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ABCWUA Utility-Wide

Comprehensive Asset Management Plan

(Appendices separate)

FINAL
Hazen Contract No. 70041-003
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Albuquerque Bernalillo County
Water Utility Authority

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List of Acronyms

Abbreviation	Definition
AACE	Association for the Advancement of Cost Engineering
AM	Asset Management
AMLT	AM Leadership Team
AMP	Asset Management Plan
AMPT	AM Program Team
ARTF	Arsenic Removal Treatment Facilities
BAMT	Business-unit AM Team
BRE	Business Risk Exposure
CAMP	Comprehensive Asset Management Plan
CCTV	Closed-Circuit Television
CIP	Capital Improvement
City	City of Albuquerque
COF	Consequence of Failure
County	Bernalillo County
EAM	Enterprise Asset Management
EPA	Environmental Protection Agency
ESRI	ArcGIS ESRI Software
EUL	Expected Useful Life
FMEA	Failure Mode and Effect Analysis
FM	Force Main
FY	Fiscal Year
GAC	Granular Activated Carbon
GIS	Geographic Information System
Hazen	Hazen and Sawyer
IIMM	International Infrastructure Management Manual
IoT	Internet of Things

Abbreviation	Definition
IT	Information Technology
KPI	Key Performance Indicator
LF	Linear Foot
LOF	Likelihood of Failure
LOS	Levels of Service
M	Million
Maximo	Maximo® Version 7.6
MCL	Maximum Concentration Level
MGD	Million Gallons per Day
Misc.	Miscellaneous
NBPS	Non-Potable Booster Pump Stations
O&M	Operation and Maintenance
P&ID	Piping and Instrumentation Diagram
PWBPS	Potable Water Booster Bump Stations
RCP	Reinforced Concrete Pipe
ROW	Right of Way
RTF	Run-to-Failure
RUL	Remaining Useful Life
RWPS	Raw Water Pump Station
SAF	Soil Amendment Facility
SAMP	Strategic Asset Management Plan
SJCWTP	San Juan-Chama Water Treatment Plant
SOR	System of Record
SWRP	Southside Water Reclamation Plant
TDC	Total Direct Costs
UEC	Utility Expansion Charges
US	United States of America

Abbreviation	Definition
UWAMP	Utility-wide Asset Management Plan
Water Authority	Albuquerque Bernalillo County Water Utility Authority
WQ	Water Quality

Acknowledgement

Hazen wishes to express our appreciation to the Albuquerque Bernalillo County Water Utility Authority (Water Authority) for support in completing the Comprehensive Asset Management Plan (CAMP). The people listed below played key roles in completing the CAMP including the many Asset Management Plans that were conducted during the course of this project.

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Quality Information for CAMP Deliverable

Version	Prepared by	Checked by	Approved by
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	Bryan Oldham, PE, PMP Senior Associate	Steve Price Associate Vice President	Greg Gates Vice President
1.2			
	Bryan Oldham, PE, PMP Senior Associate	Steve Price Associate Vice President	Greg Gates Vice President

Revision History

Date	Version	Description	Authors
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April 2023	1.1	Address Initial Water Authority Comments	Oldham, Sion
May 2023	1.2	Final Update	Oldham

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How-to-Use Guide for the 2023 CAMP

The Comprehensive Asset Management Plan document consists of two major parts:

- **CAMP Document** (This document): Highlights the methodology used to create detailed asset management plans
- **Appendices:** Includes the detailed asset management plans and relevant supporting documents pertaining to the Water Authority facilities

The CAMP document is best used for the following:

- Finding background information on the Water Authority and its asset management (AM) mission
- Understanding the strategic components associated with the AM program
- Providing AM program recommendations
- Understanding the Asset Management Plan (AMP) methodology for vertical and linear assets
- Reviewing the current Water Authority systems and facilities
- Assessing the system-wide risk profile
- Reviewing the projected capital improvement plan (CIP) renewal needs
- Gaining insight into the existing levels of service (LOS) and associated performance criteria

It is recommended that the CAMP document (this document) be reviewed annually and updated as needed to account for major changes to the Water Authority's facilities (e.g., when the Bosque plant comes on-line). It is anticipated that there will be only minor changes to the document as CIP projects are completed and the associated costs are removed from the overall CIP costs. Most of the asset related updates will take place directly in Maximo and be reflected in the Digital Dashboard component of this deliverable. With the process the Water Authority is putting in place to maintain accurate data in Maximo, the specific AMPs do not need to be updated annually. The AMPs should stay as living documents with the asset register always being current.

Report Overview

This 2023 CAMP is organized into nine (9) sections with the purpose of providing a wholistic view of the Water Authority AM Program, strategies and methodologies, state of utility assets, and planning and renewal needs. Error! Reference source not found. includes descriptions of each report section.

Table A: Report Section Descriptions

Section	Section Name	Description
1	Introduction	Background, purpose, and description of the CAMP report
2	Albuquerque Bernalillo County Water Utility Authority	Water Authority history and background, AM policy descriptions, and overview of AM Program
3	Strategic Asset Management Plan	AM purpose and goals, standardized frameworks, and strategies
4	AMP Methodology	Methodologies used for each component of specific asset-category AMPs
5	Water Authority Infrastructure	High-level descriptions of Water Authority process systems and the types of facilities within those systems
6	System-Wide Asset Profile	Cumulative look at Water Authority's asset valuation and risk profile
7	Projected CIP Renewal	Cumulative profile of asset-category CIPs
8	Financial Summary	Water Authority renewal projection and funding scenarios
9	Performance Measurement	Performance measurement for continuous improvement of Water Authority AM Program

The Appendices (separate document) contain the following:

- AMPs by major facility (e.g., San Juan Chama Water Treatment Plant) (**Appendix A**)
- Water Authority AM Policies (**Appendix B**)
- Water Authority AM Data Standards (**Appendix C**)
- Stakeholder AM Perceptions and Needs (**Appendix D**)
- 2021 Strategic Asset Management Plan (SAMP) (created outside of the scope of this project) (**Appendix E**)
- 100-year Projected CIP Costs (**Appendix F**)

Appendix B and **Appendix C** may require periodic updates to incorporate new utility wide policies or data standards. **Appendix D** can be updated periodically to show changes in stakeholder perceptions and needs over time. **Appendix E** is provided as reference and background. An update to the 2021 SAMP is included as part of this project (**Section 3**). **Appendix F** is a snapshot in time for planning purposes.

Appendix A contains all the specific AMPs developed for the Water Authority. These AMPs contain the following information:

- Asset risk
- Asset rehabilitation projects
- Asset replacement projects
- Anticipated CIP Costs
- LOS and key performance indicators (KPIs)

Stakeholders should refer to the specific AMP for details on any specific Water Authority asset grouping. The AMPs should be considered a snapshot of the Water Authority's needs at the time of the AMP's creation.

To enhance its AM practices, the Water Authority upgraded its Maximo system in 2019. In addition, the Water Authority is in the process of developing an AM training program and implementing the Maximo mobile application (planned for 2023). Part of the training program's focus is instructing field crews on how to perform on-going condition assessments and entering that data into Maximo via the mobile application. The Water Authority has also implemented developer/contractor handover standards that will require developers/contractors to provide AM data for any new or replacement assets in a manner that can easily be integrated into the Water Authority's Maximo system.

When training is complete and the mobile application is in use, the Water Authority will be able to maintain asset condition and risk scoring in near real-time. This will allow the Water Authority to identify CIP needs in near real time as well, facilitating decade planning. The Digital Dashboard component of this deliverable will further assist the Water Authority's decade planning efforts.

The Water Authority's dynamic and forward-thinking AM team anticipates that the detailed AMPs included in **Appendix A** will not be necessary in the future. Moving forward, the Water Authority will be able to use information directly from Maximo to drive their AM program, CIP and decade plan development, and budgeting efforts.

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Executive Summary

The Albuquerque Bernalillo County Water Utility Authority (Water Authority) began developing its asset management (AM) program in 2009 and developed its first Utility-wide Asset Management Plan (UWAMP) in 2011. Between 2011 and 2021, multiple individual Asset Management Plans (AMPs) were developed for specific groups of assets to help prioritize rehabilitation efforts. In 2021, the Water Authority engaged Hazen and Sawyer (Hazen) to develop a Comprehensive Asset Management Plan (CAMP) that incorporated previously developed AMPs and also encompassed all facilities that had not been previously reviewed, and to establish methodologies, standards, and frameworks to be utilized in the development of AMPs for the remaining asset groups and future AMP updates. Water Authority facilities reviewed by Hazen as part of the 2023 CAMP development are shown in **Table ES - 1**. Previously developed AMPs incorporated into this CAMP are presented in **Table ES-2.**

Table ES - 1: Facilities Reviewed by Hazen

Facility Group	Facility Group
San Juan Chama Water Treatment Plant	Pump Stations
Wells (assets not previously studied)	Southside Water Reclamation Plant
Arsenic Treatment Plants	South Side Non-potable Facility
Odor Control Stations	SAF and Water Quality Lab
Buildings not included in other AMPs	Raw Water Pipeline
Conversion of previous Lift and Vacuum Station scoring to CAMP scoring	Lift Station 24 Force Mains (18-inch and 24-inch diameter)

Table ES - 2: Previously Developed AMPs

Facility Group
2016 Lift and Vacuum Station AMP (Carollo)
2018 Well AMP Update (CDM Smith)
2019 Reservoir Desktop Assessment (Jacobs)
2019 Transmission Water Line AMP (Smith Engineering)
2020 Large Diameter Sewer AMP Update (Smith Engineering)
2020 Small Diameter (Water and Sewer Lines) AMP Update)Smith Engineering)

Each facility group has its own Asset Management Plan (AMP) that includes the following:

- Asset hierarchy
- Condition assessment results
- Estimated Remaining Useful Life (RUL)
- Estimated replacement/rehabilitation costs for each asset
- Estimated asset risk score based on Likelihood of Failure (LOF) and Consequence of Failure (COF) score for each asset
- Developed list of recommended Capital Improvement Plan (CIP) projects with estimated costs and timeline for implementation

Visual condition assessments and asset inventory validations were performed for the facilities listed in **Table ES - 1** except for the Raw Water Pipeline and Lift Station 24 Force Mains which included desktop assessments. The risk assessment for each asset includes condition assessment, criticality assessment, and yields an overall Business Risk Exposure (BRE), or risk score, for each asset. The BRE scores are used to estimate the timeline for recommended replacement and rehabilitation projects in the respective AMP CIP. BRE is calculated as shown in **Figure ES - 1**.

Figure ES - 1: Business Risk Exposure

For all Hazen-developed vertical asset AMPs, the Water Authority and Hazen agreed on a consistent methodology to classify the likelihood of failure (LOF) and consequence of failure (COF) components. It should be noted that the non-Hazen AMPs have used different risk scoring methodologies, but the end result is still a prioritized list of risks and CIP projects. The Lift Station and Vacuum Station reports were converted to the risk methodology scoring developed for all the Hazen-developed AMPs. LOF measures an asset's likelihood of, or timing to, failure. LOF accounts for both the physical condition and when available performance condition of the asset. COF measures the direct and indirect implications and costs associated with the failure of an asset.

As part of each AMP, Levels of Service (LOS) and Key Performance Indicators (KPIs) were reviewed. The Water Authority maintains a robust set of LOS and KPIs, and additional LOS/KPIs were recommended when they were identified as being useful for the Water Authority. LOS and KPIs should be looked at as indicators of continuous improvement and not taken as individual definitive measurements.

CIP and Rehabilitation Projections

After the business risk exposure of the various assets was determined, CIP and rehabilitation projects were identified for each AMP. Association for the Advancement of Cost Engineering (AACE) Class 5 initial replacement cost estimates for bare assets were developed, covering only labor, material, and equipment required to install the asset. Class 5 estimates have a typical accuracy range of -50% on the low side and +100% on the high side.

Project cost adders were developed and completed in 2020 using previous pump station projects as a baseline and guided by Water Authority historical knowledge to estimate projected total project costs. Project adders were utilized for all AMP CIPs developed as part of this report to provide a consistent metric for comparison and resulted in an effective 3.75 multiplier applied.

The Digital Dashboard component of this project includes a built-in functionality to adjust the effective multiplier that allows the Water Authority to modify cost adders at a global, AMP, or selected asset level. The flexibility allows the Water Authority to run various scenarios using different adder values based on additional historical data not available for this report and increased AACE Class accuracy.

2023 CAMP project adders and percentages that resulted in an effective 3.75 multiplier are shown in Error! Reference source not found..

Table ES - 3: Project Adders and Percentages Used

Adder	Percent
Demolition, Mechanical, Structure, Civil, etc. Allowance	35
General Conditions	15
Contractor Overhead	10
Contractor Profit	10
Bonding & Insurance	3
Electrical and Instrumentation Allowance	15
Construction Contingency	10
Engineering Design	8
Construction Administration	10
Project Contingency	30

Since the development of the initial adders, external factors have changed that can influence cost including inflation, contractor availability, work brought in-house, and other external factors. Work completed in-house, for example, results in an approximately 2.0 effective multiplier instead of 3.75. Due to multiple factors affecting variability, system-wide projected CIP costs are presented using both established multipliers:

1) Adder cost factor of 2.0 multiplier

2) Adder cost factor of 3.75

For CIP planning purposes, it is recommended the Water Authority use the 2.0 multiplier during planning and adjust annually as actual data can be observed for projects in the previous 1-2 years. **The costs represented are a snapshot in time and should be considered for illustrative purposes only. The Water Authority reviews the numbers annually, and as needed throughout the year, to update the decade plan.** The following two tables are presented to represent a low and high cost estimate range. The tables represent a 20-year planning horizon. **Appendix F** includes the full 100-year planning horizon for the 2.0 and 3.75 multiplier scenarios.

- **Table ES – 4** provides a 20-year CIP cost estimate with the 2.0 multiplier applied for each Hazen AMP recommendation
- **Table ES – 5** provides a 20-year CIP cost estimate with the 3.75 multiplier applied for each Hazen AMP recommendation

Each table shows Hazen-developed and non-Hazen AMP CIP projected costs for the respective years, where available. All previously developed, non-Hazen AMP costs, have different multipliers than those applied in Tables ES-4 and ES-5. These costs are presented in the “Total Non-Hazen” line to represent the estimated annual CIP expenditures from these AMPs. An overall average CIP requirement for each year is then determined.

Table ES - 4: 20-year Projected CIP Renewal with a 2.0 Multiplier (x 1,000)

Hazen AMP Year[1,2]	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Year #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Wells	$ 5,800	$ 4,000	$ 5,400	$ 2,800	$ 6,000	$ 2,000	$ 2,400	$ 1,800	$ 1,600	$ 2,000	$ 6,800	$ 10,800	$ 9,600	$ 7,800	$ 8,200	$ 7,200	$ 5,600	$ 4,200	$ 3,800	$ 4,400
LS 24 FMs	$ -	$ 20	$ -	$ -	$ 100	$ -	$ 200	$ 400	$ 400	$ 400	$ 400	$ 400	$ 600	$ 600	$ -	$ -	$ -	$ -	$ -	$ -
RWP	$ -	$ 100	$ -	$ -	$ 200	$ 200	$ -	$ -	$ -	$ -	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Misc. Bldgs	$ -	$ -	$ -	$ -	$ 100	$ -	$ 400	$ -	$ -	$ 400	$ 160	$ 400	$ 600	$ 600	$ 1,400	$ 1,400	$ -	$ 200	$ -	$ -
Odor Control	$ -	$ 1,800	$ 200	$ 200	$ 200	$ 200	$ 180	$ 160	$ 180	$ 180	$ 200	$ 160	$ 140	$ 160	$ 400	$ 200	$ 200	$ 400	$ 400	$ 400
SAF & WQ Labs	$ 400	$ 200	$ 600	$ 400	$ 400	$ 400	$ 600	$ 600	$ 1,000	$ 600	$ -	$ 1,000	$ 800	$ 800	$ 100	$ 200	$ 600	$ 600	$ 100	$ 400
Pump Stations	$ 1,800	$ 60	$ 600	$ 1,200	$ -	$ -	$ 1,400	$ 1,200	$ 1,200	$ 1,200	$ -	$ 1,200	$ 1,200	$ 1,000	$ 1,400	$ 1,200	$ 1,000	$ 800	$ 4,000	$ 2,400
SWRP	$ 18,400	$ 7,600	$ 6,800	$ 7,600	$ 6,600	$ 6,200	$ 7,600	$ 7,000	$ 7,200	$ 5,400	$ 7,800	$ 8,200	$ 8,200	$ 6,600	$ 8,400	$ 8,000	$ 8,000	$ 7,800	$ 8,000	$ 6,800
SJCWTP	$ 3,600	$ 3,800	$ 4,400	$ 4,400	$ 5,600	$ 6,400	$ 7,000	$ 7,200	$ 7,000	$ 7,400	$ 7,200	$ 7,000	$ 6,000	$ 6,600	$ 6,800	$ 6,400	$ 6,000	$ 6,800	$ 6,800	$ 6,200
LS & VS	$ 1,800	$ 1,000	$ 800	$ 3,400	$ 2,400	$ 7,200	$ 1,600	$ 600	$ 2,200	$ 1,000	$ 3,400	$ 4,600	$ 9,000	$ 3,400	$ -	$ 160	$ -	$ -	$ -	$ -
Arsenic RTFs	$ 1,200	$ 200	$ 100	$ 2,600	$ 5,800	$ 4,000	$ 4,000	$ 400	$ 400	$ 400	$ 400	$ 800	$ 600	$ 400	$ 600	$ 800	$ 800	$ 800	$ 800	$ 800
Total Hazen AMPs	$ 33,000	$ 18,800	$ 18,900	$ 22,600	$ 27,400	$ 26,600	$ 25,400	$ 19,400	$ 21,200	$ 19,000	$ 26,400	$ 37,600	$ 36,700	$ 28,000	$ 27,300	$ 25,600	$ 22,200	$ 21,600	$ 23,900	$ 21,400
Decade Plan Year[2]	2023	2024	2025	2026	2027	2028	2029	2030	2031	*2032	*2033	*2034	*2035	*2036	*2037	*2038	*2039	*2040	*2041	*2042
Decade Plan: 100 - Sewerline Renewal	$ 15,500	$ 23,900	$ 27,600	$ 30,300	$ 27,600	$ 31,600	$ 34,600	$ 48,600	$ 51,600	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400
Decade Plan: 200 - DWater Renewal	$ 6,500	$ 6,200	$ 11,300	$ 11,500	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200
Decade Plan: 719 - Reservoirs Renewal	$ 2,300	$ 1,800	$ 1,900	$ 4,400	$ 5,200	$ 6,100	$ 5,100	$ 4,100	$ 5,200	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Decade Plan: 732 - LV Valve Equip/Repl	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Decade Plan: 901 - Reuse Pipeline Renewal	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Total Non-Hazen	$ 24,500	$ 32,100	$ 41,000	$ 46,400	$ 44,200	$ 49,100	$ 51,100	$ 64,100	$ 68,200	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800
GRAND TOTAL	$ 57,500	$ 50,900	$ 59,900	$ 69,000	$ 71,600	$ 75,700	$ 76,500	$ 83,500	$ 89,400	$ 65,800	$ 73,200	$ 84,400	$ 83,500	$ 74,800	$ 74,100	$ 72,400	$ 69,000	$ 68,400	$ 70,700	$ 68,200
*Decade Plan budget estimated as average of 2023-2031.								Average Yr 1-9	$ 70,400										Average Yr 1-20	$ 71,900

[1]The average annual CIP cost per AMP was utilized for years outside of the respective AMP CIP years (highlighted in purple). Total CIP cost across all AMP CIP years was divided by the total number of AMP CIP years to provide the average annual CIP cost.

[2]Total costs greater than 100,0000 have been divided by 1,000 and rounded to nearest 100 place value, less than 100,000 divided by 1,000 and rounded to nearest 10 place value.

Table ES - 5: 20-year Projected CIP Renewal with 3.75 Multiplier (x 1, 000)

Hazen AMP Year[1,2]	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Year #	1	2	3	4	5	6	7	8	9	10
Wells	$ 10,800	$ 7,500	$ 10,200	$ 5,200	$ 11,300	$ 3,700	$ 4,600	$ 3,300	$ 3,100	$ 3,700
LS 24 FMs	$ -	$ 30	$ -	$ -	$ 200	$ -	$ 400	$ 900	$ 900	$ 900
RWP	$ -	$ 200	$ -	$ -	$ 400	$ 400	$ -	$ -	$ -	$ -
Misc. Bldgs	$ -	$ -	$ -	$ -	$ 200	$ -	$ 600	$ -	$ -	$ 700
Odor Control[3]	$ -	$ 1,000	$ 400	$ 400	$ 400	$ 400	$ 300	$ 300	$ 200	$ 200
SAF & WQ Labs	$ 800	$ 400	$ 1,000	$ 900	$ 800	$ 800	$ 1,300	$ 1,200	$ 1,700	$ 1,000
Pump Stations	$ 3,300	$ 100	$ 1,300	$ 2,100	$ -	$ -	$ 2,800	$ 2,200	$ 2,200	$ 2,300
SWRP	$ 34,500	$ 14,300	$ 12,700	$ 14,400	$ 12,200	$ 11,600	$ 14,100	$ 13,100	$ 13,600	$ 10,300
SJCWTP	$ 6,700	$ 7,000	$ 8,100	$ 8,400	$ 10,600	$ 12,000	$ 13,200	$ 13,400	$ 13,200	$ 13,800
LS & VS	$ 3,400	$ 2,000	$ 1,400	$ 6,400	$ 4,500	$ 13,600	$ 2,900	$ 1,200	$ 4,100	$ 1,700
Arsenic RTFs	$ 2,400	$ 500	$ 200	$ 5,000	$ 11,000	$ 7,500	$ 7,500	$ 800	$ 600	$ 600
Total Hazen AMPs	$ 61,900	$ 33,000	$ 35,300	$ 42,800	$ 51,600	$ 50,000	$ 47,700	$ 36,400	$ 39,600	$ 35,200
Decade Plan Year[2]	2023	2024	2025	2026	2027	2028	2029	2030	2031	*2032
Decade Plan: 100 - Sewerline Renewal	$ 15,500	$ 23,900	$ 27,600	$ 30,300	$ 27,600	$ 31,600	$ 34,600	$ 48,600	$ 51,600	$ 32,400
Decade Plan: 200 - DWater Renewal	$ 6,500	$ 6,200	$ 11,300	$ 11,500	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 10,200
Decade Plan: 719 - Reservoirs Renewal	$ 2,300	$ 1,800	$ 1,900	$ 4,400	$ 5,200	$ 6,100	$ 5,100	$ 4,100	$ 5,200	$ 4,000
Decade Plan: 732 - LV Valve Equip/Repl	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Decade Plan: 901 - Reuse Pipeline Renewal	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Total Non-Hazen	$ 24,500	$ 32,100	$ 41,000	$ 46,400	$ 44,200	$ 49,100	$ 51,100	$ 64,100	$ 68,200	$ 46,800
GRAND TOTAL	$ 86,400	$ 65,100	$ 76,300	$ 89,200	$ 95,800	$ 99,100	$ 98,800	$ 100,500	$ 107,800	$ 82,000
*Decade Plan budget estimated as average of 2023-2031.								Average Yr 1-9	$ 91,000	

Hazen AMP Year[1,2]	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Year #	11	12	13	14	15	16	17	18	19	20
Wells	$ 12,600	$ 20,100	$ 17,900	$ 14,800	$ 15,400	$ 13,400	$ 10,500	$ 7,800	$ 7,300	$ 8,300
LS 24 FMs	$ 700	$ 700	$ 1,200	$ 1,100	$ -	$ -	$ -	$ -	$ -	$ -
RWP	$ -	$ 5,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Misc. Bldgs	$ 300	$ 600	$ 1,000	$ 1,100	$ 2,700	$ 2,700	$ -	$ 500	$ -	$ -
Odor Control[3]	$ 200	$ 300	$ 200	$ 300	$ 300	$ 500	$ 400	$ 400	$ 600	$ 600
SAF & WQ Labs	$ -	$ 1,700	$ 1,500	$ 1,500	$ 200	$ 500	$ 1,200	$ 1,200	$ 200	$ 900
Pump Stations	$ -	$ 2,100	$ 2,400	$ 2,000	$ 2,500	$ 2,200	$ 1,800	$ 1,400	$ 7,600	$ 4,600
SWRP	$ 14,500	$ 15,400	$ 15,500	$ 12,500	$ 15,600	$ 14,900	$ 14,900	$ 14,500	$ 15,000	$ 12,900
SJCWTP	$ 13,500	$ 13,100	$ 11,100	$ 12,400	$ 12,800	$ 12,100	$ 11,100	$ 12,700	$ 12,700	$ 11,500
LS & VS	$ 6,300	$ 8,600	$ 16,800	$ 6,500	$ -	$ 300	$ -	$ -	$ -	$ -
Arsenic RTFs	$ 700	$ 1,600	$ 1,200	$ 800	$ 1,200	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
Total Hazen AMPs	$ 48,800	$ 70,000	$ 68,800	$ 53,000	$ 50,700	$ 48,100	$ 41,400	$ 40,000	$ 44,900	$ 40,300
Decade Plan Year[2]	*2033	*2034	*2035	*2036	*2037	*2038	*2039	*2040	*2041	*2042
Decade Plan: 100 - Sewerline Renewal	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400
Decade Plan: 200 - DWater Renewal	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200
Decade Plan: 719 - Reservoirs Renewal	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Decade Plan: 732 - LV Valve Equip/Repl	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Decade Plan: 901 - Reuse Pipeline Renewal	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Total Non-Hazen	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800
GRAND TOTAL	$ 95,600	$ 116,800	$ 115,600	$ 99,800	$ 97,500	$ 94,900	$ 88,200	$ 86,800	$ 91,700	$ 87,100
									Average Yr 1-20	$ 93,800

[1]The average annual CIP cost per AMP was utilized for years outside of the respective AMP CIP years (highlighted in purple). Total CIP cost across all AMP CIP years was divided by the total number of AMP CIP years to provide the average annual CIP cost.

[2]Total costs greater than 100,0000 have been divided by 1,000 and rounded to nearest 100 place value, less than 100,000 divided by 1,000 and rounded to nearest 10 place value.

[3]Odor Control CIP total project costs include a mix of 2.0 and 3.75 multipliers applied to assets for in-house work and contract work, respectively.

The 20-year average annual projected CIP requirement is approximately $71.8M with the 2.0 multiplier and approximately $93.7M with the 3.75 multiplier, as shown in **Table ES - 4** and **Table ES -5**, respectively.

Dashboard

As part of the overall CAMP, the Water Authority Digital Dashboard was created showing the results of individual AMPs. The power of the dashboard is that the Water Authority can review any of the data by facility, by group, or by major business unit. **Figure ES - 2** shows the dashboard landing page.

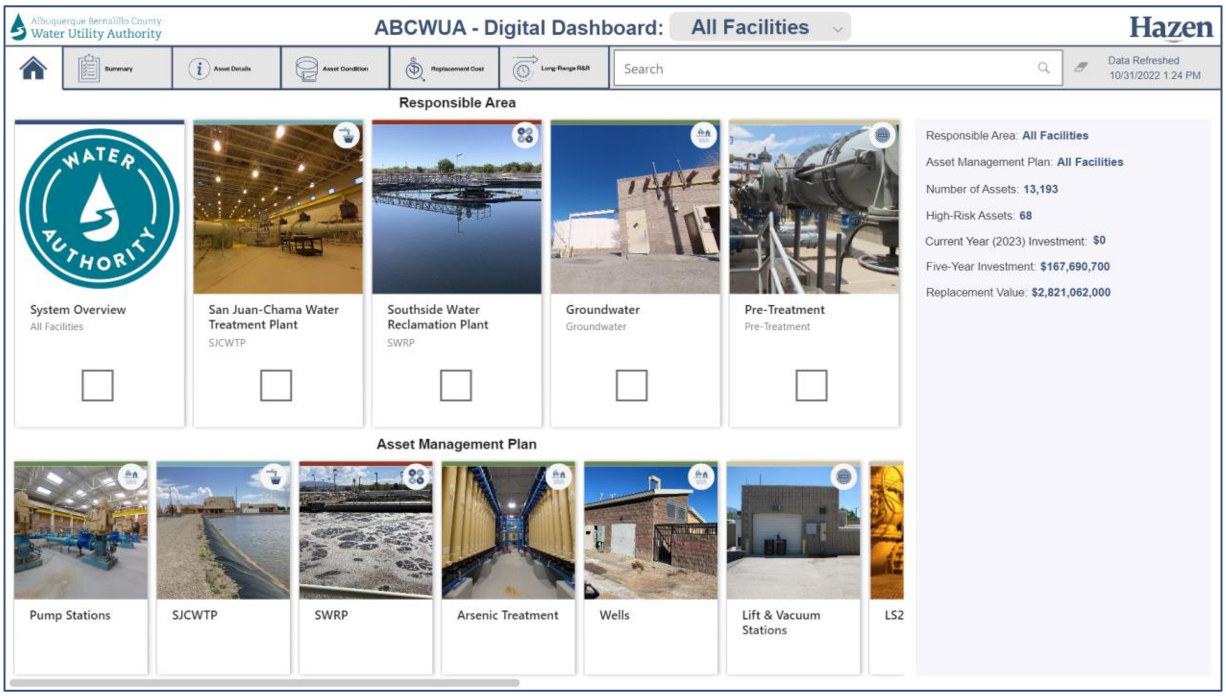

Figure ES - 2: Digital Dashboard Landing Page

Also included in the dashboard will be non-Hazen AMP information that was provided by the Water Authority in an electronic format.

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1. Introduction

The Albuquerque Bernalillo County Water Utility Authority (Water Authority) Comprehensive Asset Management Plan (CAMP) was established through Resolution R-04-20 for the Water Authority Asset Management (AM) Program. The objective of the CAMP is to support continuous improvement towards minimizing total asset lifecycle costs for capital infrastructure while maintaining desired service levels for key stakeholders.

The 2023 CAMP is a consolidated document of policies and goals, strategies, and frameworks developed for the AM Program. Standard elements of Water Authority AMPs developed for facilities and facility groups are explained. Consistent AMP methodologies were developed as part of the 2023 CAMP and utilized for AMPs since 2021. These methodologies are defined for system-wide future and consistent use. Six non-Hazen AMPs had similar methodologies but are slightly different than the current methodologies. These AMPs are:

- 2016 Lift and Vacuum Station AMP (Carollo)
- 2018 Well AMP Update (CDM Smith)
- 2019 Reservoir Desktop Assessment (Jacobs)
- 2019 Transmission Water Line AMP (Smith Engineering)
- 2020 Large Diameter Sewer AMP Update (Smith Engineering)
- 2020 Small Diameter AMP Update (Smith Engineering)

An overview of major infrastructure describes facilities and major system connections. Major infrastructure is organized to reflect how facilities are grouped for AM budgeting and planning purposes. Current AMPs located in **Appendix A** are referenced individually in the respective facility description sections. Combined data from individual AMPs shows a high-level snapshot of the Water Authority asset profile and system-wide cost projections for asset renewal needs.

Measuring AM performance is discussed in multiple sections of the 2023 CAMP including strategies for the AM Program and methodology for AMPs. The last section of this report summarizes the current Water Authority performance results related to the AM Program.

2. Albuquerque Bernalillo County Water Utility Authority

The Water Authority provides water and wastewater services to approximately 214,000 customer accounts which includes more than 650,000 water users in the greater Albuquerque metropolitan area. As the largest water and wastewater utility in New Mexico, the Water Authority strives to maintain reliable, high quality, affordable and sustainable water, wastewater, and reuse systems while meeting customer needs and minimizing asset lifecycle costs. Since 2009, the Water Authority has continued to develop utility asset management best practices.

2.1 Water Authority Background

In January 2003, ownership of the municipal water and wastewater utility was transferred to the newly created Water Authority by New Mexico Legislature Senate Bill 887. Senate Bill 887 became law in June 2003 (NMSA 1978 § 72-1-10). Later the same year, the Water Authority, City of Albuquerque (City), and Bernalillo County (County) entered into a formal agreement for the City to manage operations and maintenance (O&M). In 2005, the Water Authority was granted statutory powers provided to all public water and wastewater utilities in the state by Senate Bill 879, and full transition of the water and wastewater utility administration to the Water Authority was finalized in 2007.

The Water Authority is a political subdivision of the state and is governed by an (8) eight-member Governing Board. The Governing Board consists of three (3) City Councilors, three (3) County Commissioners, one (1) non-voting member from the Village of Los Ranchos, and the Mayor of Albuquerque.

2.2 Asset Management Program

In 2007, the Water and Sewer Rate Ordinance – Section 1-1-7(G) (**Appendix B-1**) established the Water Authority AM Program to manage capital infrastructure. The ordinance directed the program to focus on minimizing asset lifecycle costs while maintaining desired service levels. The AM Program strategy is to improve the understanding of long-term asset renewal needs and to document AM business processes.

Administrative Instruction No. 30 (**Appendix B-2**) established the Strategic Asset Management Program (SAMP) to be led by the AM Program Team (AMPT). The AMPT is responsible for development and implementation of SAMP policies and procedures and is appointed by the Water Authority Executive Director. The AM Leadership Team (AMLT), Business-unit AM Team (BAMT), Information Technology (IT) Team, and Geographical Information System (GIS) Team are the four (4) subcommittees that support the AMPT. Each subcommittee provides a different supporting role, as described in **Figure 2-1**.

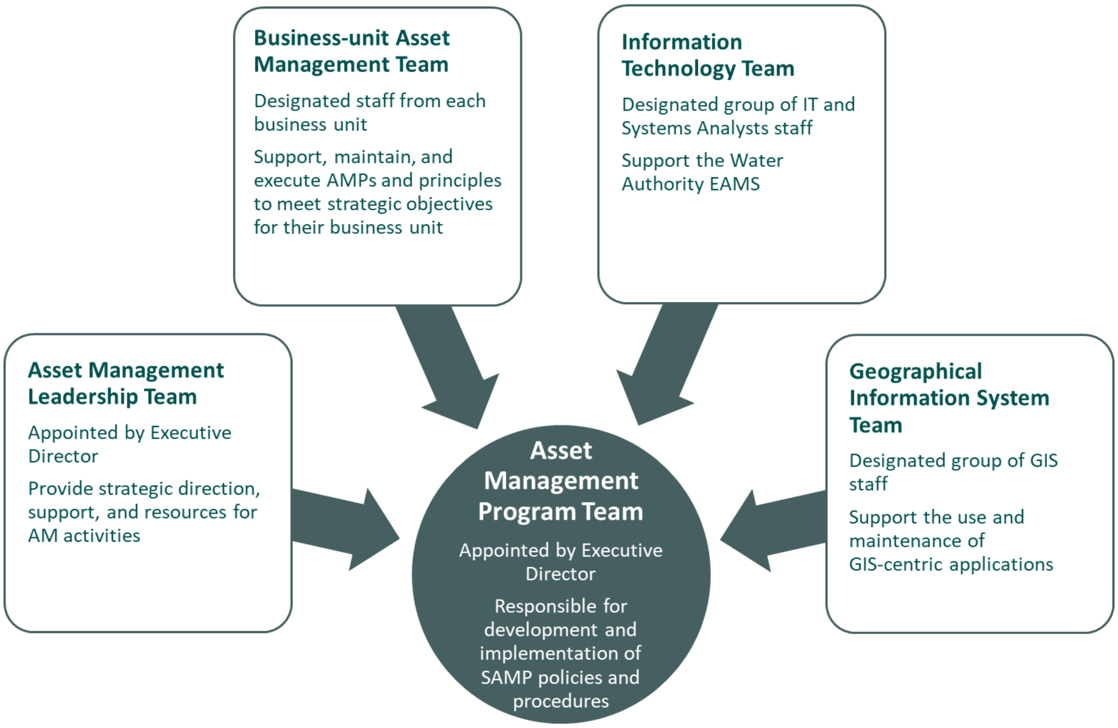

Figure 2-1: Asset Management Program Support Teams

2.3 Asset Management Policies

AM policies are the principles, protocols, and rules for developing and implementing of the AM Program framed by the Governing Board. Starting in 2007, the Water Authority adopted and implemented policy and guideline documents involving AM strategy and long-term planning. **Table 2-1** summarizes Water Authority AM ordinance, resolution, and guideline documents located in **Appendix B**.

Table 2-1: Water Authority AM Policy Documents

Year	Type	Subject/Title	Directive
2004	Resolution	Establishing a CAMP to Assist the Water Authority in Managing Its Capital Assets and Plan for Future Needs (R-04-20)	Establishment of CAMP and basic elements to be included
2007	Resolution	Utility Development and Planning on Asset Management (R-07-06)	Asset management principles are to be utilized for determining asset rehabilitation, replacement, or acquirement of new assets
2007	Ordinance	Water and Sewer Rate – Section 1-1-7(G)	AM Program is to be in perpetuity to manage capital infrastructure
2020	Administrative Instruction	Capitalization and Depreciation Policy for Capital Assets (No. 28)	Capital asset and asset useful life definitions and instructions for documenting asset valuation
2020	Administrative Instruction	SAMP (No. 30)	Establishment of SAMP, including AM mission and vision, goals, and governance structure

Table 2-2 summarizes the AM Program objectives for the CAMP and SAMP.

Table 2-2: AM Program Objectives for Planning Documents

Program/Publication	Objective
Comprehensive Asset Management Plan (CAMP)	Minimize total asset lifecycle cost, while achieving desired service levels through the following strategies: • Collect and organize detailed information about capital assets • Analyze data to set priorities and make better decisions • Integrate data and decision making across the organization • Link AM strategy to service goals, operating budgets, and CIPs
Strategic Asset Management Plan (SAMP)	Implement policies and procedures to develop detailed asset lifecycle cost accounting system that includes: • Installation date • Purchase cost • Replacement cost • Current condition • Asset attributes • EUL and RUL

3. Strategic Asset Management Plan

The Water Authority Strategic Asset Management Plan (SAMP) provides the purpose, vision, goals, guidelines, framework, and strategy for implementing the Water Authority AM Program.

3.1 Asset Management Purpose

The purpose of the Water Authority's AM Program is to provide and maintain defined levels of service (LOS) for customers and stakeholders at an optimal asset lifecycle cost within a sustainable level of business risk.

3.2 Asset Management Mission and Vision

The Water Authority AM Mission and Vision supports the Water Authority's system-wide Mission.

> **Water Authority AM Mission and Vision**. To develop, sustain, and continuously improve asset management policies and procedures to support the Water Authority's mission of responsive customer care; providing reliable, high-quality, affordable, and sustainable water supply, wastewater collection treatment, and reuse systems; and support a healthy, environmentally sustainable, and economically viable community.

3.3 Asset Management Goals

Water Authority AM goals include:

- Develop and utilize a common vertical asset register with identified assets owned by the Water Authority
- Develop and utilize a common linear asset register with identified assets owned by the Water Authority
- Minimize business risk exposure (BRE) by identifying risk-mitigating capital improvement program (CIP) projects through a standardized risk assessment framework
- Develop asset rehabilitation and replacement projections for short and long-term CIP planning
- Communicate purpose and benefits of asset management to staff and stakeholders

The SAMP goals, as stated in Administrative Instruction No. 30 (**Appendix B-2**):

- Strive to continuously improve accuracy and have up-to-date asset register
- Explain asset management principles as part of new employee orientation process
- Conduct periodic role-based training for end users
- Improve asset performance and implement asset condition monitoring

- Apply lifecycle cost accounting to all assets
- Strive for data integrity and reliability by continuous monitoring using key performance indicators (KPIs) for AM performance measurement
- Extend the useful life of assets to reach the maximum potential life at rated efficiency
- Maintain and/or exceed established levels of service aligned to performance indicators
- Consistently apply AM business processes across the Water Authority
- Use risk-based decision making with asset data to support operational and capital planning
- Coordinate with operations and maintenance staff to review and optimize maintenance practices by leveraging operational knowledge and analytics
- Provide approach to implement an internet of things (IoT) strategy to support SAMP
    - IoT is interconnection via the internet of computing devices embedded in everyday objects such as advanced metering infrastructure (AMI) devices, sensors for real time data collection, etc.
- Provide guidance for AMP activities
- Optimize insurance coverage of Water Authority's assets in partnership with Water Authority's Risk Management Division
- Monitor performance indicators for storeroom in partnership with warehouse staff and optimize processes

3.4 Asset Management Register

The Water Authority classifies assets as either vertical or linear for AM purposes and it determines how asset data is stored and accessed. As part of the 2023 CAMP, the Water Authority standard asset register structure was developed and incorporated into the Maximo system. The asset register, asset classification, and system of records is discussed below.

3.4.1 Water Authority Standard Asset Register Structure

An asset register is an inventory of capital assets organized in an asset hierarchy framework and is a vital decision-making tool used for asset verification and resource planning. A complete list of physical assets is used to track the date assets were installed, estimate replacement value, identify asset locations, estimate remaining useful lives (RULs), and capture other asset attributes. Standardized asset register fields were developed as part of the 2023 CAMP and utilized for all AMPs starting in 2021. The standardized Water Authority asset register structure is located in **Appendix C-1**. **Table 3-1** describes asset register data fields and the purpose utilized by the Water Authority.

Table 3-1: Asset Register Data Field Descriptions

Purpose	Data Field Description

Asset Identification	• Unique Asset ID
	• Asset Hierarchy Levels:
	    • Level 1: Water Authority
	    • Level 2: Facility Name
	    • Level 3: Area
	    • Level 4: Sub-area
	    • Level 5: Asset Class
	    • Level 6: Asset Type
	• Asset Description
	• Discipline (Electrical, I&C, Mechanical, or Structural)
	• Asset Material
	• Asset Size/Capacity

Historical Cost	• Install Year • Install Cost ($)
Inspection Data	• Inspection Date • Field Comments • Photo Hyperlink • Condition Score (1-Excellent, 2-Good, 3-Average, 4-Fair, 5-Poor)
Lifecycle Info and Costs	• Expected Useful Life (years) • Remaining Useful Life (years) • Lifecycle Logic: Rehab or Replace • Rehab/Replace Cost ($) • Rehab/Replace Frequency (years) • Condition Score based on RUL (1-5)
Business Risk Analysis	• LOF Criteria Category Scores (1-5; Score*Criteria Weight) • Overall LOF Score (1-5) • COF Criteria Category Scores (1-5; Score*Criteria Weight) • Overall COF Score (1-5) • BRE Score (1-25) • BRE Threshold Level (High, Medium, or Low)
CIP Planning	• CIP Project • CIP Project Cost • CIP Project Year

3.4.2 Vertical and Linear Assets

The Water Authority classifies tangible capital assets as either vertical or linear. Vertical assets are located inside the limits of vertical asset facilities, including facility piping systems. Linear assets are typically below-ground pipeline assets located outside the limits of vertical asset facilities. Pipe appurtenances include, but are not limited to, valves, junction boxes, fittings, and manholes; typically, anything attached to the pipeline. **Figure 3-1** shows Water Authority asset facilities classified in terms of vertical and linear assets.

	Surface Water	Groundwater	Distribution	Collection	Reclamation	Non-Potable Reuse
Vertical	Raw Water Diversion Facility Raw Water Pump Station	Well Sites Arsenic Removal Treatment Facilities Potable Reservoir Sites	Potable Booster Stations	Lift Stations Vacuum Stations Odor Control Stations	Southside Water Reclamation Plant Southside Non-Potable Facility	Reuse Reservoir Sites Reuse Booster Stations Soil Amendment Facility
Linear	Raw Water Pipeline Raw Water Pipe Appurtenances	Well Collector Pipelines Well Collector Pipe Appurtenances	Distribution Pipelines Distribution Pipe Appurtenances Transmission Pipelines Transmission Pipe Appurtenances	Gravity Sewer Pipelines Gravity Sewer Pipe Appurtenances Force Main Sewer Pipelines Force Main Sewer Appurtenances		Reuse Pipelines Non-Potable Pipe Appurtenances

Figure 3-1: Vertical and Linear Asset Facilities

3.4.3 Asset System of Record

IBM® Maximo Asset Management 7.6.1.1 (Maximo) system serves as the Water Authority asset system of record (SOR). Maximo was modified by the Water Authority to reflect the data fields and structure of the asset register.

The Water Authority maintains a geographic information system (GIS) in ArcGIS® by ESRI (ESRI) software system. ESRI captures linear asset data and is synchronized with Maximo weekly. Each linear asset is assigned a unique identifier (MaxGIS ID) for Maximo which links the two systems via Active G software.

3.5 Levels of Service and Key Performance Indicators

According to the International Infrastructure Management Manual (IIMM), levels of service (LOS) are the parameters, or combination of parameters, which reflect social, economic, and environmental outcomes that an organization delivers to its stakeholders. LOS provide the link between organizational goals and objectives and operational objectives and strategies. Water Authority FY22 Five-Year Goals, shown in **Figure 3-2**, are modeled after the AWWA business model and central to the Water Authority FY22 Performance Plan.

Figure 3-2: FY22 Five-Year Goals

FY22 Five-Year Goals align with Water Authority LOS. Established performance metrics with defined key performance indicators (KPIs) and targets are used for tracking the Water Authority's LOS performance. A KPI target can be a minimum or maximum value, trending directive (up or down), or establishment of a baseline (prior to setting KPI target) **Table 3-2** lists LOS categories that are measured for performance by the Water Authority and how they align with FY 22 Five-Year Goals. A standard performance metric with a KPI and KPI target are included to demonstrate how operational performance and organizational performance are linked. The Water Authority actively tracks performance at multiple levels and across departments, and specific KPIs are inherit for different facilities. Facility-specific KPIs are discussed in individual AMPs, organizational KPIs are discussed in the FY22 Performance Plan, and AM Program performance is discussed in **Section 9** of this report.

Table 3-2: AMP KPI Examples

LOS Category	Five-Year Goals					Performance Metric	KPI	KPI Target
	Customer Services	Organization Development	Business Planning & Management	Wastewater Collection & Operations	Water Supply & Operations			
Continuous regulatory compliance				✓	✓	Regulatory violations	# of Violations	0
Continuous water and wastewater services	✓	✓	✓	✓	✓	Service interruptions	# of Interruptions	0
Maintain stakeholder satisfaction	✓	✓	✓	✓	✓	Customer complaints	# of Complaints	0
Efficient energy utilization			✓	✓	✓	Energy consumption	Kilowatt-hours/MG of treated water	Trending down
Conservation of water resources			✓	✓	✓	Water loss	% of Non-revenue water	0%
Efficient O&M strategy		✓	✓	✓	✓	Planned versus total maintenance	CM to PM ratio	60%
Optimal utilization of resources			✓	✓	✓	Budget utilization	% of R&R planned budget spent	100%
Ensure health and safety of stakeholders	✓	✓		✓	✓	Time-lost injuries	# of Time-lost injuries	0
Support a sustainable environment	✓		✓	✓	✓	Beneficial biosolids use	% of Compost biosolids	30%

3.6 Risk Management Framework

The Water Authority assesses asset risk in terms of business risk exposure (BRE). Risk assessments involve quantifying the potential loss that may arise from planned or ongoing activities in an organization. BRE is quantified for each asset in terms of likelihood of failure (LOF) multiplied by consequence of failure (COF) as shown in **Figure 3-3**.

Figure 3-3: Business Risk Exposure Equation

With the current and going forward AMPs, BRE is scored on the same scale from 1 (lowest risk) to 25 (highest risk) for all Water Authority assets to provide consistency system-wide for assessing risk.

LOF measures an asset's likelihood of, or timing to, failure and can be measured based on the physical condition and/or capacity performance. In the absence of available capacity performance data, LOF is based on physical condition alone. As the Water Authority continues to collect historical data related to asset capacity performance, AMPs will include the information into calculating LOF scores. LOF scoring criteria used by the Water Authority for vertical and linear assets are described in **Table 3-3**.

Table 3-3: LOF Evaluation Criteria

LOF Evaluation Criteria	Criteria Description
Physical Condition	• Condition rating • Per IIMM Condition Scoring Guidelines for vertical assets • Per pipe-decay curve[1] for linear assets
Capacity Performance	• Ability of an asset to perform as designed or intended

[1]Pipe-decay curves are discussed further in **Section 4**.

COF measures the direct and indirect implications and cost associated with the failure of an asset. It is determined by evaluating the social, environmental, and financial impact of an asset failure. COF scoring criteria for vertical assets is described in **Table 3-4**.

Table 3-4: Vertical Asset COF Evaluation Criteria

Vertical Asset COF Evaluation Criteria	Criteria Description
Service Delivery	Impact of asset failure on level of service delivery
Redundancy/Criticality	Impact of asset failure on system capacity
Safety/Security	Impact of asset failure on health and safety of staff and public
Public Perception	Impact of asset failure on customer complaints and/or negative media/public relations
Regulatory/Environmental	Impact of asset failure on environment and/or regulatory compliance
Financial Impact	Impact of asset failure in terms of repair/replacement costs

GIS capabilities are leveraged for automating linear asset COF evaluations. Linear COF criteria is directly related to asset attributes (e.g., size, material) or impact of failure to surrounding area and downstream customers. This allows for criteria to be evaluated with available data within GIS. Social, environmental, and financial impacts of asset failure are evaluated using the criteria described in **Table 3-5**.

Table 3-5: Linear Asset COF Evaluation Criteria

Linear Asset COF Evaluation Criteria	Criteria Description
Diameter	Impact of asset failure on level of service delivery
In Interstate	Impact of asset failure on resources for repair
High Traffic Corridor (Primary Arterials)	Impact of asset failure on resources, public perception, and challenges with accessibility
Crossing Major Utility/Is SJC Line	Impact of asset failure on level of service delivery and challenges with accessibility
Under Railroad	Impact of asset failure on resources and challenges with accessibility
Intersecting a Contaminated Site	Impact of asset failure on resources and challenges with accessibility

Linear Asset COF Evaluation Criteria	Criteria Description
Within Landfill Buffer Zone	Impact of asset failure in terms of accessibility
Moderate Traffic Corridor (Minor Arterials and Major Collectors)	Impact of asset failure on resources, public perception, and challenges with accessibility
Near a Hospital (within 100 ft)	Impact of asset failure on critical customers
Crossing Waterway (River, Ditch, Wetland)	Impact of asset failure on environment
Within 100ft of Public Transportation (Airport, Railroad/Railrunner Station)	Impact of asset failure on public perception, and challenges with accessibility
Within 100ft of Schools/Universities	Impact of asset failure on critical customers
Within 100ft of Tourist Areas (Balloon Fiesta, Bio Park)	Impact of asset failure on critical customers
Within 100ft of Comp Plan Areas	Impact of asset failure on critical customers
Operations Critical (Needed for operation of system)	Impact of asset failure on critical customers

3.7 Stakeholder Expectations

Stakeholder confidence and trust is maintained through effective communication and responsible business practices. The Water Authority actively engages stakeholders internally and externally including two (2) key stakeholders: Water Authority customers and Water Authority staff.

A biennial customer survey is conducted to assess customer opinion about the performance of the Water Authority. The survey allows the Water Authority to track customer satisfaction on the programs, policies, and operational performance of the organization. Results of the customer opinion survey are presented to the Governing Board.

As part of the 2023 CAMP development, one-on-one interviews were conducted with key Water Authority staff to ascertain their thoughts and needs with respect to AM. The questions and answers focused on individual departments and looked across three (3) dimensions: people, process, and technology. Interviews took place in October 2021 and May 2022.

Water Authority staff awareness and understanding of AM is fundamental to the AM Program. Staff communicated an organizational acceptance and shift towards AM business processes and responses were generally positive. A positive cultural shift towards new business and operational processes is a significant accomplishment for any organization and provides a milestone the Water Authority should celebrate. Staff interview questions and a summary of answers are located in **Appendix D**.

3.8 2023 SAMP Recommendations

SAMP recommendations for continued AM Program enhancement were developed as part of the 2023 CAMP and based on stakeholder feedback and field observations. The 2023 SAMP recommendations were assigned a priority level of high, medium, or low based on the potential benefits to the Water Authority AM Program. High-priority recommendations are presented in the next section followed by medium-priority recommendations; there are no low-priority recommendations. The 2021 SAMP (EMA) recommendation for updating the Water Authority Maximo system structure to reflect the standards and frameworks developed as part of the 2023 CAMP is included last.

3.8.1 High-Priority Recommendations

High-priority recommendations are presented in **Table 3-6** and include an estimated development and implementation timeframe and benefits to the Water Authority AM Program.

Table 3-6: High-Priority Recommendations

Recommendation	Description	Estimated Timeframe	Benefit
Review of CIP Project Over-runs	Annual review of root causes of CIP project budget exceedances > 5-10%	Ongoing	Increase confidence in planned contingency, mitigate potential future overruns by understanding common causes
Digital Dashboard LOS and KPIs	Automate data collection of KPIs for continuous LOS performance tracking on the Digital Dashboard	1 year	Operational insight into tracked LOS/KPIs, data collection automation, flexibility in reporting, less labor hours spent on data collection
Formalize AM Training Program	Comprehensive, multi-layer, continuous AM training program	Ongoing	Increase staff knowledge and expectations, strengthen AM activities
Strategic Staff Engagement	Increase AM Team staff and field staff engagement	Ongoing	Strengthen staff communication, increase staff cross-departmental knowledge, build the confidence of field personnel in the AM team staff

It is anticipated that all of the high-priority recommendations will be accomplished with Water Authority staff. Below each high-priority recommendation is described in further detail.

3.8.1.1 Review of Over-budget CIP Projects

The Water Authority should consider reviewing annually all over budget CIP projects (e.g., > 5-10% over) to determine root causes of why projects go over budget. This information should be incorporated into future budget contingencies to better reflect planned CIP dollars required. It is anticipated that this will be accomplished with Water Authority staff on an ongoing basis.

3.8.1.2 Develop Digital Dashboard for LOS/KPIs

The Water Authority does an outstanding job tracking levels of service (LOS) and key performance indicators (KPIs) across its entire operations. However, capturing and reporting out on all the data can be time consuming since the information is tracked down from multiple sources and then incorporated into an Excel spreadsheet. The Water Authority has stated it can take a month to pull all the data together and place it into Excel.

The Water Authority can benefit by reviewing the currently tracked LOS/KPIs to make sure the LOS/KPIs are meaningful and provide insight into operations across the gambit of Water Authority activities. In addition, the Water Authority should move the collection of the LOS / KPI information into PowerBI to facilitate data collection and reporting. The ability of PowerBI to collect data from disparate data sources and surface the data in a number of ways can be very beneficial to the Water Authority and practically automate the collection and dissemination of the data. This will free up staff time many hours each month for other critical activities. It is anticipated that this will be accomplished with Water Authority staff within one (1) year. The timeframe includes development of PowerBI layout, identifying data sources, and linking data sources into the PowerBI layout.

3.8.1.3 Continue Developing Comprehensive AM Program Training

As part of the overall asset management program, the Water Authority needs a multi-layer asset management training program that continuously builds staff knowledge and expectations. The training program should include reasons for asset management, the benefits the employee receives from using assets management, and the benefit to the Water Authority. The Water Authority is currently working with all Water Authority groups to formalize the annual training program. The training program should consist of the following at a minimum:

- Asset Management responsibilities as part of the new employee on-boarding
- How to capture asset management data as part of the work order
- Walk through asset management business processes impacting various employee groups

3.8.1.4 Have Asset Management Team Staff Spend Time in the Field

During stakeholder interviews, it was suggested that the asset management team staff spend time in the field to understand better what the field does. This would include ride-alongs to see what the staff do, understand how assets are used in the field, and build confidence of the field personnel in the asset management team staff. It is anticipated that this will be accomplished with Water Authority staff on an ongoing basis.

3.8.2 Medium-Priority Recommendations

Medium-priority recommendations are described below followed by a summary table (**Table 3-7**) with estimated development and implementation timeframe, potential consultant cost (if applicable), and benefits for the Water Authority AM Program.

Table 3-7: Medium-Priority Recommendations

Recommendation	Description	Estimated Timeframe	Estimated Consultant Cost	Benefit
Asset Naming Standards	Common asset naming convention and unique asset IDs based on asset hierarchy and utilized across all Enterprise Systems	< 1 year	$100,000	Improve efficiency in making business critical decisions and reduce risk of errors in data collection and analysis
P&IDs for Major Processes	Diagramming piping, valving, and instrumentation of major plant processes	1 year	$50,000	Enhance operations and streamline training procedures, support asset onboarding workbook
Failure Mode and Effect Analysis	Ongoing FMEA program	Ongoing	$30,000	Preventive maintenance optimization

Below each medium-priority recommendation is described in further detail.

3.8.2.1 Create Standard Asset Nomenclature

The Water Authority should consider implementing a unique asset ID (common naming and numbering convention) based on asset hierarchy that works across the Water Authority and makes sense to all. The unique asset ID can then be a common field across all Water Authority's Enterprise Systems (e.g., Maximo, Oracle Financials, GIS) to facilitate end-to-end asset management activities.

This will require a significant effort to make this change, but in the long run, makes the Water Authority more efficient in making business critical decisions and reduces the risk of errors in data collection and analysis. There will be a change management component to this as this could change the way field crews find and maintain assets. As such, the Water Authority may need to have the old name and the new name in the systems until everyone can be trained on the new naming convention. Outside consultants can be utilized to modify data structure in relevant software. An estimated timeframe of less than one (1) year includes identifying naming conventions, systems to be modified, system changes, staff rollout.

3.8.2.2 Create Major Process P&IDs

The Water Authority has implemented an asset onboarding workbook for new CIP projects. This is an excellent step to placing creation of new CIP assets on the contractors that are most familiar with the new assets as construction is being undertaken. The workbook requires updated P&IDs throughout the design process. The Water Authority can enhance operations and streamline training procedures by diagramming piping, valving, and instrumentation of major existing plant processes. This will require significant effort from plant operations and engineering staff as minimal O&M manuals exist and various processes have been modified over the years to suit operational needs. In addition, the Water Authority should develop / utilize standard P&ID nomenclature across all operations and implement this on P&IDs along with asset numbers on existing vertical assets. Outside consultants can be utilized to offset staff resources. An estimated timeframe of one (1) year includes identifying major processes, identifying appropriate operations staff, and to draft engineering diagrams. P&IDs and asset numbers on existing vertical assets can be accomplished in the same time period.

3.8.2.3 Implement Failure Mode and Effect Analysis (FMEA)

The Water Authority does a very good job maintaining its assets. In order to optimize the preventive maintenance activities, it is recommended that the Water Authority perform FMEA analysis. FMEA is a step-by-step method for identifying and analyzing all possible ways an asset can fail and designing a maintenance strategy to prioritize and mitigate the biggest risks. This type of analysis is a critical component towards preventive maintenance optimization. It is recommended that the Water Authority utilize a consultant to perform the first one or two FMEAs, teamed up with the asset management team. After the first initial one or two FMEAs, future analyses can be accomplished with Water Authority staff on an ongoing basis.

3.8.3 Continuation of 2021 SAMP Recommendation

The SAMP section of the 2023 CAMP is an update to the 2021 SAMP (EMA, Inc.) (**Appendix E**). The previous SAMP focused on high-level requirements for fulfilling the goals of the Water Authority AM Program and identified the 2023 CAMP/SAMP for establishing the Water Authority risk framework standard. The previous SAMP timetable for implementing key 2023 CAMP risk framework components into the Water Authority Maximo structure is shown in **Table 3-8**

Table 3-8: Maximo Update Timeline

Actions	2021	2022	2023	2024
Asset Condition Score Template				
Document Asset Condition Score on Work Order				
Develop Standard COF, LOF, Risk Score Structure				
Decade Planning				

4. AMP Methodology

AMP development primarily includes asset inventory and condition assessment, LOF calculation, COF calculation, BRE assessment, asset replacement and rehabilitation valuations, estimated expected useful life (EUL) and remaining useful life (RUL), CIP project recommendations based on BRE thresholds and asset lifecycle logic, and asset renewal projections. This section discusses the Water Authority's approach and methodology for each of the primary elements in AMP development for a facility or group of assets.

4.1 Asset Inventory and Hierarchy

An asset register's usefulness is determined by the quality and organization of the data. Asset inventory and asset hierarchy provide the data and structure, respectively, to the asset register.

4.1.1 Asset Inventory Validation

An asset register is a complete list of assets with defined data fields that support AM for CIP and renewal planning needs. The asset inventory is a listing of assets in the asset register. Asset inventory validation begins with a data export from the SOR (Maximo or ESRI) for a particular asset group or facility. The data export is reviewed for data quality, consistency, and completeness. A comparison of existing physical assets with assets listed in the SOR is performed either through a desktop analysis with key staff, field data collection activities (typically as part of condition assessment activities), or a combination of both.

Discrepancies between existing physical assets in the field and SOR asset data is noted and the SOR is updated to reflect current asset inventory. Discrepancies can include missing assets, new assets, incorrect attribute data, and missing attribute data. Data gaps and corrections are summarized to assess the quality of asset data and identify areas for improvement in data collection protocols.

4.1.2 Asset Hierarchy

An asset hierarchy provides a structured framework for organizing an asset inventory within an asset register. A well-defined hierarchy provides a structured relationship among assets which allows for segmentation of asset register data to support asset management decisions. **Table 4-1** describes the Water Authority vertical and linear asset hierarchy levels.

Table 4-1: Water Authority Asset Hierarchy

Order	Hierarchy Level	Description	Example
1	Owner	Asset Owner	Water Authority
2	Facility Name	Facility/Asset Group	SJCWTP
3	Area	Major Area	Backwash Equalization
4	Subarea	Location within Major Area	Backwash Equalization Pumps
5	Asset Class	Equipment Category	Gauge
6	Asset Type	Equipment Category Type	Pressure

During AMP development, existing asset parent-child relationships in the SOR are utilized to draft the agreed to hierarchy structure. Asset hierarchy relationships are refined to reflect operations and maintenance (O&M) and budgetary strategies for that asset group or facility. Asset parent-child relationships are updated in the SOR based on the developed AMP asset hierarchy and is to be continuously updated to reflect new or obsolete systems.

4.2 Condition Assessment

Condition assessments are necessary to determine the physical condition of an asset. Typically, condition assessments are performed visually or through desktop analysis and are based on a scale from 1 (Excellent) to 5 (Poor) per the IIMM Condition Scoring Guides shown in **Table 4-2**. However, the Linear AMPs, performed by Smith Engineering, used a modified scoring version that changes the scoring to account for the very poor condition of many of the Water Authority's pipelines. The poor condition is primarily due to the lack of a pipeline maintenance program prior to the Water Authority being formed. **Table 4-2.** highlights the modified linear scoring methodology for probability (or likelihood) of failure.

Table 4-2: IIMM Condition Scoring Guidelines

IIMM Rating	Condition	Definition
1	Excellent	Asset physical condition is new or like-new, well maintained, fully operable, and performs at or above standards.
2	Good	Asset is sound, well maintained, delivers full efficiency with little or no performance deterioration, but may show signs of wear.
3	Average	Asset is functionally sound and shows normal signs of wear relative to age and use but may have minor failures or performance deterioration. Minor or moderate refurbishment of 10-20% of asset may be needed within next 2 years.
4	Fair	Asset functions but requires sustained high level of maintenance to remain operational. Substantial wear is visible and likely to cause significant performance deterioration. Refurbishment of 20-40% of asset may be needed within next 2 years.
5	Poor	Asset is very near, or beyond, its useful life. Incapable of performing to a satisfactory standard under normal operational conditions without ongoing or corrective maintenance. Replacement needed in the near term (less than 2 years).

Table 4-3: Linear Condition Scoring Guidelines

SCORE	LABEL	Water Probability of Failure*	Sewer Probability of Failure*
1	LOW	More than 20% of service life remaining	More than 20% of service life remaining or CCTV inspection observed minimal structural defects
2	MEDIUM	Less than 20% of service life remaining	Less than 20% of service life remaining or CCTV inspection observed moderate structural defect
3	HIGH	Beyond anticipated service life, may include Field Identified Scoring	Beyond anticipated service life or CCTV inspection observed high structural defects (5)
4	SEVERE	Beyond anticipated service life plus Field Identified Scoring	CCTV inspection observed severe structural defects (Failure expected within 12 months)
5	EXTREME	Beyond anticipated service life plus significant Field Identified Scoring	CCTV inspection observed extreme structural defects (Failure expected within 6 months)

* Probability of Failure from the Smith Engineering Report is the same as Likelihood of Failure

An initial Level 1 visual assessment is typically performed for vertical assets and does not include non-destructive or destructive testing. When a visual assessment is not feasible for vertical assets, a desktop assessment is performed based on the asset's percent of RUL.

RUL is the estimated number of years remaining before an asset requires replacement. To estimate the number of asset life-years remaining, an EUL value is established for the asset class-type and asset age is known or assumed. Established EUL values for vertical assets developed as part of the 2023 CAMP are included in **Appendix C-2** and discussed further in **Section 4.7**. The equation for RUL years based on asset EUL and age is shown in shown in **Figure 4-1**.

Figure 4-1: Age-based RUL Equation

Percent of RUL (% of RUL) is equal to RUL divided by EUL, as shown in **Figure 4-2,** and is the estimated percent of useful life remaining.

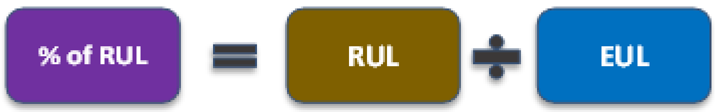

Figure 4-2: Percent of RUL Equation

The higher percent of RUL estimated the better asset condition is assumed to be. **Table 4-4** shows the straight-line correlation between condition score and percent of RUL for vertical assets.

Table 4-4: Vertical Asset Condition Score by RUL

IIMM Rating	Condition	% of RUL
1	Excellent	100%
2	Good	75%
3	Average	50%
4	Fair	25%
5	Poor	0%

Large- and small-diameter gravity sewer pipelines are visually assessed through CCTV inspections. Pressurized pipelines (force mains and transmission and small-diameter water pipelines) are generally not visually assessed due to challenges in pipe access. When visual assessment of linear assets is not feasible, condition scores are estimated using pipe-decay curves for established EUL values by pipe material. Pipe-decay curves are discussed further in **Section 4.7**, and linear EUL values are located in **Appendix C-3**.

Table 4-5 shows the visual and desktop condition score methodologies for vertical and linear assets.

Table 4-5: Condition Assessment Score Equations

Asset System	Condition Assessment Type	Condition Score Derivation[1]
Vertical	*Visual*	*Physical Condition = IIMM Physical Condition Score*
	Desktop[2]	*Physical Condition = 5 – 4 x (RUL/EUL)*
Linear	*Visual*	*Physical Condition = CCTV Physical Condition Score*
	Desktop[2]	*Physical Condition is derived from pipe-decay curve*

[1]All physical condition scores are on a scale from 1 (excellent) to 5 (poor)
[2]Rounded to the nearest whole number

Condition scores can be updated in the SOR on an ongoing basis as maintenance and/or inspection activities occur.

4.3 Likelihood of Failure

As discussed in **Section 3.6**, LOF measures an asset's likelihood of, or timing to, failure and can be measured based on asset condition and/or capacity performance. Physical condition scores can be derived through visual or desktop assessments, as shown in the previous section (**Table 4-5**). Capacity performance data can be incorporated into LOF scoring criteria as data is available.

A weighting factor of less than or equal to one ($W \leq 1$) is assigned to each criterion with the sum of all weighting factors equal to one (1). For example, when performance data is not available, performance data is assigned a weighting factor equal to zero ($W = 0$) and physical condition is assigned a weighting factor equal to 1 ($W = 1$).

Table 4-6 shows LOF equations with and without performance data. LOF criteria and overall scores are on a scale of 1 (highly unlikely to fail) to 5 (highly likely to fail).

Table 4-6: LOF Score Equations

LOF Criteria	LOF Equation[1]
Asset Condition	$LOF = W_A * (Physical\ Condition)_{(Score\ 1\text{-}5)}$; $W_A = 100\%$
Asset Condition and Performance Capacity	$LOF = W_A * (Physical\ Condition)_{(Score\ 1\text{-}5)} + W_B * (Performance\ Capacity)_{(Score\ 1\text{-}5)}$; $W_A + W_B = 100\%$

[1]*W = Weighting Factor*

4.4 Consequence of Failure

An asset's criticality, represented by the Consequence of Failure (COF), measures the direct and indirect implications and costs associated with the failure of an asset. Water Authority COF scores are calculated using sets of COF criteria specific to vertical and linear assets, respectively. COF methodologies for vertical and linear assets are discussed separately in the following sections.

4.4.1 Vertical Asset COF

Vertical asset COF scores are the weighted sum of six (6) criterion described previously in **Table 3-4**. Distribution of weighting factors varies by facility/asset group with specific weighting found in the respective AMP. COF criteria are scored on a scale of 1 (failure has very low significance) to 5 (failure is significant) based on the IIMM standard criticality rating guidelines in **Table 4-7**.

Table 4-7: IIMM Criticality Ratings

Criticality Rating	Description
1	Failure is not disruptive and of very low significance to the surrounding community and requires infrequent inspection triggered by complaint or problem evidence.
2	Failure typically low disruption and impact to surrounding community requiring infrequent inspection but should be on proactive maintenance.
3	Failure can be moderately disruptive to the affected community and should be on proactive maintenance.
4	Failure can be moderately disruptive and of significance to the community and should be on proactive maintenance.
5	Failure is disruptive, significant, and costly to repair. Inspections should be more frequent in order to proactively plan maintenance activities.

4.4.2 Linear Asset COF

Linear asset COF considers how necessary the asset is for meeting the defined LOS and how serious the effects would be to surrounding infrastructure in the event of failure. The larger the impact of a failure of the asset, the greater the COF. Linear COF scoring criteria include 15 yes-or-no categories with associated scores that are summed to provide the total asset COF score.

Table 4-8 lists the linear asset COF scoring categories and the respective sub-scores.

Table 4-8: Linear Asset COF Scoring Categories

Criteria	Score
All Pipe (Diameter in Feet, Min 1)	1+
Within Interstate Corridor/ROW	4
High Traffic Corridor (Primary Arterials)	3
Within 20ft of Major Utility (San Juan-Chama WL)	2
Within Railroad Corridor/ROW	4
Intersecting a Contaminated Site	2
Within Landfill Buffer Zone	2
Moderate Traffic Corridor (Minor Arterials and Major Collectors)	2
Within 500ft of a Hospital	3
Within Waterway Corridor (River, Ditch, Arroyo, Wetland)	2
Within Public Transportation Access Point (Airport, Railroad/Railrunner Station)	2
Within 100ft of Schools/Universities/Daycare	2
Within 100ft of Tourist Areas (Balloon Fiesta, Bio Park)	1
Within 100ft of Comp Plan Areas	1
Operations Critical (Needed for operation of system)	5

The sum of COF sub-scores for each linear asset is normalized to the IIMM Criticality Ratings scale, as shown in

Table 4-9.

Table 4-9: Linear Asset COF Score Normalization

COF Score	Total COF Sub-Score
1	COF ≤ 1
2	1 < COF ≤ 3
3	3 < COF ≤ 4
4	4 < COF ≤ 5
5	5 > COF

4.5 Business Risk Exposure

As discussed previously in **Section 3.6**, asset risk assessments quantify potential loss that may arise from planned or ongoing activities in terms of business risk exposure (BRE). BRE is equal to likelihood of failure (LOF) multiplied by consequence of failure (COF) (**Figure 3-3**). LOF and COF scores are scaled from 1 (best case scenario) to 5 (worst case scenario), therefore BRE is on a scale from 1 (lowest risk) to 25 (highest risk).

Established AMP BRE thresholds guide prioritization of projects for CIP and asset renewal planning. As the Water Authority minimizes organizational risk by addressing high-risk assets through CIP and renewal projects, the BRE thresholds can be revised to reflect changes in the risk profile. The BRE thresholds for vertical and linear assets are shown in **Table 4-10** and **Table 4-11**, respectively.

Table 4-10: Vertical Asset BRE Thresholds

BRE Threshold	BRE Score Range
High	BRE ≥ 18
Medium	6 ≤ BRE < 18
Low	BRE < 6

Table 4-11: Linear Asset BRE Thresholds

BRE Threshold	BRE Scoring Range
Extreme	≥ 16
Severe	9 < BRE ≤ 16
High	4 < BRE ≤ 9
Medium	1 < BRE ≤ 4
Low	BRE ≤ 1

4.6 Asset Valuation

Asset valuation is the estimated asset total replacement value based on total direct costs (TDC) (labor, material, and equipment) multiplied by a replacement cost multiplier (RCM), as shown in **Figure 4-3**.

$$\text{Total Replacement Value} = \text{TDC} \times \text{RCM}$$

Figure 4-3: Asset Total Replacement Value Equation

RCM accounts for asset replacement indirect costs which are estimated as a percentage of TDC. Indirect costs and percentages were standardized for Water Authority AMPs and derived from industry trends and Water Authority staff knowledge. The RCM equation shown in **Figure 4-4** shows the calculation for RCM based on indirect costs and TDC.

$$\text{RCM} = 1 + \left(\frac{\textit{Indirect Cost}_1}{\textit{TDC}}\right) \times 1 + \left(\frac{\textit{Indirect Cost}_2}{\textit{TDC}}\right) \times 1 + \left(\frac{\textit{Indirect Cost}_x}{\textit{TDC}}\right)$$

Figure 4-4: Replacement Cost Multiplier Equation

The RCM value is equal to 3.75 using the equation above and percent factors listed in **Table 4-12.**

Table 4-12: Estimated Indirect Replacement Costs Percent Factors

Indirect Cost	Estimated Percent of TDC
Demolition, Mechanical, Structure, Civil, etc. Allowance	35%

Indirect Cost	Estimated Percent of TDC
General Conditions	15%
Contractor Overhead	10%
Contractor Profit	10%
Bonding & Insurance	3%
Electrical and Instrumentation Allowance	15%
Construction Contingency	10%
Engineering Design	8%
Construction Administration	10%
Project Contingency	30%

Replacement values are American Association of Cost Engineering (AACE) Class 5 estimates, which can range in accuracy from 50% low to 100% high and serve for budgetary planning purposes only. Water Authority EAM software escalates the original replacement value of all assets using yearly cost inflation indices.

4.7 Asset Useful Life and Lifecycle Logic

Expected Useful Life (EUL) is the average number of years a newly installed asset is estimated to function with routine maintenance, typically based upon manufacturer's recommendations and historical data. Remaining useful life (RUL) is the estimated number of years an asset will operate before requiring replacement.

Lifecycle logic determines the frequency of renewal and estimated costs of rehab over the course of an asset EUL. EUL and lifecycle logic directly affect projected asset renewal costs and how projected costs are distributed over time. EUL values and lifecycle logic were developed for vertical and linear assets based on historical asset information, staff institutional knowledge, and industry trends.

4.7.1 Vertical Asset RUL and EUL

Vertical asset RUL is estimated using visual condition assessment scores. RUL is calculated from established EUL values, located in **Appendix C-2**, and estimated asset life percent consumed derived from condition scores. A straight-line decay model represents the relationship between visual condition scores and asset life percent consumed, as shown in **Table 4-13**.

Table 4-13: Percent Consumed based on Condition

Condition	Percent Consumed
1	0%
2	25%
3	50%
4	75%
5	100%

Condition-based RUL is equal to the product of one (1) minus percent consumed and EUL. When a visual condition assessment is not feasible, an age-based methodology is employed as discussed previously in **Section 4.2**. Age-based RUL and condition-based RUL equations are shown in **Figure 4-5**.

Age-Based:

Remaining Useful Life (years) = Expected Useful Life (years) – Age (years)

Condition-Based:

Remaining Useful Life (years) = (1 - % Consumed) * Expected Useful Life (years)

Figure 4-5: Vertical Asset RUL Equations

4.7.2 Linear Asset RUL and EUL

RUL for linear assets is determined using a pipe-decay curve specific to pipe material. Each pipe-decay curve represents an EUL value associated with pipe material. Pipe-decay curves were developed as part of the 2019 Transmission Waterline AMP relate EUL, RUL, age, and LOF, as shown in **Figure 4-6**.

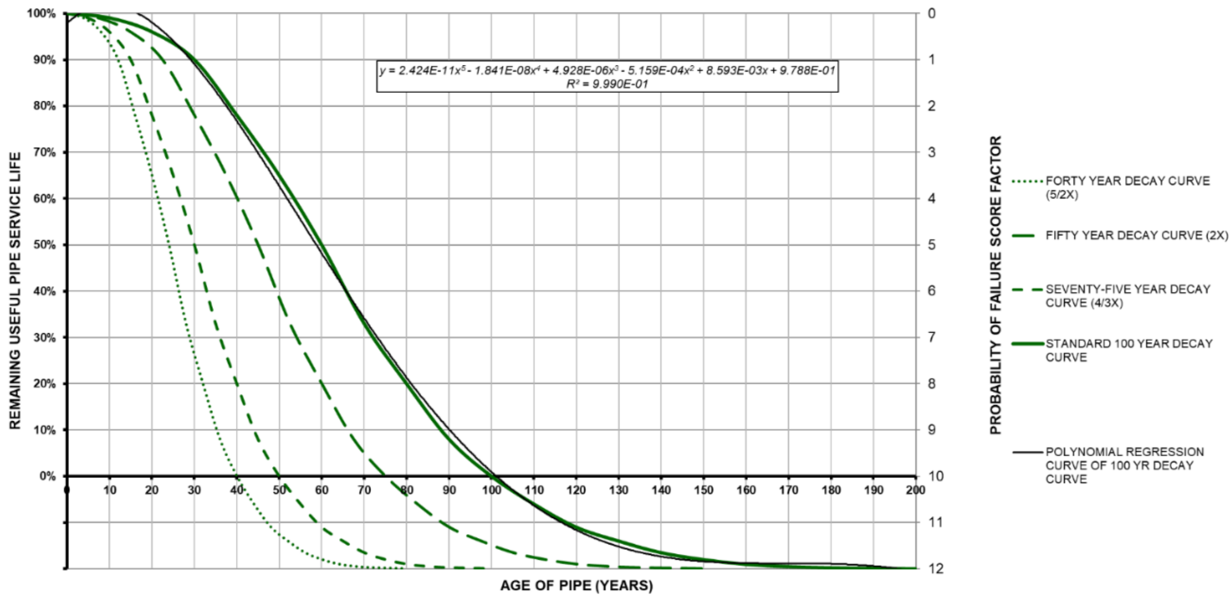

Figure 4-6: Linear Asset RUL Pipe-Decay Curves

When physical condition is the sole criterion for LOF scoring, physical condition can also be estimated using pipe-decay curves. Linear asset EUL values are located in **Appendix C-3**.

4.7.3 Renewal Lifecycle Logic

Lifecycle logic determines long-term planning and renewal strategies for specific Water Authority assets. Assets are planned to be either rehabilitated (rehab) every set number of years (frequency) over the asset expected useful life (EUL), or the asset is planned to run-to-failure (RTF) without rehab and replaced at the end of the EUL.

For example, a potable water flow meter and potable water inline pump both have an EUL of 25 years. However, RTF lifecycle logic is applied to the potable water flow meter and a (7) seven-year rehab-frequency lifecycle logic is applied to the potable water inline pump. Each rehab planned over the pump's EUL is estimated to cost 30% of the asset replacement cost. The differences in the example are summarized in **Table 4-14**.

Table 4-14: Lifecycle Logic Example

Newly Installed Asset	EUL	Lifecycle Logic	Rehab Frequency	Estimated Rehab Cost (% of Replacement)
Potable Water Flow Meter	25 years	RTF		
Potable Water Inline Pump	25 years	Rehab	7 years	30%

A complete list of lifecycle logic developed for specific AMP vertical assets is included in **Appendix C-2**. All linear asset lifecycle logic is assumed to be RTF for planning purposes.

4.8 CIP Methodology

A capital improvement plan (CIP) is developed for each AMP for short and long-term resource planning. An AMP CIP includes, but is not limited to, a recommended CIP project list with project cost estimates and schedule, O&M project recommendations, annual CIP renewal projections for a minimum of 10 years, and long-term projections for continuous rehab and renewal needs.

4.8.1 CIP Project List

Capital projects create, replace, or revitalize fixed assets, have a monetary value of at least $5,000, and a useful life of more than two (2) years. Water Authority CIP projects are developed as part of a (5) five-phase CIP planning cycle (**Figure 4-7)**.

Figure 4-7: CIP Planning Cycle

CIP projects approved by the Governing Board are included in the Water Authority recurring biennial Decade Plan (moving to annual planning for FY 2024 and beyond). Decade Plan projects are organized by identified capital funding resources. The Basic Rehabilitation Program (Basic Program) is the dedicated funding resource for Water Authority asset renewal projects. The Basic Program divides asset renewal projects into thirteen (13) categories listed in **Table 4-15**.

Table 4-15: Basic Program Priority Renewal Categories

Category No.	Category Description
100	Sanitary Sewer Pipeline Renewal
200	Drinking Water Pipeline Renewal

300	Southside Water Reclamation Plant Renewal
400	Soil Amendment Facility (SAF) Renewal
500	Lift Station and Vacuum Station Renewal
600	Odor Control Facilities Renewal
700	Drinking Water Plant: Groundwater System Renewal
800	Drinking Water Plant: Treatment Systems Renewal
900	Reuse Line and Plant Renewal
1000	Compliance
1100	Shared Renewal
1200	Franchise Agreement Compliance
1300	Vehicles and Heavy Equipment

Decade Plan projects in the appropriate project category respective to the AMP being developed are carefully reviewed to identify projects that include AMP-specific assets. Relevant project information including project description, projected total cost, planned start date, and estimated duration (number of project years) is gathered from the Decade Plan for each existing project associated with respective AMP assets.

AMP project recommendations for asset renewal are developed for all AMP assets that are not associated with a Decade Plan project. AMP project recommendations leverage location-based renewal needs and asset groups with similar EUL/RUL/rehab cycles to minimize total project costs and mitigate unacceptable levels of asset BRE. Asset replacement and rehab values developed as part of AMP asset valuation and applied lifecycle logic methodologies include direct and indirect costs. The sum of asset replacement/rehab values for each project's respective assets is the estimated total project cost.

AMP project recommendations are combined with the identified associated Decade Plan projects to form the AMP CIP project list. The Water Authority AMP CIP project list standard was developed as part of the 2023 CAMP and is located in **Appendix C-4**. Standard data fields include CIP ID and project prioritization rank.

CIP ID is a unique identifier necessary for relating assets in the asset register with the correct project in the AMP CIP table. The CIP ID is included as a field in both tables. Linking the (2) two tables automate data population of AMP CIP data fields for minimum RUL/rehab values, total project costs (not sourced from the Decade Plan), and average BRE score of project assets.

Project prioritization rank is on a scale from 1 (highest priority) to a number equal to the number of total AMP CIP projects, with no duplicate rank values. Project rank is relative to project start years. The lower the rank number, the higher the priority, and the earlier the start year. Rank values are modified as the AMP CIP schedule is developed and finalized. All projects are assigned a start year and duration that starts before the last year of the smallest asset RUL value associated with the project and prioritized as feasible from highest to lowest overall project BRE scores.

AMP CIP projects are grouped into one (1) of two (2) CIP project funding categories, as shown in **Table 4-16**.

Table 4-16: AMP CIP Project Funding Categories

AMP CIP Project Category	Description
Category 1 – CIP-Supported Maintenance	Ongoing contingency funds and building rehabilitations projects
Category 2 – Design Projects	All other identified projects

Significant jumps in year-to-year CIP projections are challenging to plan funding for. Flexibility in modifying project schedules is identified and utilized as needed for levelling out annual costs. Adjusting a project start year or modifying a project duration potentially moves total project cost from a year with a significant spike in annual CIP costs to a year with significantly lower annual costs. The annual CIP totals for both affected years move towards an average annual cost. AMP CIP development is outlined in **Table 4-17**.

Table 4-17: Development of CIP Project List

1. Review Existing CIP Projects
A. Identify assets already included in planned CIP projects
B. Identify additional assets to include in planned CIP projects based on
• Geographic location of existing CIP
• Asset RUL/rehab frequency alignment with CIP project timeline
2. Identifying Assets for O&M Projects
A. Level 2 condition assessment
• Verification of asset physical condition
B. O&M strategy optimization
• For facility or asset group
C. Specified maintenance activity
• Physical condition score can be improved
3. Develop New CIP Project Recommendations
A. Group assets with similar rehab/replacement timelines by location
B. Prioritize (not necessarily in the following order) assets with

• Fair (4) or poor (5) condition ratings
• High-risk BRE threshold (high, severe, or extreme for linear assets)
• RUL < 5 years of current CIP in development
C. Project start year < minimum asset RUL or rehab frequency associated with CIP
4. Level Annual Capital Expenditures
A. Modify project start dates and durations to level out resource spending year-to-year
B. Keep project schedule within prioritized project implementation window (before minimum RULs)
C. Leveled project start dates preferred to be moved earlier than moved later from initial start date
5. Create CIP Project List Table
A. Include all CIP projects (previously planned and newly created) associated with AMP assets
B. Project prioritization considers RUL values, asset risk, and rehab frequencies
C. Include project description, identified AMP assets, and overall project BRE
D. Included estimated total project cost, project start year, and duration

4.8.2 Long-term Projected Renewal

As assets are replaced or rehabbed through strategically planned CIP projects, the asset BRE scores are improved, and annual renewal needs become more predictable over time. Replacement and rehab costs based on current asset RUL, estimated replacement asset EUL, and lifecycle logic are projected over a 100-year horizon to estimate expected, recurring annual renewal resource needs for long-term planning. All assets are assumed to be replaced at the end of the asset class-type EUL with rehabilitation at the class-type specified frequency of years.

5. Water Authority Systems and Facilities

Infrastructure included in this section of the report is grouped by water system. Within each water system, facilities and asset groups are organized by general process flow. Information for some of these facilities was gathered from the AMPs Hazen completed as part of this CAMP. Data from other facilities was incorporated from previously completed AMPs the Water Authority had commissioned prior to 2021.

5.1 Surface Water

Infrastructure related to surface water intake and transmission, treatment, storage, and distribution is discussed below. Note that water within Water Authority systems is defined by level or stage of treatment received. For example, surface water is raw water once it has been drawn from the Rio Grande.

5.1.1 Raw Water Diversion Facility

The Raw Water Diversion Facility is located south of the Alameda Boulevard Bridge. The facility is comprised of a pneumatically controlled adjustable-height dam, fish passage, and intake facility, as shown in **Figure 5-1** and **Figure 5-2**.

Figure 5-1: Raw Water Diversion Intake Location

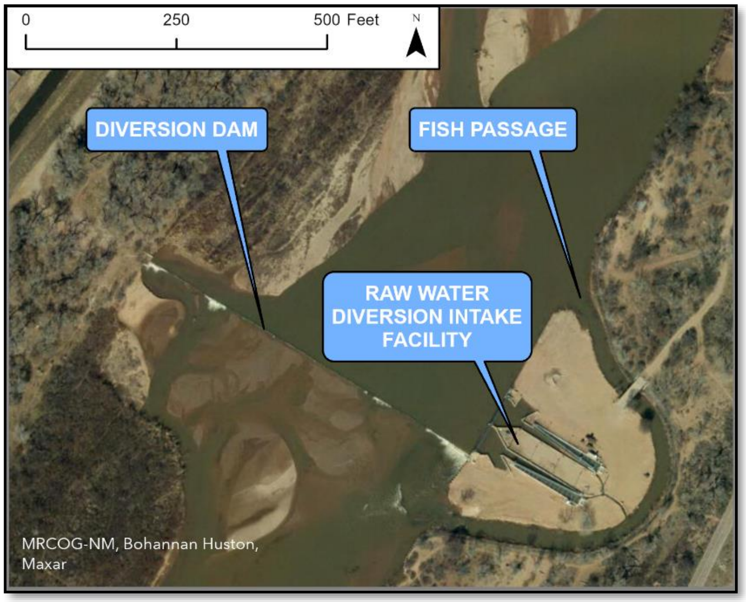

Figure 5-2: Raw Water Diversion Intake Aerial View

The total span of the dam across the river is approximately 625 feet. Diverted surface water flows into the intake facility on the east side of the Rio Grande before being drawn into suction piping connected to the Raw Water Pump Station discussed in the next section. The reinforced-concrete intake structure is divided into two independent channels that each have a bar screen and a fish screen to prevent large debris and fish from entering the structure. Raw Water Diversion Facility assets were assessed as part of the 2022 SJCWTP AMP (Hazen) located in **Appendix A-1.**

5.1.2 Raw Water Pump Station

The Raw Water Pump Station (RWPS) provides suction head to withdraw surface water from the Rio Grande through the diversion intake structure. The RWPS pressurizes raw water for transmission to the SJCWTP. The RWPS includes twelve (12) 500-hp vertical turbine pumps. Each pump has a design flow capacity of 16 MGD. The total pump station capacity is approximately 160 MGD with two pumps on standby for firm capacity. **Figure 5-3** and **Figure 5-4** show the RWPS location relative to the intake and an aerial satellite view of the RWPS site, respectively.

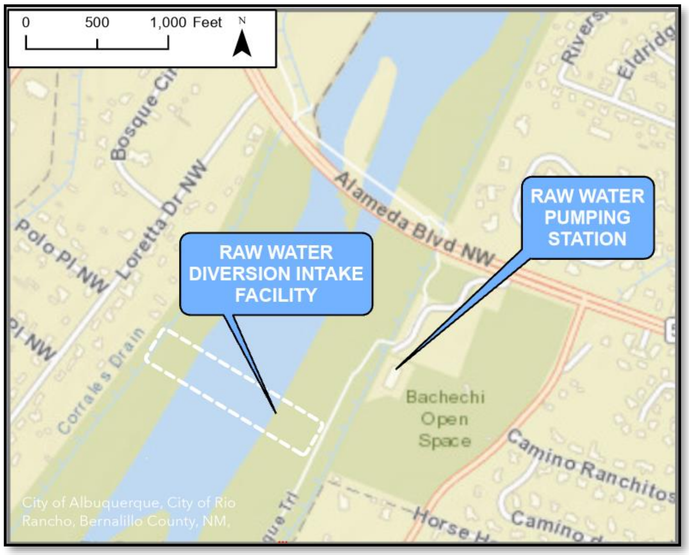

Figure 5-3: Raw Water Pump Station Location

Figure 5-4: Raw Water Pump Station Aerial View

RWPS assets were assessed as part of the 2022 SJCWTP AMP (Hazen) located in **Appendix A-1.**

5.1.3 Raw Water Pipeline

The Raw Water Pipeline (RWP) is a 72-inch diameter, 5.8-mile-long pipeline that serves as the transmission main from the RWPS, delivering water diverted from the Rio Grande to the SJCWTP. **Figure 5-5** depicts the pipeline route.

Figure 5-5: Raw Water Transmission Pipeline Route

The RWP route begins as steel pressure-pipe and departs south from the RWPS until it intersects Paseo Del Norte, then turns east and parallels the road for approximately 2.5 miles. The pipeline crosses the North Diversion Channel (Channel) and turns south, paralleling the Channel for approximately 2 miles before turning west to the San Juan-Chama Water Treatment Plant. The pipeline rises above grade and is supported by weathering steel bridges five (5) times along the route. The approximately 1/3-mile-long last leg from the Channel to San Juan-Chama Water Treatment Plant consists of reinforced concrete pipe (RCP) segmented by five (5) 9-foot-diameter drop manholes, allowing for an approximately 100-foot descent into the headworks of the treatment plant.

RWTP assets were assessed as part of the 2022 Raw Water Pipeline AMP (Hazen) located in **Appendix A-2**.

5.1.4 San Juan-Chama Water Treatment Plant

The San Juan-Chama Water Treatment Plant (SJCWTP) treats raw water sourced from the Rio Grande to produce finished water at safe drinking water standards. SJCWTP is located approximately 3 miles east of the Rio Grande and approximately 2 miles south of Paso del Norte, as shown in **Figure 5-5** above. An aerial satellite view of the plant site is shown in **Figure 5-6**.

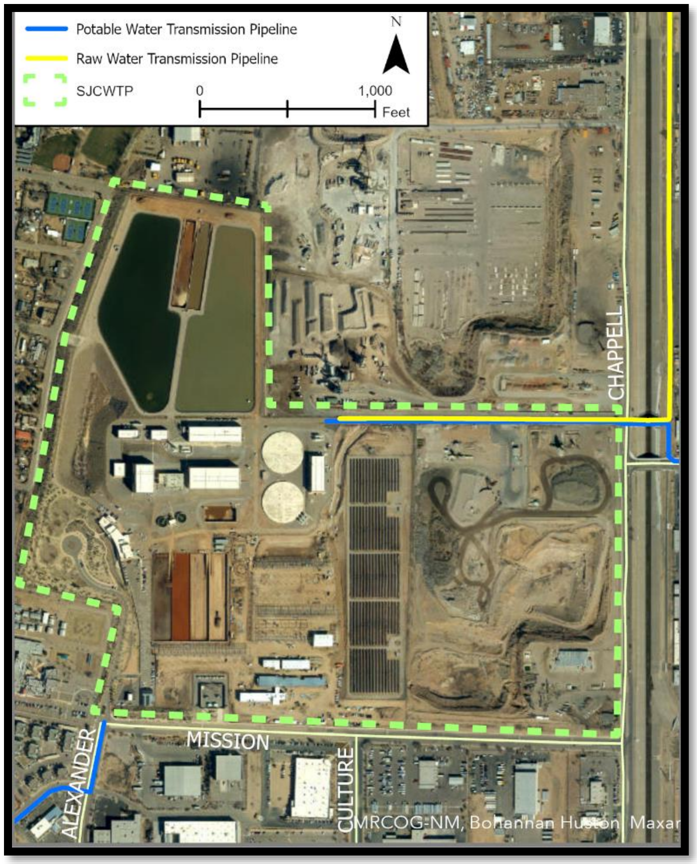

Figure 5-6: SJCWTP Aerial Site View

The SJCWTP process flow diagram is shown in **Figure 5-7**.

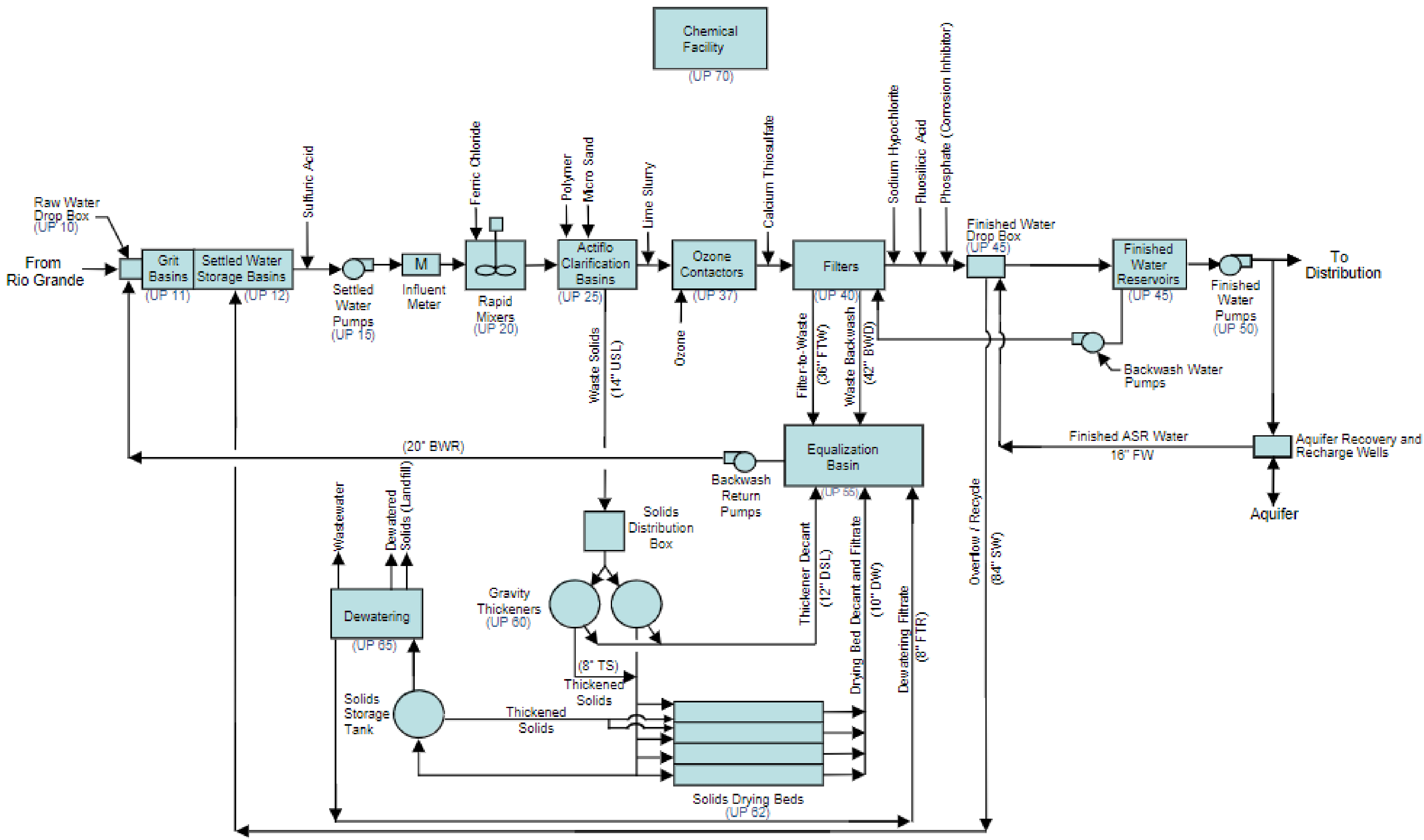

Figure 5-7: SJCWTP Process Flow Diagram

SJCWTP treatment flow begins with raw water entering the raw water drop box and flows into a pre-sedimentation system for grit and sedimentation removal. Settled water from one of the two (2) 50-MG settling basins is pumped into rapid mixers before entering the Actiflo® system for clarification. Clarified water flows through ozone contactors for primary disinfection and granular activated carbon (GAC) deep bed filters for taste and odor removal. Filtered water is treated with chlorine and fluoride before entering one of two (2) 10-MG clearwells, and the high-service pumping station pressurizes finished water for potable water distribution and is planned to have the option to pump into aquifer recovery and recharge. In addition to the process treatment infrastructure, the plant site is home to an administration building and water quality laboratory. SJCWTP assets were assessed as part of the 2022 SJCWTP AMP (Hazen) located in **Appendix A-1** and SJCWTP water quality laboratory assets were assessed as part of the 2022 Soil Amendment Facility and Water Quality Labs AMP (Hazen) located in **Appendix A-3**.

5.2 Groundwater

Infrastructure for groundwater supply, collection, treatment, and storage is discussed below.

5.2.1 Well Sites

The 80 active Water Authority groundwater wells are grouped into 26 wellfields spread out across the northern Albuquerque metropolitan area. **Figure 5-8** shows the distribution of well site locations in the area.

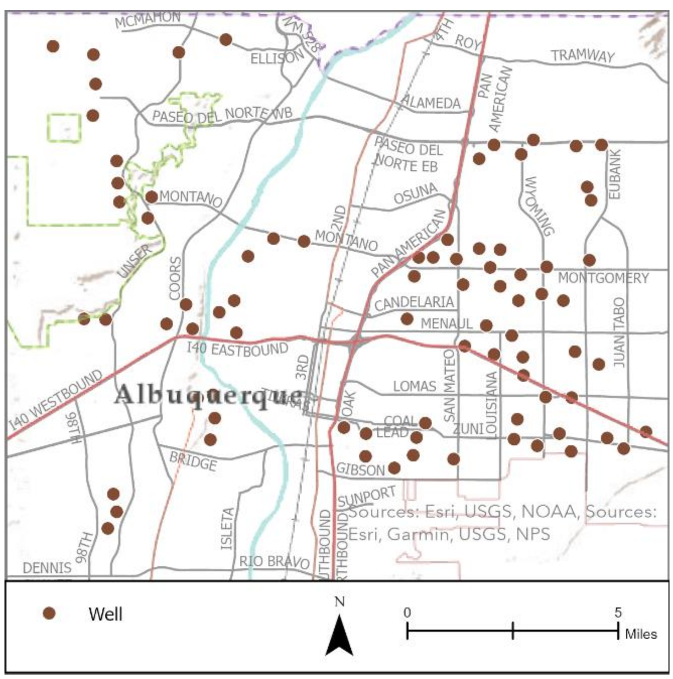

Figure 5-8: Well Site Locations

Wellfields have one or more well sites and vary in shared wellfield facilities and total wellfield capacity. Shared facilities not discussed as part of well sites include well collector pipelines, chlorination system (not located within a well building), arsenic removal treatment (existing treatment available in 5 wellfields), potable water reservoir, and booster pump station.

Well site assets typically include well boring, casing, and wellhead, one or more well pumps, well head enclosure structure and concrete pad, electrical and instrumentation and process piping associated with operation of the well. If a chlorination system is located inside of the enclosure structure, it is considered part of the well facility.

Condition of well borings, casings, screen filters, and location-based specific capacity was assessed as part of the 2018 Well AMP Update (CDM Smith) located in **Appendix A-4**. Well site assets that were not previously considered in 2018 were assessed as part of the 2022 Well Sites AMP (Hazen) located in **Appendix A-5**.

5.2.2 Well Collector Pipelines

Well collector pipelines bring raw or treated (depending on well) well water to reservoir sites for chlorination and storage before entering the distribution system. Future plans include the option to bypass reservoir storage and pump directly into the distribution system. GIS data shows approximately 59 miles total LF in the system. The majority of well collector pipes are concrete and have a diameter between 14 and 20 inches, as shown in **Figure 5-9** and **Figure 5-10**, respectively. Well collector pipeline assets were assessed as part of the 2019 Transmission Waterline AMP (Smith Engineering) located in **Appendix A-6**.

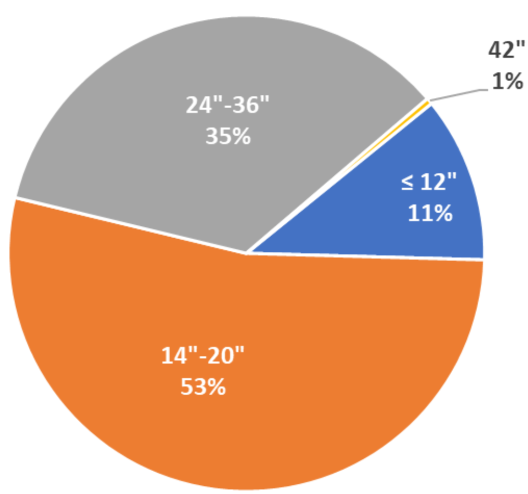

Figure 5-9: Well Collector Pipe-Mile Distribution of Pipe Size

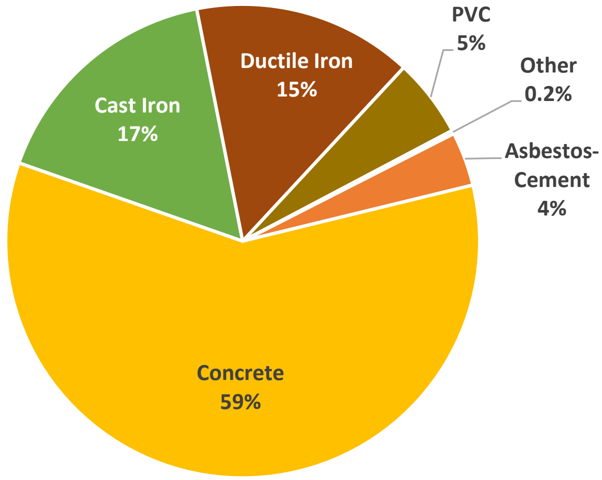

Figure 5-10: Well Collector Pipe-Mile Distribution of Pipe Material

5.2.3 Arsenic Removal Treatment Facilities

Arsenic Removal Treatment Facilities (ARTFs) remove arsenic from well water in 5 of the 26 Water Authority wellfields to produce safe drinking water with arsenic levels below the EPA MCL. **Figure 5-11** shows locations of ARTF sites in the water system.

Figure 5-11: Arsenic Removal Water Treatment Plants Location Map

Table 5-1 lists the facility names, treatment system type, and facility capacity. The treatment process for arsenic removal is the same for 4 out of 5 ARTFs.

Table 5-1: Arsenic Removal Facilities and Treatment Types

Facility Name	Arsenic Removal Treatment Type	Facility Capacity
College Demonstration Facility	Ferric chloride addition followed by microfiltration	5.0 MGD
Bernalillo County Industrial Park (BCIP)	Granular ferric hydroxide media contained in a set of pressure vessels	0.6 MGD
Corrales Reservoir 3		4.2 MGD
Corrales Well 7		1.3 MGD
Corrales Well 9		1.9 MGD

ARTF assets were assessed as part of the 2022 Arsenic Removal Facilities AMP (Hazen) located in **Appendix A-7**.

5.2.4 Potable Water Reservoirs

Potable water reservoirs provide storage of treated groundwater for use in the distribution system. A map of the 61 active reservoirs is shown in **Figure 5-12**.

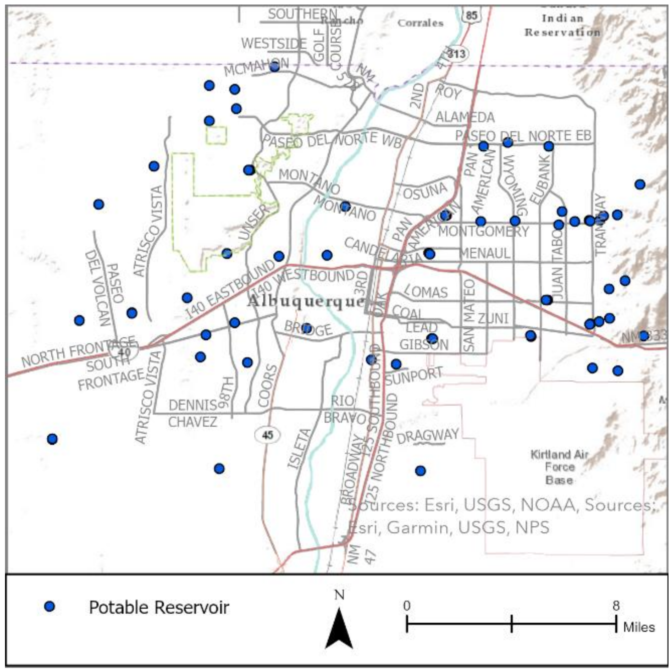

Figure 5-12: Potable-use Reservoir Location Map

Reservoirs are constructed of either reinforced concrete or welded steel, and storage-volume ranges from 0.6 MG to 7.0 MG. 72% were constructed at grade and the rest are either buried or partially buried except for 2 elevated tanks. Potable water reservoir assets were assessed as part of the 2019 Reservoir Desktop Assessment Review (Jacobs) located in **Appendix A-8**.

5.3 Potable Water Distribution

The distribution system includes potable water booster pump stations, pipelines, and pipe appurtenances. Pipelines are grouped into small (≤ 12 inches) and large (>12 inches) diameter groups to address the differences in AM strategies and operational function in the distribution system.

5.3.1 Potable Water Booster Pump Stations

The Water Authority has a total of 39 potable water booster bump stations (PWBPS). All of the PWBS pump water to higher pressure zones except for Corrales 7 which maintains flow through a closed-loop system. Plans are in place to convert Corrales 7 to pump to pressure zone 5W.

PWBPS firm capacities range from 0.7 MGD to 56.2 MGD. PWBPS assets were assessed as part of the 2022 Pump Station AMP (Hazen) located in **Appendix A-9**.

5.3.2 Large-Diameter Waterlines

The Water Authority GIS inventory shows approximately 109 miles of large-diameter potable pipelines in the distribution system. The distribution of pipe miles by pipe size and pipe material is shown in **Figure 5-13** and **Figure 5-14**, respectively.

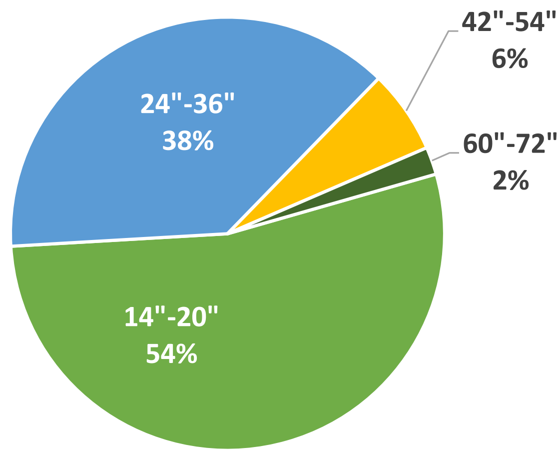

Figure 5-13: Large Diameter Pipe-Mile Distribution by Pipe Size

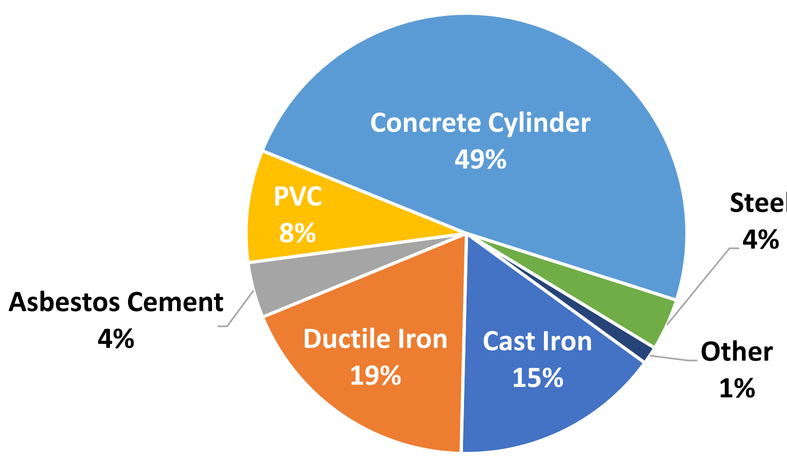

Figure 5-14: Large Diameter Pipe-Mile Distribution by Pipe Material

Large-diameter waterlines were assessed as part of the 2019 Transmission Waterline AMP (Smith Engineering) located in **Appendix A-6**.

The Water Authority has 45,727 active water valves in GIS data. As shown in **Table 5-2**, the majority (73%) are gate valves.

Table 5-2: Water Valve Types

Valve Type	Count	Percent of Total
Gate	33,410	73%
Air Release	3,444	10%
Butterfly	4,440	7%
Pressure Reducing	1,413	3%
Other	3,020	7%

Large-diameter water valve assets were assessed as part of the 2019 Transmission Waterline AMP (Smith Engineering) located in **Appendix A-6**.

5.3.3 Small-Diameter Waterlines

The Water Authority GIS inventory shows approximately 2,800 miles of small-diameter (≤ 12-inch diameter) potable pipelines in the distribution system. The distribution of pipe miles by pipe size and pipe material is shown in **Figure 5-15** and **Figure 5-16**, respectively.

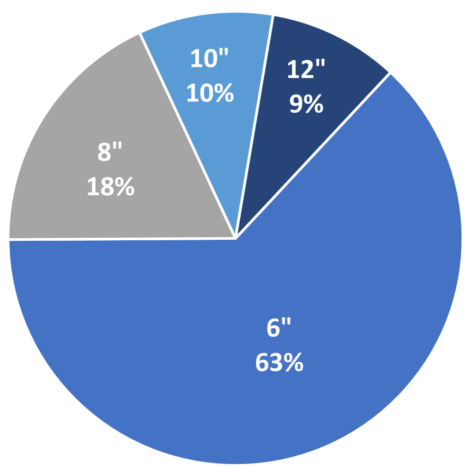

Figure 5-15: Small Diameter Pipe-Mile Distribution by Pipe Size

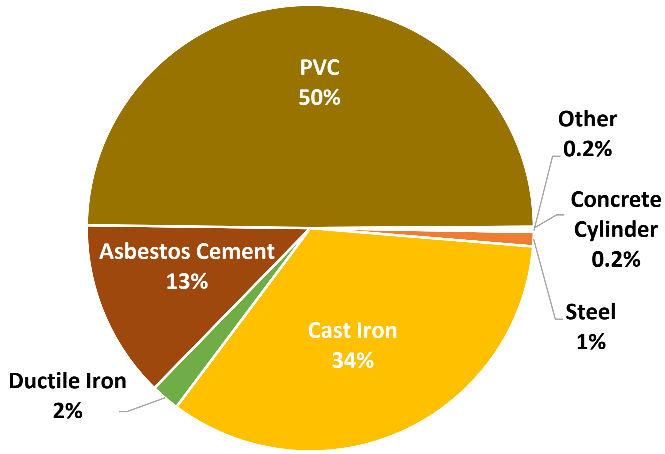

Figure 5-16: Small Diameter Pipe-Mile Distribution by Pipe Material

More than half (63%) of the small-diameter pipe-mile inventory has a 6-inch diameter, and the majority of pipe material is PVC (50%). Small-diameter pipeline assets were assessed as part of the 2020 Small Diameter Waterline and Sewerline AMP Update (Smith Engineering) located in **Appendix A-10**.

5.4 Wastewater Collection

The collection system includes sanitary sewer pipelines and appurtenances, lift stations, vacuum stations, and odor control stations. Pipelines are grouped into small (≤ 12 inches) and large (>12 inches) diameter groups to address the differences in AM strategies and operational function in the distribution system.

5.4.1 Sanitary Sewer Pipelines

Water Authority sewer pipelines are grouped into seven (7) categories based on size and function in the system. **Table 5-3** lists collection system pipeline categories and descriptions.

Table 5-3: Collection System Pipeline Categories

Pipeline Category	Description
Grinder pump line	Pressurized line from a localized grinder pump holding tank connecting to the gravity sewer
Collector	Upstream end of gravity collection system, receives wastewater from customers and conveys it to larger lines (interceptors); ≤ 12-inch diameter

Pipeline Category	Description
Interceptor	Downstream end of gravity system, receives wastewater from numerous smaller-diameter, collector lines and conveys to treatment; > 12-inch diameter
Vacuum line	Pneumatic system with a partial vacuum, wastewater is "sucked" through the pipeline to a vacuum station
Force main	Pressurized system, wastewater is conveyed via discharge from a lift station typically to a downstream interceptor
Siphon	Gravity sewer lines installed to slope downwards, pass under an obstruction, and return to the established sewer gradient, wastewater is forced through the siphon by the upstream (higher) sewer pressure
Air jumper	Typically installed with siphon lines, run parallel and above gravity pipe where air is likely to get trapped due to changes in pipe slope

The distribution of materials and pipe size for small-diameter (≤12 inch) collector lines and large-diameter (>12 inch) interceptor pipelines and all-diameter force mains in the Water Authority sewer collection system are shown in **Figure 5-17**, **Figure 5-18**, and **Figure 5-19**, respectively.

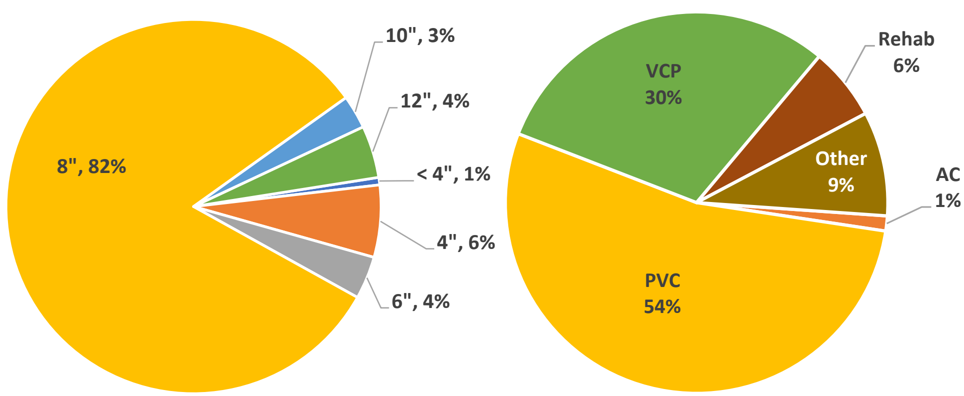

Figure 5-17: Collector Pipe-Mile Distribution by Pipe Size and Material

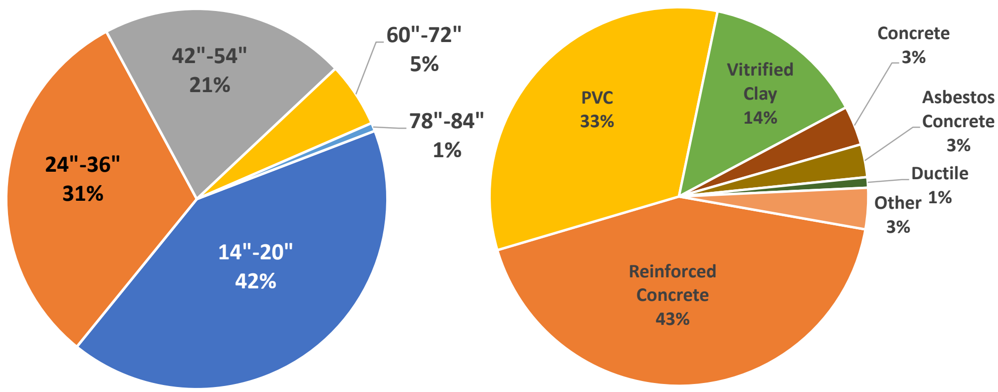

Figure 5-18: Interceptor Pipe-Mile Distribution by Pipe Size and Material

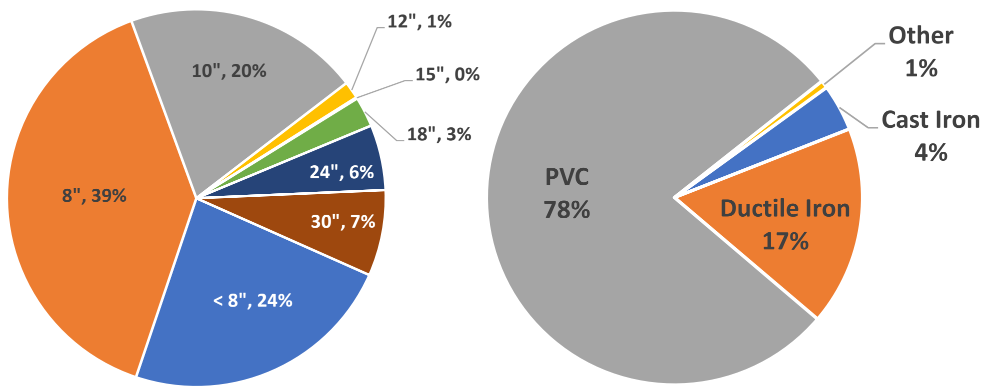

Figure 5-19: Force Main Pipe-Mile Distribution by Pipe Size and Material

Collection system pipeline appurtenances include manholes, valves, buffer tanks, cleanouts, and Airvac valve pits. **Table 5-4** lists the count of appurtenances in the system.

Table 5-4: Count of Manholes and Valves in Sewer System

Asset		Count
Manhole		48,823
Valves		943
	Air Release	41
	Bypass	2
	Check	2
	Isolation	890
	Unknown	8

Asset	Count
Buffer Tanks	35
Cleanouts	217
Airvac Valve Pit	3,220

Small-diameter and large-diameter pipelines were assessed as part of the 2020 Small Diameter Waterline and Sewerline AMP Update (Smith Engineering) and 2020 Large Diameter Sewerline AMP Update (Smith Engineering) located in **Appendix A-10** and **Appendix A-11**, respectively. Force main assets for Lift Station 24 were assessed as part of the 2022 Lift Station 24 Force mains AMP (Hazen), located in **Appendix A-12**.

5.4.2 Lift Stations

The Water Authority has 33 active lift stations in the collection system. Lift stations receive wastewater from localized pipelines and discharge into pressurized force mains for wastewater delivery typically to interceptors. **Figure 5-20** shows the distribution of lift stations capacity ranges. The majority (64%) of stations have a pumping capacity below 1,000 gpm, and almost a third (30%) have pumping capacities between 1000 and 2000 gpm.

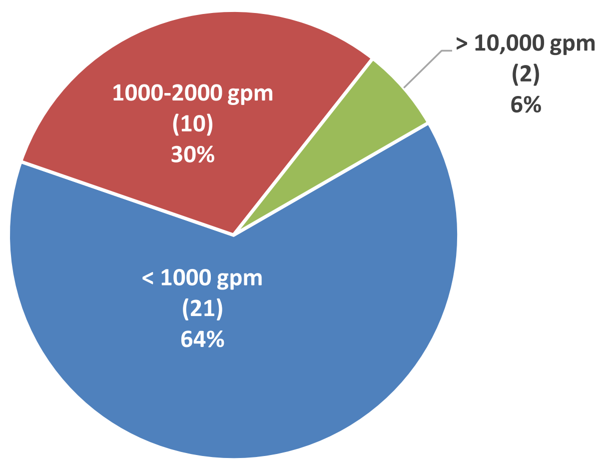

Figure 5-20: Lift Station Firm Pumping Capacity Ranges

As shown in **Figure 5-20**, there are no lift station pumping capacities between 2,000 and 10,000 gpm. The next two largest lift stations are Lift Station 20 and Lift Station 24 with firm pumping capacities of 39,400 gpm and 12,600 gpm, respectively.

Site infrastructure varies among lift stations. Some stations have a pump building and/or a drywell, and some stations are contained within a manhole. **Table 5-5** lists the types of site infrastructure with station counts.

Table 5-5: Count of Lift Station Infrastructure Types

Site Infrastructure	Count of Lift Stations
Lift Station Wetwell, Drywell, and Building	13
Lift Station Wetwell, Drywell, No Building	4
Lift Station Wetwell, No Building	1
Lift Station Manhole	16

Lift station assets were assessed as part of the 2016 Lift Station Condition Assessment and Decade Plan (Carollo Engineers). The 2022 Lift Station & Vacuum Station Risk Analysis Update TM (Hazen), located in **Appendix A-13**, updated the 2016 asset register and risk calculations in accordance with 2023 CAMP standards and methodologies and developed a CIP project list based on 2022 risk analysis results. The 2016 report is included for reference in the 2022 TM.

5.4.3 Vacuum Stations

The Water Authority has 14 active vacuum stations in the collection system. Vacuum stations are on the receiving end of localized vacuum lines and include vacuum pumps, a collection tank, and sewage pumps. Vacuum pumps maintain the appropriate vacuum in vacuum lines to draw wastewater from Airvac pits into the collection tank. Sewage pumps transfer the wastewater from the collection tank into a force main and/or gravity system. Vacuum station capacities in the system range from 272 gpm to 1,600 gpm.

Vacuum station assets were assessed as part of the 2016 Vacuum Station Condition Assessment and Decade Plan (Carollo Engineers). The 2022 Lift Station & Vacuum Station Risk Analysis Update TM (Hazen), located in **Appendix A-13**, updated the 2016 asset register and risk calculations in accordance with 2023 CAMP standards and methodologies and developed a CIP project list based on 2022 risk analysis results. The 2016 report is included for reference in the 2022 TM.

5.4.4 Odor Control Stations

The Water Authority system includes 19 active odor control stations that are located at strategic points in the collection system and are not considered part of a lift station, plus one portable unit. Odor control stations typically include a blower assembly and carbon unit with granular activated carbon (GAC) media to adsorb odors. Some stations utilize chemicals or a combination of GAC and chemicals to control odor. **Table 5-6** lists the types of odor control systems and the system counts.

Table 5-6: Odor Control System Types

Odor Control System	Count
Blower assembly and carbon unit	8
Blower assembly, carbon unit, and chemical addition	5
Chemical addition	6

Odor control station assets were assessed as part of the 2022 Odor Control Stations AMP located in **Appendix A-14**.

5.5 Water Reclamation

Infrastructure for water reclamation treatment is discussed below.

5.5.1 Southside Water Reclamation Plant

The Southside Water Reclamation Plant (SWRP) has a rated capacity of 76 MGD and typically operates between 50 and 60 MGD. The plant site is located on the bank of the Rio Grande approximately 6 miles south of Interstate 40, as shown in **Figure 5-21**.

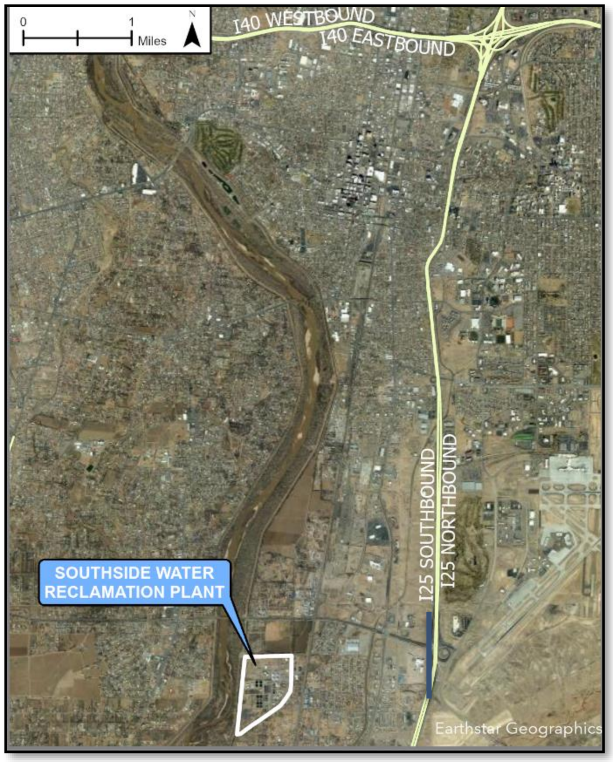

Figure 5-21: SWRP Location Map

SWRP treatment processes include screening and grit removal, primary clarification, activated sludge basins, final clarification, ultraviolet disinfection (UV), pressure filtration, dissolved air flotation thickening, anaerobic digestion, sludge dewatering, and cogeneration. SWRP treated effluent is used as reclaimed water for the Water Authority non-potable distribution system and non-potable SWRP site use, and the remainder outfalls into the Rio Grande. **Figure 5-22** shows the liquids handling process flow diagram. SWRP assets were assessed as part of the 2022 SWRP AMP (Hazen) located in **Appendix A-15** and SWRP water quality assets were assessed as part of the 2022 Soil Amendment Facility and Water Quality Labs AMP (Hazen) located in **Appendix A-3**.

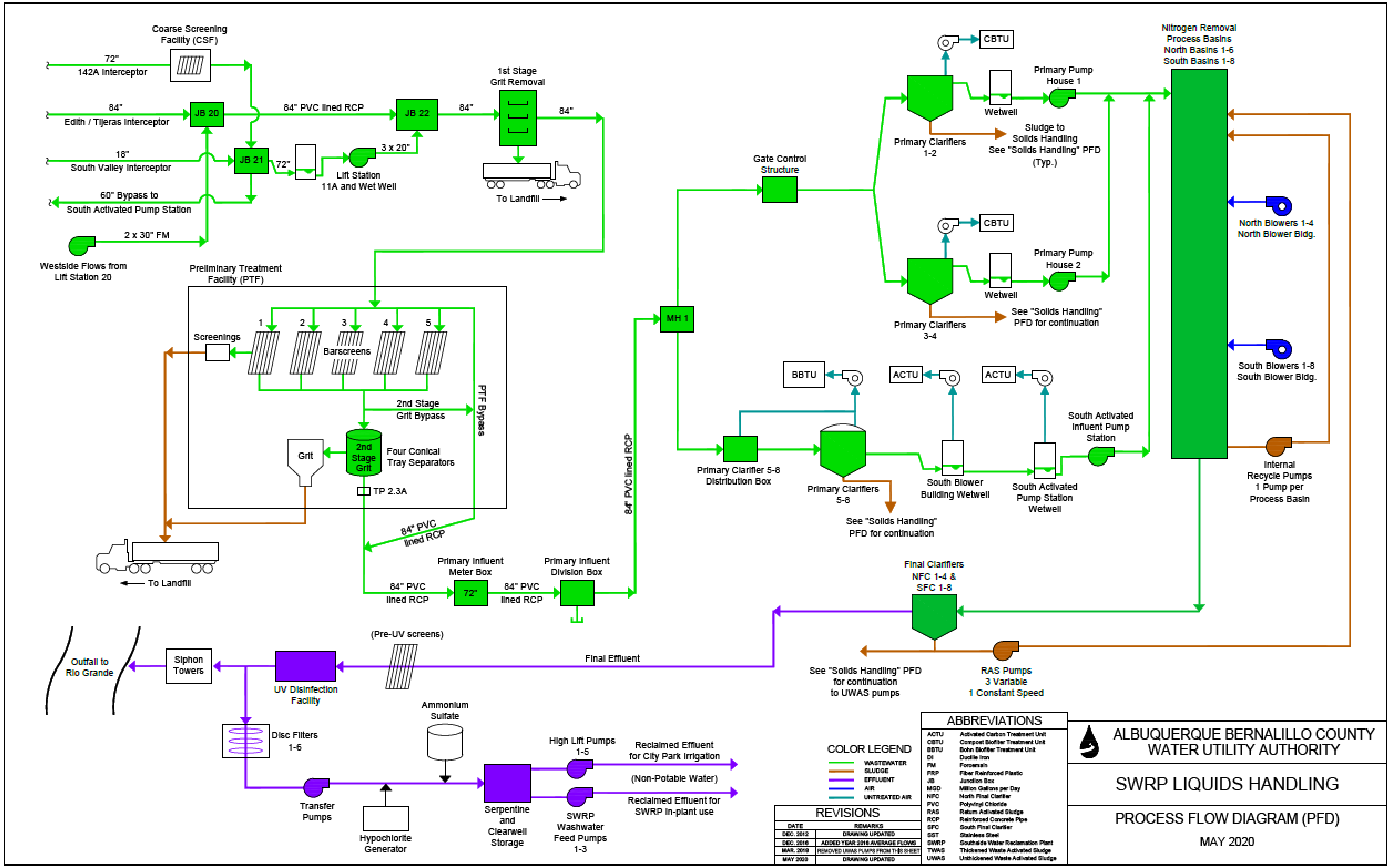

Figure 5-22: SWRP Liquids Handling Process Flow Diagram

5.5.2 Southside Non-Potable Filtration Facility

The Southside Non-Potable Filtration Facility provides an added level of treatment to SWRP effluent for non-potable water reuse and has treatment capacity of approximately 20 MGD. The treatment includes cloth disc filters, sodium hypochlorite, and ammonium sulfate. High lift pumps with a total capacity of 6 MGD pumps the water to the Southside non-potable distribution system and a second pumping station (2 MGD) pumps non-potable water for use as SWRP, as shown in **Figure 5-23**.

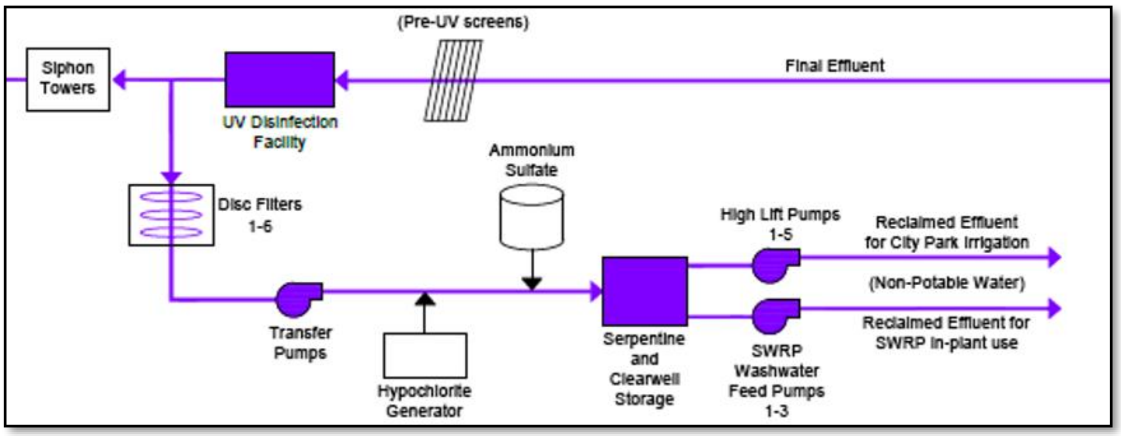

Figure 5-23: Southside Non-Potable Filtration Process Flow Diagram

Southside Non-Potable Filtration Facility assets were assessed as part of the 2022 SWRP AMP (Hazen) located in **Appendix A-15**.

5.6 Water Reuse

Reuse water is distributed by the Northeast Non-potable Distribution System and the Southside Non-Potable Distribution System and includes a total of five (5) non-potable reservoirs and six (6) non-potable pump stations.

5.6.1 Northeast Water Reuse Distribution System

The Northeast Non-potable system receives water withdrawn from subterranean intakes on the Rio Grande, south of the Alameda Boulevard Bridge, mixed with treated industrial wastewater. The non-potable system includes a Ranney collector intake with a caisson wetwell that provides water storage capacity. Reuse pipelines were assessed as part of the 2019 Transmission Waterline AMP (Smith Engineering) located in **Appendix A-6**.

5.6.2 Southside Water Reuse Distribution System

The Southside Non-potable distributes approximately 1,000 acre-feet per year of treated wastewater effluent from SWRP for irrigation and industrial use in the Southeast Heights and South Valley of the City. The system pumps from the Southside Non-potable Filtration Facility. Reuse pipelines were assessed as part of the 2019 Transmission Waterline AMP (Smith Engineering) located in **Appendix A-6**.

5.6.3 Water Reuse Reservoirs

The Water Authority has five (5) active non-potable water reservoirs with four (4) in the Northeast and one (1) in the Southside. The reservoir storage volumes range from 0.6 MG to 2.5 MG and are constructed from either reinforced concrete (4) or steel (1). Non-potable reservoir assets were assessed as part of 2019 Reservoir Desktop Assessment Review (Jacobs) located in **Appendix A-8.**

5.6.4 Water Reuse Booster Pump Stations

The Water Authority has six (6) non-potable booster pump stations (NBPS) located in the Northeast (5) and Southside (1) non-potable distribution systems. Station firm pumping capacities range from 3.6 to 9.2 MGD. Non-potable booster station assets were assessed as part of the 2022 Pump Station AMP (Hazen) located in **Appendix A-9**.

5.7 Soil Amendment Facility (Biosolids)

The Soil Amendment Facility (SAF) is located on the West Mesa (7400 Shooting Range Access Road NW) and consists of a 418-acre land application area, composting facility, vehicle maintenance shop, administration building, truck weigh scale, water storage tank, pumping station, vehicle wash-down station, and synthetically lined evaporation lagoon for vehicle wash water. In addition to soil application, the SAF produces up to 45,000 cu. yds. per year of Class A compost that is used to fertilize turf and other plants. SAF uses specialized heavy equipment to land apply the solids and turn the compost. It also uses front-end loaders and a set of tractor trailers to haul the biosolids from the SWRP to the SAF. SAF assets were assessed as part of the 2022 SAF and Water Quality Labs AMP (Hazen) located in **Appendix A-3**.

5.8 Miscellaneous Buildings

Miscellaneous buildings that were not covered as part of other asset group AMPs were identified and include:

- Burton Disinfection Building/Vault
- Leyendecker Disinfection Building/Vault

- Miles Disinfection Building/Vault
- Ponderosa Disinfection Building/Vault
- Volcano Cliffs Chemical Dis Building 2
- Ridgecrest Disinfection Building/Vault
- Metro Detention Center
- SWRP Flare Building
- Burton Sodium Hypo Building
- Volcano Cliffs Jockey Pump Building

The miscellaneous building assets were assessed as part of the 2022 Miscellaneous Buildings AMP (Hazen) located in **Appendix A-16**.

6. System-Wide Asset Profile

As part of the 2023 CAMP development, Hazen created a standardized AMP framework and methodology for utility-wide use across vertical assets. AMPs not completed by Hazen used different methodologies to assess risk. Replacement costs were presented as part of each AMP.

6.1 Asset Valuation

System-wide asset valuation is based on asset replacement cost Class 5 estimates with an accuracy of -20% to 50% on the low side, and +30% to +100% on the high side. **Table 6-1** lists replacement value estimates for facilities grouped and totaled by service system in 2022 dollars. The system-wide total estimated asset replacement value of approximately $9.38B is comprised of mostly water system assets (approximately $5.79B) followed by wastewater (approximately $3.40B), reuse (approximately $145M), and shared (approximately $48.7M) assets.

Table 6-1: System-wide Asset Replacement Value Estimate

Water		
Raw Water Intake, Raw Water PS, and SJCWTP[1]	$	641,700,000
Raw Water Pipeline[1]	$	204,200,000
Wells[1]	$	424,900,000
Arsenic Removal Treatment Facilities[1]	$	50,400,000
Potable Reservoir Sites[2]	$	269,500,000
Potable Pump Stations[1]	$	88,900,000
Potable Waterlines[3]	$	3,752,600,000
Pressure Reducing Valves[3]	$	32,800,000
Fire Hydrants[2]	$	312,600,000
Miscellaneous Buildings[1]	$	12,900,000
Total	$	5,790,500,000
Wastewater		
Sewerlines and Manholes[3]	$	2,344,700,000
Lift Stations[1]	$	49,700,000
Vacuum Stations[1]	$	16,300,000
Odor Control Stations[1]	$	26,700,000
SWRP and Soutside Non-Potable Filtration Facility[1]	$	957,700,000
Miscellaneous Buildings[1]	$	1,200,000
Total	$	3,396,300,000
Reuse		
Reuse Reservoir Sites[2]	$	8,600,000
Reuse Pump Stations[1]	$	11,700,000
Reuse Pipelines[3]	$	103,500,000
Soil Amendment Facilty[1]	$	21,600,000
Total	$	145,400,000
Shared		
Compliance and Water Quality Labs[1]	$	6,300,000
Vehicles and Mobile Equipment[2]	$	40,700,000
Computer Equipment and Software[2]	$	1,700,000
Total	$	48,700,000
Total Estimated Asset Replacement Value	**$**	**9,380,900,000**

[1]Estimated by Hazen for 2021 and 2022 AMPs, [2]Estimated by Water Authority for 2020 Draft U-AMP, [3]Estimated by Smith for 2019 and 2020 pipeline AMPs

Values shown in **Table 6-1** are 2022 dollars and are not intended to be used for accounting purposes.

Figure 6-1 shows the distribution of estimated asset replacement value in terms of vertical (approximately 27.5%) and linear (approximately 72%) assets for water, wastewater, and reuse and shared (approximately 0.5%) systems. The water system represents the majority of estimated asset replacement values for vertical (approximately 16%) and linear (approximately 46%) assets followed by wastewater (approximately 11% and 25%, respectively). The reuse system vertical and linear assets represent the smallest replacement value (approximately 0.4% and 1%, respectively).

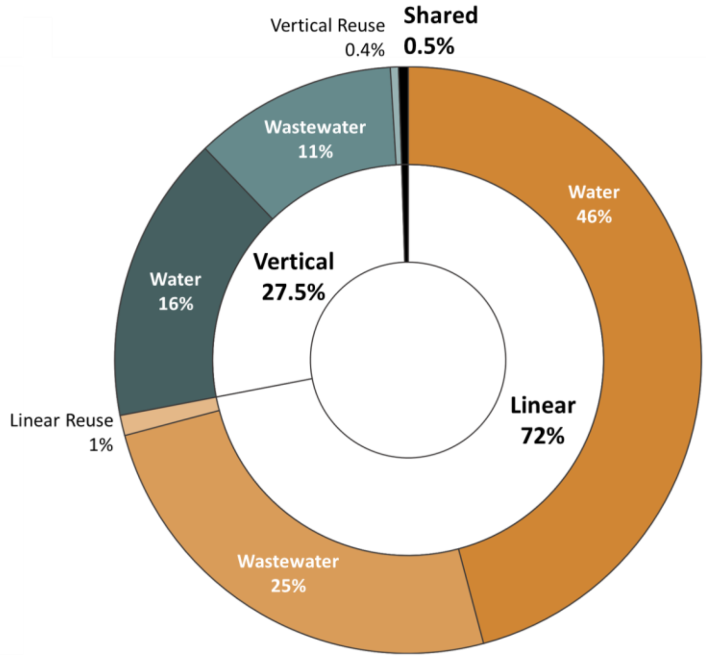

Figure 6-1: Distribution of Asset Value by System

6.2 Risk Profile

System-wide asset risk is quantified in terms of estimated asset replacement value and miles of pipeline for vertical and linear assets, respectively.

6.2.1 Vertical Assets

BRE threshold levels and asset replacement costs were developed in accordance with **Section 4.5** and **Section 4.6** of this report for nine (9) of the vertical asset AMPs in **Appendix A**. The cumulative AMP data is shown in **Figure 6-2** to illustrate system-wide distribution of estimated vertical asset replacement value by BRE threshold level.

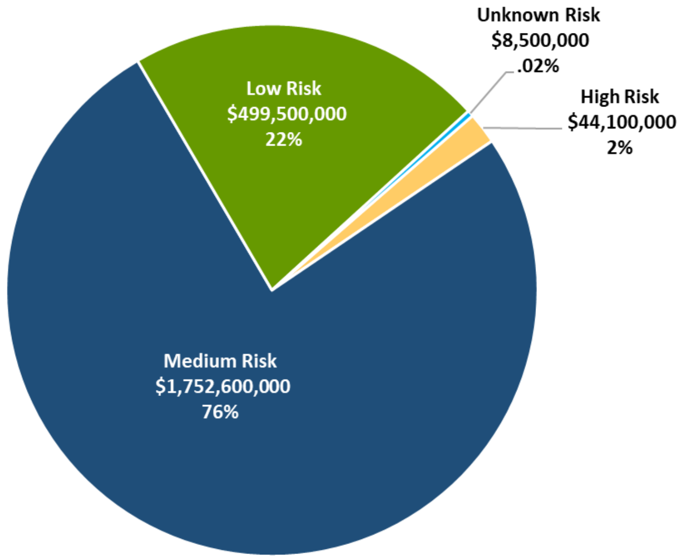

Figure 6-2: Distribution of Vertical Asset Value by BRE Threshold

The majority (approximately 76% or $1.75B) of estimated total replacement value for vertical assets has a medium-risk level and less than one-quarter (approximately 22% or $501M) has a low-risk level. The high-risk asset total for estimated replacement value represents the smallest portion (approximately 2% or $44M). Unknown risk (approximately 0.02% or $8M) accounts for assets with unknown physical condition due to being inaccessible or not found during AMP development.

6.2.2 Linear Assets

Combined linear asset risk data includes available pipeline data with BRE threshold levels of extreme, severe, high, medium, or low risk assigned through the development of AMPs and in accordance with **Section 4.5** of this report. Pipeline lengths were summarized for each BRE threshold and presented in **Figure 6-3.**

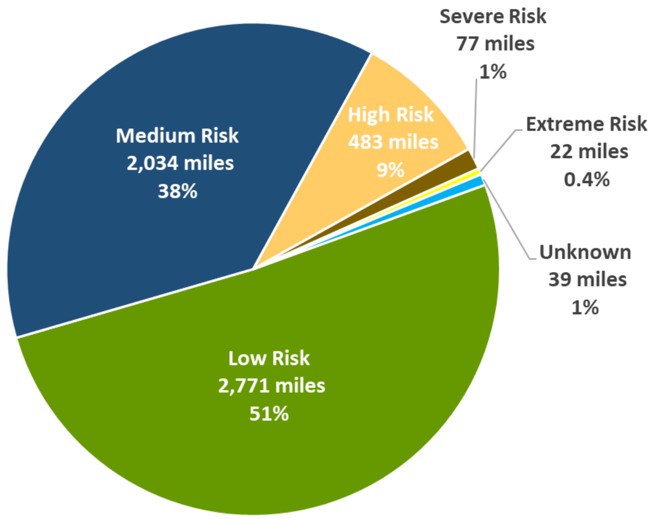

Figure 6-3: Distribution of Pipe-Miles by BRE Threshold

The majority (approximately 51% or 2,771 miles) of total pipe-miles are low risk and over two-thirds (approximately 38% or 2,034 miles) are medium risk. High, severe, and extreme risk levels account for approximately 483 miles (9%), 77 miles (1%), and 22 miles (0.4%), respectively. Approximately 39 miles of pipe miles with unknown risk represent approximately 90% of system force mains which are not addressed in the current library of AMPs.

7. Projected CIP Renewal

Projected CIP renewal costs are based on Capital Improvement Plan (CIP) project recommendations included in each Hazen-developed AMP. Recommended projects include CIP renewal projects developed as part of the AMP and FY2021-32 planned Decade Plan projects for AMP facility assets. Decade Plan budgets are strategically developed to navigate CIP renewal in the near-term and include necessary projects that do not replace or rehab assets (e.g., an evaluation study).

External factors such as inflation, contractor availability, and in-house work which influence asset replacement cost changed over the course of the 2023 CAMP development. Work completed in-house, for example, results in an approximately 2.0 effective raw cost multiplier instead of 3.75 as discussed in **Section 4.6**. Due to multiple factors affecting variability, system-wide projected CIP renewal costs are presented using both established multipliers:

1) Adder cost factor of 2.0 multiplier

2) Adder cost factor of 3.75 multiplier

Decade Plan budgets are included for project categories and facilities not covered by Hazen-developed AMPs and are not adjusted using a multiplier. The FY2022-2031 average annual budget for each included project category was used to estimate Decade Plan budgets for 2032 through 2122. The average annual projected CIP per individual AMP was utilized for years outside of the respective AMP CIP years.

AMP CIP project recommendations using each established multiplier are combined with Decade Plan budgets to represent total projected CIP renewal over a 20-year and 100-year horizon.

7.1 20-year Planning Horizon

Table 7-1 and **Table 7-2** show annual projected CIP costs for each Hazen-developed AMP CIP for 2023 through 2042 using the 2.0 and 3.75 multipliers, respectfully. Water Authority Decade Plan project categories for 2023 through 2042 are included to provide a comprehensive picture of CIP needs. Hazen recommends using a 2.0 multiplier Due to the recent unpredictable nature of inflation, material, and labor costs, cost escalation may result in higher projected CIP costs. **The costs represented are a snapshot in time and should be considered for illustrative purposes only. The Water Authority reviews the numbers annually, and as needed throughout the year, to update the decade plan.**

Table 7-1: 20-year Projected CIP Renewal with 2.0 multiplier (x 1,000)

Hazen AMP Year[1]	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Year #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Wells	$ 5,800	$ 4,000	$ 5,400	$ 2,800	$ 6,000	$ 2,000	$ 2,400	$ 1,800	$ 1,600	$ 2,000	$ 6,800	$ 10,600	$ 9,600	$ 7,800	$ 8,200	$ 7,200	$ 5,600	$ 4,200	$ 3,800	$ 4,400
Lift Station 24 FMs	$ -	$ 20	$ -	$ -	$ 80	$ -	$ 200	$ 400	$ 400	$ 400	$ 400	$ 400	$ 600	$ 600	$ -	$ -	$ -	$ -	$ -	$ -
Raw Water Pipeline	$ -	$ 80	$ -	$ -	$ 200	$ 200	$ -	$ -	$ -	$ -	$ -	$ 3,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Misc. Buildings	$ -	$ -	$ -	$ -	$ 120	$ -	$ 400	$ -	$ -	$ 400	$ 160	$ 400	$ 600	$ 600	$ 1,400	$ 1,400	$ -	$ 200	$ -	$ -
Odor Control Stations	$ 600	$ 400	$ 400	$ 200	$ 200	$ 60	$ 60	$ 60	$ 400	$ 80	$ 80	$ 160	$ 140	$ 400	$ 80	$ 600	$ 200	$ 200	$ 200	$ 200
SAF & WQ Labs	$ 400	$ 200	$ 600	$ 400	$ 400	$ 400	$ 600	$ 600	$ 1,000	$ 600	$ -	$ 1,000	$ 800	$ 800	$ 120	$ 200	$ 600	$ 600	$ 80	$ 400
Pump Stations	$ 1,800	$ 60	$ 600	$ 1,200	$ -	$ -	$ 1,400	$ 1,200	$ 1,200	$ 1,200	$ -	$ 1,200	$ 1,400	$ 1,000	$ 1,400	$ 1,200	$ 1,000	$ 800	$ 4,000	$ 2,400
SWRP	$ 18,400	$ 7,600	$ 6,800	$ 7,600	$ 6,400	$ 6,200	$ 7,400	$ 7,000	$ 7,200	$ 5,600	$ 7,800	$ 8,200	$ 8,200	$ 6,600	$ 8,400	$ 8,000	$ 8,000	$ 7,800	$ 8,000	$ 7,000
SJCWTP	$ 3,600	$ 3,800	$ 4,400	$ 4,400	$ 5,600	$ 6,400	$ 7,000	$ 7,200	$ 7,000	$ 7,400	$ 7,200	$ 7,000	$ 6,000	$ 6,600	$ 6,800	$ 6,400	$ 6,000	$ 6,800	$ 6,800	$ 6,200
Lift & Vacuum Stations	$ 1,800	$ 1,000	$ 800	$ 3,400	$ 2,400	$ 7,200	$ 1,600	$ 600	$ 2,200	$ 1,000	$ 3,400	$ 4,600	$ 9,000	$ 3,400	$ -	$ 160	$ -	$ -	$ -	$ -
ARTFs	$ 1,400	$ 200	$ 100	$ 2,600	$ 5,800	$ 4,000	$ 4,000	$ 400	$ 400	$ 400	$ 400	$ 800	$ 600	$ 400	$ 600	$ 800	$ 800	$ 800	$ 800	$ 800
Total Hazen AMPs	$ 33,800	$ 17,400	$ 19,100	$ 22,600	$ 27,200	$ 26,500	$ 25,100	$ 19,300	$ 21,400	$ 19,100	$ 26,200	$ 37,400	$ 36,900	$ 28,200	$ 27,000	$ 26,000	$ 22,200	$ 21,400	$ 23,700	$ 21,400
Decade Plan Year[1]	2023	2024	2025	2026	2027	2028	2029	2030	2031	*2032	*2033	*2034	*2035	*2036	*2037	*2038	*2039	*2040	*2041	*2042
Decade Plan: 100 - Sewerline Renewal	$ 15,500	$ 23,900	$ 27,600	$ 30,300	$ 27,600	$ 31,600	$ 34,600	$ 48,600	$ 51,600	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400
Decade Plan: 200 - DWater Renewal	$ 6,500	$ 6,200	$ 11,300	$ 11,500	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200
Decade Plan: 719 - Reservoirs Renewal	$ 2,300	$ 1,800	$ 1,900	$ 4,400	$ 5,200	$ 6,100	$ 5,100	$ 4,100	$ 5,200	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Decade Plan: 732 - LV Valve Equip/Repl	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Decade Plan: 901 - Reuse Pipeline Renewal	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Total Other Facilities	$ 24,500	$ 32,100	$ 41,000	$ 46,400	$ 44,200	$ 49,100	$ 51,100	$ 64,100	$ 68,200	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800
GRAND TOTAL	$ 58,300	$ 49,500	$ 60,100	$ 69,000	$ 71,400	$ 75,600	$ 76,200	$ 83,400	$ 89,600	$ 65,900	$ 73,000	$ 84,200	$ 83,700	$ 75,000	$ 73,800	$ 72,800	$ 69,000	$ 68,200	$ 70,500	$ 68,200

*Decade Plan budget estimated as an average of 2023-2031.

Grand Total Average (Years 1-9) $ 70,300

Grand Total Average (Years 1-20) $ 71,900

[1]Total costs greater than 100,0000 have been divided by 1,000 and rounded to nearest 100 place value, less than 100,000 divided by 1,000 and rounded to nearest 10 place value.

Table 7-2: 20-year Projected CIP Renewal with 3.75 multiplier (x 1,000)

Hazen AMP Year[1]	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Year #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Wells	$ 10,800	$ 7,500	$ 10,200	$ 5,200	$ 11,300	$ 3,700	$ 4,600	$ 3,300	$ 3,100	$ 3,700	$ 12,600	$ 20,100	$ 17,900	$ 14,800	$ 15,400	$ 13,400	$ 10,500	$ 7,800	$ 7,300	$ 8,300
Lift Station 24 FMs	$ -	$ 30	$ -	$ -	$ 200	$ -	$ 400	$ 900	$ 900	$ 900	$ 700	$ 700	$ 1,200	$ 1,100	$ -	$ -	$ -	$ -	$ -	$ -
Raw Water Pipeline	$ -	$ 200	$ -	$ -	$ 400	$ 400	$ -	$ -	$ -	$ -	$ -	$ 5,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Misc. Buildings	$ -	$ -	$ -	$ -	$ 200	$ -	$ 600	$ -	$ -	$ 700	$ 300	$ 600	$ 1,000	$ 1,100	$ 2,700	$ 2,700	$ -	$ 500	$ -	$ -
Odor Control Stations	$ 1,000	$ 700	$ 700	$ 400	$ 400	$ 60	$ 60	$ 60	$ 500	$ 100	$ 100	$ 200	$ 300	$ 600	$ 100	$ 1,000	$ 500	$ 500	$ 500	$ 500
SAF & WQ Labs	$ 800	$ 400	$ 1,000	$ 900	$ 800	$ 800	$ 1,300	$ 1,200	$ 1,700	$ 1,000	$ -	$ 1,700	$ 1,500	$ 1,500	$ 200	$ 500	$ 1,200	$ 1,200	$ 200	$ 900
Pump Stations	$ 3,300	$ 100	$ 1,300	$ 2,100	$ -	$ -	$ 2,800	$ 2,200	$ 2,200	$ 2,300	$ -	$ 2,100	$ 2,400	$ 2,000	$ 2,500	$ 2,200	$ 1,800	$ 1,400	$ 7,600	$ 4,600
SWRP	$ 34,500	$ 14,300	$ 12,700	$ 14,400	$ 12,200	$ 11,600	$ 14,100	$ 13,100	$ 13,600	$ 10,300	$ 14,500	$ 15,400	$ 15,500	$ 12,500	$ 15,600	$ 14,900	$ 14,900	$ 14,500	$ 15,000	$ 12,900
SJCWTP	$ 6,700	$ 7,000	$ 8,100	$ 8,400	$ 10,600	$ 12,000	$ 13,200	$ 13,400	$ 13,200	$ 13,800	$ 13,500	$ 13,100	$ 11,100	$ 12,400	$ 12,800	$ 12,100	$ 11,100	$ 12,700	$ 12,700	$ 11,500
Lift & Vacuum Stations	$ 3,400	$ 2,000	$ 1,400	$ 6,400	$ 4,500	$ 13,600	$ 2,900	$ 1,200	$ 4,100	$ 1,700	$ 6,300	$ 8,600	$ 16,800	$ 6,500	$ -	$ 300	$ -	$ -	$ -	$ -
ARTFs	$ 2,400	$ 500	$ 200	$ 5,000	$ 11,000	$ 7,500	$ 7,500	$ 800	$ 600	$ 600	$ 700	$ 1,600	$ 1,200	$ 800	$ 1,200	$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
Total Hazen AMPs	$ 62,900	$ 32,700	$ 35,600	$ 42,800	$ 51,600	$ 49,700	$ 47,500	$ 36,200	$ 39,900	$ 35,100	$ 48,700	$ 69,900	$ 68,900	$ 53,300	$ 50,500	$ 48,600	$ 41,500	$ 40,100	$ 44,800	$ 40,200
Decade Plan Year[1]	2023	2024	2025	2026	2027	2028	2029	2030	2031	*2032	*2033	*2034	*2035	*2036	*2037	*2038	*2039	*2040	*2041	*2042
Decade Plan: 100 - Sewerline Renewal	$ 15,500	$ 23,900	$ 27,600	$ 30,300	$ 27,600	$ 31,600	$ 34,600	$ 48,600	$ 51,600	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400	$ 32,400
Decade Plan: 200 - DWater Renewal	$ 6,500	$ 6,200	$ 11,300	$ 11,500	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 11,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200	$ 10,200
Decade Plan: 719 - Reservoirs Renewal	$ 2,300	$ 1,800	$ 1,900	$ 4,400	$ 5,200	$ 6,100	$ 5,100	$ 4,100	$ 5,200	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000
Decade Plan: 732 - LV Valve Equip/Repl	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Decade Plan: 901 - Reuse Pipeline Renewal	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Total Other Facilities	$ 24,500	$ 32,100	$ 41,000	$ 46,400	$ 44,200	$ 49,100	$ 51,100	$ 64,100	$ 68,200	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800	$ 46,800
GRAND TOTAL	$ 87,400	$ 64,800	$ 76,600	$ 89,200	$ 95,800	$ 98,800	$ 98,600	$ 100,300	$ 108,100	$ 81,900	$ 95,500	$ 116,700	$ 115,700	$ 100,100	$ 97,300	$ 95,400	$ 88,300	$ 86,900	$ 91,600	$ 87,000
*Decade Plan budget estimated as an average of 2023-2031.							Grand Total Average (Years 1-9)		$ 91,100									Grand Total Average (Years 1-20)		$ 93,800

[1]Total costs greater than 100,0000 have been divided by 1,000 and rounded to nearest 100 place value, less than 100,000 divided by 1,000 and rounded to nearest 10 place value.

[2]Odor Control CIP total project costs include a mix of 2.0 and 3.75 multipliers applied to assets for in-house work and contract work, respectively.

Figure 7-1 visually summarizes the data presented in **Table 7-1** and **Table 7-2**. The total projected CIP renewal needs for non-Hazen assessed Decade Plan project categories are shown as the base cost with each of the planning scenarios stacked above. The 20-year average annual projected CIP and Decade Plan budget need is $93.8M with 3.75 multiplier applied and $71.9M with 2.0 multiplier applied.

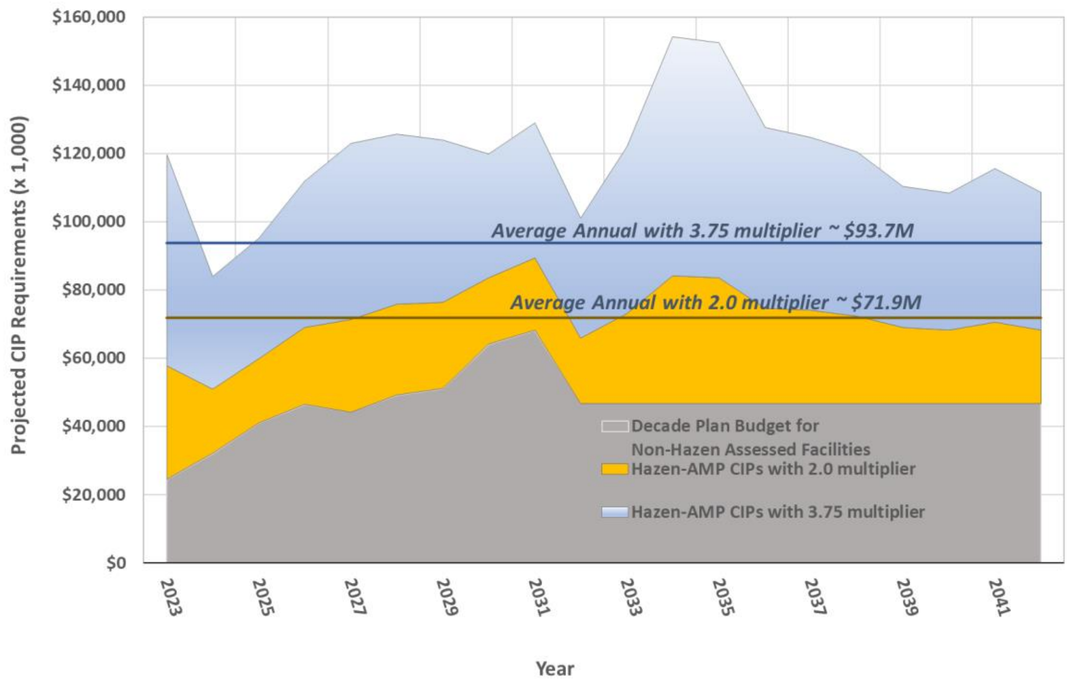

Figure 7-1: 20-year Projected CIP Renewal

7.2 100-year Planning Horizon

Figure 7-2 visually summarizes the tables found in **Appendix F** showing 100-year horizons for both planning scenarios. The total projected CIP renewal needs for non-Hazen assessed Decade Plan project categories are shown as the base cost with each of the adder cost scenarios stacked above. The 100-year average annual projected CIP and Decade Plan budget need is approximately $84.0M with 3.75 multiplier applied and $66.6M with 2.0 multiplier applied.

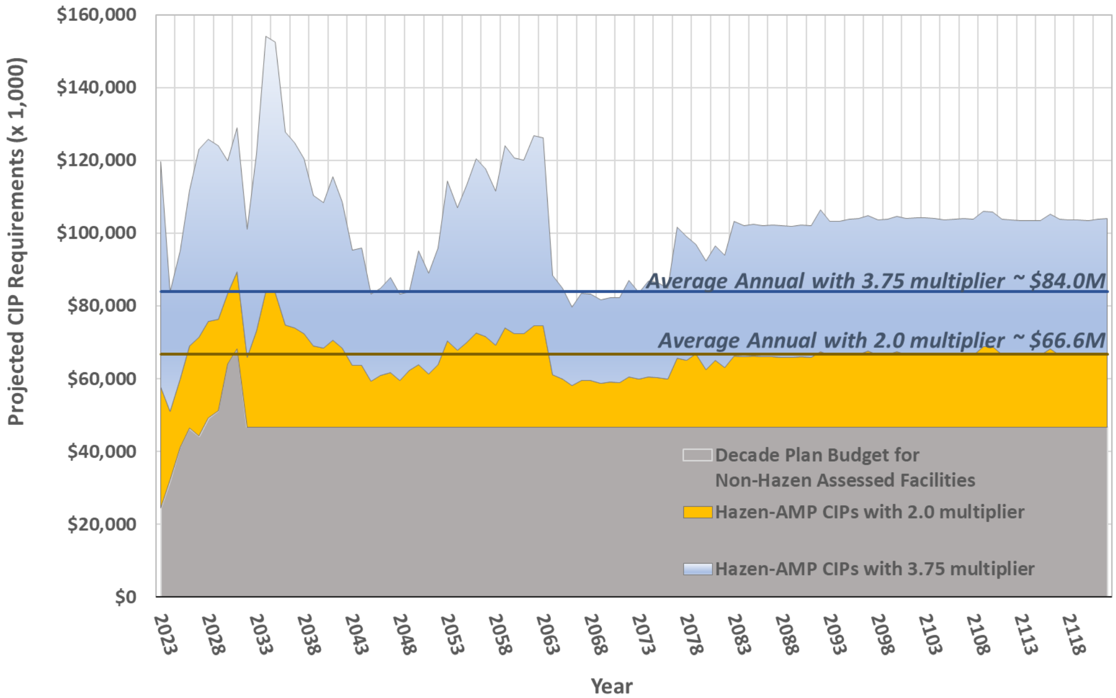

Figure 7-2: 100-year Projected CIP Renewal

8. Long-term Renewal Strategy

Long-term renewal includes continuous asset replacement and rehabilitation throughout the planning horizon. Projections are based on asset replacement costs for all facilities instead of using Decade Plan budgets for facilities not assessed as part of this project. Asset replacement costs and lifecycle logic for facility assets not assessed by Hazen were estimated using previous reports and available asset inventory data provided by the Water Authority.

In general, long-term renewal strategy based on asset data can be comprehensive and informative, and Hazen has provided the Water Authority with asset condition assessments and a useful dashboard tool to be able to project future annual CIP renewal needs, as shown in Figures 7-1 and 7-2 from the previous section. However, a major potential pitfall of projecting long-term spending needs is that the modeling tool strictly depends on modeling results that have specific limitations. These limitations include an inability to account for: 1) how assets are operated and maintained over time; 2) future changes in the economic climate (i.e., availability of materials and labor, runaway inflation and cost escalation); and 3) changes in government regulations that may impact standards and treatment methods, resulting in unanticipated infrastructure investments. As a result, asset cost data accuracy has an amplified effect on long-term projections due to the continuous renewal model. Any inaccuracies are repeated or passed on multiple times over the planning horizon.

Based on the efforts conducted for this CAMP, current asset replacement costs have a high degree of variability with an accuracy range of -20% to 50% on the low side and +30% to +100% on the high side. However, by treating this CAMP as a living document, regularly updating and revising it as needed through improvements in data collection standards and cost data accuracy, factoring in how the Water Authority operates and maintains the assets, and accounting for current and near-term fiscal and regulatory conditions, improved accuracy of long-term projections should be realized over time.

9. Performance Measurement

The performance of the AM Program is quantified through KPIs tracked as part of the Performance Plan. KPIs measure the performance of each Five-Year Goal, as discussed previously in **Section 3.5**. The performance measures shown in **Figure 9-1** are used to benchmark internally and externally long-term continuous improvement.

Figure 9-1: Performance Measures by Goal Area

Water Authority division managers are responsible for their respective goal areas and objectives and for tracking their performance. The Executive Director reviews performance progress with staff, and performance results are communicated to elected officials and customers through the Performance Plan. Performance reporting is integrated into the budget process to drive the allocation of resources and to address performance gaps. The Five-Year Goal Performance Scorecard (**Figure 9-2**) published in the FY23 Performance Plan summarizes the Water Authority's performance progress over the last three fiscal years (FY20, FY21, and FY22). Hazen is currently working with the Water Authority to place the LOS/KPI dashboards currently collected into a dashboard. This should simplify the production of the Water Authority's LOS/KPI dashboards.

Goal	Performance Measure	Baseline	Current	Target
Water Supply & Operations	Drinking Water Compliance Rate	Excellent	Excellent	Excellent
	Distribution System Water Loss	Excellent	Excellent	Excellent
	Water Distribution System Integrity	Good	Good	Good
	Operations and Maintenance Cost Ratios	Excellent	Excellent	Excellent
	Planned Maintenance Ratio	Good	Good	Good
	Water Use per Capita Consumption	Good	Good	Excellent
Wastewater Collection & Operations	Sewer Overflow Rate	Good	Good	Good
	Collection System Integrity	Good	Good	Good
	Wastewater Treatment Effectiveness Rate	Good	Good	Good
	Operations and Maintenance Cost Ratios	Excellent	Excellent	Excellent
	Planned Maintenance Ratio	Good	Good	Good
Customer Services	Customer Service and Technical Quality Complaints	Excellent	Excellent	Excellent
	Customer Service Cost per Account	Good	Good	Good
	Billing Accuracy	Fair	Good	Good
	Call Center Indicators	Good	Excellent	Excellent
	Residential Cost of Water/Sewer Service	Good	Good	Good
	Stakeholder Outreach Index	Excellent	Excellent	Excellent
Business Planning & Management	Debt Ratio	Fair	Fair	Fair
	Return on Assets	Fair	Fair	Good
	System Renewal/Replacement Rate	Fair	Fair	Good
	Triple Bottom Line Index	Good	Good	Good
Organization Development	Employee Health and Safety Severity Rate	Good	Fair	Good
	Training Hours per Employee	Good	Excellent	Excellent
	Customer Accounts per Employee	Excellent	Excellent	Excellent
	Employee Turnover	Excellent	Good	Excellent
	Retirement Eligibility	Excellent	Excellent	Excellent
	Organizational Best Practices Index	Excellent	Excellent	Excellent

Performance Key

Excellent (▲ green) | Good (■ cyan) | Fair (■ yellow) | Poor (▼ red)

Figure 9-2: Five-Year Goal Performance Scorecard (FY20-FY22)

In addition to the annual Performance Plan KPI reporting, the Water Authority is implementing the ABCWUA Digital Dashboard tool as part of the development of the 2023 CAMP.

The Digital Dashboard summary page allows the Water Authority to see the distribution of asset BRE, RUL, and projected long-term costs system-wide, as shown in **Figure 9-3**. The Digital Dashboard includes data-specific tabs for asset details, asset condition (**Figure 9-4**), replacement cost, and long-range renewal. The Digital Dashboard provides real-time performance reporting directly related to the AM Program.

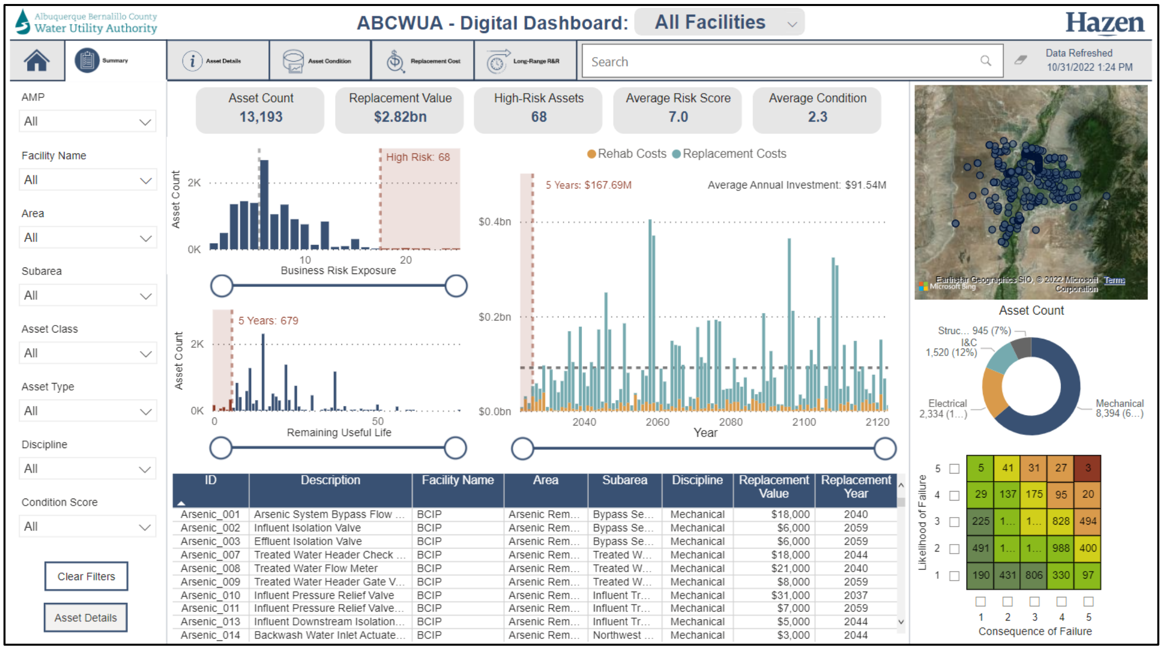

Figure 9-3: ABCWUA Digital Dashboard Summary Page

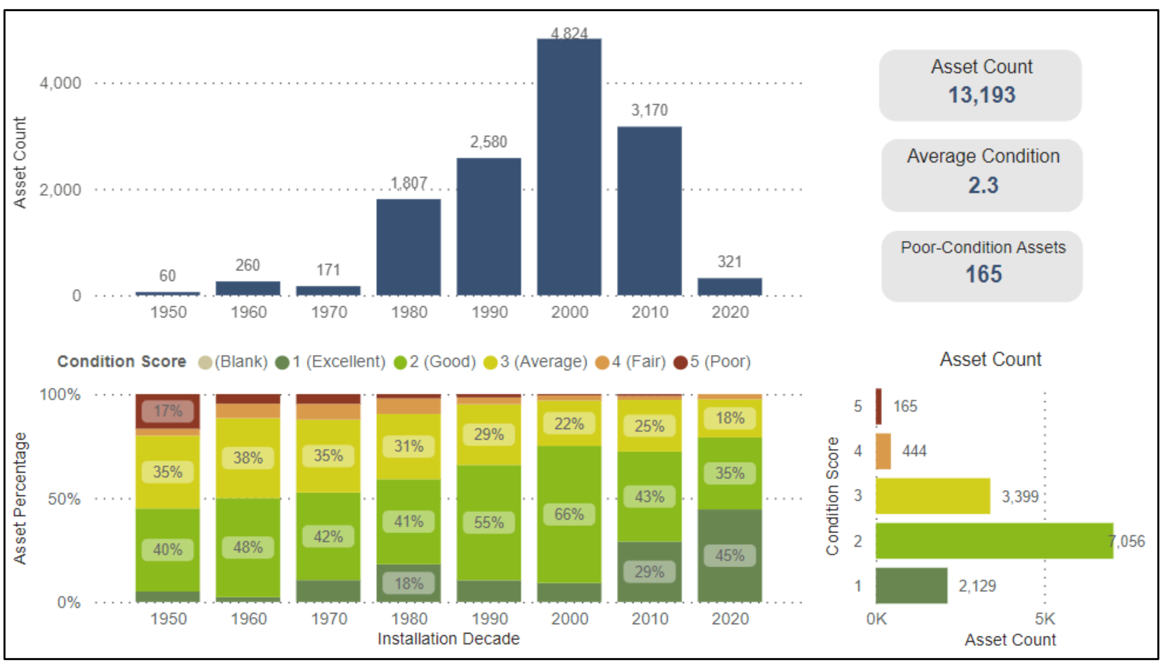

Figure 9-4: ABCWUA Digital Dashboard Asset Condition Page

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