assuming a 3% growth rate, these expenses are estimated to grow to $7.0M in 2035.

10.4 Break Even Analysis

After making the projections in Section 1.3, this analysis adjusted the user rate to break even each year until 2035. Section 10.8.2 describes the two rate increase options utilized to break even. Revenue is currently generated almost entirely by user rates. This analysis assumed the current estimated 10,315 user accounts would not grow through the 10-year period. Approximately 90% of the user accounts are residential connections. The others are industrial, government, and commercial. This analysis assumed a uniform percentage rate increase across all categories. A future analysis could review the specific cost recapture needed among and between specific categories if desired by ASPA.

10.5 Capital Improvement Plan

After analyzing the break-even scenario, the next step was to add the full capital improvement plan for the next 10-years into the analysis. The 0-5 year projects were averaged across the next 5 years, and the 6-10 year projects were averaged over years 6 to 10 to create an average capital expense each year. The 0-5 year projects averaged $6.9M/year and the 6-10 year projects $2.9M/year. Projects beyond this timeframe will be analyzed in a future analysis.

10.6 Funding Options

This analysis then assumed 2 major funding options:

1. 100% grant funding and 0% debt.
2. 0% grant funding and 100% debt.

ASPA has many options to fund debt. This analysis is not a recommendation but simply an estimate of one widely available option which is the USDA's Water and Waste Disposal Loan & Grant Program. This debt was assumed to be issued every 3 years with a 40-year repayment at 4.0% interest rate.

10.7 Financial Metrics

Aside from simply breaking even, a financially healthy utility must also meet certain other financial metrics. The metrics utilized in this analysis were obtained from S&P Global Ratings Criteria for U.S. Public Finance: U.S. Municipal Water, Sewer, And Solid Waste Utilities: Methodology and Assumptions published on March 25, 2015.

These financial metrics allow for evaluation of a healthy utility regardless of the size of the system. The metrics are as follows:

- **Cash on Hand** – 100% of operating expense in a reserve fund for emergency purposes.
- **Debt Service Coverage** – 1.25x net debt service coverage. This metric measures the ability to service debt. For every $1 of debt service, the 1.25x net debt service coverage ratio assumes $1.25 of net operating revenue, after paying all operating expenses, is available.
- **Affordability** – the affordability ratio comes from the USDA Water and Waste Disposal Loan and Grant Program which recommends 1.5% of the territories Average Median Household Income (AMHI) is spent on sewer. In the 2020 US Census, the AMHI for American Samoa was $28,539

which provides an affordable monthly rate of $35.67 per month. The AMHI grew from $23,892 in 2010 to 2020 which is an average annual growth rate of 1.79%. The growth in AMHI was assumed at 1.79% over the next 10 years.

10.8 Scenario Analysis

This analysis provides four scenarios as follows. Each are provided below along with a set of charts that provide a summary of the financial metrics and outputs for each scenario.

10.8.1 Scenario 1 – No New Capital, No Rate Increase

This first scenario is a status quo assuming historic growth in expenses but no increase in the rate nor any future capital. Note that the 2025 rate per user increases above the 2024 rate due to the use of budgeted 2025 revenue figures. This is not a rate increase for purposes of this analysis. **Figure 10-1** provides a summary of the outputs. Cash Reserves become highly negative at the end of the period. This scenario is not feasible. The following describes **Figure 10-1**.

- **Expenditures:** This graph depicts operational expenses which are assumed to increase at 3% annually.
- **Revenues:** This scenario assumed no rate increase during the measurement period.
- **Cash Reserves:** Cash balances become negative as expenditures grow and revenue stays flat.
- **Coverage:** With no debt allocated currently to the wastewater unit, this graph provides no data for this scenario.
- **Rate Affordability:** The rate affordability chart demonstrates room to increase annual rates.
- **Rate Change:** This graph depicts the rate change as a percentage and as revenue per account per month which is flat in this scenario.
- **Grant Needs:** There are no future grants assumed in this scenario.

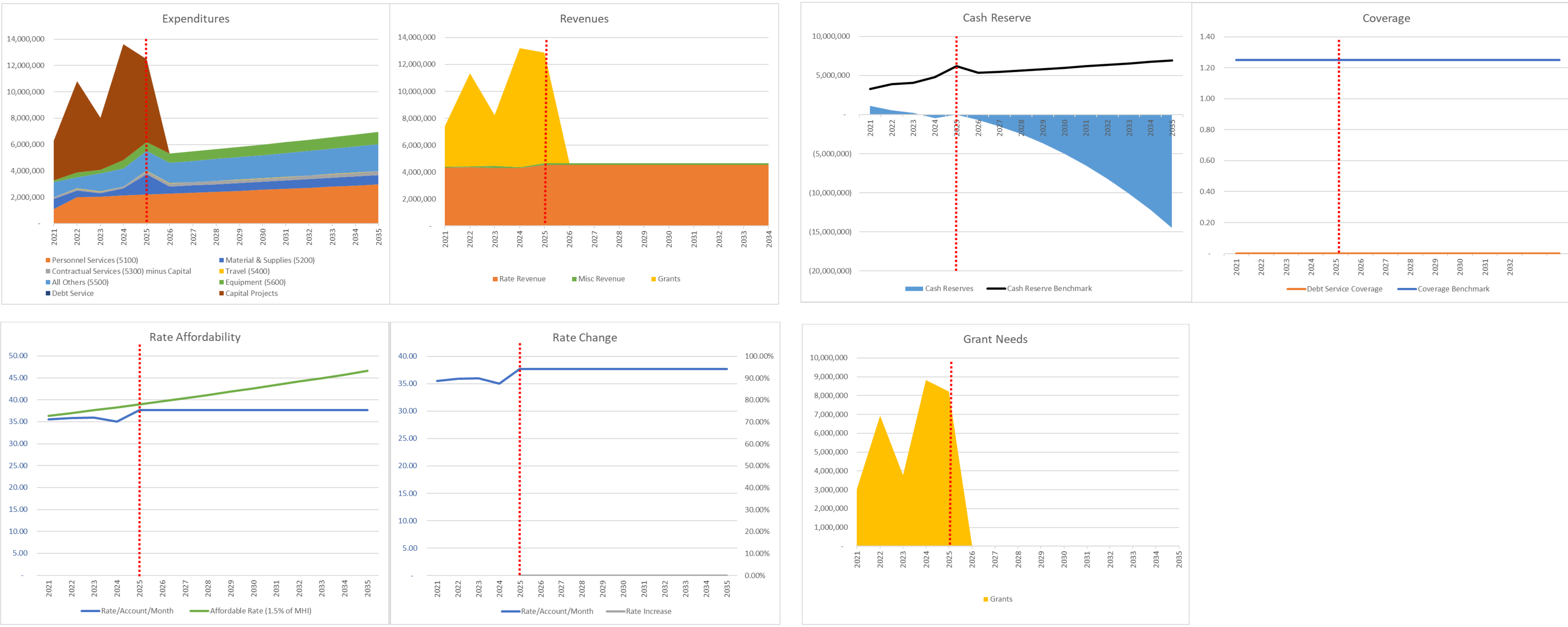

Figure 10-1: Scenario 1 Outputs – No New Capital, No Rate Increase

10.8.2 Scenario 2 – No New Capital, Rate Increase to Break Even

Scenario 2 assumes no new capital and a rate increase necessary to break even. Scenario 2a assumes a larger, one-time increase with smaller increases thereafter. Rates would need to increase by 14.7% in 2026 and then 3.1% thereafter. Scenario 2b assumes smaller annual increases to break even by the end of the period with annual rate increases at 5% per year. **Figure 10-2** and **Figure 10-3** provide a summary of the outputs for each respective scenario.

Scenario 2a would increase the rate affordability metric above the metric by approximately $10/year in 2035.

Scenario 2b would require some type of borrowing to cover operations during the analysis period. This scenario would also push up the rate affordability metric to nearly $15/year above the metric in 2035.

The following describes **Figure 10-2**.

- **Expenditures:** This graph depicts operational expenses which are assumed to increase at 3% annually.
- **Revenues:** This scenario assumes a one-time, large rate increase followed by smaller increases.
- **Cash Reserves:** Cash balances break even and stay at near $0 through 2035. This assumes that internal funds at ASPA may be allocated to the wastewater utility.
- **Coverage:** With no debt allocated currently to the wastewater unit, this graph provides no data for this scenario.
- **Rate Affordability:** The rate affordability chart depicts that break-even would require rates to be above the affordability metric.
- **Rate Change:** This graph depicts the rate change as a percentage and as revenue per account per month.
- **Grant Needs:** There are no future grants assumed in this scenario.

Figure 10-2: **Scenario 2a Outputs – No New Capital, Rate Increase to Break Even**

The following describes **Figure 10-3**.

- **Expenditures:** This graph depicts operational expenses which are assumed to increase at 3% annually.
- **Revenues:** This scenario assumed 5% annual rate increases through 2035.
- **Cash Reserves:** Cash balances become negative but break-even by 2035.
- **Coverage:** With no debt allocated currently to the wastewater unit, this graph provides no data for this scenario.
- **Rate Affordability:** The rate affordability chart portrays increases are above the affordability benchmark.
- **Rate Change:** This graph depicts the rate change as a percentage and as revenue per account per month.
- **Grant Needs:** There are no future grants assumed in this scenario.

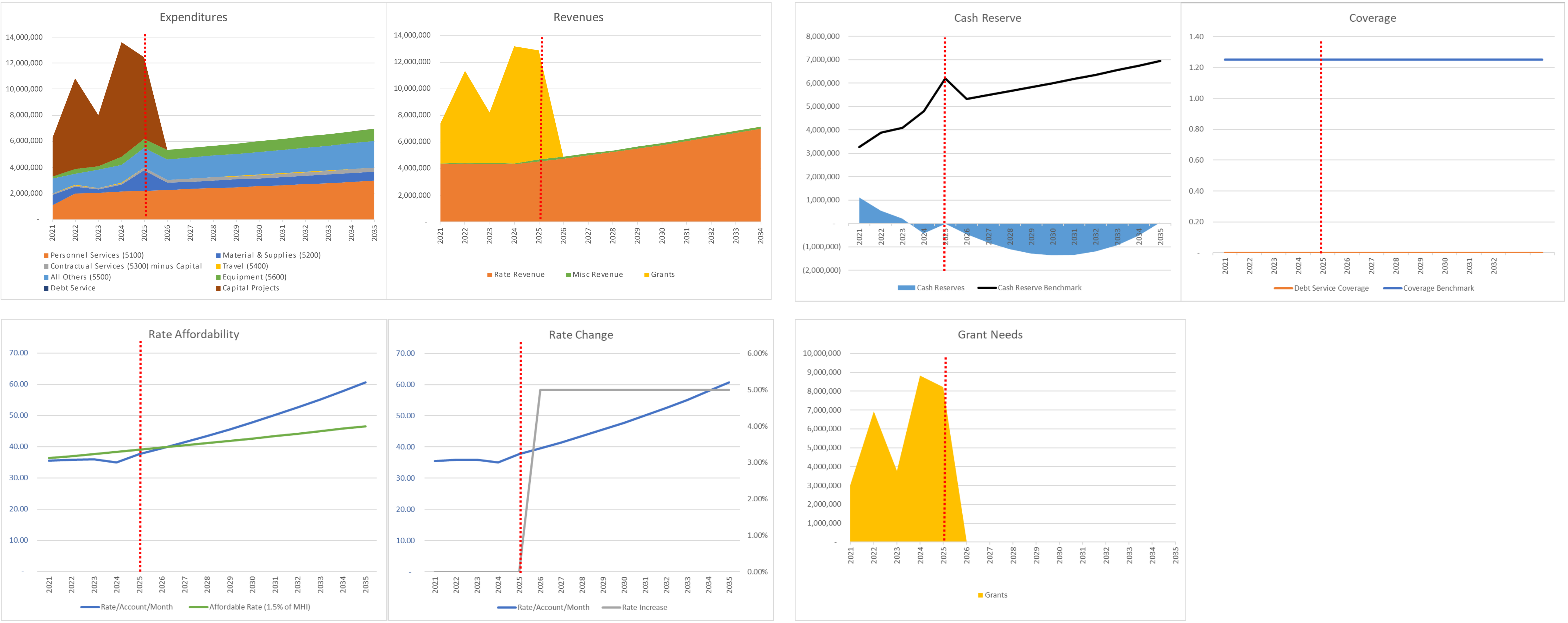

***Figure 10-3: Scenario 2b Outputs* - No New Capital, Rate Increase to Break Even**

10.8.3 Scenario 3 – Master Plan Capital – 100% Grant Funded

Scenario 3 starts with the breakeven analysis in Scenario 2b. The full capital plan is added and assumed to be funded 100% by grants. **Figure 10-4** provides a summary of the outputs. This scenario does not change the rates as it assumes grants cover the full capital costs.

- **Expenditures:** This graph depicts operational expenses which are assumed to increase at 3% annually as well as added capital projects identified in this plan.
- **Revenues:** This scenario assumed 5% annual rate increases through 2035. Grant revenues are used to pay for capital.
- **Cash Reserves:** Cash balances become negative but break-even by 2035.
- **Coverage:** With no debt allocated currently to the wastewater unit, this graph provides no data for this scenario.
- **Rate Affordability:** The rate affordability chart portrays increases are above the affordability benchmark.
- **Rate Change:** This graph depicts the rate change as a percentage and as revenue per account per month.
- **Grant Needs:** This scenario assumes the full capital improvement plan is covered by grants.

Figure 10-4: Scenario 3 - 100%, Rate Increase to Break Even

10.8.4 Scenario 4 – Master Plan Capital – 100% Bond Funded

Scenario 4 assumes the full capital plan is implemented and paid 100% through debt issuance as described in Section 1.6. **Figure 10-5** provides a summary of the outputs. This scenario would require a dramatic rate increase. The affordability metric would be nearly double by 2035. This scenario is not feasible.

- **Expenditures:** This graph depicts operational expenses which are assumed to increase at 3% annually as well as added capital projects identified in this plan.
- **Revenues:** This scenario assumed 5% annual rate increases through 2035. No grant revenues are used to pay for capital.
- **Cash Reserves:** Cash balances become negative but increase by 2035 as revenue increases to meet debt coverage requirements.
- **Coverage:** The use of debt requires that net debt service coverage remains above 1.25x.
- **Rate Affordability:** The rate affordability chart portrays increases are nearly 2x the affordability benchmark.
- **Rate Change:** This graph depicts the rate change as a percentage and as revenue per account per month.
- **Grant Needs:** This scenario assumes all future capital is covered by debt.

Figure 10-5: Scenario 4 – 100% Bond, Rate Increase to Break Even

10.9 Conclusions and Recommendations

Based upon the analysis provided herein, this analysis recommends the following:

- Annual rate increases will be necessary even without a new Capital Improvement Plan. The most cost-effective long-term increase is a one-time increase as shown in Scenario 2a.
- Rate increases should be adjusted such as to build a cash balance that will be higher than the increases shown herein.
- Grant funding will need to be utilized to cover the capital costs. EFG Consulting suggests providing this same analysis for the Water Utility. The grant funds available from EPA, ARPA, BIL and others can then be allocated between the Water and Wastewater Utilities by ASPA. Future bonds and grants from USDA Rural Development or other funding can then be considered.
- This analysis can be updated each year during the development of the budget by EFG Consulting or by staff to ensure the long-term financial sustainability of each utility within ASPA.

10.10 References

None