City of Thousand Oaks

Water and Wastewater Asset Management and Financial Plans

FINAL REPORT

September 2013

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Glossary

BS: Acrylonitrile butadiene styrene, pipe material
AC: Asbestos Cement, pipe material
BR: Bronze, pipe material
CI: Cast Iron, pipe material
DI: Ductile Iron, pipe material
HDPE: High-density polyethylene, pipe material
Mixed: Consist of different pipe material
PEP: Polyethylene Pipe
PVC: Polyvinyl chloride, pipe material
RCP: Reinforced Concrete Pipe
RPMP: Reinforced Plastic Mortar Pipe
STL: Steel, pipe material
UNK: Unknown pipe material
VCP: Vitrified Clay Pipe

Executive Summary

ES.1 Purpose

The City of Thousand Oaks Public Works Department (City) is strengthening its asset management practices to foster more efficient financial and physical resource investments to prolong the life of the infrastructure system. As part of this effort, the City began developing integrated asset management and financial plans that provided the basis to understand the current state and future needs, and to develop a financial plan to sustain the delivery of water and wastewater services.

The goal of the integrated plans is to understand the future infrastructure needs and ensure user rates are set to recover the full capital, operations, and maintenance costs of providing water and wastewater services. An asset management plan is a long-range planning document used to provide a rational framework for understanding and planning the asset portfolio. It consolidates the City's asset information into a structured framework and uses it to provide a justifiable basis to support long-term planning and asset management decisions. A financial plan provides the financial framework for the City's operating and capital budgets, impact fees and utility rates.

The City's Asset Management Plan documented the current state (e.g., condition, risk, valuation) of its water and wastewater infrastructure system. It also projected the long-range capital investment required to sustain the delivery of the assets. The City's Water and Wastewater Financial Plans incorporated the results of the Asset Management Plan to provide a financial basis for covering the City's operating and capital budgets, impact fees, and utility rates. The City's objectives for the updates to the financial plan are to provide sufficient funding for ongoing operations and maintenance and capital projects, and to provide excellent water and wastewater services to City customers at the lowest responsible rate.

ES.3 Asset Inventory and Valuation

The City owns and manages over $1.3 billion worth of water and wastewater assets. The City's overall asset inventory is summarized in Table ES-1 and Table ES-2.

Table ES-1 Asset Inventory – Water Infrastructure System

Asset Group	Facilities	Number of Assets	Total Length
Water Linear Asset Group			
Water Mains		6,137	220.1 miles
Fire Laterals		1,952	9.0 miles
Hydrants		1,965	
Meters		16,997	
Valves		4,685	
Appurtenances		213	
Water Network Facilities			
Reservoirs	16	396	
Pump Stations	15	443	
Pressure Reducing Stations	13	86	
Wells	2	10	
Water Fleet (including portable equipment)		22	
Total	**46**	**32,906**	**229.2 miles**

Table ES-2 Asset Inventory – Wastewater Infrastructure System

Asset Group	Facilities	Number of Assets	Total Length
Wastewater Linear Asset Group			
Force Mains		58	2.4 miles
Gravity Pipes		9,220	406.3 miles
Casings		568	15.8 miles
Manholes		7,957	
Access Structures		8	
Cleanouts		683	
Control Valves		11	
System Valves		27	
Wastewater Network Facilities			
Lift Stations	2	53	
Canyon Structures	5	39	
Hill Canyon Treatment Plant	1	953	
Wastewater Fleet (including portable equipment)		86	
Total	**8**	**18,618**	**424.5 miles**

Complete list of the City's water and wastewater infrastructure systems assets is provided in the accompanying excel spreadsheets described in Appendix A.

Table ES-3 summarizes the valuation of the City's water and wastewater infrastructure systems by asset groups. The estimated total replacement cost of the City's water and wastewater systems is $1.3 billion. This value is represented in 2013 dollars. At a high level, the total estimated value of the wastewater infrastructure system is $823 million (63% of the total valuation). Similarly, the estimated value of the water infrastructure system is $489 million (37% of the total valuation).

Table ES-3 Water and Wastewater Systems Asset Valuation

Facility Name		Asset Valuation	
Water Infrastructure System:			
	Water Linear Asset Group	$347,204,143	
	Water Network Facilities	$140,559,156	
	Water Fleet	$852,584	
	Subtotal Water Infrastructure System		$488,615,883
Wastewater Infrastructure System:			
	Wastewater Linear Asset Group	$690,843,470	
	Wastewater Network Facilities	$5,761,055	
	Wastewater Fleet	$2,969,382	
	Hill Canyon Treatment Plant	$137,153,000	
	Subtotal Wastewater Infrastructure System		$836,726,907
		Total	**$1,325,342,790**

ES.3 Risk Assessment

Risk assessment for the City's water and wastewater infrastructure system assets were quantified using Business Risk Exposure (BRE) methodology. BRE is comprised of three major components: probability of failure, consequence of failure, and redundancy. The probability of failure quantifies the asset's likelihood of or timing to failure. The consequence of failure measures the direct and indirect impacts of an asset failure. Redundancy, the presence of backup equipment, helps to decrease the overall risks of a failure when available.

BRE assessment was performed for all City water and wastewater assets. BRE was used to help differentiate and prioritize assets. Limited resources need to be allocated to assets with high BRE scores (high risk). High risk assets are defined as those that have the potential to fail soon and have a high impact upon the asset failure.

Tables ES-4 and ES-5 summarize the BRE analysis results of the City's water and wastewater infrastructure systems.

Table ES-4 BRE Summary – Water and Wastewater Pipes

Asset Group	Risk level by Total Length (miles)		
	Low Risk	Medium Risk	High Risk
Water mains and fire laterals	91% (208 miles)	9% (21 miles)	-
Wastewater force mains, gravity and pipe casings	98% (417 miles)	2% (8 miles)	-
Total (%)	96% (625 miles)	4% (29 miles)	

Out of 229 miles of water mains and fire laterals, only 9% (21 miles) are identified as medium risk. No assets were identified as being high risk. Similar trend applies for wastewater force mains and gravity and pipe casings. Out of 425 miles, only 2% or 8 miles are identified as medium risk, and no wastewater assets were identified as high risk.

Table ES-5 BRE Summary – Water and Wastewater Facilities

Asset Group	Risk level by Asset Count		
	Low Risk	Medium Risk	High Risk
Water Network Facilities	40%	46%	14%
Wastewater Network Facilities	49%	43%	8%
Hill Canyon Treatment Plant	79%	13%	8%
Total (%)	59%	30%	11%

Out of 1,980 assets located in 54 facilities, 215 assets (11%) are identified as being high risk. Notable high risk assets include all pumping units at Erbes Pump Stations, chemical pumps in the disinfection system, electrical assets in the tertiary filtration system at Hill Canyon Treatment Plant, and 8" and 10" valves at Road Runner Pressure Reducing Stations.

ES.4 Long-Range Investment Needs Projection

It is projected that, on average, the City will need to invest approximately $9.86 million per year to fully fund the rehabilitation and replacement requirements for the next 100 years (Figure ES-1). The different color bars in the figures represent the various asset groups.

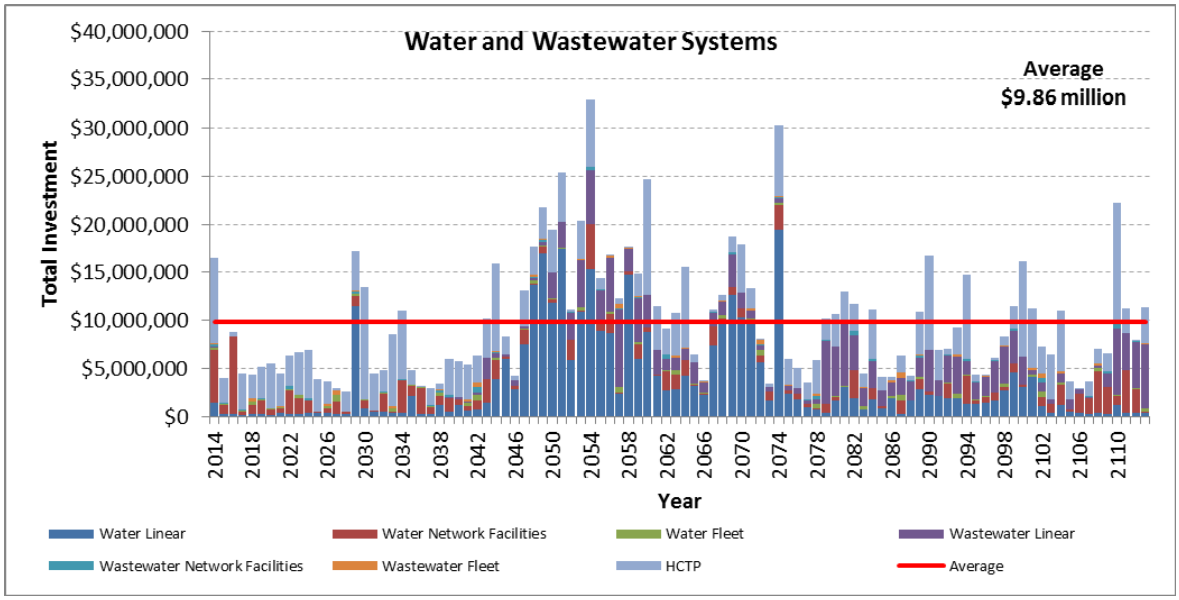

Figure ES-1 Long-Range Investment Needs Projection – Water and Wastewater Infrastructure System

However, the annual average will change depending on the planning horizon. Table ES-6 shows the fluctuation of annual average needs by planning horizon. The 10-year and 25-year planning horizons have significantly lower averages when compared to the 100-year annual average. This is due to the relatively young age of the City's water and wastewater infrastructure systems. Within the next 50 years, however, a majority of the City's assets are due for rehabilitation or replacement, causing the annual average to increase above $10 million.

Table ES-6 Annual Average by Planning Horizon

Planning Horizon	Annual Average
10 years (2014-2023)	$6.62 million
25 years (2014-2038)	$6.39 million
50 years (2014-2063)	$10.31 million
100 years (2014-2113)	$9.86 million

More than $16 million is projected to be needed for the first year (2014). The largest portion of this spike is contributed by Hill Canyon Treatment Plant assets. The treatment process related assets within the treatment plant generally have a shorter useful life than linear assets in the distribution or collection systems. A detailed condition assessment is recommended to understand the true renewal need for these assets. Depending on the condition assessments results, the actual useful life of these assets can probably be extended with lower cost options.

ES.5 Key Components of Asset Management Plan

Detailed assessment and analysis results of the City's water and wastewater asset management plan are provided in the main body of this report:

Chapter 1: Introduction defines the asset management plan and explains the purpose of developing the plan. It also introduces the City and its asset management structure.

Chapter 2: Assets Owned and Managed provides information on the state of the assets. It identifies the assets owned, their current statuses, and their replacement costs.

Chapter 3: Asset Management Practices outlines the plans for managing the assets (management strategies), including useful lives, renewal timing, condition trigger, and estimated renewal costs.

Chapter 4: Future Demand identifies factors influencing future demand or regulatory requirements, anticipated changes in customer expectations, and impact of changes in demand on asset utilization.

Chapter 5: Performance Measurement documents the current and future levels of service based on Triple Bottom Line (Environmental, Economic, and Social) factors.

Chapter 6: Business Risk Exposure assesses and visually presents the risks presented by the City assets.

Chapter 7: Financial Summary presents the 100-year renewal (rehabilitation and replacement) funding requirements for the City.

Chapter 8: Improvement Plan documents the confidence level ratings for the data and processes used to create the asset management plan. It also documents the improvement steps required to increase the confidence level of the asset management plan.

References & Appendices include any reference documents necessary to support the asset management plan.

The City's Asset Management Plan is a living document. It should be periodically updated and continually refined as part of an ongoing asset management and business improvement process.

1. Introduction

The City of Thousand Oaks Public Works Department (City) is strengthening its asset management program to ensure sustainable delivery of its water and wastewater services. As part of this effort, the City embarked on development of an integrated, long-term asset management and financial plan that provides the basis for operating and maintaining reliable water and wastewater systems at an acceptable level of risk, with effective financial management strategies that provide the desired levels of service to the City's customers. The goal of the integrated plan is to ensure user rates are set to recover the full capital, operations, and maintenance costs of providing water and wastewater services. The plans will provide the financial framework for the City's operating and capital budgets, impact fees, and utility rates. The City's objectives for the updates to the financial plans are to provide sufficient funding for ongoing operations and maintenance and capital projects, and to provide excellent water and wastewater services to City customers at the lowest responsible rate.

The City contracted GHD Inc. (GHD) and Raftelis Financial Consultants (Raftelis) to help develop the integrated plan. GHD took the lead in development of the asset management plan. Raftelis incorporated the outputs of the asset management plan to develop the financial plan. This report focuses on the asset management plan development.

1.1 Asset Management Plan

An asset management plan is a long-range planning document used to provide a rational framework for understanding and documenting the assets the City owns, service levels it provides, risks it faces, and financial investments it requires. The asset management plan helps to answer the following five fundamental questions of asset management:

1. *What is the current state of the assets?*
2. *What is the required sustained level of service?*
3. *Which assets are critical to sustained performance?*
4. *What are the best O&M and CIP investment strategies?*
5. *What is the best long-term funding strategy?*

An asset management plan consolidates and documents information currently available for infrastructure assets and service delivery programs. Using this information, an asset management plan documents the current state of assets and projects the future needs to sustain the delivery of services.

The City's asset management plan is developed around the five fundamental questions of asset management presented above. Figure 1-1 below presents the fundamental 10-step process used to develop the asset management plan with respect to the five core questions of asset management.

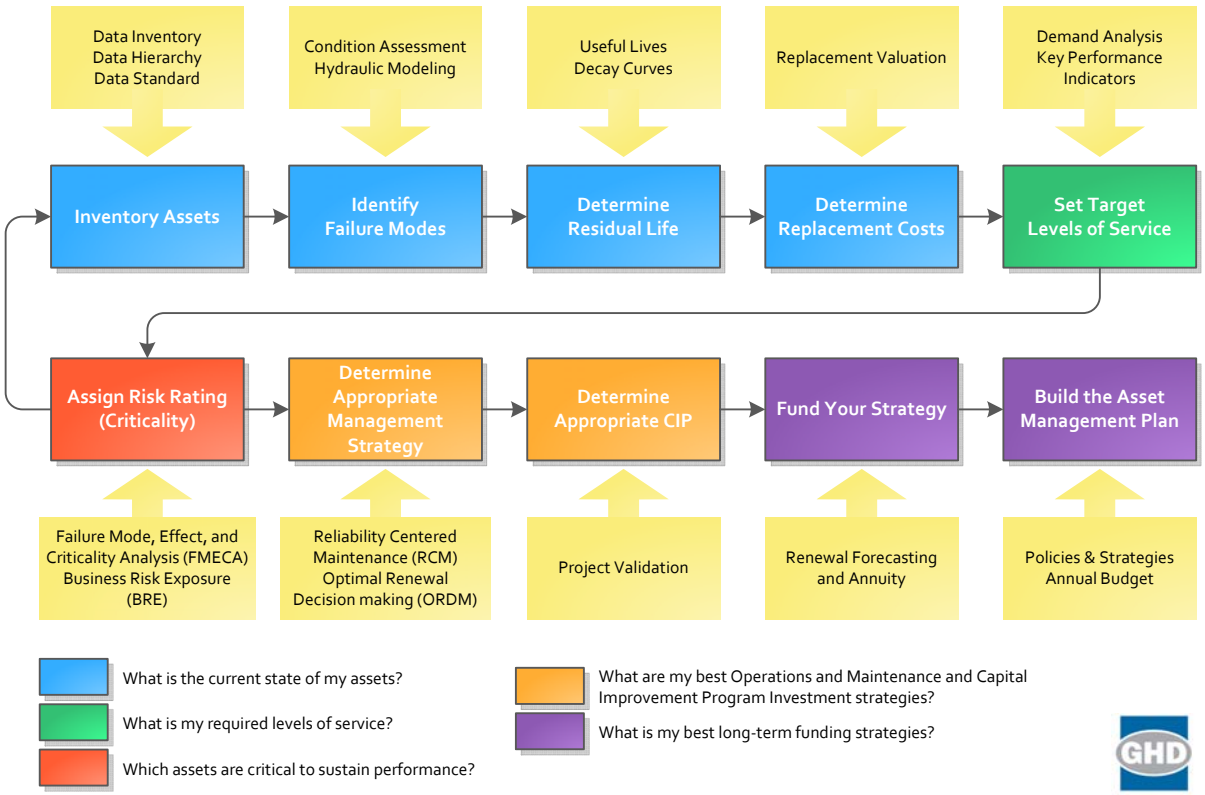

Figure 1-1 Fundamental Processes for Asset Management Plan Development

An outline and brief description of each chapter of the City's asset management plan is presented below.

Chapter 1: Introduction defines the asset management plan and explains the purpose of developing the plan. It also introduces the City and its asset management structure.

Chapter 2: Assets Owned and Managed provides information on the state of the assets. It identifies the assets owned, their current statuses, and their replacement costs.

Chapter 3: Asset Management Practices outlines the plans for managing the assets (management strategies), including useful lives, renewal timing, condition trigger, and estimated renewal costs.

Chapter 4: Future Demand identifies factors influencing future demand or regulatory requirements, anticipated changes in customer expectations, and impact of changes in demand on asset utilization.

Chapter 5: Performance Measurement documents the current and future levels of service based on Triple Bottom Line (Environmental, Economic, and Social) factors.

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Chapter 8: Improvement Plan documents the confidence level ratings for the data and processes used to create the asset management plan. It also documents the improvement steps required to increase the confidence level of the asset management plan.

References & Appendices include any reference documents necessary to support the asset management plan.

An asset management plan is intended to become a living document. It should be periodically updated and continually refined as part of an ongoing asset management and business improvement process.

1.2 City of Thousand Oaks Public Works Department

The City of Thousand Oaks is located in eastern Ventura County and consists of 56 square miles. The City population is approximately 128,000. The City is a general law city operating under the Council/Manager form of government. The City Council is comprised of five members elected at large for overlapping terms, with one member serving as Mayor on an annual basis.

The City of Thousand Oaks is one of four water purveyors and one of two wastewater purveyors serving residences and businesses in the Conejo Valley. The City-operated utilities are public enterprises administered by the Public Works Department. The City serves approximately 16,900 potable water customers and 37,600 wastewater customers. The water system is reliant on imported water from the Calleguas Municipal Water District for its potable water supply. Potable water is delivered through 10 turnouts throughout the water system and dispersed into 19 service area zones via gravity, pump stations, and pressure reducing stations. The City's wastewater collection system consists of 382 miles of sanitary sewer ranging in size from 6 inches to 48 inches in diameter. The oldest sewers in the system date back to 1958.

The City's service area is shown in Figure 1-2. The City is responsible for all publicly-owned water and wastewater distribution, collection, and facilities assets.

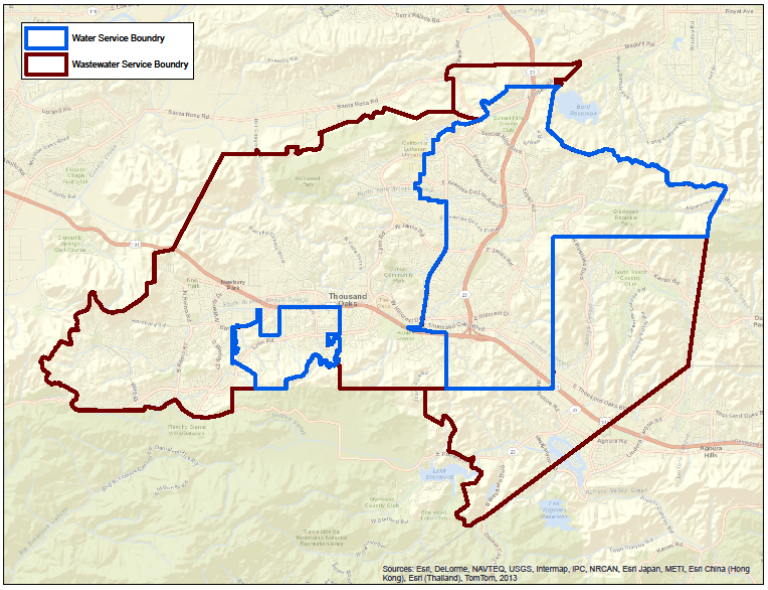


Figure 1-2 City of Thousand Oaks Service Area

The Water Division is responsible for the operation and maintenance of the City's water storage and distribution system. The Water Division operates and maintains two hydraulically independent water distribution systems, Newbury Park and the main Thousand Oaks area. This includes the operation

of 16 reservoir storage facilities, 15 pump stations, 13 pressure reducing stations, and 2 groundwater wells. It is one of three water purveyors in the City of Thousand Oaks. It provides water service to a population of approximately 50,000 customers, or 40% of the total City of Thousand Oaks population, within approximately 12,000 acres. The City also provides water service to a couple small areas of unincorporated Ventura County, such as the Rolling Oaks Service Area and the Ventu Park Service Area.

The Wastewater Division provides a safe and reliable wastewater collection system for the residents of Thousand Oaks. They maintain over 400 miles of wastewater collection pipes and 7,900 manholes. The wastewater service area boundaries mainly coincide with the City boundary, with exclusion of some areas at the south-eastern part of the City that are served by Triunfo Sanitation District.

1.2.1 Organization

The City's Public Works organization structure is shown in Figure 1-3. At the strategic level, the Public Works Director will operate, maintain, and manage the assets required to achieve the strategic goals. At the tactical level, the Public Works Department recognized that the Municipal Service Center Superintendent and Wastewater Treatment Plant Superintendent will be the ones leading the asset management implementation.

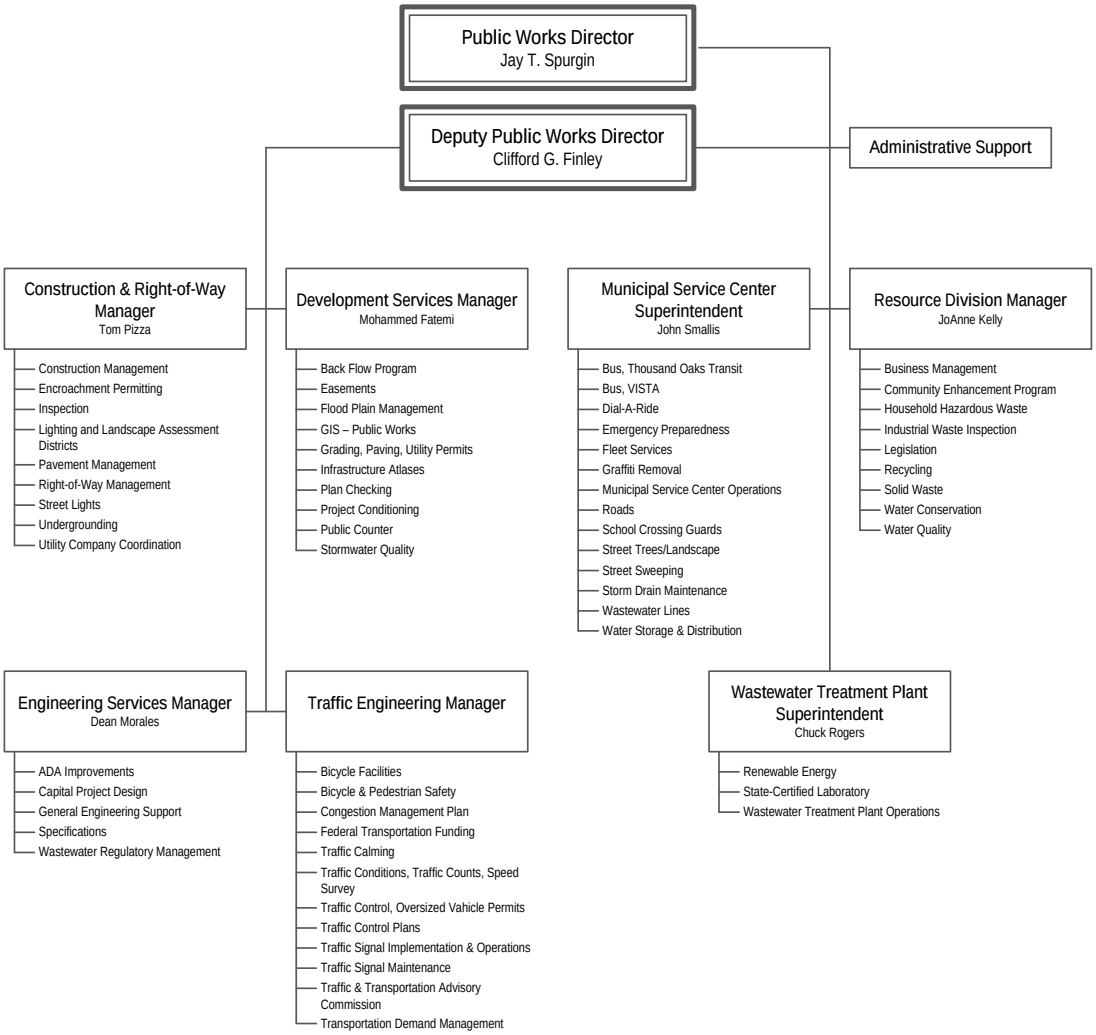


Figure 1-3 Public Works Organization Structure

Along with the asset management organization structure, the City established an asset management strategic framework that clearly identifies the mission, goals, and objectives. It also links the levels of service to the strategic framework to initiate performance measurement. The details of the strategic framework and performance measurements are presented in Chapter 5.

2. Assets Owned and Managed

This chapter provides a snapshot of the current state of the City's assets. It documents the assets owned and managed, asset installation and consumption profiles, and asset valuation. The information presented in this chapter combined with the management strategies (Chapter 3) provides the foundation for the long-range replacement and rehabilitation (renewal) projections (Chapter 7).

2.1 Asset Register

An asset register is a central database that records all of the capital assets owned and managed by the City. Using a unique asset identification number (Asset ID), the asset register establishes a relationship with supporting asset management information systems (e.g., CMMS, GIS, and CIS). A structured hierarchy enables the City to effectively organize and track assets at different levels of the hierarchy.

An asset register has numerous key components. Among them, the ones that significantly influence the asset management plan are the following:

- Asset Definition – provides a formal asset definition to identify which assets should or should not be included in the asset register.
- Asset Hierarchy – organizes the assets based on location, functionality, and classification to facilitate tracking of asset inventory, condition, and cost.
- Asset Classification – groups like assets to facilitate more efficient management of assets.

These key components work to filter, organize, and manage the assets in the asset register.

2.1.1 Asset Definition

An asset definition was established for the asset management plan. To be considered an asset, it must meet at least one of the following criteria:

- Has a value greater than $5000.
- Has a useful life greater than one year.
- Will be the lowest level where a work order is generated.
- Is critical to the delivery of process, compliance of regulatory standards, and/or provision of staff safety.

Thousands of assets were filtered based on the above criteria. The criteria helped to distinguish an asset versus a component. Only those that fulfill the requirements were captured in the asset register.

2.1.2 Asset Hierarchy

An asset hierarchy helps to efficiently and effectively organize thousands of assets in the asset register. It provides a parent-child relationship between assets and allows information (i.e., cost, asset valuation) to be presented at all levels of the hierarchy. The City's asset hierarchy framework is presented in Figure 2-1 below. At the higher level, the City's assets are grouped into Water Network, Wastewater Network, and Fleet. Water Network is further classified into Linear Assets

(e.g., pipes, hydrants, valves) and Facility Assets (i.e., reservoir, pump stations, pressure reducing stations, and wells). Similarly, Wastewater Network is classified into Linear Assets (e.g., pipes, manholes), Facility Assets (i.e., lift stations, canyon structures), and Treatment Plant (i.e., Hill Canyon Treatment Plant).

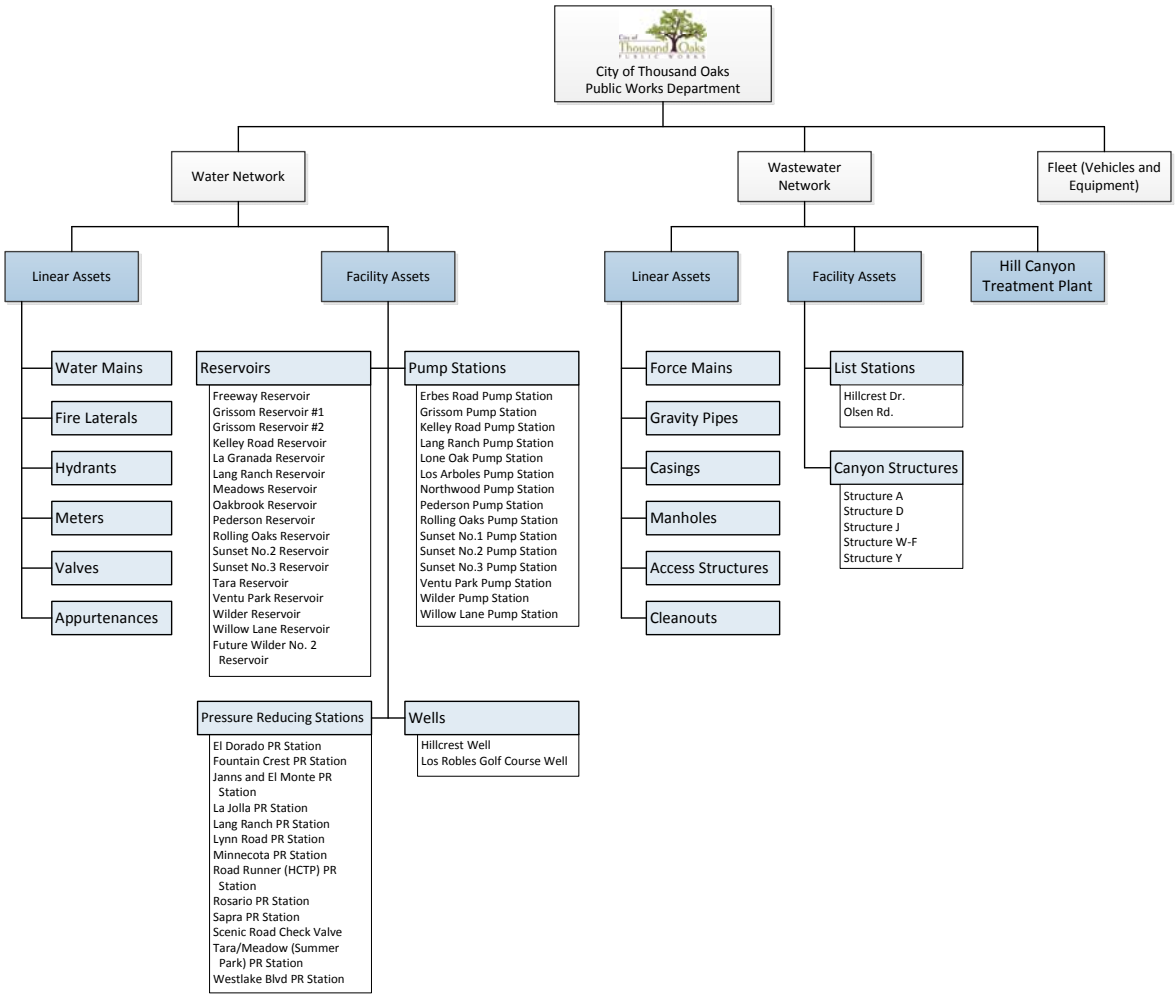


Figure 2-1 City of Thousand Oaks Water and Wastewater Asset Hierarchy

2.1.3 Asset Classification

Assets are categorized into asset types and asset classes. Four asset types were developed to categorize the City's water and wastewater assets:

1. Water Linear – water mains, fire laterals, hydrants, valves, meters
2. Water Network Facilities (Vertical) – reservoirs, pump stations, pressure reducing stations
3. Wastewater Linear – force mains, gravity pipes, manholes, cleanouts
4. Wastewater Network Facilities (Vertical) – lift stations, canyon structures
5. Treatment Plant – Hill Canyon Treatment Plant

In order to more efficiently model similar assets, an asset class is assigned. An asset class refers to a group of assets that behave in a similar manner (e.g., useful life, function, type, value). Because there are thousands of assets in the asset register, grouping and managing them with respect to asset classes greatly eases the modeling of asset lifecycle behavior. Every asset in the asset register belongs to an asset class. Additionally, required asset attributes (HP, GPM, gallons, tons, KVA, etc.) are determined by the asset's class. Chapter 3 will provide more information about the management strategies used in the renewal forecasting process. Table 2-1 summarizes the City's asset classes. These classes are created in consultation with the members of the City's management and engineering staff. Management strategies (e.g., useful life, decay pattern condition limit, refurbishments) are developed at the asset class level to help define and project the lifecycle behavior of each asset.

Table 2-1 The City's Asset Classes

Linear Asset Class	Network Facility Asset Class	Treatment Plant Asset Class
Water Main - AC	Reservoirs - concrete	Bar screen
Water Main – Metal (DI, CI)	Reservoirs - steel	Blowers
Water Main - PVC	Electrical panel (transformers, circuit breakers, switchboard, etc.)	Boilers
Fire Lateral - AC	Control (MCC, SCADA)	Heat exchangers
Fire Lateral – Metal (DI, CI)	Pumps - large (>=25 HP)	Belt press
Fire Lateral - PVC	Pumps - small (<25 HP)	Conveyor
Force main-ACP	Motor - diesel	Chlorine contact chambers
Force main-ACP, Lined	Motors - large (25HP)	Clarifier drive (Primary, secondary)
Force main-Metal	Motors - small (<25 HP)	Scum skimmer
Force main-Plastic (PVC, HDPE)	Vault	Digester
Force main-Concrete	Valves - large (>=6")	Mixers
Gravity Pipe-Clay	Valves - small (<6")	Filters
Gravity Pipe-Concrete	Tanks	Electrical service (transformers, circuit breakers, switchboard, etc.)
Gravity Pipe-Metal	Meters	Motor Control Center (MCC)
Gravity Pipe-Mixed	Piping	Variable Frequency Drive (VFD)
Gravity Pipe-Plastic	Fittings (couplings, reducers, etc.)	Instruments and controls (sensors)
Gravity Pipe-Lined	Compressors	SCADA hardware
Casing-Metal	Non-office structures and improvements (Pump/Lift station structure, storage strcture, etc.)	SCADA network (fiber optics, etc)

Linear Asset Class	Network Facility Asset Class	Treatment Plant Asset Class
Casing-Concrete	Site improvements (fencing, landscaping)	SCADA software
Manhole	Pavement - asphalt	Valves (Discharge valves, check valves, suction valves, etc.)
Manhole-Lined	Access road	Valve actuators
Access Structure	Security (CCTV, lighting)	Valve and actuators set
Clean-Out	Other (signage, etc.)	Gates
System Valve	Gauge	Pumps - large (>=25 HP)
System Valve-4" and Less		Pumps - small
Fire Hydrant		Pumps - sump
Water Meter - 1" and below		Pumps - chemical
Water Meter - 2" and above		Pumps - fuel
Water Valves -3" and below		Natural gas compressor
Water Valves - 6" and above		Motors - large (>=25HP)
		Motors - small
		Mechanical - other
		Chemical storage tanks
		Fueling tank
		Meters
		HVAC (air handling unit, etc)
		Chillers
		Piping
		Equipment (overhead crane, etc)
		Generators
		Compressors
		Process structures (basins)
		Outfall
		Office-type buildings and improvements (admin offices, etc.)
		Non-office structures and improvements (Pump/Lift station structure, storage structure, etc.)
		Storage (metal)
		Carport (roof structure)
		Site improvements (fencing, landscaping)
		Pavement - concrete
		Pavement - asphalt
		Security (CCTV)
		Laboratory equipment
		Lighting
		Programmable Logic Control (PLC)

2.1.4 Asset Inventory

This section summarizes the assets owned and managed by the City. The asset register was initially populated with asset information from various data sources (e.g., GIS, CMMS). Linear asset (e.g., pipes, manholes, cleanouts, hydrants, and valves) data were extracted from the GIS, while equipment data (Hill Canyon Treatment Plant) were obtained from the CMMS, and meter data were available from the City's financial system. To further supplement the initial asset data, site visits were performed to collect and/or verify the asset data. Site visits were made for all reservoirs, pump stations, pressure reducing stations, lift stations, wells, and the Hill Canyon Treatment Plant. Additionally, staff knowledge was collected to identify capital and maintenance activities.

Water Linear

Water linear assets included water mains, fire laterals, hydrants, meters, valves, and appurtenances. These assets summed to more than 31,000 assets. Any assets identified as abandoned, removed, and/or not owned by the city were excluded. Table 2-2 provides a summary list of water linear assets.

Table 2-2 Water Linear Asset Inventory

Asset Class	Asset Count	Total Length
Water Mains	6,137	220.11 miles
Fire Lateral	1,952	9.04 miles
Hydrant	1,965	
Meter	16,997	
Valve	4,685	
Appurtenance	213	
Total	31,949	229.15 miles

Table 2-3 provides a detailed look at the water mains and fire laterals. There are more than 8,000 pipe segments totaling a length of 229 miles (1,209,920 ft). The summary shows that the City pipes are dominated by asbestos cement (70%) and Polyvinyl Chloride (23%). They make up 212 miles of the 229 total miles of pipe. Additionally, the most common pipe diameter is 8 inches (41%), followed by 6 inches (34%). For the purpose of lifecycle modeling, pipe materials that are unknown were assumed to be the most common pipe material, asbestos cement.

Table 2-3 Water Distribution Pipe Summary

Diameter (in)	Pipe Length by Material (ft)							Total		
	AC	BR	CI	DI	PVC	STL	UNK*	(ft)	(mi)	(%)
2	35	33		10			119	197	0.04	<1%
3	853			30		14		901	0.17	<1%
4	20,421			262	434	397	11	21,525	4.08	2%
6	380,276		54	193	23,465	2,345	2,722	409,054	77.47	34%
8	294,219		13	573	192,120	6,403	7,114	500,442	94.78	41%
10	77,284			307	27,758	8,535	3,308	117,192	22.20	10%
12	53,806			26	34,011	20,286	6	108,134	20.48	9%
14	2,939				1,356	12,560		16,855	3.19	1%
16	12,076					13,050		25,127	4.76	2%
18	12					8,087		8,099	1.53	1%
20	1,668					450		2,118	0.40	<1%
24						277		277	0.05	<1%
Total (ft)	843,591	33	67	1,404	279,144	72,402	13,279	1,209,920	229.15	100%
Total (mi)	159.77	0.01	0.01	0.27	52.87	13.71	2.51	229.15	229.15	100%
Total (%)	70%	0%	0%	0%	23%	6%	1%	100%	100%	

Water Network Facilities

Table 2-4 summarizes the vertical water assets owned and managed by the City. There are total of 935 assets spread over 16 reservoirs, 15 pump stations, 13 pressure reducing stations, and 2 well sites. A listing of the assets at each site can be found in the asset register.

Table 2-4 Water Network Facilities Asset Inventory

Facility Name		Asset Count
Reservoirs:		
	Freeway Reservoir	53
	Grissom Reservoir #1	14
	Grissom Reservoir #2	8
	Kelley Road Reservoir	20
	La Granada Reservoir	35
	Lang Ranch Reservoir	32
	Meadows Reservoir	18
	Oakbrook Reservoir	32
	Pederson Reservoir	20
	Rolling Oaks Reservoir	25
	Sunset No.2 Reservoir	21
	Sunset No.3 Reservoir	21
	Tara Reservoir	22
	Ventu Park Reservoir	23
	Wilder Reservoir	24
	Willow Lane Reservoir	27
	(Future) Wilder No. 2 Reservoir	1
Pump Stations:		
	Erbes Road Pump Station	39
	Grissom Pump Station	31
	Kelley Road Pump Station	47
	Lang Ranch Pump Station	22
	Lone Oak Pump Station	45
	Los Arboles Pump Station	24
	Northwood Pump Station	23
	Pederson Pump Station	22
	Rolling Oaks Pump Station	24
	Sunset No.1 Pump Station	36
	Sunset No.2 Pump Station	23
	Sunset No.3 Pump Station	34
	Ventu Park Pump Station	28
	Wilder Pump Station	22
	Willow Lane Pump Station	23
Pressure Reducing Stations:		
	El Dorado PR Station	8
	Fountain Crest PR Station	5
	Janns and El Monte PR Station	4

Facility Name		Asset Count
	La Jolla PR Station	4
	Lang Ranch PR Station	8
	Lynn Road PR Station	4
	Minnecota PR Station	24
	Road Runner (HCTP) PR Station	3
	Rosario PR Station	8
	Sapra PR Station	3
	Scenic Road Check Valve	3
	Tara/Meadow (Summer Park) PR Station	4
	Westlake Blvd PR Station	8
Wells:		
	Hillcrest Well	4
	Los Robles Golf Course Well	6
	Total	935

Wastewater Linear

The linear wastewater assets include pipes (force main and gravity), manholes, access structures, cleanouts, and valves. Assets identified as privately-owned or abandoned were excluded from the asset register. Table 2-5 summarizes the linear wastewater assets. The City has more than 400 miles of wastewater pipes (force mains and gravity) and over 8,600 manholes, access structures, and cleanouts.

Table 2-5 Wastewater Linear Asset Inventory

Asset Class	Asset Count	Total Length
Force Mains	58	2.44 miles
Gravity Pipes	9,220	406.28 miles
Casings	568	15.77 miles
Manholes	7,957	
Access Structures	8	
Cleanouts	683	
Control Valves	11	
System Valves	27	
Total	18,532	424.49 miles

More detailed assessment of the gravity pipes is provided in Table 2-6. In total, the City is responsible for 406 miles (2,145,175 ft) of gravity pipes throughout its service area. The most common materials are VCP (42%) and PVC (25%). The most common pipe size was 8 inches; they made up 81% of the overall wastewater pipes.

Table 2-6 Wastewater Pipe Summary

Pipe Diameter (in)	Pipe Length by Material (ft)																	Total		
	ABS	AC	ACwPVC	CI	DI	FPM	HDPE	Mixed	PEP	PVC	RCP	RPMP	STL	URCP	VCP	VCP/ACP	VCP/PVC	(ft)	(mi)	(%)
4		326								1,145					577			2,049	0.39	<1%
6	17	24,871								1,823	10			20	33,905	948		61,595	11.67	3%
8	101,386	429,727	1,153	587	792		207	5,606	373	465,140	20	469	1,184	30	711,001	12,900	11,380	1,741,942	329.91	81%
10	537	32,295			528			111		25,213					45,145	779	300	104,909	19.87	5%
12	2,191	7,305			1,280					18,580		979		235	48,274		154	78,998	14.96	4%
14															15			15	0.00	<1%
15		5,798								5,472				1,136	24,643			37,048	7.02	2%
16		1,061					471			3,708					832			6,072	1.15	<1%
18		16,318			2,119		203			3,016		4,648		1,482	11,905	1,085		40,775	7.72	2%
20		4,234			956													5,190	0.98	<1%
21		9,942									1,157				9,675			20,774	3.93	<1%
24		2,362			24		1,390	205		4,166	105	3,327			2,356			13,935	2.64	<1%
27															1,815			1,815	0.34	<1%
30					3,898	3,583	86			3,139	3,769				2,435			16,911	3.20	<1%
33		3,222													1,388			4,610	0.87	<1%
36					118	1,006												1,124	0.21	<1%
42					5,861													5,861	1.11	<1%
48						1,541												1,541	0.29	<1%
Total (ft)	104,131	537,460	1,153	587	15,578	6,130	2,357	5,922	373	531,390	5,062	9,423	1,184	2,903	893,965	15,711	11,835	2,145,175	406.28	100%
Total (mi)	19.72	101.79	0.22	0.11	2.95	1.16	0.45	1.12	0.07	100.64	0.96	1.78	0.22	0.55	169.31	2.98	2.24	406.28	406.28	100%
Total (%)	5%	25%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	25%	<1%	<1%	<1%	<1%	42%	<1%	<1%			

Wastewater Network Facilities

The vertical wastewater assets include 53 lift stations and 39 canyon structures. Table 2-7 provides a high level summary of vertical wastewater assets owned and managed by the City.

Table 2-7 Wastewater Network Facilities Asset Inventory

Facility Name		Asset Count
Lift Stations:		
	Hillcrest Drive	22
	Olsen Road	31
Canyon Structures:		
	Structure A	7
	Structure D	16
	Structure J	4
	Structure W-F	9
	Structure Y	3
	Total	92

Water Network Facilities

Table 2-8 shows the summary of assets in the Hill Canyon Treatment Plant by treatment process. There are 953 assets as part of Hill Canyon Treatment Plant.

Table 2-8 Hill Canyon Treatment Plant Asset Inventory

Process	Asset Count
Non-Process	131
Headworks	81
Flow Equalization	25
Primary Clarification	70
Secondary System	184
Tertiary Filtration	176
Disinfection	81
Biosolid Handling	205
Total	953

2.2 Asset Installation Profile

With an understanding of the assets owned and managed, an installation profile was developed (Figure 2-2). It should be noted that the dollar value represented in the figure is expressed in today's (2013) estimated replacement costs. It does not represent the actual capital investment that took place in any given year. The historical asset installation profile not only provides insight into the City's development trend, but also provides a high level understanding of how old the assets are. One would expect the installation profile to correlate with the City's major developments.

According to asset data, installation of all the assets started in the early 1900's and there wasn't any development until the early 1950's. The major development of the City's assets peaked in the early 1960's, mid 1970's, and early 2000's. Since then, no major spurts were noticeable.

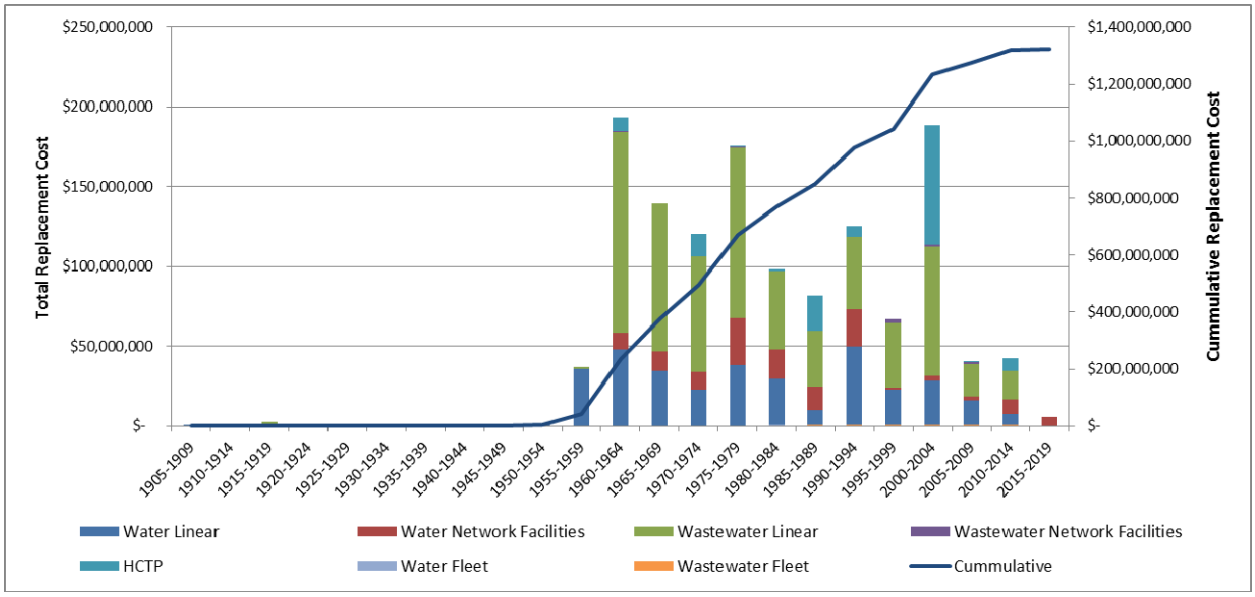


Figure 2-2 Installation Profile – Water and Wastewater System

Figure 2-3 shows installation profile of the water linear asset. The water assets peaked in the early 1960's and mid 1990's.

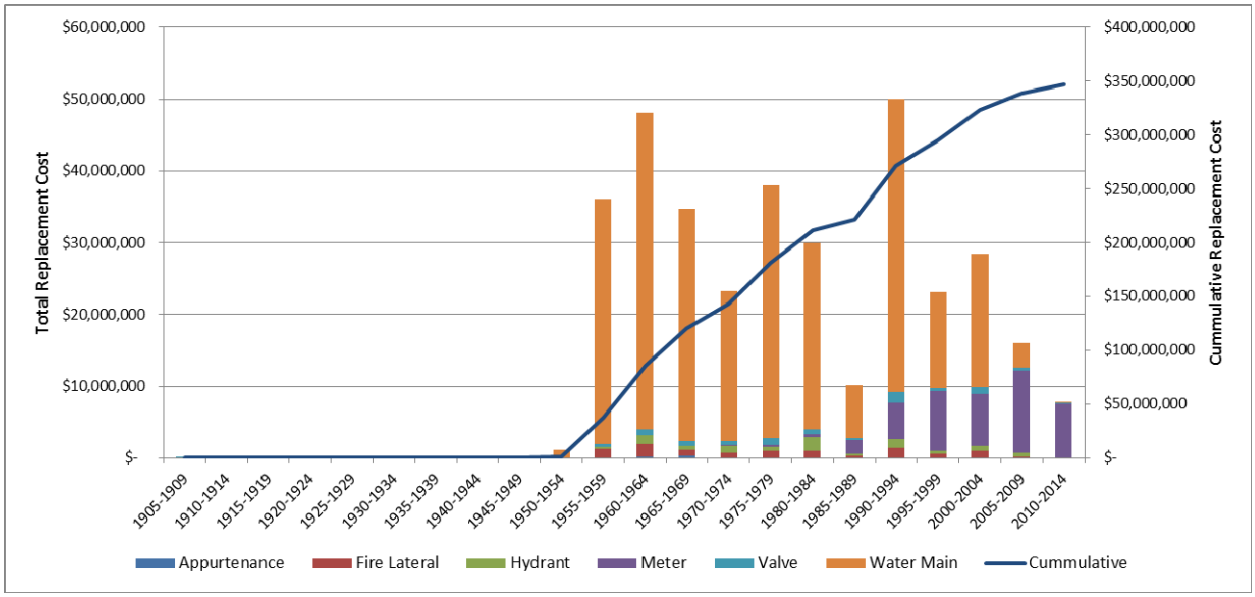


Figure 2-3 Installation Profile – Water Linear

Figure 2-4 presents installation profile of the water network facilities. The trend of water network facilities closely matches City's overall asset installation profile. Pump station and reservoirs were first constructed in early 1960's and peaked in mid 1970's and early 1990's.

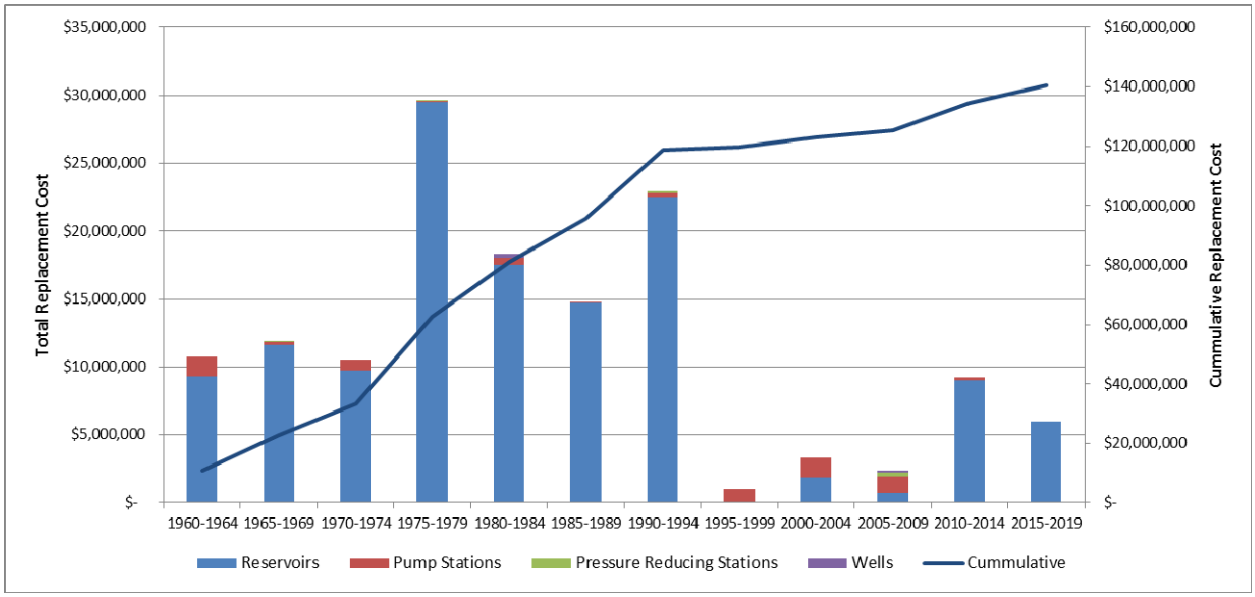


Figure 2-4 Installation Profile - Water Network Facilities

Figure 2-5 provides a look at the wastewater linear asset installation profile. The trend of wastewater linear asset closely matches City's overall asset installation profile. Installation of wastewater assets peaked in the 1960's, mid 1970's, and early 2000's.

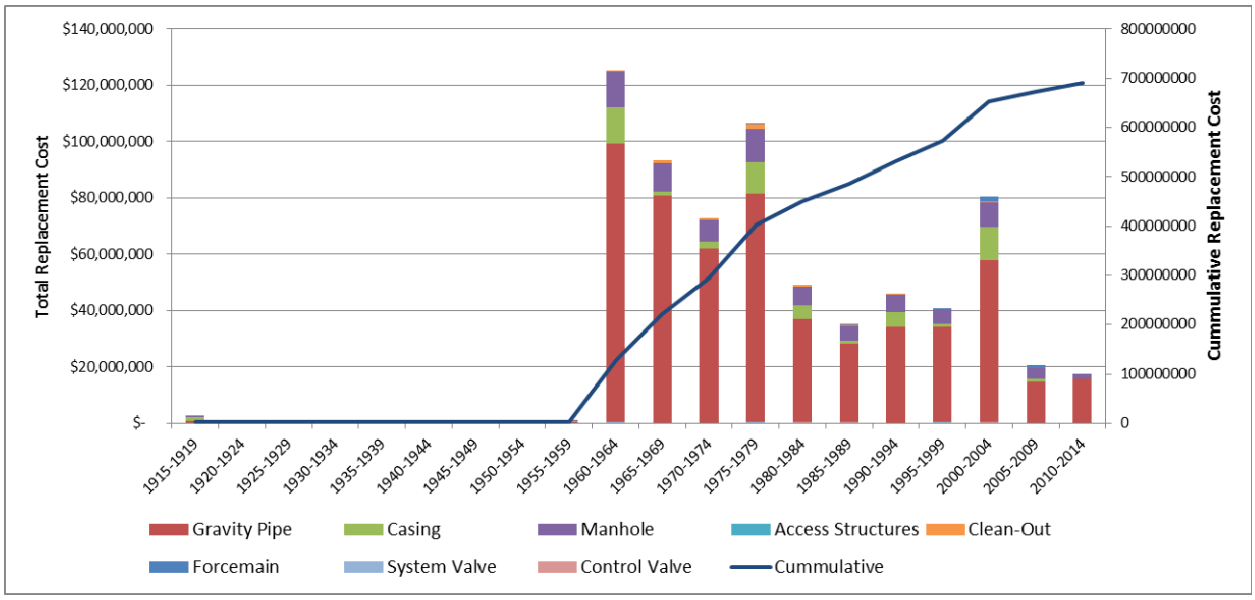


Figure 2-5 Installation Profile - Wastewater Linear

Figure 2-6 shows installation profile of the wastewater network facilities. First wastewater facility was constructed in early 1960's. There is a peak in mid 1990's when all the canyon structures were built.

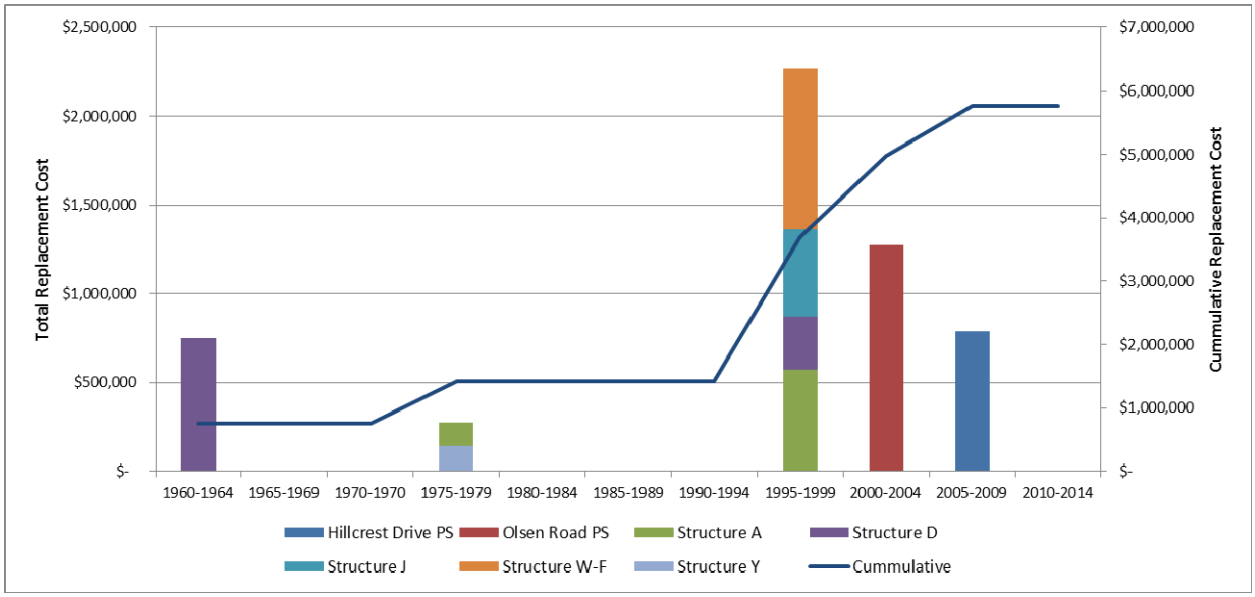


Figure 2-6 Installation Profile - Wastewater Network Facilities

Figure 2-7 presents the installation profile for the Hill Canyon Treatment Plant. The Plant is represented by process. Based on the graph, most of the processes were installed in mid 1980's and early 2000's.

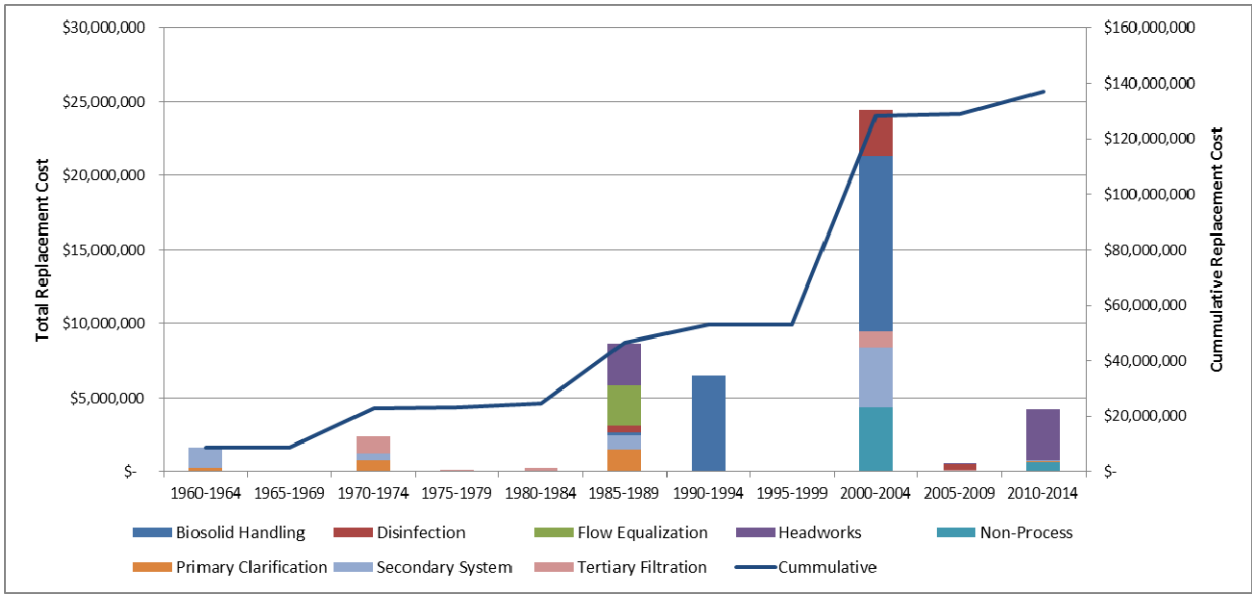


Figure 2-7 Installation Profile – Hill Canyon Treatment Plant

2.3 Asset Consumption Profile

More important than the installation profile is the asset consumption profile. The consumption profile provides an indication of the number of assets reaching the end of their expected lives. The City's overall asset consumption profile is presented in Figure 2-8. It should be noted that the dollar value represented in the figure is expressed in today's (2013) estimated replacement costs.

The majority of the assets are currently 5% to 25% consumed. However, assets nearing the end of estimated useful life are also evident. According to the analysis, approximately $15 million worth of assets are 90% to 100% consumed. These assets mostly consist of water network assets (pipes

and reservoir) and Hill Canyon Treatment Plant assets. Further analyses of assets requiring replacement will be made in Chapter 7.

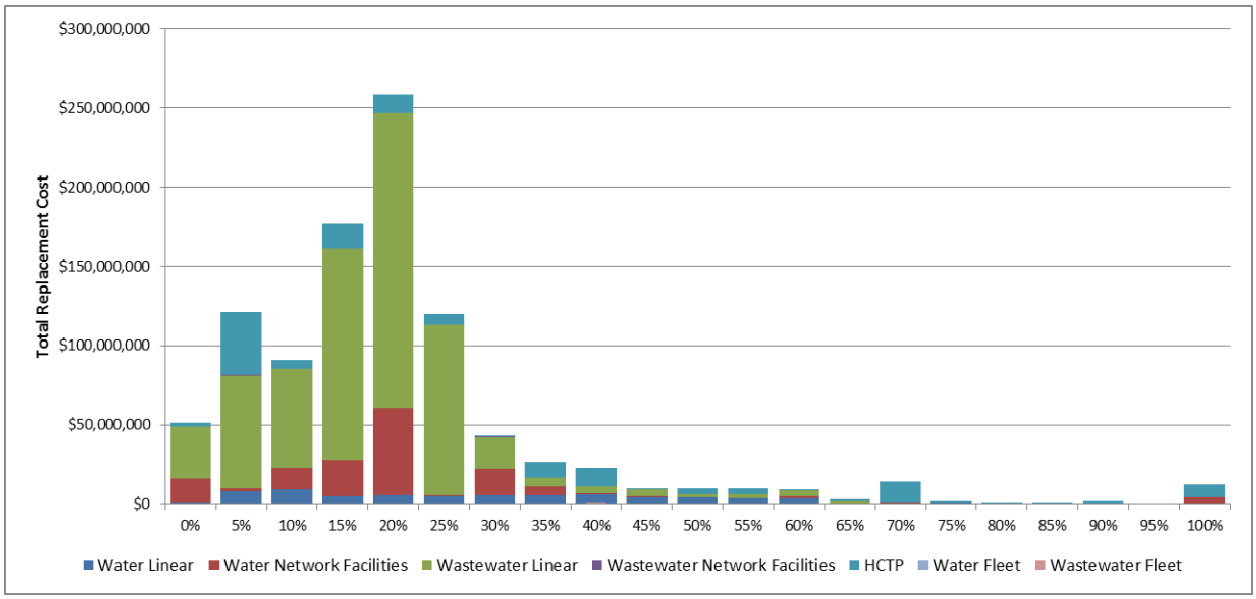


Figure 2-8 Consumption Profile – Water and Wastewater System

A consumption profile for water distribution is represented in Figure 2-9. Overall, most assets are around 5% to 60% consumed. However, the data indicates that few appurtenances and meters need to be replaced.

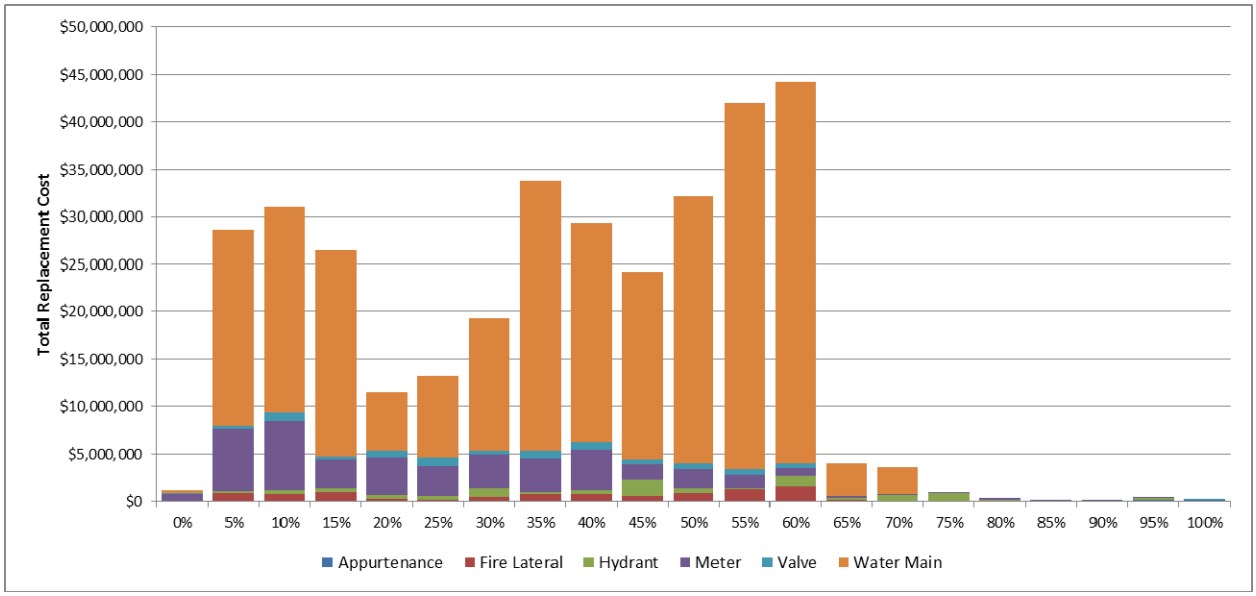


Figure 2-9 Consumption Profile – Water Linear

The consumption profile of water network facilities (reservoirs, pump stations, pressure reducing stations, reservoirs, and wells) is presented in Figure 2-10. Here, the data indicates that most facilities are below 40% consumption range. However, there are some reservoirs and pump stations in the 90% to 100% consumption range. The City has already initiated a reservoir rehabilitation program. Older reservoirs should be investigated to verify their conditions and the associated remaining lives.

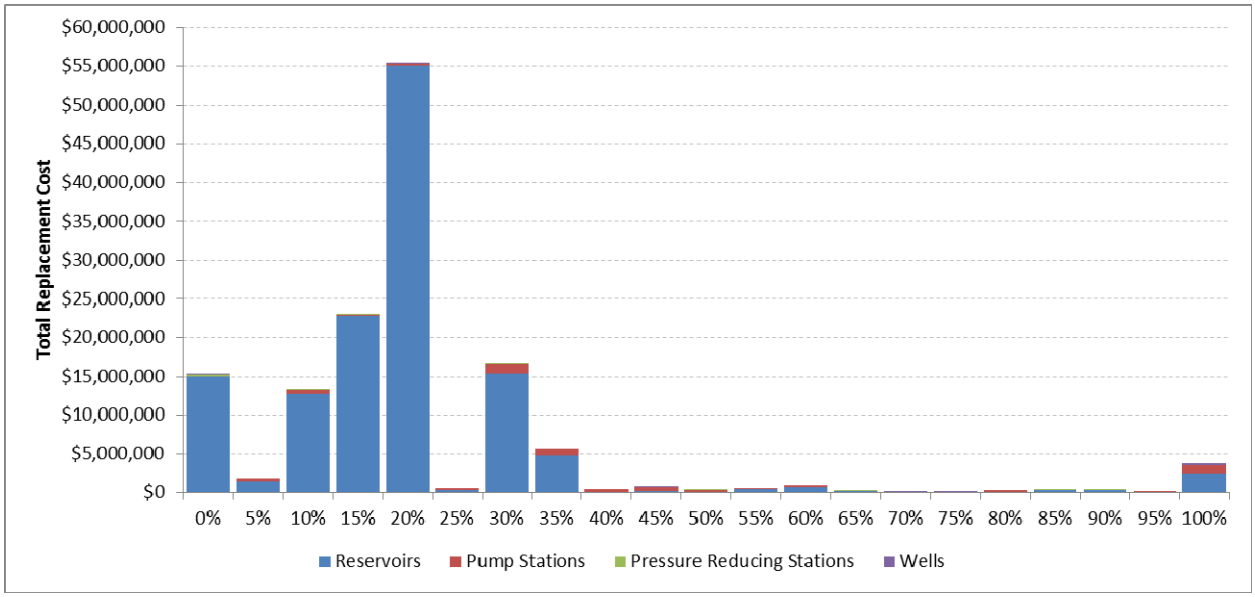


Figure 2-10 Consumption Profile – Water Network Facilities

The wastewater linear consumption profile is shown in Figure 2-11. According to the data, linear wastewater assets are in good shape. Most wastewater pipes were about 5% to 25% consumed.

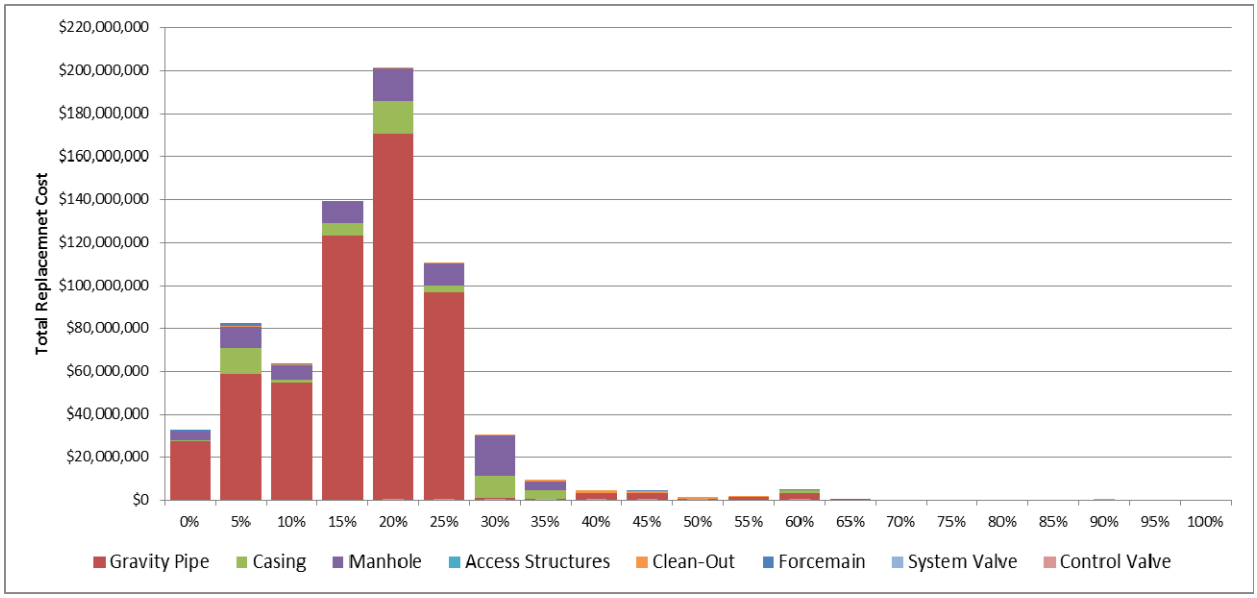


Figure 2-11 Consumption Profile – Wastewater Linear

The consumption profile of wastewater network facilities is shown in Figure 2-12. Data indicates that most lift station assets are not yet fully consumed. However, some canyon structures are in the 90% to 100% consumption range. The asset register will identify assets that are identified as being fully consumed.

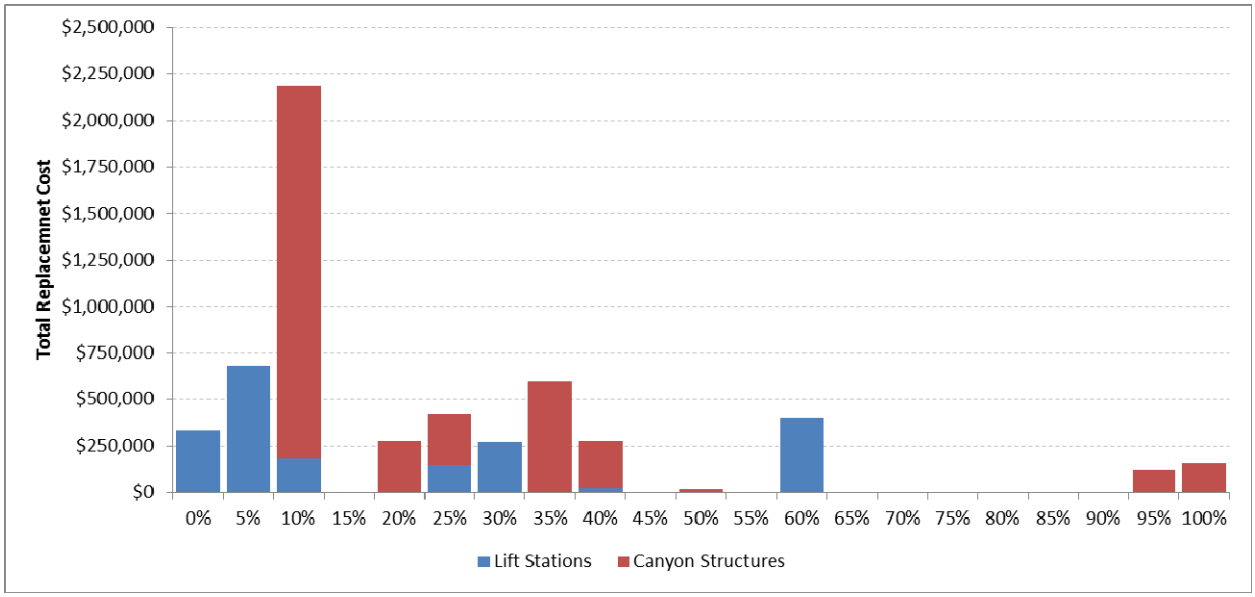


Figure 2-12 Consumption Profile – Wastewater Network Facilities

The consumption profile of Hill Canyon Treatment Plant is presented in Figure 2-13. Data indicates that most of the assets are not yet fully consumed. However, some of them are in the 100% consumption range.

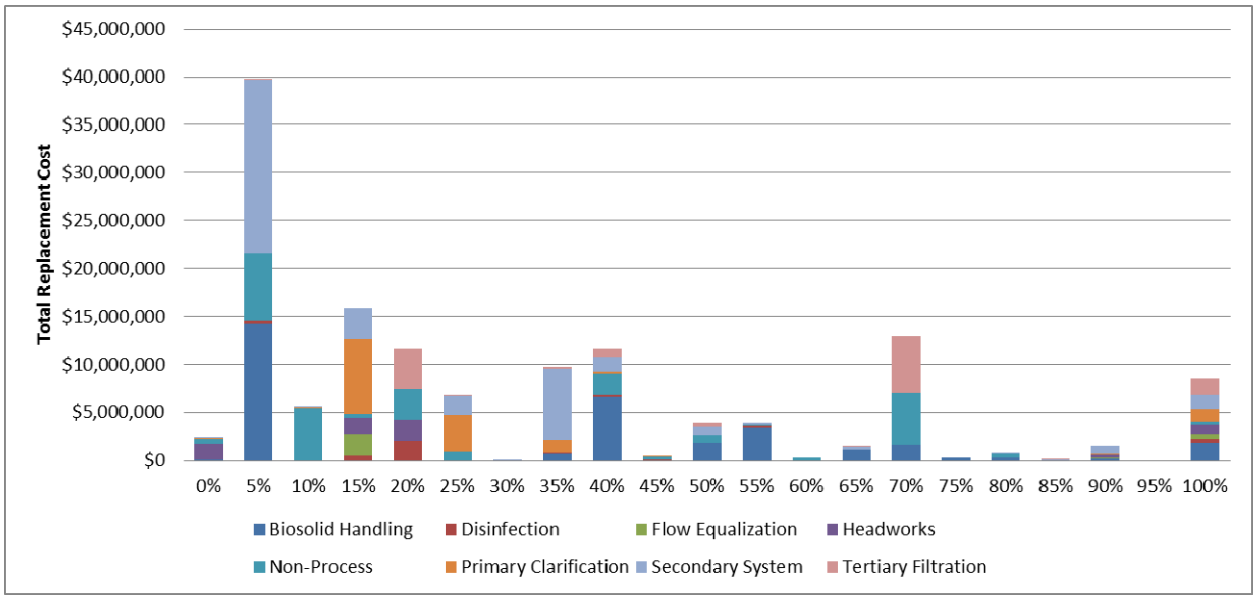


Figure 2-13 Consumption Profile – Hill Canyon Treatment Plant

2.4 Asset Valuation

Asset valuations are an integral part of asset management. The valuation process provides asset managers with the knowledge of estimated current replacement costs. As part of the asset valuation process, every asset in the asset register was assigned an estimated replacement cost. The replacement value of assets within a facility is summed to estimate the replacement value for the facility. The replacement value is assigned based on the estimated cost to replace the asset in

today's dollars (2013). The estimated replacement costs are based on recent construction bids, staff knowledge, and/or financial records.

The City's estimated total replacement value in 2013 dollar is shown in Figure 2-14 and Table 2-9. It is estimated that it will take about $1.3 billion dollars to replace all water and wastewater assets owned and managed by the City. As represented in the figure, the City's water and wastewater assets were divided into seven categories: water linear, water facilities, water fleet, wastewater linear, wastewater facilities, wastewater fleet, and wastewater treatment (Hill Canyon Treatment Plant). At a high level, wastewater assets equated to about 63% of the total value (~$823 million). Furthermore, 79% of the total valuation (~$1 billion) is in pipes and appurtenances. The valuation of wastewater pipes is nearly two times the valuation of water pipes. The detailed breakdown of each category is summarized below.

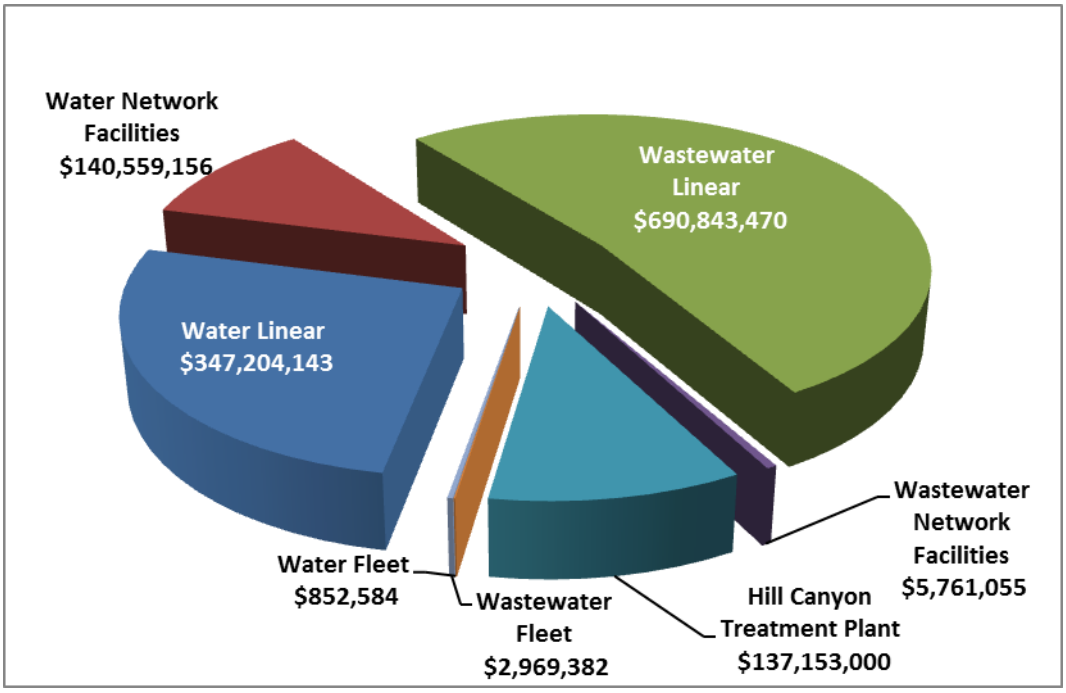


Figure 2-14 Asset Valuation – Water and Wastewater Systems

Table 2-9 Water and Wastewater Systems Asset Valuation

Facility Name		Asset Valuation
Water:		
	Water Linear	$347,204,143
	Water Network Facilities	$140,559,156
	Water Fleet	$852,584
Wastewater:		
	Wastewater Linear	$690,843,470
	Wastewater Network Facilities	$5,761,055
	Wastewater Fleet	$2,969,382
	Hill Canyon Treatment Plant	$137,153,000
	Total	$1,325,342,790

Figure 2-15 presents the estimated total replacement costs for water linear assets (i.e., water mains, fire laterals, hydrants, meters, valves, and appurtenances). The total replacement cost of all

water linear assets is estimated to be $347.2 million. Water mains account for 80% of replacement cost at $277.4 million, followed by meters at $42.3 million (12%).

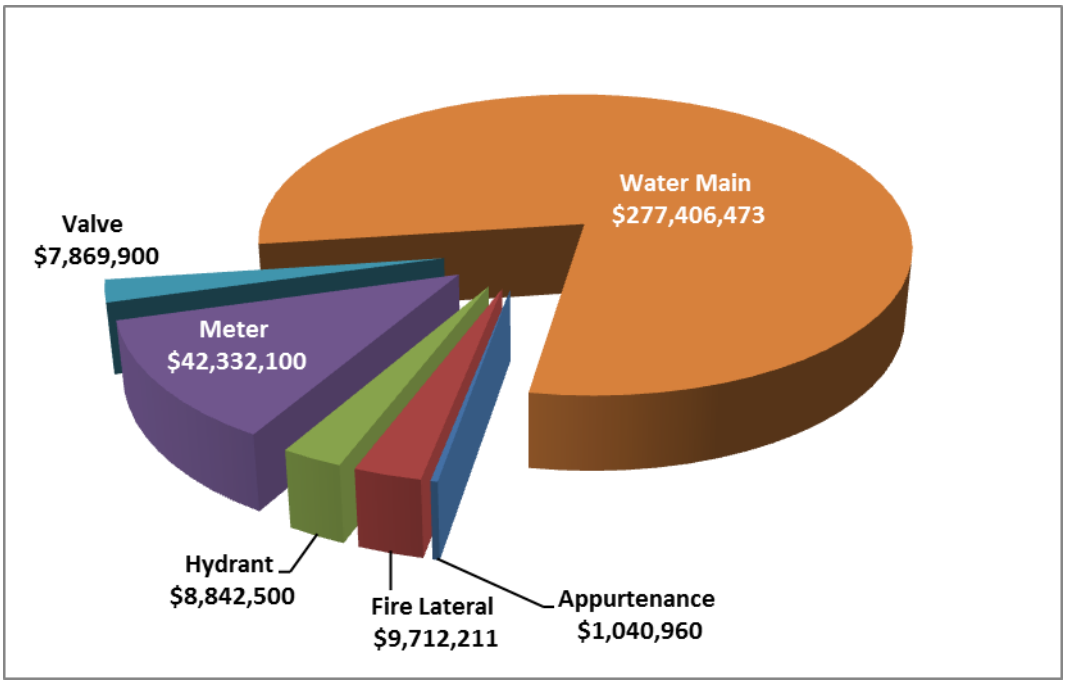


Figure 2-15 Asset Valuation – Water Linear

Figure 2-16 presents the estimated total replacement costs for water network facilities (i.e., reservoirs, pump stations, pressure reducing stations, and wells). The total replacement value of all reservoirs was estimated to be $132.5 million. All pump stations are estimated to have a $7.1 million replacement value. All pressure reducing stations are estimated to be $0.6 million in replacement value, and wells are estimated to be $0.36 million to replace.

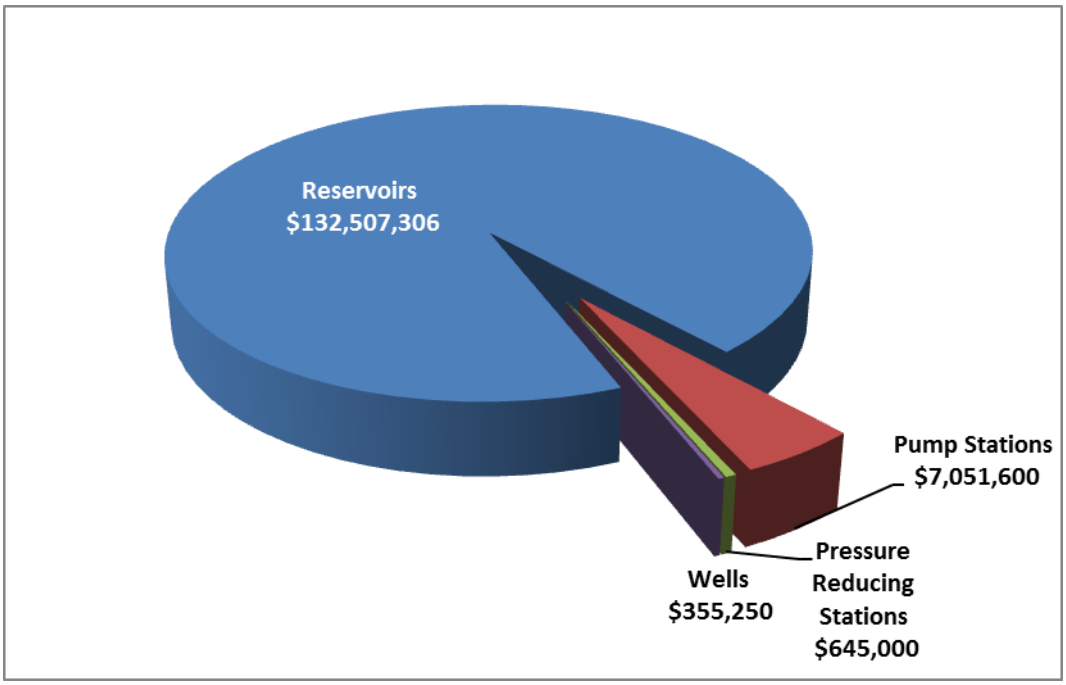


Figure 2-16 Asset Valuation – Water Network Facilities

Estimated replacement cost for each water network facility is provided in Table 2-10.

Table 2-10 Asset Valuation by Facility

Facility Name		Total Replacement Cost
Reservoirs:		
	Freeway	$4,763,741
	Grissom #1	$1,389,728
	Grissom #2	$1,087,000
	Kelley Road	$2,608,062
	La Granada	$13,343,325
	Rolling Oaks	$1,882,869
	Ventu Park	$13,207,600
	Wilder	$4,676,170
	Willow Lane	$16,533,171
	Lang Ranch	$16,423,270
	Meadows	$9,869,100
	Oakbrook	$9,484,261
	Pederson	$10,676,924
	Sunset No.3	$2,649,006
	Sunset No.2	$4,736,506
	Tara Reservoir	$13,176,572
Pump Stations:		
	Erbes Road	$989,500
	Grissom	$502,000
	Kelley Road	$730,500
	Lone Oak	$952,000
	Rolling Oaks	$708,600
	Ventu Park	$828,000
	Wilder	$746,000
	Willow Lane	$736,500
	Los Arboles	$423,000
	Northwood	$60,500
	Pederson	$53,000
	Sunset No.1	$56,000
	Sunset No.2	$121,000
	Sunset No.3	$53,000
	Lang Ranch	$92,000
Pressure Reducing Stations:		
	El Dorado	$18,000
	Fountain Crest	$19,000
	Lang Ranch	$18,000
	Minnecota	$53,000
	Sapra	$53,750
	Tara/Meadow (Summer Park)	$70,000
	Scenic Road Check Valve	$60,000
	Westlake Blvd	$74,750
	Janns and El Monte	$65,000
	Rosario	$69,500
	La Jolla	$59,000
	Lynn Road PR Station	$65,000

Facility Name		Total Replacement Cost
	Road Runner (HCTP) PR Station	$20,000
Wells:		
	Hillcrest	$100,250
	Los Robles Golf Course	$255,000
	Total	$134,559,155

Figure 2-17 presents the estimated total replacement costs for wastewater linear assets (i.e., gravity pipe, casing, manholes, forcemains, valves, and cleanout). The total estimated replacement value of all wastewater linear assets is $690.8 million. Gravity pipes accounted for 79% of the total wastewater linear assets.

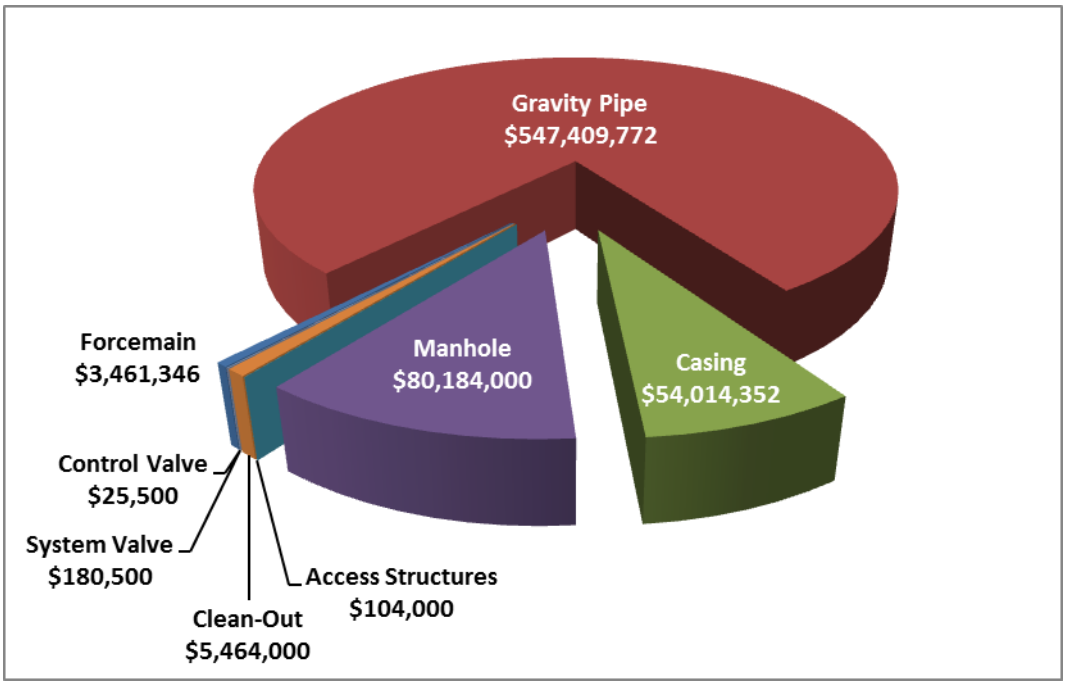


Figure 2-17 Asset Valuation – Wastewater Linear

Figure 2-18 presents the estimated total replacement costs for wastewater network facilities (i.e., lift stations and canyon structures). The total estimated replacement value of all canyon structures was $3.7 million and of all lift stations was $2.1 million.

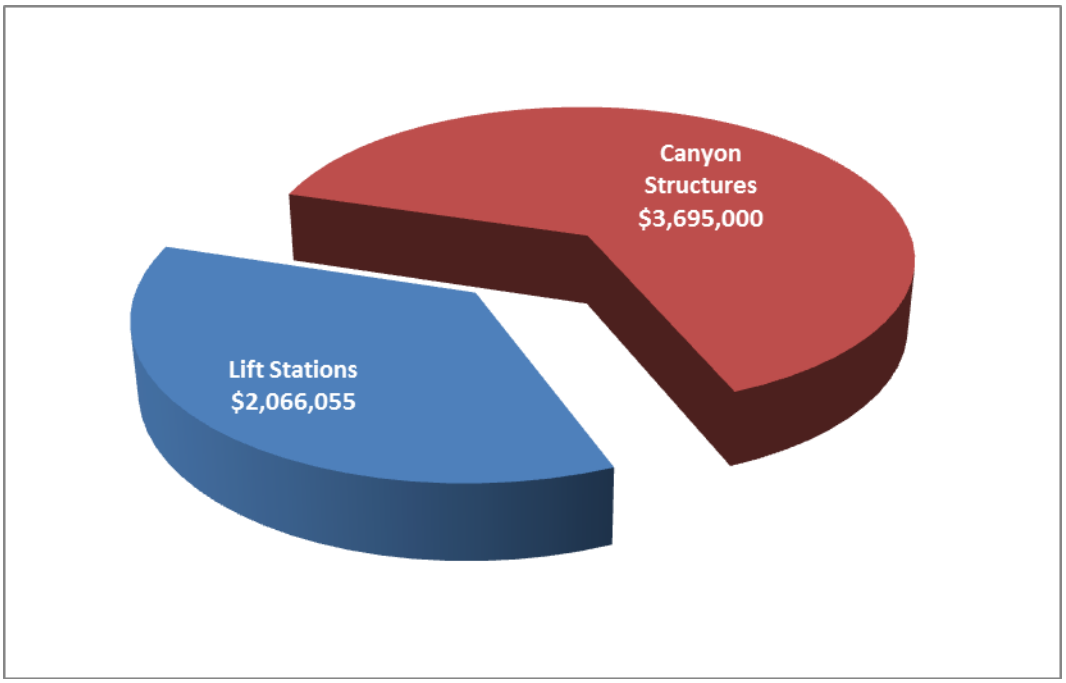


Figure 2-18 Asset Valuation – Wastewater Network Facilities

The individual valuation for each of the wastewater network facility is provided in Table 2-11.

Table 2-11 Wastewater Network Facilities Asset Valuation

Facility Name		Asset Valuation
Lift Stations:		
	Hillcrest Drive	$789,155
	Olsen Road	$1,276,900
Canyon Structures:		
	Structure A	$850,000
	Structure D	$1,045,000
	Structure J	$495,000
	Structure W-F	$905,000
	Structure Y	$400,000
	Total	$5,761,055

Figure 2-19 presents the estimated total replacement costs for the Hill Canyon Treatment Plant. The Plant is represented by process. Based on the assessment, the secondary system, biosolids handling, and non-process (e.g., site improvements, office and storage buildings) assets account for about 70% of total replacement costs. The total estimated replacement cost of all the Hill Canyon Treatment Plant assets is $137.2 million.

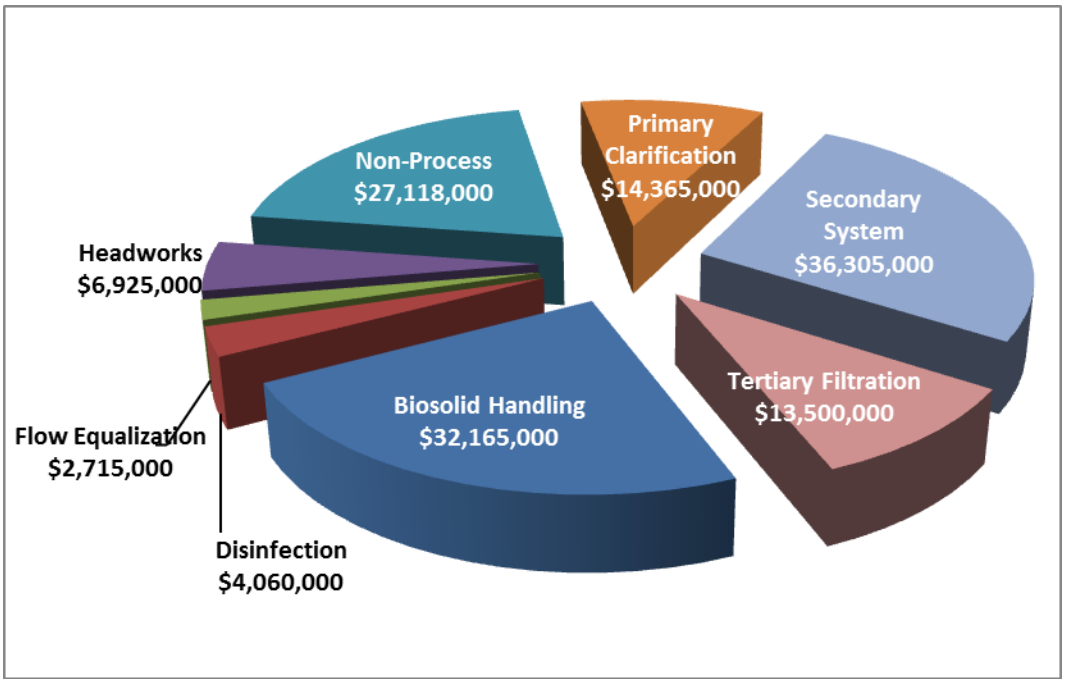


Figure 2-19 Asset Valuation – Hill Canyon Treatment Plant

3. Asset Management Practices

This chapter introduces the management strategies used to develop the City's asset management plan. The asset management plan is developed through consolidating data in the asset register, organizing the data in an asset hierarchy, and modeling the timing and amount of capital investment required for each asset. The timing and investment activity is driven by the management strategies. The management strategies represent the trends in asset behavior and the City's current practices.

3.1 Management Strategies

The City owns and manages a large number of water and wastewater assets, over 52,000, making it nearly impossible to plan and forecast for every asset at the individual asset level. In order to facilitate the modeling of the future investment requirements, generic but intelligent assumptions are used. Assets that are similar in characteristics and functionality are grouped into asset classes (e.g., ductile iron pipes, hydrants, large pumps, manholes). A complete list of asset classes can be found in Chapter 2. Each asset class is assigned a management strategy to portray the lifecycle behavior (e.g., useful life, rehabilitation activity and timing, decay pattern) that is representative of the asset class.

Management strategies reflect the City's current asset management practices. Management strategies are developed in conjunction with the key members of the City's management and operations or maintenance staff. The general strategy for replacement and/or refurbishment timing is summarized for each asset class in the tables below. These strategies incorporate the working knowledge of the City staff regarding the special characteristics or behavior of the assets.

In total, the City has over a hundred different management strategies. Tables 3-1 to 3-5 list management strategies for water linear assets, water network facility assets, wastewater linear assets, wastewater network facility assets, and Hill Canyon Treatment Plant, respectively.

Table 3-1 Management Strategies – Water Linear

No	Asset Class	Useful Life (years)	Rehabilitation
1	Pipe – PVC	150	
2	Pipe – AC	90	
3	Pipe – Metal	80	
4	Meters (include services) – 1"	45	Rehab every 15 years at 7% of replacement cost
5	Meter only – 1"	15	
6	Meters (include services) – 2"	40	Rehab every 20 years at 33% of replacement cost
7	Meter only – 2"	20	
8	Hydrants	70	
9	Valves	30	

Table 3-2 Management Strategies – Water Network Facilities

No	Asset Class	Useful Life (years)	Rehabilitation
1	Reservoir – Steel	150	Rehab every 20 years at 10% of replacement cost
2	Reservoir – Concrete	170	Rehab every 30 years at 10% replacement cost
3	Pump (>=25HP)	40	Rehab every 5 years at 3% of replacement cost
4	Pump (<25HP)	15	
5	Motor (>=25HP)	20	Rehab every 10 years at 40% of replacement cost
6	Motor (<25HP)	10	
7	Motor - Diesel	20	Rehab every 5 years at 5% of replacement cost
8	Tanks	50	Rehab every 10 years at 10% replacement cost
9	Valve (>=6”)	40	
10	Valve (<6”)	30	
11	Pipe	150	
12	Electrical	20	
13	Control	15	
14	Vault	150	Rehab every 50 years at 10% of replacement cost
15	Yard Pavement	20	Maintenance work every 5 years at 5% of replacement cost
16	Road	40	Resurface every 5 years at 5% replacement cost
17	Buildings – non office	100	Rehab every 20 years at 10% of replacement cost

Table 3-3 Management Strategies – Wastewater Linear

No	Asset Class	Useful Life (years)	Rehabilitation
1	Pipe – Clay	200	Reline at 120 years, cost vary by diameter[1)]
2	Pipe – Concrete	200	Reline at 90 years, cost vary by diameter[1)]
3	Pipe – AC	200	Reline at 90 years, cost vary by diameter[1)]
4	Pipe – PVC	150	
5	Pipe – AC, Lined	+150	
6	Pipe – Metal	80	
7	Pipe – Mixed	80	
8	Manholes	150	Reline at 90 years, $270/VF
9	Access structures	150	Reline at 90 years, $270/VF
10	Cleanouts	90	
11	Casings (encasement)	150	

[1)] Pipe relining cost starts at $60/LF for 6”-8” pipe up to $400/LF for 39” pipe.

Table 3-4 Management Strategies – Wastewater Network Facilities

No	Asset Class	Useful Life (years)	Rehabilitation
1	Concrete structures (wet well, basins, etc.)	150	Rehab every 20 years at 10% of replacement cost
2	Large pumps (>=25HP)	40	Rehab every 5 years at 3% of replacement cost
3	Pumps (<25HP)	15	
4	Large motors (>=25HP)	20	Rehab every 10 years at 40% of replacement cost
5	Motors (<25HP)	10	
6	Tanks	50	Rehab every 10 years at 10% of replacement cost
7	Valve (>=6”)	40	
8	Valve (<6”)	30	
9	Electrical	20	
10	Control	15	
11	Vault	150	Rehab every 15 years at 10% of replacement cost
12	Pavement	20	Rehab every 5 years at 5% of replacement cost
13	Road	40	Rehab every 5 years at 5% of replacement cost
14	Buildings – non office	100	Rehab every 10 years at 10% of replacement cost

Table 3-5 Management Strategies – Hill Canyon Treatment Plant

No	Asset Class	Useful Life (years)	Rehabilitation
1	Valve actuators	15	Rehab every 7 years at 15% of replacement cost
2	Bar screen	20	Rehab every 10 years at 30% of replacement cost
3	Belt press	15	Rehab every 8 years at 10% of replacement cost
4	Blowers	25	Rehab every 8 years at 10% of replacement cost
5	Boilers	25	Rehab every 10 years at 15% of replacement cost
6	Storage (metal)	50	
7	Office-type buildings and improvements (admin offices, etc.)	150	Rehab every 15 years at 10% of replacement cost
8	Non-office structures and improvements (Pump/Lift station structure, storage structure, etc.)	150	Rehab every 10 years at 22% of replacement cost
9	Chlorine contact chambers	50	Rehab every 15 years at a cost of $350,000
10	Security (CCTV)	10	
11	Chillers	15	
12	Clarifier drive (primary, secondary)	30	Rehab every 15 years at 11% of the replacement cost
13	Compressors	20	
14	Natural gas compressor	10	

No	Asset Class	Useful Life (years)	Rehabilitation
15	Conveyor	20	Rehab every 7 years at 7.5% of the replacement cost
16	Digester	50	Rehab every 10 years at 7% of the replacement cost
17	Electrical service (transformers, circuit breakers, switchboard, etc.)	30	
18	Equipment (overhead crane, etc)	30	
19	Filters	60	Rehab every 15 years at 7.5% of the replacement cost
20	Gates	25	Rehab every 5 years at 10% of replacement cost
21	Generators	25	Rehab every 25 years at 40% of replacement cost
22	Heat exchangers	35	
23	HVAC (air handling unit, etc)	25	
24	Instruments and controls (sensors)	5	
25	Laboratory equipment	25	
26	Lighting	15	
27	Motor Control Center (MCC)	20	
28	Mechanical - Other	20	
29	Meters	10	
30	Mixers	5	
31	Motors - large (>=25HP)	20	Rehab every 10 years at 40% of replacement cost
32	Motors - small	10	
33	Pavement - asphalt	60	Rehab every 10 years at a cost of $25,000
34	Pavement - concrete	100	
35	Piping	150	
36	Programmable Logic Control (PLC)	10	
37	Pumps - chemical	10	
38	Pumps - fuel	25	Rehab every 5 years at 10% of replacement cost
39	Pumps - large (>=25 HP)	25	Rehab every 10 years at 40% of replacement cost
40	Pumps - small	15	
41	Pumps - sump	10	
42	SCADA hardware	10	
43	SCADA network (fiber optics, etc)	25	
44	SCADA software	5	
45	Site improvements (fencing, landscaping)	20	
46	Scum skimmer	20	Rehab every 10 years at a cost of $150,000
47	Process structures (basins)	150	Rehab every 15 years at 15% of replacement cost
48	Outfall	150	

No	Asset Class	Useful Life (years)	Rehabilitation
49	Carport (roof structure)	25	
50	Chemical storage tanks	30	
51	Fueling tank	30	Rehab every 10 years at 10% of replacement cost
52	Valves (discharge valves, check valves, suction valves, etc.)	30	
53	Variable Frequency Drive (VFD)	10	
54	Valve and actuators set	30	Replace every 7 years at 25% of replacement cost

Specifically for reservoirs, the management strategy also considers past rehabilitation history and planned and future rehabilitation as identified in the 2012 Reservoir Assessment Study. Table 3-6 shows recent rehabilitation works conducted on the City's reservoirs.

Table 3-6 Reservoirs – Past Rehabilitation History

No	Reservoir Name	Install Year	Last Rehab Year	Rehab Type	Rehab Cost
1	Pederson	1969	2013	Structural repairs	$1,200,000
2	Sunset No. 2	1966	2012	Recoat and minor roof work	$400,000
3	Willow	1983	2007	Interior and exterior recoat	$1,000,000

Table 3-7 shows the planned rehabilitation works related to seismic retrofit and other periodic maintenance activities to sustain the structural integrity of the reservoirs.

Table 3-7 Reservoirs – Planned and Future Rehabilitation

No	Reservoir Name	Install Year	Planned Rehabilitation			Future Rehabilitation		
			Year	Type	Cost	Year	Type	Cost
1	Freeway	1961	2021	Interior recoat, seismic anchorage	$500,000	Every 20 years, starting 2041	Interior and exterior recoat	10% of replacement cost
2	Grissom No. 1	1987	2019	Interior and exterior recoat, site improvement	$350,000	Every 20 years, starting 2039	Interior and exterior recoat	10% of replacement cost
3	Grissom No. 2	1981	2015	Interior recoat, exterior overcoat	$100,000	Every 20 years, starting 2035	Interior and exterior recoat	10% of replacement cost
4	Kelley Road	1966	2019	Interior and exterior recoat, roof repair	$200,000	Every 20 years, starting 2039	Interior and exterior recoat	10% of replacement cost
5	La Granada	1988	2015	Interior recoat, exterior overcoat	$700,000	Every 20 years, starting 2035	Interior and exterior recoat	10% of replacement cost
6	Lang Ranch	1979	2016	Coating, minor roof repair	$1,400,000	Every 20 years, starting 2034	Interior and exterior recoat	10% of replacement cost
7	Meadows	1972	2014	Minor repair and detail inspection study	$40,000	Every 20 years, starting 2023	Recoat, minor structural repairs	10% of replacement cost
8	Oakbrook	1990	2020	Exterior recoat, seismic stiffening	$225,000	Every 20 years, starting 2040	Recoat, minor structural repairs	10% of replacement cost
9	Pederson	1969	Currently under refurbishment.			Every 20 years, starting 2033	Recoat, minor structural repairs	10% of replacement cost
10	Rolling Oaks	2002	2019	Exterior overcoat	$35,000	Every 20 years, starting 2039	Interior and exterior recoat	10% of replacement cost
11	Sunset No. 2	1966	2014	Seismic stiffening	$300,000	Every 20 years, starting 2032	Interior and exterior recoat	10% of replacement cost
12	Sunset No. 3	1966	2016	Interior and exterior recoat, seismic anchorage, corrosion repair	$650,000	Every 20 years, starting 2036	Interior and exterior recoat	10% of replacement cost
13	Tara	1978	2014	Interior recoat, exterior overcoat, foundation settlement mitigation	$1,620,000	Every 20 years, starting 2034	Interior and exterior recoat	10% of replacement cost
14	Ventu Park	1992	Good condition. No required work for at least 10 years.			Every 20 years, starting 2024	Interior and exterior recoat	10% of replacement cost
15	Wilder	1964	2018	Interior and exterior recoat, seismic retrofit	$650,000	Every 20 years, starting 2036	Interior and exterior recoat	10% of replacement cost
16	Willow	1983	2023	Seismic stiffening	$400,000	Every 20 years, starting 2027	Interior and exterior recoat	10% of replacement cost
17	(Future) Wilder No. 2		2016	New construction	$6,000,000	Every 20 years, starting 2036	Interior and exterior recoat	10% of replacement cost

4. Future Demand

This chapter documents any anticipated changes in demand and levels of service that could influence the future planning and management of the City's water and wastewater infrastructure. These changes could include growth in demand due to development, increases in regulatory standards, more proactive sustainability practices, and anticipated staff changes. In alignment with the proactive planning processes of asset management, it is important to identify, document, and incorporate any factors that could influence the outcome of the asset management plan.

The City is starting its transition from "development" to "management." The City is nearly built out. By the year 2035, the City estimates 173 acres of additional residential and 168 acres of non-residential development. While a slight increase in water demand can be expected from the remaining development, a strong trend of water conservation will offset the slight increase in water demand.

The City's 2010 Urban Water Management Plan shows that recent water demand has been declining in response to droughts and economic rescission. In addition, the City has been actively educating and promoting water conservation programs. These initiatives have further contributed to reduce water demand. Figure 4-1 below summarizes the historical and the anticipated future water demand.

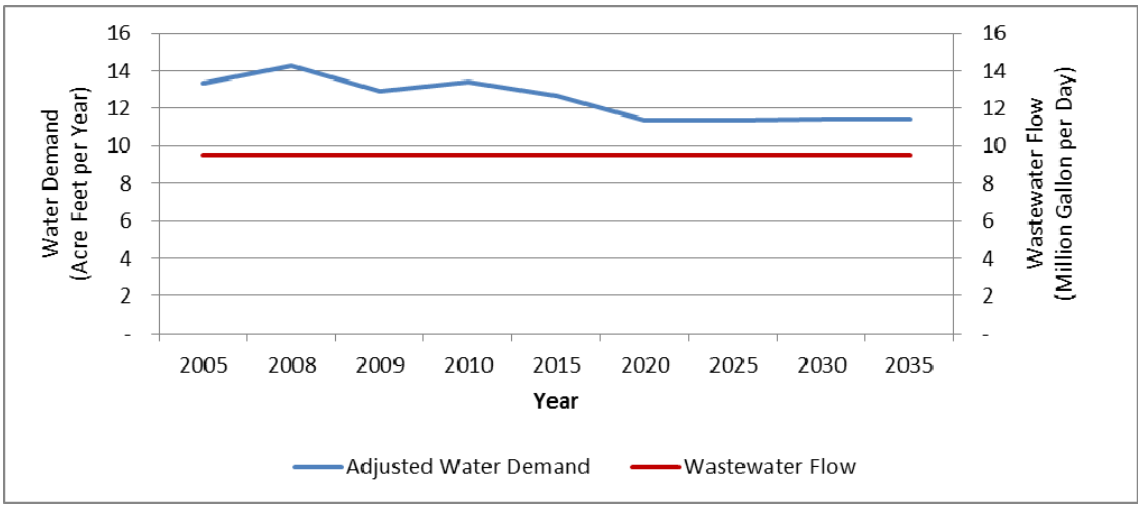


Figure 4-1 Current and Projected Water and Wastewater Demand

Additionally, the City does not foresee any changes in regulatory or service levels that can influence the management of its water and wastewater systems.

5. Performance Measurement

A key factor driving the success of an asset management program is continuous improvement. Regular assessment of its current practices is necessary to identify improvement areas. The continuous improvement process starts by establishing a strategic direction to guide the asset management program and performance measurements to track progress. The City's management decisions and day-to-day activities should work toward achieving the strategic direction. All choices and activities that do not align with or support the strategic direction should become lower priorities.

This chapter recommends strategic direction and performance measurements.

5.1 Asset Management Strategic Framework

In an effort to establish a strategic direction for the City, an asset management strategic framework (Framework) is developed. The Framework is designed not only to identify the City's asset management commitment and direction, but also to guide the asset management program implementation.

The Framework is categorized into two specific components: strategic and tactical. The strategic component defines the City's mission, goals, objectives and levels of service. The tactical component identifies and develops the processes to optimize the achievement of the strategic components.

5.1.1 Strategic Component

The strategic component provides a high level direction for the City. It defines the purpose and the intent. It also establishes a link between the processes and practices (work performed) and the levels of service (work measured). The strategic component is composed of the following elements: mission, goals, objectives, and levels of service.

The City has made extensive efforts on developing strategic policies. On March 27, 2012, the City has approved and/or reaffirmed the following policy documents:

- City Mission Statement
- City Customer Service Philosophy
- City Council Norms
- Citywide FY 2011-12 Top Ten Priorities
- Citywide Goals for FY 2011-12 & FY 2012-13

While this policy has not been specifically developed for water and wastewater asset management efforts, there are significant information and guidelines that are applicable for water and wastewater services.

Mission

A mission is a statement of purpose. It provides a condensed description of the City's fundamental purpose and articulates why the City exists or what it intends to accomplish. The mission also provides an overarching direction to guide the City's management activities. The City's approved mission statement is as follows:

"Extraordinary service to the citizens we serve is our purpose and product."

The City strives to meet this mission through the following customer service philosophy:

"The City of Thousand Oaks is committed to: Maintain a desirable living environment while ensuring that change reinforces both environmental quality and economic vitality; Respect the role of citizens, Council, and staff in establishing and implementing policies and programs; Provide excellent community services in a fair, efficient, and responsive manner; and, Promote public confidence and trust."

Goals, Objectives, and Level of Service

Goals broadly describe the expected future outcomes. They provide a programmatic, high-level direction and focus on ends rather than means. The goals must be in alignment with the mission and supported by the objectives, which in turn provide the means to achieve the goals.

In comparison to goals, objectives identify how goals are to be achieved. Objectives provide a clear and specific statement of action that helps the City achieve the goals. They specify an action to be taken without defining the individual performance metrics, which are stated in the levels of service.

Levels of service are a set of outputs the City intends to track. They are specific activities developed to meet the objectives. They include particular performance metrics to allow the City to measure how well they are achieving the target implementation. Defined levels of service can be used to accomplish the following:

- Inform customers of the proposed services to be offered
- Develop asset management strategies to deliver the required levels of service
- Measure performance against the defined levels of service
- Identify costs and benefits associated with service delivery
- Enable customers to assess the suitability, affordability, and equity of the services offered

Understanding what to measure establishes the relationship between the levels of service and the cost to provide the service. Once established, this relationship can be evaluated to determine the optimum service at the lowest lifecycle cost and risk.

The City's water and wastewater system goals, objectives, and levels of service are summarized in Table 5-1 and Table 5-2. They are designed to support the City's overarching strategic direction.

Table 5-1 Levels of Service – Water Service

Area	Goals	Objectives	Levels of Service
Administration	To provide excellent customer service to the public and responsive administrative support to Department staff.	• Provide exceptional customer service to external customers.	• Customer service complaints per 1000 customers (Target < 1) • Technical quality complaints per 1000 customers (Target < 4) • Bill accuracy rate (Target > 99%) • Customer emergency response time (Target < 2 hrs) • Customer emergency resolution time (Target < 24 hrs) • Number of unplanned service outages per 1000 customers (Target < 1.5) • Average hours of service outage per incident (Target < 3 hrs)
		• Provide exceptional customer service to internal customers.	• Process departmental CRMS cases with timely resolution • Process all documents accurately, professionally, and in a timely manner. • Provide superior administrative support to Department staff
Business management	To manage the Department's fiscal matters in an efficient and cost-effective manner.	• Develop service charges and connection fees that are sufficient to meet the cost of providing water service. • Process invoices received for payment prior to due dates ensuring eligibility for prompt payment discounts and avoiding late charges. • Monitor legislation on routine basis and prepare position reports for City Manager's review.	• Water service charges reviewed annually • Water connection fees adjusted annually • Water Financial Plan updated biennially • Water Asset Management Plan updated biennially • Debt coverage ratio (Target ≥ 130%) • Cash reserve (Target ≥ 250 days) • Bond rating (Target ≥ A)

Area	Goals	Objectives	Levels of Service
Conservation	To encourage and enable customers to utilize the water supply in an environmentally-responsible manner	• Provide City water customers with educational material that encourages water conservation. • Prepare the biennial report to the California Urban Water Conservation Council (CUWCC) describing the City's water conservation accomplishments. • Develop an automated leak advisement program for City water customers equipped with Automated Meter Readers	• CUWCC report prepared by due date • Maintain or reduce the purchased water
Engineering services	To provide efficient and safe design and construction of development and capital water system infrastructure	• Design and construct water system infrastructure in compliance with City codes and standards. • Administer Capital Improvement Program (CIP) to improve, expand, maintain, rehabilitate, and enhance existing water system infrastructure assets. • Continue safe and efficient operation of City water system through planning and engineering.	• Water system projects adhere to adopted CIP schedules • Development plan check turnaround within three weeks • Water system inspections performed within 24 hours of request • Capital program percent completion against budget (Target = 100%) • Capital projects adhere to adopted CIP schedules (Target > 90%) • Condition assessment of high risk assets
Groundwater	To provide an essential and efficient groundwater supply for irrigation service at a reduced water rate	• Maintain groundwater electrical and mechanical infrastructure through scheduled preventive maintenance. • Conduct weekly operational inspections and respond to system malfunctions. • Conduct pump efficiency testing biennially and coordinate annual well water sampling.	• Electrical maintenance schedule • Weekly inspections/reports
Municipal Service Center	To support Municipal Service Center (MSC) divisions with	• Manage and coordinate	• Work orders generated for all

Area	Goals	Objectives	Levels of Service
	facility and administrative services	maintenance and operation division activities. • Provide administrative and purchasing services to support maintenance and operation divisions. • Provide exceptional customer service to staff and residents.	division maintenance activities • Schedule compliance (Target > 90%) • Emergency maintenance (Target < 10%) • Maintenance overtime (Target < 5%) • Preventive maintenance completion (Target > 90%) • Planned work (Target > 85%) • Rework (Target < 5%)
Quality Assurance	To provide high quality water that meets or exceeds all Federal and State water quality standards.	• Maintain compliance with all United States Environmental Protection Agency (EPA) and State Department of Health Services requirements, standards, and regulations for drinking water quality	• Perform all required monitoring and reporting by mandated schedule • Water quality meets all standards (Target = 100%)
Storage and Distribution	To provide a safe, healthy, and reliable water supply to City water consumers in a fiscally-responsible manner	• Plan and coordinate a maintenance and construction upgrade program for water distribution system. • Coordinate pump station and reservoir cla-valve maintenance programs. • Continue 15-year meter upgrade program, including Automated Meter Reading (AMR) equipment.	• Conduct valve exercise program • Cla-valves serviced/rebuilt • Meter upgrade program • Pump station electrical maintenance • Conduct large meter testing • Breaks per 100 miles (Target < 10 breaks per year) • Unaccounted water (Target < 5%)

Table 5-2 Levels of Service – Wastewater Service

Area	Goals	Objectives	Levels of Service
Administration	To provide excellent customer service to the public and responsive administrative support to Department staff.	• Provide exceptional customer service to external customers.	• Customer service complaints per 1000 customers (Target < 1) • Customer emergency response time (Target < 2 hrs) • Customer emergency resolution time (Target < 24 hrs)
		• Provide exceptional customer service to internal customers.	• Process departmental CRMS cases with timely resolution • Process all documents accurately, professionally, and in a timely manner. • Provide superior administrative support to Department staff
Business Management	To manage the Department's fiscal matters in an efficient and cost-effective manner	• Develop service charges and connection fees that are sufficient to meet the cost of providing wastewater service. • Process wastewater invoices received for payment prior to their due dates to ensure eligibility for prompt payment discounts and avoid late charges. • Monitor wastewater legislation on routine basis and prepare position reports for City Manager's review.	• Wastewater service charges reviewed biennially • Wastewater connection fees adjusted annually • Wastewater Financial Plan updated biennially • Wastewater Asset Management Plan updated biennially • Debt coverage ratio (Target ≥ 150%) • Cash reserve (Target ≥ 350 days) • Bond rating (Target ≥ AA)
Engineering Services	To provide efficient and safe design and construction of development and capital wastewater system infrastructure.	• Design and construct wastewater infrastructure in compliance with City codes and standards. • Administer Capital Improvement Program (CIP) to improve, expand, maintain, rehabilitate, and enhance existing wastewater system infrastructure assets.	• Wastewater system projects adhere to adopted CIP schedules • Development plan-check turnaround within three weeks • Wastewater system inspections performed within 24 hours of request • Capital program percent completion

Area	Goals	Objectives	Levels of Service
		• Continue safe and efficient operation of City wastewater system through planning and engineering.	against budget (Target = 100%) • Capital projects adhere to adopted CIP schedules (Target > 90%) • Condition assessment of high risk assets
Hill Canyon Treatment Plant (HCTP)	To provide excellent wastewater treatment facility performance 24 hours a day, 7 days a week, 365 days a year.	• Achieve full compliance with State-issued National Pollution Discharge Elimination System (NPDES) discharge permit. • Beneficially recycle biosolids. • Preserve the infrastructure of the HCTP and operate it efficiently and economically.	• Zero discharge (NPDES) violations and comprehensive operating permit(s) compliance • Renewable energy generation/annual Kwh
Industrial waste inspection	To implement the Federally-mandated industrial pre-treatment program requirements of the Clean Water Act.	• Protect Hill Canyon Treatment Plant (HCTP) collection system and receiving waters from pollutants generated at industrial facilities that may be discharged to the wastewater system.	• All mandated program requirements are met • Pass-through or interference events at HCTP attributed to industrial dischargers • Any necessary enforcement actions are initiated promptly • Average number of industrial and commercial inspections conducted
Municipal Service Center	To support Municipal Service Center (MSC) divisions with facility and administrative services	• Manage and coordinate maintenance and operation division activities. • Provide administrative and purchasing services to support maintenance and operation divisions. • Provide exceptional customer service to staff and residents.	• Work orders generated for all division maintenance activities • Schedule compliance (Target > 90%) • Emergency maintenance (Target < 10%) • Maintenance overtime (Target < 5%) • Preventive maintenance completion (Target > 90%) • Planned work (Target > 85%) • Rework (Target < 5%)

Area	Goals	Objectives	Levels of Service
Wastewater lines	To provide dependable, safe, and fiscally responsible wastewater collection service to the City of Thousand Oaks.	• To clean 250 miles of the City's wastewater collection system annually. • To televise over 30 miles of the City's wastewater collection system annually. • Continue to incorporate technology in inspection of wastewater pipelines to ensure integrity of the collection system.	• Miles of wastewater pipeline cleaned • Percentage of 550 miles of wastewater lines cleaned annually • Percentage of wastewater pipelines televised annually • Percentage of manholes inspected • Number of Sanitary Sewer Overflows per 100 miles (Target < 0.8) • Perform condition assessment of high risk assets

6. Business Risk Exposure

This chapter provides an understanding of the City's water and wastewater asset risk profile. Risk is the key element of asset management. It is used to prioritize budgets and resources in a transparent and consistent way. The objectives of a risk assessment are as follows:

1. Identify assets representing the greatest risk to the organization
2. Promote efficient use of resources by focusing on high-risk assets (i.e., capital and operational expenditures, staff hours)
3. Highlight assets requiring detailed condition assessment or renewal
4. Prioritize inspection, cleaning, and preventative maintenance schedules
5. Develop and apply appropriate risk management strategies

Business Risk Exposure (BRE) is the term used to describe and quantify the risks associated with the management of assets. It can be assessed at an asset level and/or at the system level. Business risk exposure is comprised of three major components: probability of failure, consequence of failure, and redundancy. The probability of failure measures an asset's likelihood of or timing to failure. The consequence of failure evaluates the direct and indirect impacts of a failure. Redundancy, the presence of backup equipment, helps to decrease the overall risks of a failure when available.

Business Risk Exposure (BRE) = **Consequence of Failure (CoF)** x **Probability of Failure (PoF)** x **Redundancy**

6.1 Probability of Failure

6.1.1 Water Linear Assets

The probability of failure was classified into three classes: low, medium, and high probability (represented by green, yellow, and red, respectively). These classifications provide guidance with respect to the anticipated timing of failure. The replacement planning horizon for the high risk assets is approximately 15 to 25 years or approximately 80% consumed. Figure 6-1 summarizes the probability of failure distribution for water mains. Of the total 229 miles, approximately 63% (144 miles) are identified as low, 29% (66 miles) are medium, and approximate 8% (19 miles) are estimated to be high probability of failure. All the pipes with high probability of failure are asbestos cement pipes installed between 1950 and 1960.

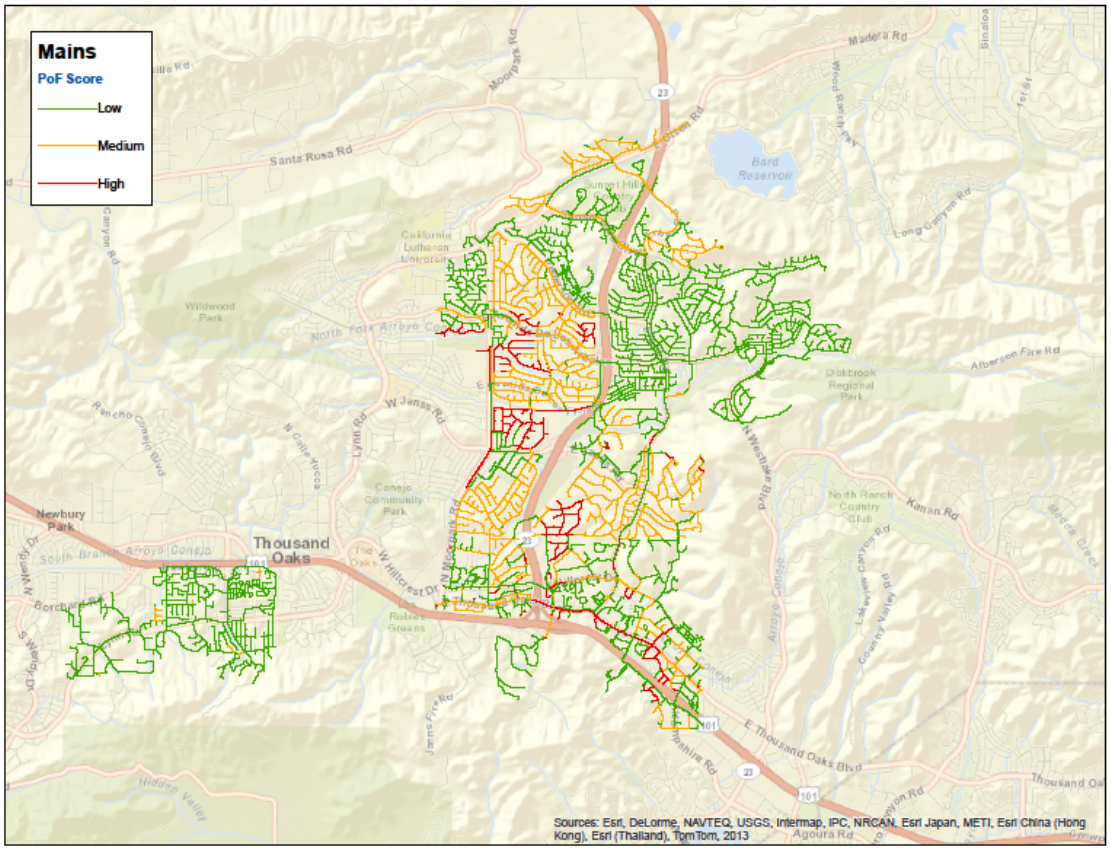


Figure 6-1 Probability of Failure Map – Water Mains

6.1.2 Water Network Facilities

Using the same approach, the probability of failure for vertical water assets was classified into three classes: low, medium, and high probability (represented by green, yellow, and red, respectively). Assets are classified into high probability of failure if they have less than 20% remaining life, 20-50% for medium probability, and more than 50% for low probability. The actual remaining useful life of each asset will vary depending on their expected life.

The probability of failure is summarized in two forms, by asset count and by asset value. The asset count simply shows the number of assets that require replacement. However, when the analysis is performed by the value of the asset, a different story can be told. Assets by count may show a large number of high probability of failure assets, but these assets may be small in terms of value and criticality.

Figure 6-2 provides a summary look for reservoirs. Probability of failure by asset count shows numerous assets nearing the end of useful life in Freeway, Lang Ranch, and Wilder reservoirs. However, closer investigation of the data reveals these assets to be non-critical assets such as fittings, gauges, and small pumps. Verification of high probability of failure assets in all reservoirs is warranted.

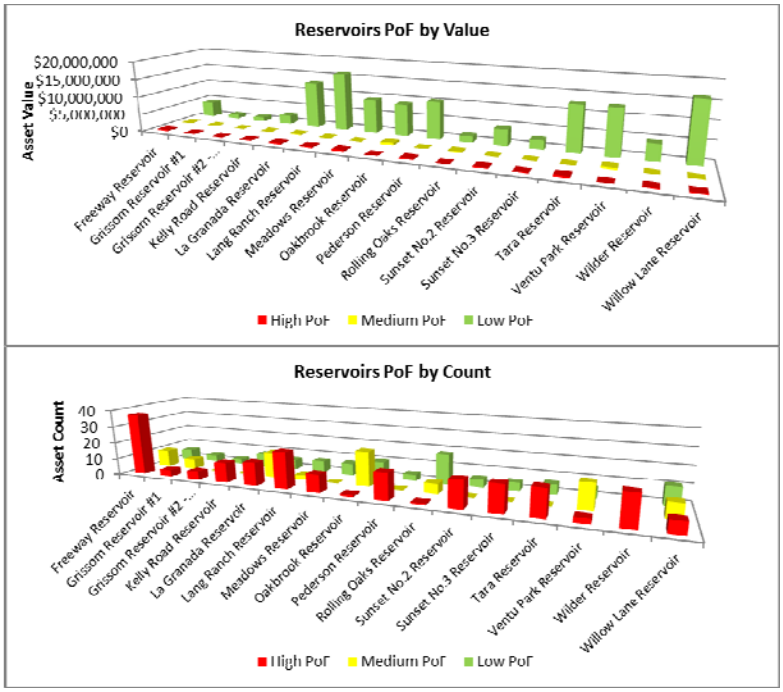


Figure 6-2 Probability of Failure – Reservoirs

Figure 6-3 provides a summary look for pump stations. Probability of failure by asset counts shows numerous assets nearing the end of useful life in Erbes, Lone Oak, and Sunset No. 3 pump stations. For Erbes Pump Station, all pumping units are identified as high probability of failure. These pumping units were installed in 1973, and the records do not show any replacement since installation. In Lone Oak Pump Station, most assets identified as high probability of failure are smaller assets (e.g., valves, air compressor, surge tanks). Similarly in Sunset No. 3, all high probability of failure assets were valves. Verification of high probability of failure assets in all pump stations is warranted.

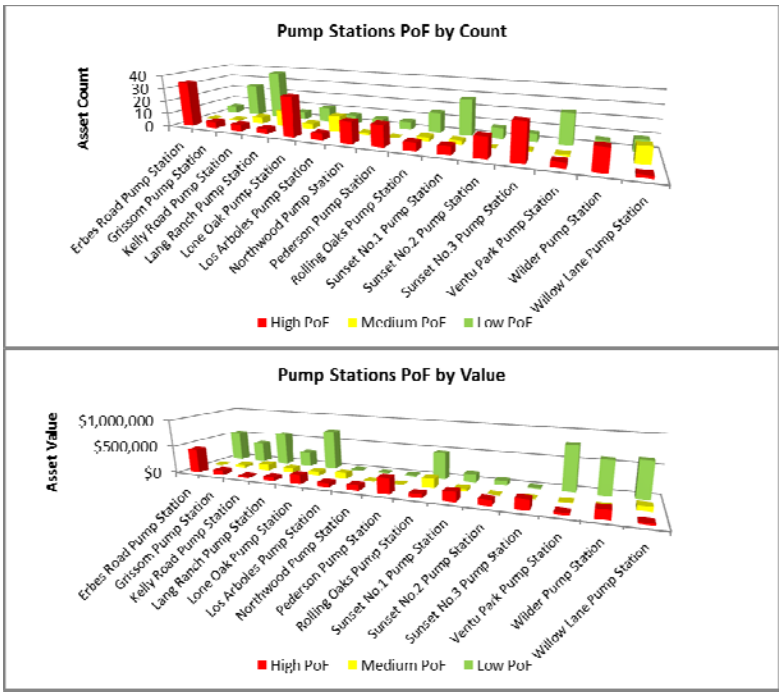


Figure 6-3 Probability of Failure – Pump Stations

Figure 6-4 provides a summary look for pressure reducing stations. Probability of failure by asset counts shows numerous assets nearing the end of useful life in Road Runner Pressure Reducing Station. This pressure reducing station was installed in 1980, and the data show no update of the station. Also, the valve sizes for this station are 8 and 10 inches. As such, the replacement cost of the Road Runner PR station will be higher. Verification of high probability of failure pressure reducing stations is warranted.

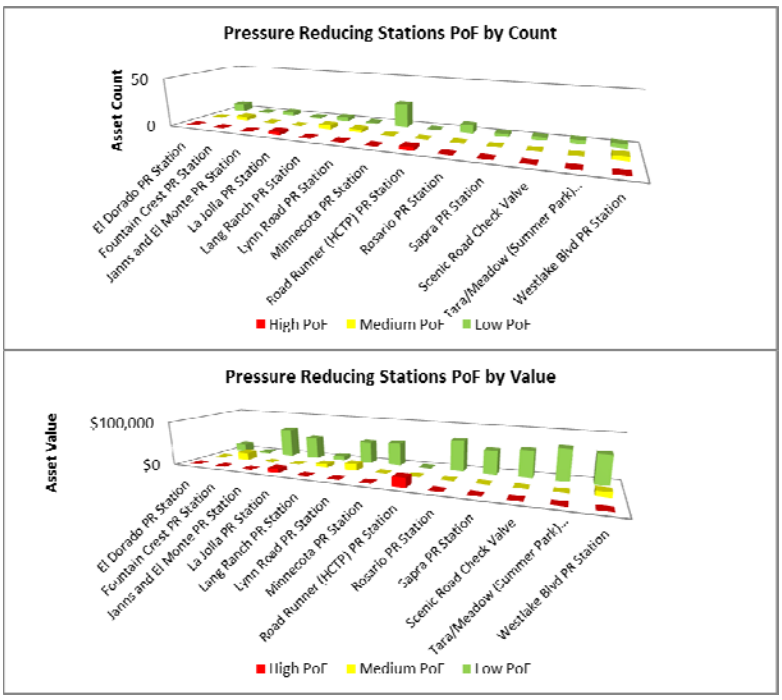


Figure 6-4 Probability of Failure – Pressure Reducing Stations

6.1.3 Wastewater Linear Assets

The probability of failure of wastewater collection assets was also classified into three classes: low, medium, and high probability (represented by green, yellow, and red, respectively). Figure 6-5 shows the distribution of probability of failure rating of wastewater gravity pipes. Out of 406 miles of gravity pipe, only less than 1 percent were identified to be high probability of failure. These asbestos concrete pipes were installed in 1959. Condition assessment of these pipes is recommended to better determine the current state of the asset. If the inspection confirms the condition of the pipe as poor, the City should schedule the pipes for renewal. However, if the inspection reveals the pipe to be in good condition, the City should adjust the condition score and recalculate the structure's probability of failure. The probability of failure results will be updated accordingly. This is part of asset management's continuous improvement process.

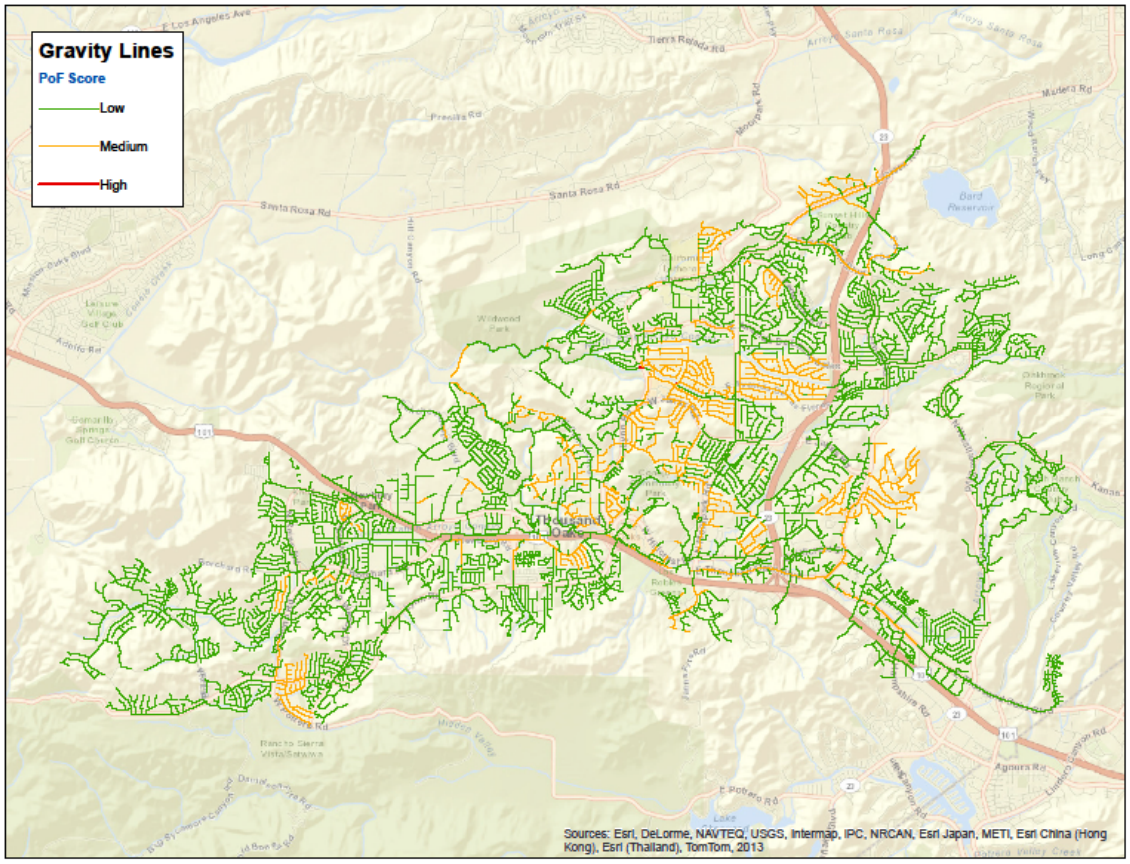


Figure 6-5 Probability of Failure Map – Gravity Pipes

6.1.4 Wastewater Network Facilities

Using the same approach as vertical water assets, the probability of failure for vertical wastewater assets was classified into three classes: low, medium, and high probability (represented by green, yellow, and red, respectively). Assets are classified into high probability of failure if they have less than 20% remaining life, 20-50% for medium probability, and more than 50% for low probability. The actual remaining useful life of each asset will vary depending on their expected life.

Figure 6-6 provides a summary look for lift stations. The only asset with high probability of failure is the flow meter at Olsen Road lift stations.

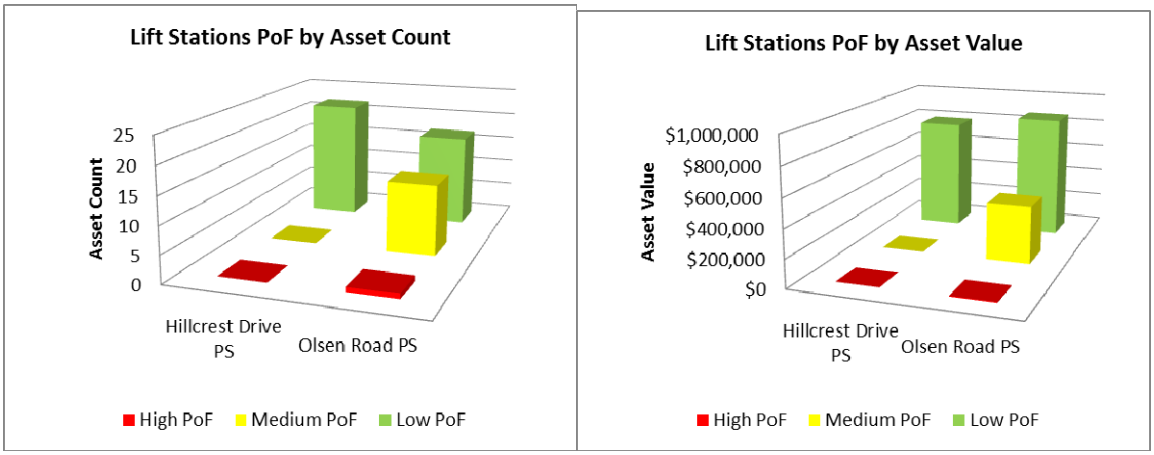


Figure 6-6 Probability of Failure – Lift Stations

Figure 6-7 provides a summary look for canyon structures. Overall, Structure Y has the most assets with high probability of failure. These assets consist of concrete vault and various valves installed in 1975.

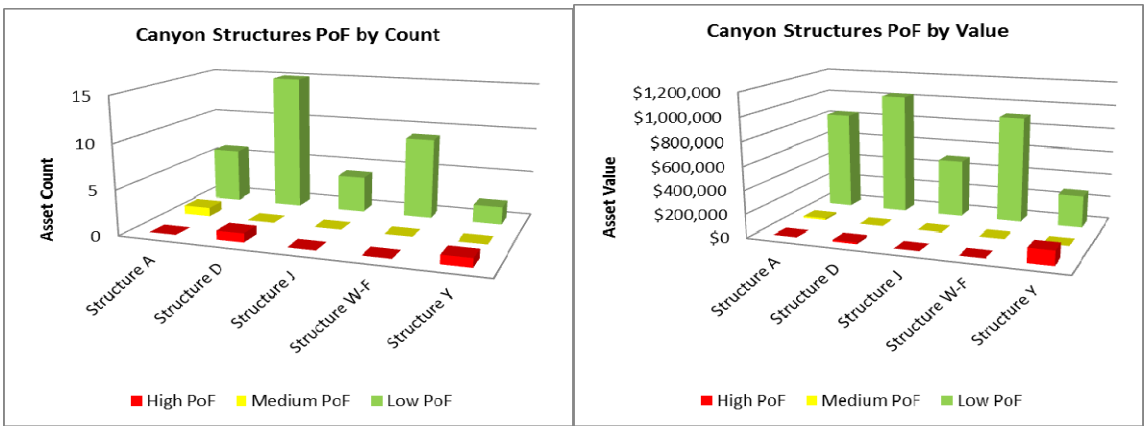


Figure 6-7 Probability of Failure – Canyon Structures

6.1.5 Hill Canyon Treatment Plant

Using the same approach, the probability of failure for Hill Canyon Treatment Plant (HCTP) assets was classified into three classes: low, medium, and high probability (represented by green, yellow, and red, respectively). Assets are classified into high probability of failure if they have less than 20% remaining life, 20-50% for medium probability, and more than 50% for low probability. The actual remaining useful life of each asset will vary depending on their expected life.

Figure 6-8 summarizes the distribution of probability of failure for Hill Canyon Treatment Plant by process. With regards to asset counts, around 48% of assets are nearing the end of their useful life. However, these assets only represent 7% of the total plant valuation. Notable ones include chemical pumps as part of disinfection system and electrical assets at tertiary filtration system.

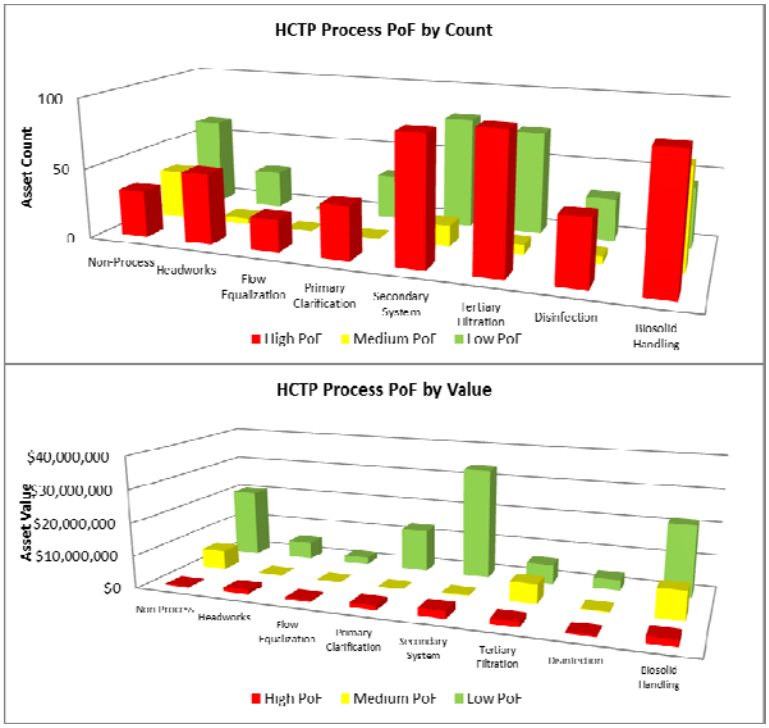


Figure 6-8 Probability of Failure – HCTP

6.2 Consequence of Failure

The consequence of failure measures the direct and indirect impacts of an asset failure. The impact of a failure is considered from a Triple Bottom Line perspective, encompassing the elements of economic, environmental, and social effects. The geospatial factors used to assess the consequence of failure for linear assets include the following:

1. Economic
    - Interceptor / Transmission Mains – The greater the size of the pipe, the greater the consequence of failure due to the large volumes of liquid flowing through the pipe. It was determined that wastewater and storm water collection pipes with diameter 31” or larger and water distribution pipes 20” or larger are deemed critical (high consequence of failure).
2. Social
    - Road Classification – This factor is used to determine the varying degrees of impact depending on the functionality classification of the roads above the underground pipes.
    - Vicinity to Storm Channels, Care Facilities, Medical Center, Parks, and Schools – These factors are used to highlight areas where a failure would result in social consequences. Among the three factors, it was determined that the social consequences of water asset failure in the vicinity of Care Facilities and Medical Center were highest, followed by Parks and School.

- Land Use Zones – This factor considers the zoning or use of the land at the location of the pipe. The location has a huge impact on the social consequence. This factor is used to highlight residential, commercial, and industrial area pipes.

3. Environmental

- Water Bodies and Storm Channel – This factor considers environmentally sensitive areas at the location of the wastewater assets.

Based on the above factors, the results of the water and wastewater linear asset consequence of failure are presented in Figure 6-9 and Figure 6-10 , respectively. Figure 6-9 shows the distribution of consequence of failure rating of water main pipes. Out of 229 miles of pipe, approximately 73% (168 miles) have low consequence of failure, 27% (61 miles) have medium consequence of failure, and none have high consequence of failure. This is expected as water main failure will have lower environmental impact. Its failure impacts are mostly economic and social. As such, most of the pipes with medium consequence of failure were located near freeways, major roads, or care/shopping facilities.

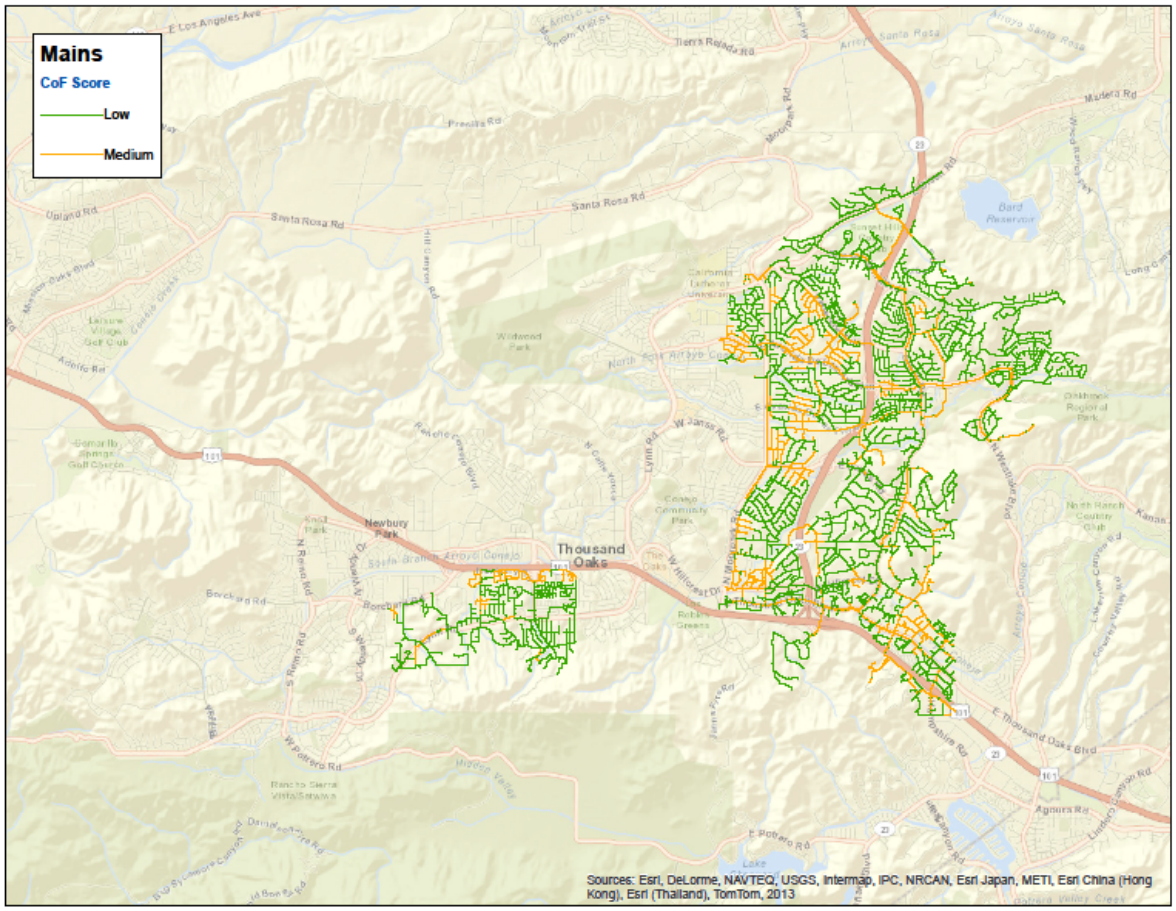


Figure 6-9 Consequence of Failure Map – Water Mains

The consequence of failure assessment for gravity pipes are mapped in Figure 6-10. Out of 406 miles of pipe, approximately 87% (354 miles) have low consequence of failure, 10% (42 miles) have medium consequence of failure, and 2% (10 miles) have high consequence of failure. The high consequence of failure pipes, represented in red, is near storm channels and/or high traffic areas. As expected, a wastewater pipe failure near a storm channel can result in significant environmental

damage. This failure also impacts the economics with respect to cost of mitigation and regulatory violation fines. High consequence of failure pipes are large diameter pipes (over 24 inches). The pipes with medium consequence of failure, highlighted in yellow, are concentrated around major roads and business districts. However, they are not near environmentally sensitive areas.

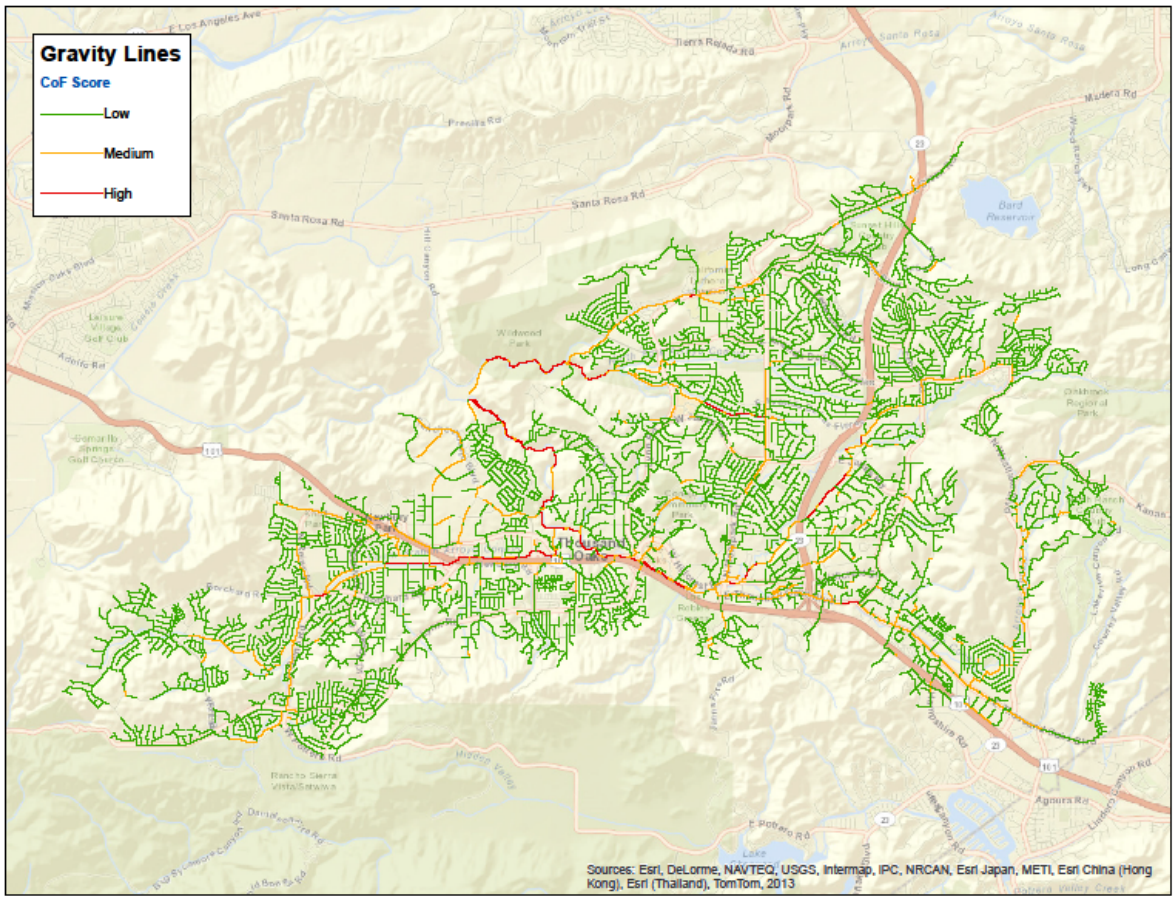


Figure 6-10 Consequence of Failure Map – Gravity Pipes

The consequence of failure for vertical assets is assigned differently, using a two-tiered scale of facility (location) and asset classes. Figure 6-11 shows the illustration of the methodology using pump stations as an example.

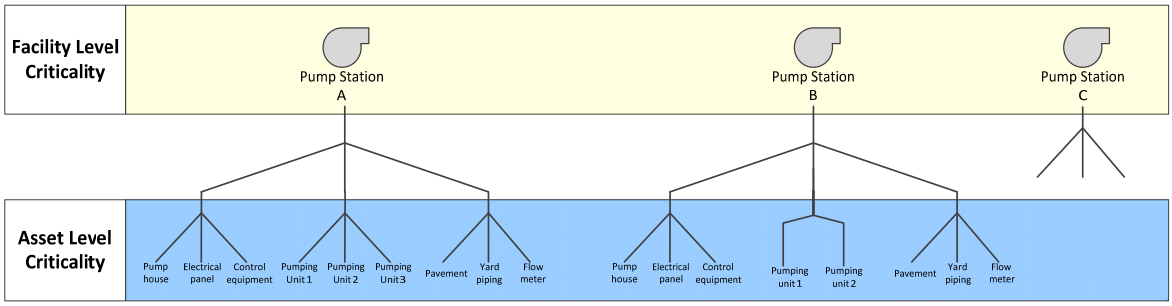


Figure 6-11 Two-Tier Consequence of Failure Method

Specifically for reservoirs, the criticality at facility level is determined using the combination of existing capacity and availability of secondary supply, and the zoning/land use of the service areas. Figure 6-12 shows the components and weights used in reservoir criticality assessment.

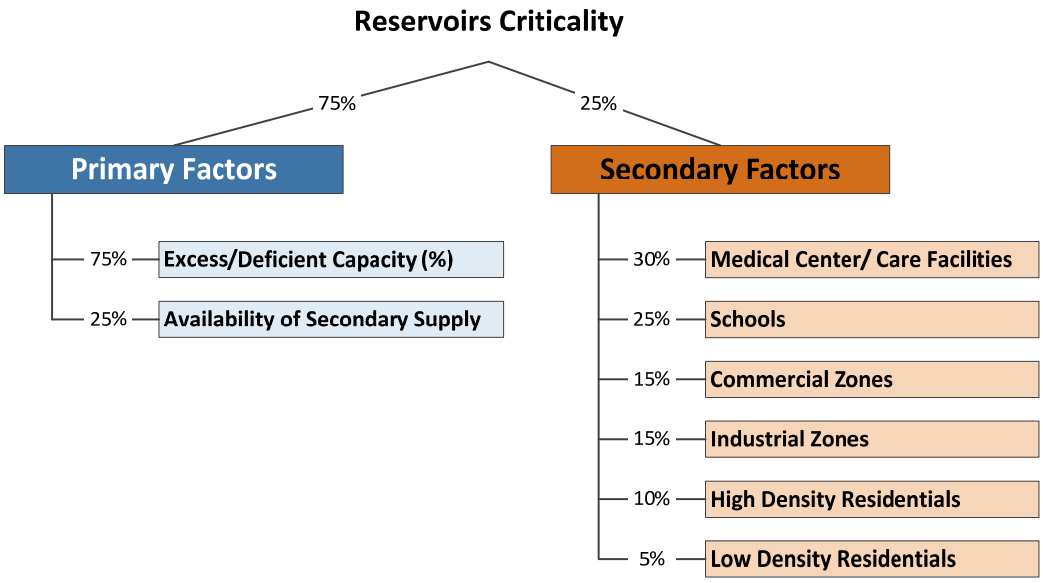


Figure 6-12 Reservoir Criticality Assessment Factors

Table 6-1 shows the consequence of failure ranking of the City's reservoirs.

Table 6-1 Reservoir Consequence of Failure Ranking

Ranking	Reservoirs
1	Zone 2 Wilder Reservoir
2	Zone 2 Rolling Oaks Reservoir
3	Zone 3 Grissom No. 1 & 2 Reservoirs
4	Zone 1 Pederson & Willow Reservoirs
5	Zone 3 Oakbrook & Sunset No. 3 Reservoirs
6	Zone 1 Ventu Park Reservoir
7	Zone 1 Kelley Road Reservoir
8	Zone 2 Meadows Reservoir
9	Zone 2 Freeway & La Granada Reservoirs
10	Zone 2 Lang Ranch and Sunset No. 2 Reservoirs
11	Zone 2 Tara Reservoir

Consequence of failure of pump stations is determined by the type of customer and the availability of backup source. Pump stations are classified into three criticality group as follows:

- High - pump station supplies directly to customer
- Medium - pump station is a single source of supply to reservoir(s)
- Low - pump station supplies to reservoir(s) with multiple supply sources available

Table 6-2 shows the ranking of the City's pump stations based on their consequence of failure. Pump stations with same ranking indicate the same level of criticality.

Table 6-2 Pump Station Consequence of Failure Ranking

Ranking	Pump Stations
1	Lone Oak Pump Station
1	Rolling Oaks Pump Station
1	Wilder Pump Station
2	Kelly Road Hydro Pump Station
2	Ventu Park Hydro Pump Station
2	Grissom Hydro Pump Station
2	Sunset No. 3 Hydro Pump Station
2	Northwood Booster Pump Station
3	Erbes Road Pump Station
3	Lang Ranch Pump Station
3	Pederson Pump Station
3	Los Arboles Pump Station
3	Sunset No. 1 Pump Station
3	Sunset No. 2 Pump Station
3	Willow Lane Pump Station

The consequence of failure for pressure reducing stations is determined by the type of functionality it provides. A pressure reducing station is considered to have high criticality if it regulates pressure to customer or fire flow and medium criticality if only used to provide emergency/backup flow. Table 6-3 ranks the consequence of failure of the City's pressure reducing stations. Pressure reducing stations with the same ranking indicate equal level of criticality.

Table 6-3 Pressure Reducing Station Consequence of Failure Ranking

Ranking	Pressure Reducing Station
1	El Dorado PR Station
1	Lang Ranch PR Station
1	Minnecota PR Station
1	Sapra PR Station
1	Tara/Meadow (Summer Park) PR Station
1	Westlake Blvd PR Station
1	Janns and El Monte PR Station
1	Rosario PR Station
1	La Jolla PR Station
1	Road Runner (HCTP) PR Station
2	Fountain Crest PR Station
2	Scenic Road Check Valve
2	Lynn Road PR Station

Consequence of failure for of wastewater network facilities (i.e., lift stations and canyon structures) is determined by the amount of wastewater flow coming through the facility. All canyon structures have high criticality because almost 11 MGD of the wastewater flow coming into Hill Canyon Treatment Plant will pass through these canyon structures. Table 6-4 shows the complete list of the City's wastewater network facilities with their consequence of failure ranking.

Table 6-4 Lift Stations and Canyon Structures Consequence of Failure Ranking

Ranking	Wastewater Network Facilities
1	Structure W-F
1	Structure A
1	Structure D
1	Structure J
1	Structure Y
2	Olsen Road Lift Station
3	Lawrence Dr./Hillcrest Lift Station

The City should closely monitor the condition of all high consequence of failure assets and develop emergency response plans to ensure that failure does not occur and/or to minimize the impact of failure. The cost of failure of these assets will far outweigh the cost of replacement. A proactive management strategy should be applied for high consequence of failure assets.

6.3 Business Risk Exposure Assessment Results

As defined earlier, risk (Business Risk Exposure) is a combination of probability of failure and consequence of failure. The results of the business risk exposure assessment for the services are summarized below.

6.3.1 Water Linear

The business risk assessment for water mains is mapped in Figure 6-13. This map provides a visual representation of where the medium and low risk water main pipes are located. Out of 229 miles of pipe, approximately 91% (208 miles) have low risk, 9% (21 miles) have medium risk, and none of the pipes have high risk. It is reassuring to realize that all water mains in the high consequence of failure areas are, by data, in good state. However, the data is based on age of the pipe and staff input; as such, a field inspection is warranted for high consequence of failure assets.

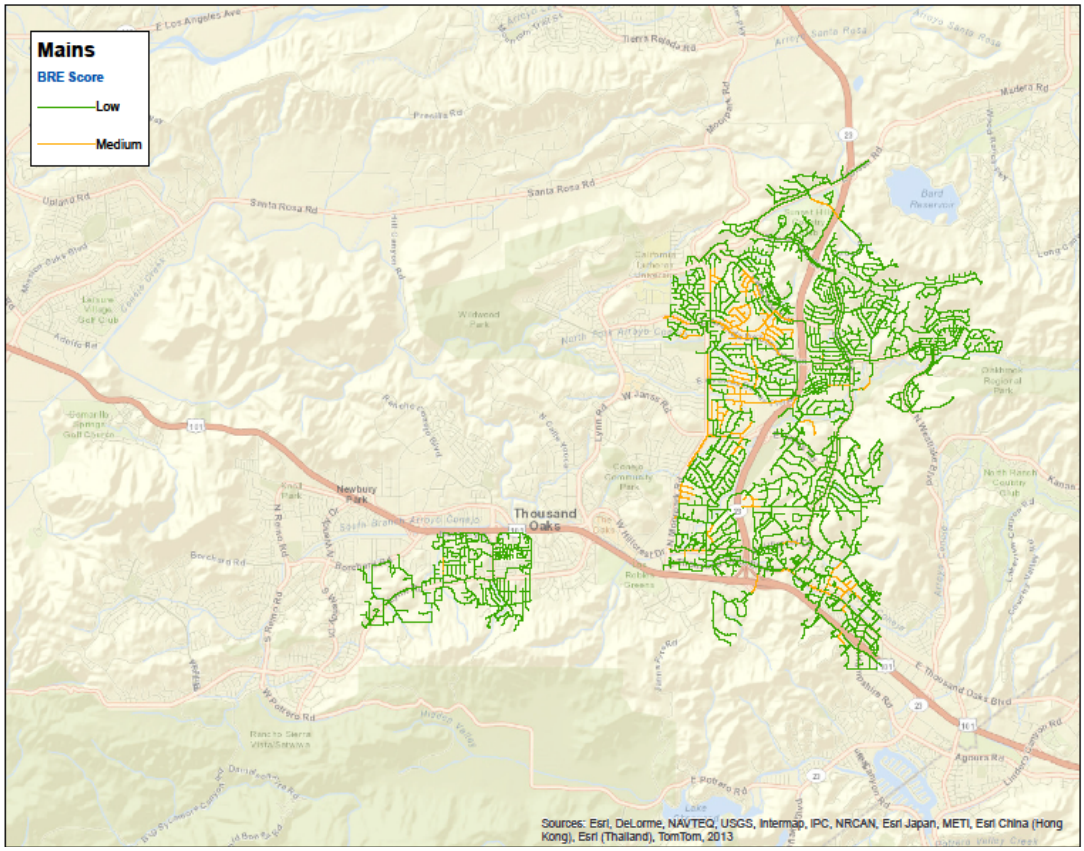
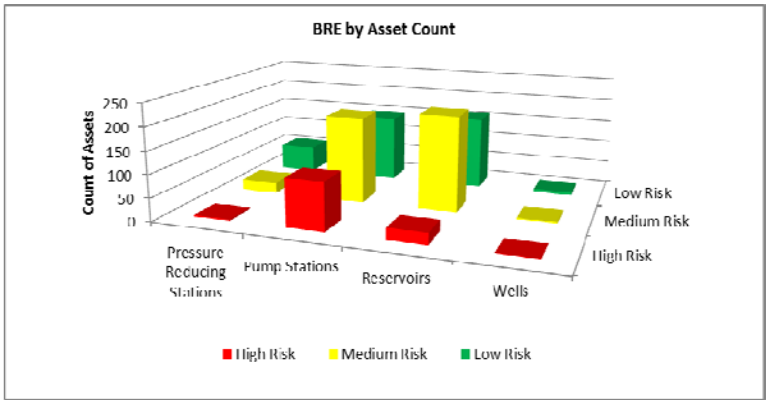


Figure 6-13 Business Risk Exposure Map – Water Mains

6.3.2 Water Network Facilities

Figure 6-14 presents a high level summary of the business risk exposure results for the City's water network facility assets. In terms of asset count, approximately 40% of all vertical water assets are low probability and low consequence of failure (green zone). Approximately 46% of the assets have medium probability and/or medium consequence of failure (yellow zone), and about 14% of assets have a high probability and high consequence of failure. Based on the data, in terms of value, these high risk assets only represent 2% of total asset valuation for vertical water assets.



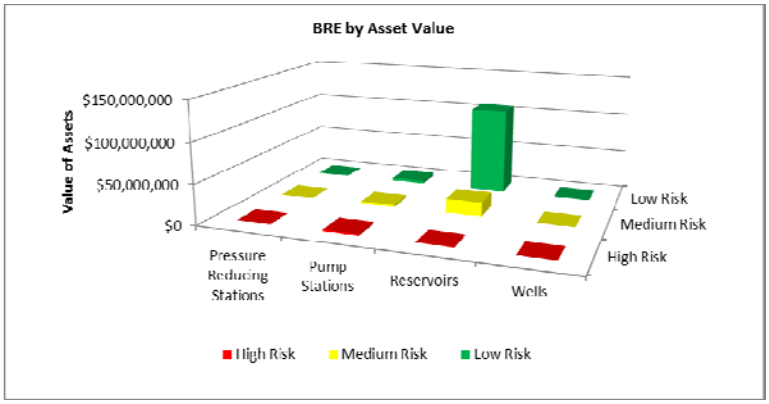


Figure 6-14 Business Risk Exposure – Water Network Facilities

6.3.3 Wastewater Linear

The business risk exposure results for the gravity pipes are mapped in Figure 6-15. This map provides a visual representation of where the medium and low risk gravity pipes are located. Similar to water, there were no high business risk exposure assets. According to data, all assets located in the high consequence of failure areas were identified to be in good state of condition.

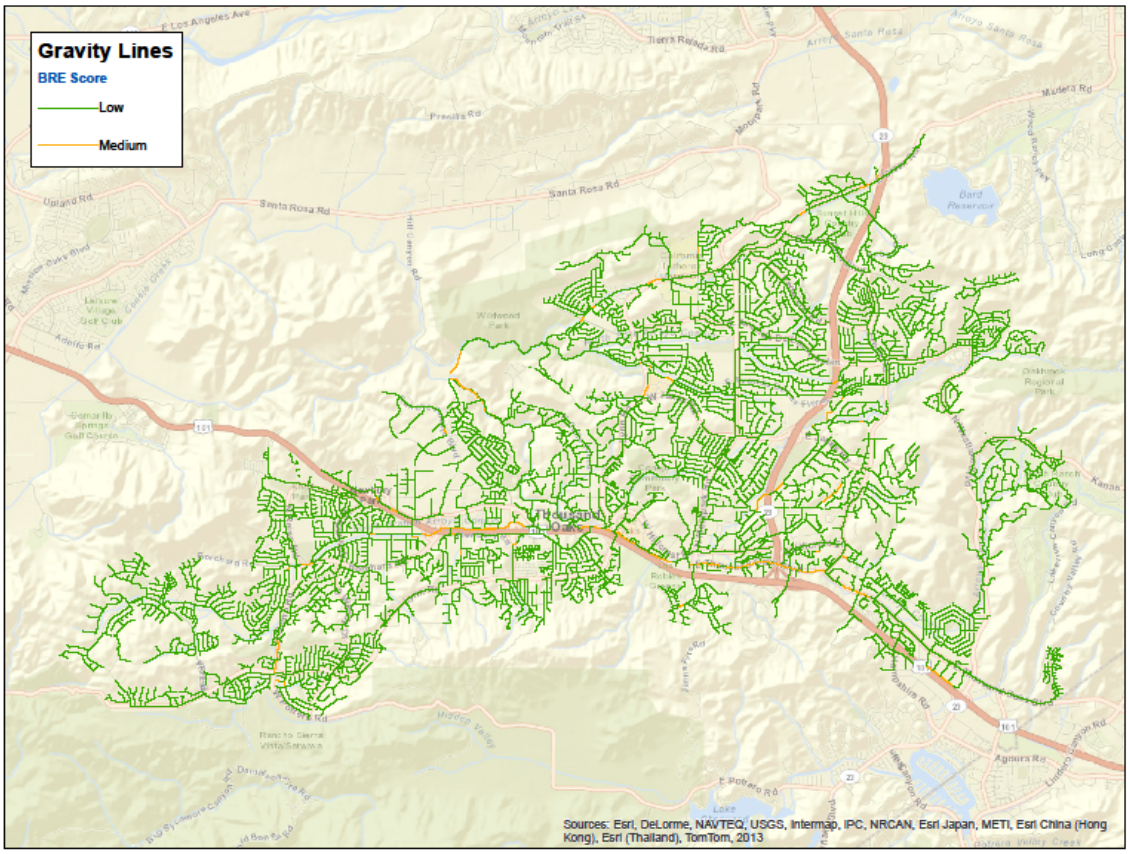


Figure 6-15 Business Risk Exposure Map – Wastewater Gravity Pipes

6.3.4 Wastewater Network Facilities

The summary of the business risk exposure results for the City's wastewater network facility assets is presented Figure 6-16. In terms of asset count, approximately 52% of all vertical water assets are low probability and low consequence of failure (green zone). Approximately 46% of the assets have medium probability and/or medium consequence of failure (yellow zone), and about 2% of assets have a high probability and high consequence of failure. In terms of value, these high risk assets also represent 2% ($140,000) of total asset valuation for vertical wastewater assets.

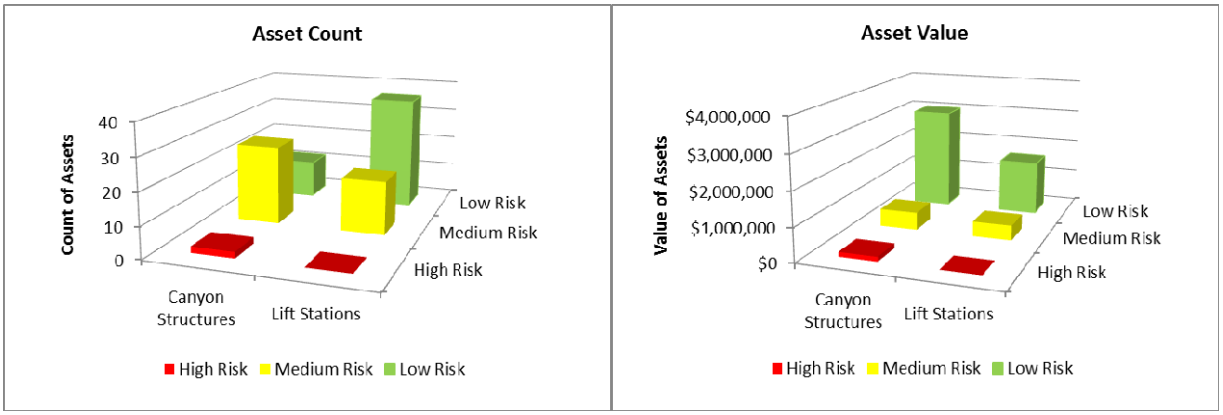
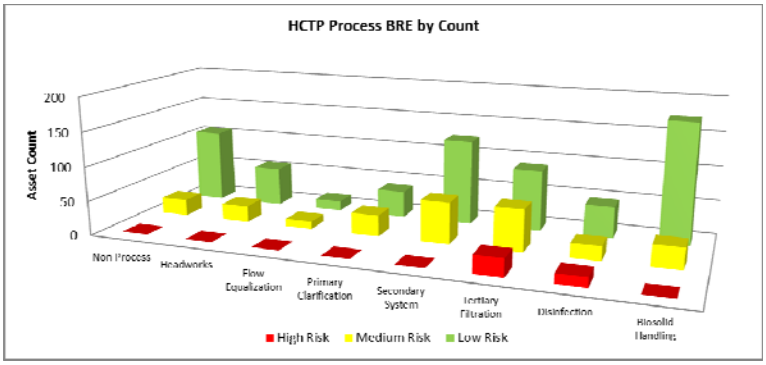


Figure 6-16 Vertical Wastewater Business Risk Exposure

6.3.5 Hill Canyon Treatment Plant

The summary of the business risk exposure results for the Hill Canyon Treatment Plant assets is presented in Figure 6-17. In terms of asset count, approximately 79% of assets are low probability and low consequence of failure (green zone). Approximately 13% of the assets have medium probability and/or medium consequence of failure (yellow zone), and about 8% of assets have a high probability and high consequence of failure. In terms of value, these high risk assets represent 2% ($2.4 million) of total asset valuation for Hill Canyon Treatment Plant.



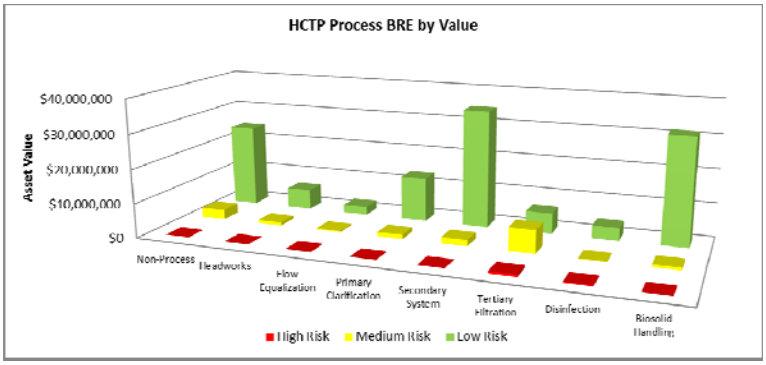


Figure 6-17 Business Risk Exposure – Hill Canyon Treatment Plant

6.4 Risk-Based Management Strategies

Renewal decisions are often made solely on the assessment of an asset's probability of failure. Introducing the concept of the consequence of failure adds a new perspective to the renewal decision-making process. An asset with high probability of failure, but low consequence of failure should have a lower priority than an asset of similar probability of failure, but with a higher consequence of failure. Without the combination of the two factors (probability and consequence of failure), the renewal decision-making process is not optimized.

Based on the results of the risk assessment, a risk-based management strategy can be created. The optimized risk mitigation strategy is graphically illustrated in Figure 6-18. The first priority is to focus on assets in the red zone, high risk assets. These are the assets that will soon fail and will cause the largest impact. The second priority is the yellow zone, medium risk assets. These assets require aggressive monitoring in order to gain a sound understanding of the timing to failure. Knowing when these assets transition from medium risk to high risk is essential to optimizing renewal decisions. Finally, the lowest priority is to focus on the assets in the green zone, low risk assets. These assets pose little immediate risk to the City. However, sample monitoring should be performed to understand the general decay trend of the assets and to know when they transition to medium risk assets.

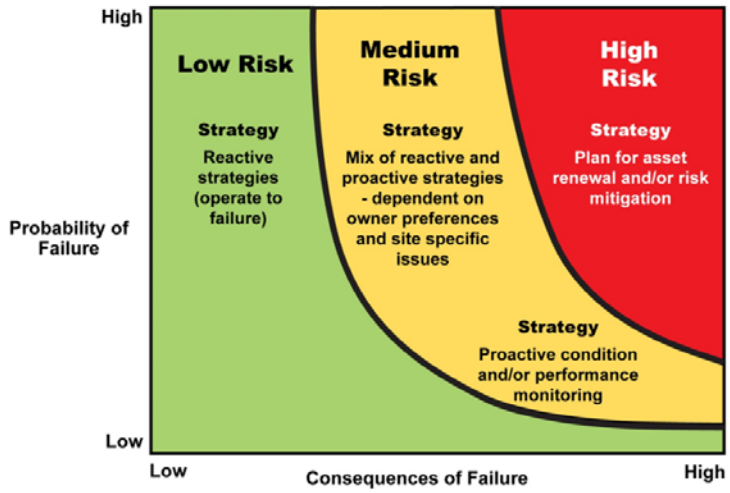


Figure 6-18 Risk-Based Management Strategy Chart

Expanding further on this concept, a sample risk-based management strategy matrix is presented in Table 6-5. This sample management strategy should be used as a guideline for decision-making, utilizing an asset's business risk exposure score. The aim is to develop a transparent and consistent decision-making platform where justification can be made for proactive decisions and asset replacements or against the allocation of resources to low priority items.

Table 6-5 Sample Risk-Based Management Strategies

Risk Rating	Probability of Failure		Consequence of Failure
	Structural	Operational	
High	• Verify the structural condition with field data • Consider capital project development • Replace • Rehabilitate • Consider non-asset solution	• Verify the situation with field data • Implement the appropriate operational option	• Develop an emergency response program with appropriate mitigation measures
Medium	• Monitor the structural condition • Consider future capital project options	• Monitor the operational condition • Consider long-term capital options	• Develop appropriate mitigation measures
Low	• Sample monitoring of similar pipe segments	• Sample monitoring	• Develop appropriate mitigation measures

Implementing similar management strategies will allow the City to be more proactive in the management of its assets. Instead of reacting to failure, the City now has a mechanism to be proactive in identifying, diagnosing, and mitigating high risk assets before they fail.

7. Financial Summary

This chapter introduces the long range renewal projection for the City's water and wastewater infrastructure. The information in this chapter is built off the inputs, assumptions, and logic presented in previous chapters. The renewal projection is a long range look at the future capital investment needs. Understanding the long-range renewal projection is a key step in making proactive management decisions.

7.1 Renewal Projection

Using the data in the asset register, estimated replacement/rehabilitation costs, and management strategies, a 100-year replacement and rehabilitation (renewal) projection was generated for the City's water and wastewater assets. For proper asset management planning, a long-range planning horizon is required to fully capture the cyclic nature of the installation and replacement trends of the full asset register. A short-range (e.g., 5-year, 10-year) planning horizon often fails to consider the large capital requirements that may lie just beyond the analysis window. Due to the enormous capital investment needs of infrastructure assets, an organization will not be able to financially prepare for the massive renewal requirements of future years without long-range consideration.

The renewal projections are modeled through the application of management strategy logic for each record in the asset register. Every renewal activity and cost is linked to an individual asset, and this data is aggregated to create the summary figures shown in this section. The budget for the renewal needs is based on estimated 2013 replacement costs. Inflation is not generally used in a 100-year planning horizon due to the drastic (exponentially increasing) effect it has on costs over 100 years. The City's projected 100-year renewal requirements are presented in Figure 7-1.

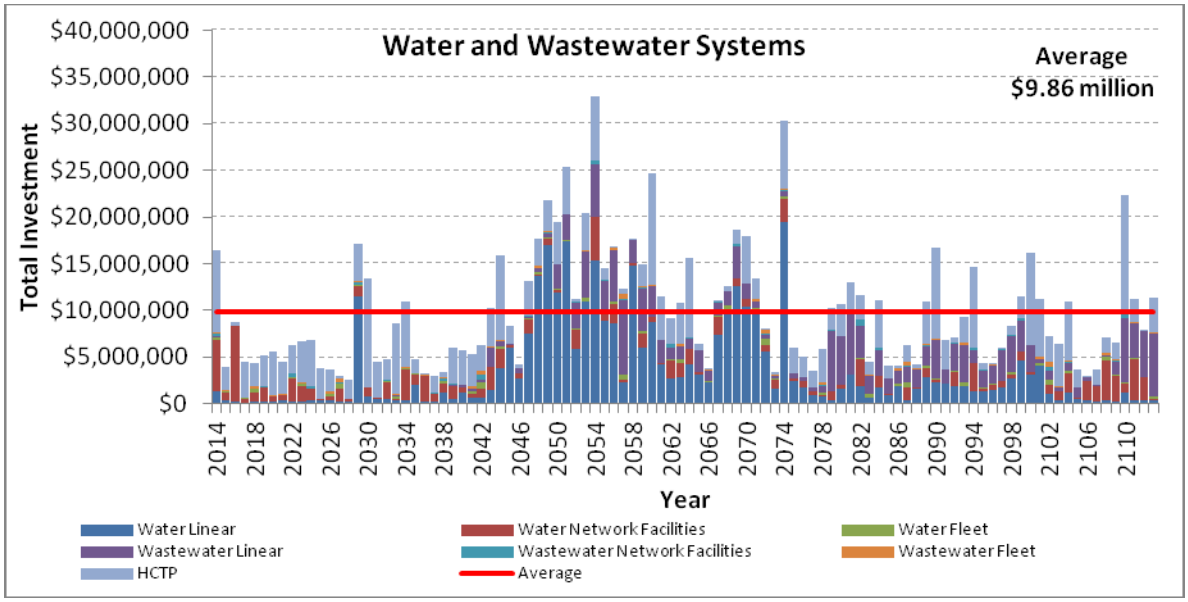


Figure 7-1 Long-Range Investment Needs Projection – Water and Wastewater

For the asset register valued at approximately $1.3 billion, it is projected to cost a little less than $1.0 billion to sustain the renewal needs of the assets over the next 100 years. The different color bars in the figures represent the various service types (i.e., water linear, water network facilities,

wastewater linear, wastewater network facilities, Hill Canyon Treatment Plant, and water and wastewater fleet). The bars represent the combined cost of asset replacement and rehabilitations activities. The annual average is calculated by dividing the total expenditure over a given planning horizon by the number of years in the planning horizon. The figure illustrates the eventual need to replace nearly all of the City's water and wastewater assets.

The results indicate that, on average, the City will need to invest approximately $9.86 million per year to fully fund the projected rehabilitation and replacement requirements for the next 100 years. However, this annual average will change depending on the planning horizon. Table 7-1 shows the fluctuation of annual average by planning horizon. The 10-year and 25-year planning horizons have significantly lower averages than the 100-year annual averages due to the relatively young age of the City's water and wastewater infrastructure systems. However, within the next 50 years a majority of the City's assets are due for rehabilitation or replacement, causing the annual average to increase above $10 million.

Table 7-1 Annual Average by Planning Horizon

Planning Horizon	Annual Average
10 years (2014-2023)	$6.62 million
25 years (2014-2038)	$6.39 million
50 years (2014-2063)	$10.31 million
100 years (2014-2113)	$9.86 million

More than $16 million is projected for the first year (2014). This corresponds directly to 100% consumed assets in the consumption profile from Chapter 2. The largest portion of this spike is contributed by HCTP assets. The treatment process related assets within the treatment plant generally have a shorter useful life than linear assets in the distribution or collection systems. A detailed condition assessment is recommended to understand the true renewal need for these assets. Depending on the condition assessments results, the actual useful life of these assets can probably be extended with lower cost options.

Figure 7-2 and Figure 7-3 show the 100-year investment needs for water and wastewater systems, respectively.

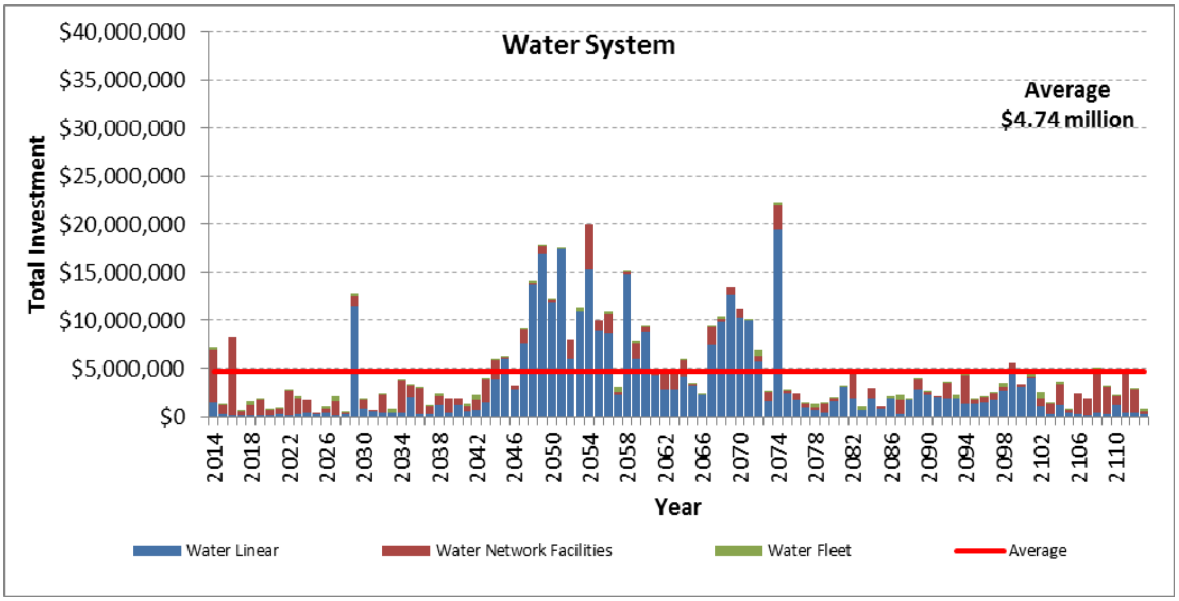


Figure 7-2 Long-Range Investment Needs Projection – Water System

As shown in Figure 7-2, the City needs an annual average of $4.74 million for to cover the rehabilitation and replacement of its water system assets. This amount comprise of 48% of the annual investement needs of the City's water and wastewater systems. The first two peaks on the graph are related to reservoirs rehabilitions and new construction projects. Over time the water linear assets dominate the investment needs with 75% of the total water system needs.

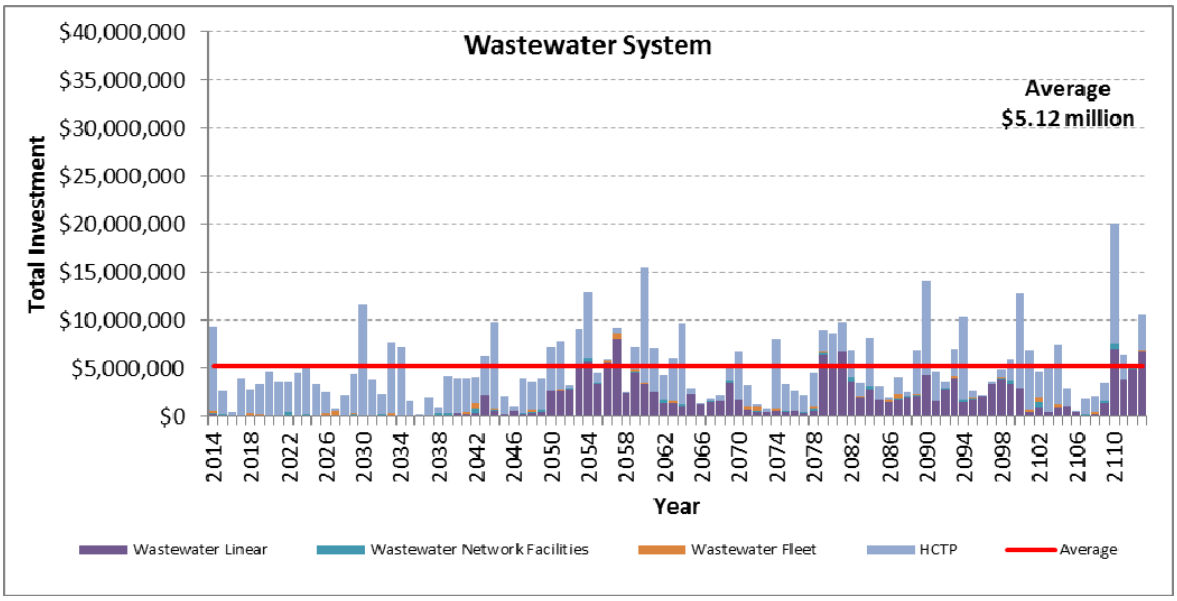


Figure 7-3 Long-Range Investment Needs Projection – Wastewater System

The wastewater system assets accounts for 52% of the City's total water and wastewater system investment needs with an annual average of $5.12 million (Figure 7-3). About 64% of this annual average is related to rehabilitation and replacement works required by Hill Canyon Treatment Plant.

7.2 Investment Needs Projection by Asset Group

To allow for more detailed analysis, the renewal projection profiles are further broken down by the separate work groups or service types. Figure 7-4 to Figure 7-9 show the long-range (100-year) investment needs projection for the water linear, water network facilities, wastewater linear, wastewater network facilities, HCTP, and water and wastewater fleet.

With a $3.43 million annual average, water linear assets renewal accounts for 35% of total water and wastewater systems renewal. The majority of water linear assets will need some type of renewal starting 2046 to 2074. This result corresponds to the installation profile of the City's water linear assets provided in Chapter 2. With an average useful life of 100 years, the majority of water mains installed in the 1950-1970 will be in need of rehabilitation or replacement in 2050-2070. Other investment peaks in 2029 and 2074 are caused by meter replacement to maintain meter accuracy. The 45 years between 2029 and 2074 represent the average useful life of meters.

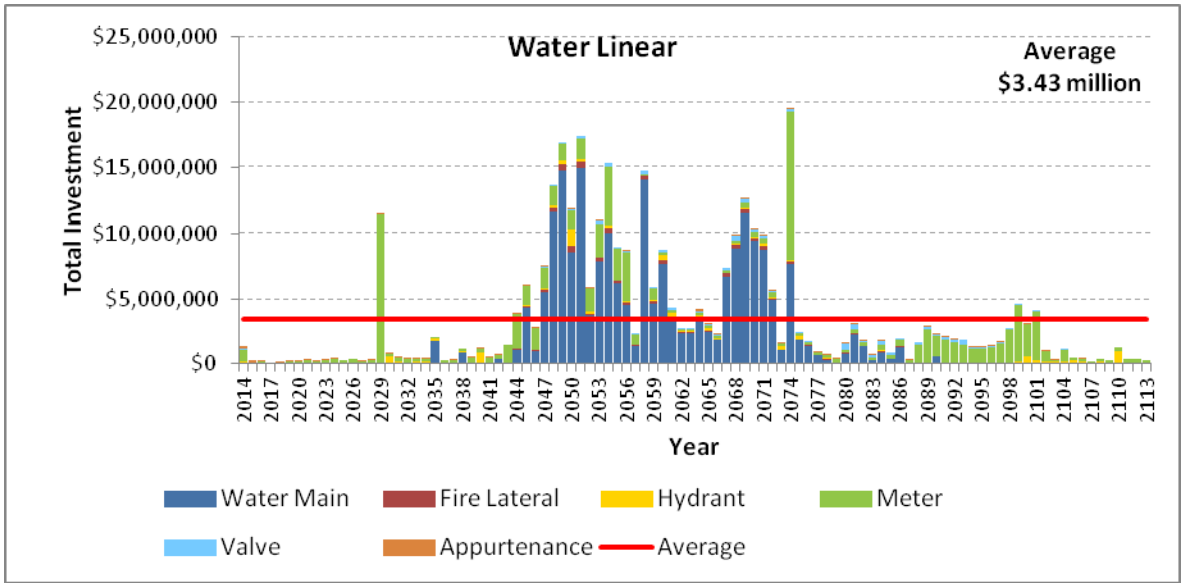


Figure 7-4 Long-Range Investment Needs Projection – Water Linear

Water network facilities account for 12% of total water and wastewater systems renewal with an annual average of $1.16 million (Figure 7-5). Over 98% of this annual average will be used to maintain reservoir (75%) and pump station (23%) assets. Investment peaks in the first few years include rehabilitation at Tara reservoir ($1.6 million in 2014) and the construction of the new Wilder No. 2 reservoir ($6 million in 2016). In addition, over $7 million is required to fund various rehabilitation projects related to seismic retrofit in the next 7 years.

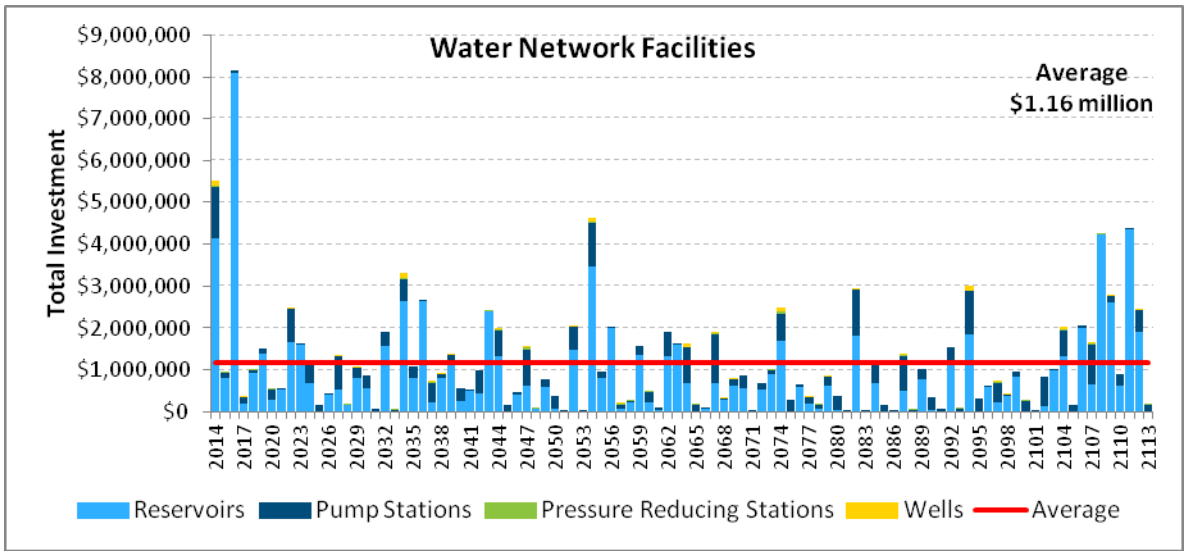


Figure 7-5 Long-Range Investment Needs Projection – Water Network Facilities

Figure 7-6 shows the long-range investment needs projection for wastewater linear assets. With an annual average of investment needs of $1.67 million, wastewater linear accounts for 17% of the total renewal needs of water and wastewater systems. Within wastewater linear assets, gravity pipes and manholes represent 70% and 20% of total investment needs, respectively. The renewal (e.g., relining, replacement) pattern, which starts in 2050, mirrors the installation profile of the City's wastewater gravity pipes when the big development started in the 1950s.

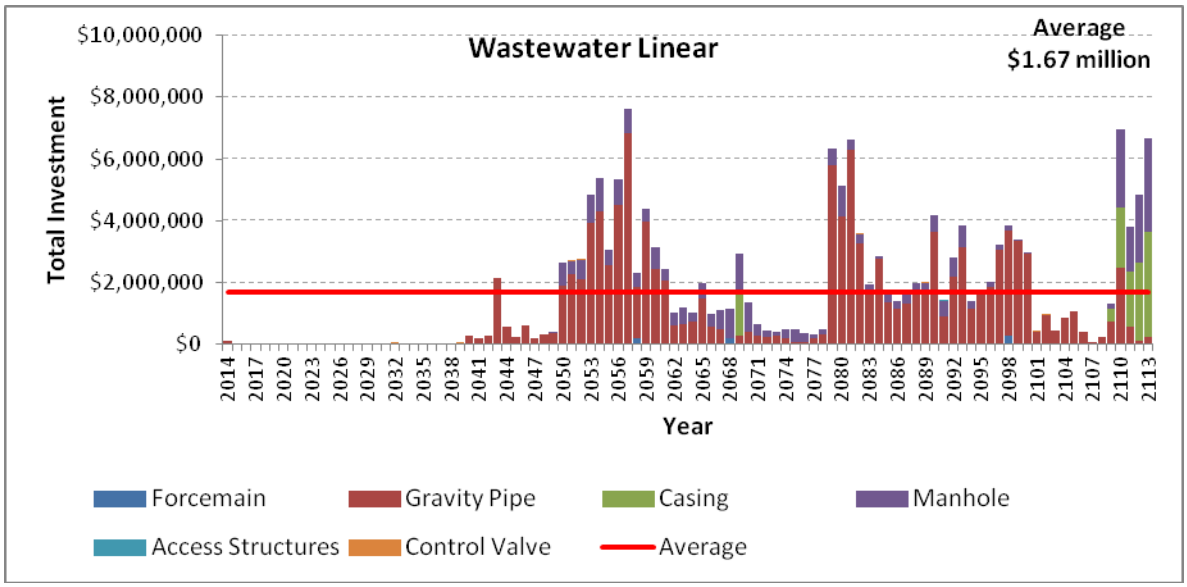


Figure 7-6 Long-Range Investment Needs Projection – Wastewater Linear

Figure 7-7 shows the long-range investment needs projection for wastewater network facility assets. With annual average investment needs of $94,000, wastewater linear accounts for less than 1% of total renewal needs of water and wastewater systems. Due to their relatively short useful life, the mechanical and electrical assets within the lift stations need frequent upgrade/replacement, hence the peaks every 10 to 15 years in Figure 7-7.

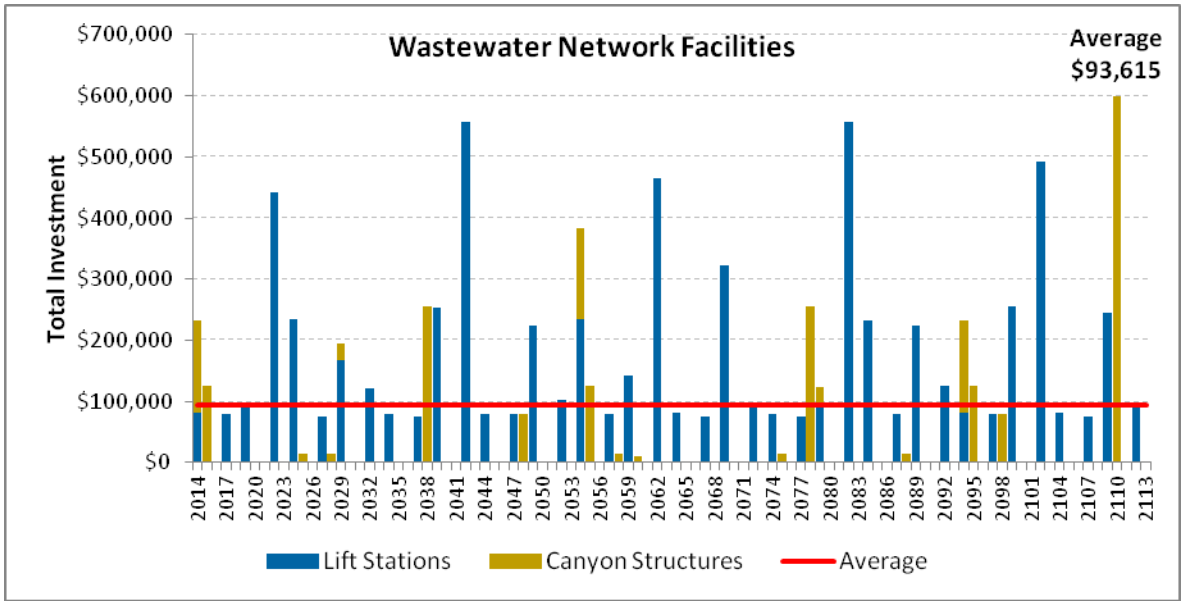


Figure 7-7 Long-Range Investment Needs Projection – Wastewater Network

Figure 7-8 shows the long-range investment needs projection for Hill Canyon Treatment Plant assets. At $3.26 million, its annual average of investment needs accounts for over 33% of total renewal needs of water and wastewater systems. Since the treatment process assets have relatively short useful lives, they need to be maintained or replaced regularly to ensure minimum disruption to the plant's processes. The majority of mechanical and electrical equipment have 10-25 years of useful life. One of the most critical processes in the plant, tertiary filtration systems, has 60 years of useful life and requires media replacement every 15 years. The replacement of the filtration system contributes to the highest peaks in Figure 7-8 with the replacement of six filtration systems in 2030 and 2090 and four others in 2060. The replacement of bioreactors as part of the secondary system contributes to the last peak in 2110.

The non-process assets (e.g., office buildings, storage, and site improvements) represent almost 25% of total rehabilitation and replacement needs at the Hill Canyon Treatment Plant. However, due to a lower risk score, the rehabilitation or replacement of non-process assets can be delayed with minimum disruption to the treatment plant performance.

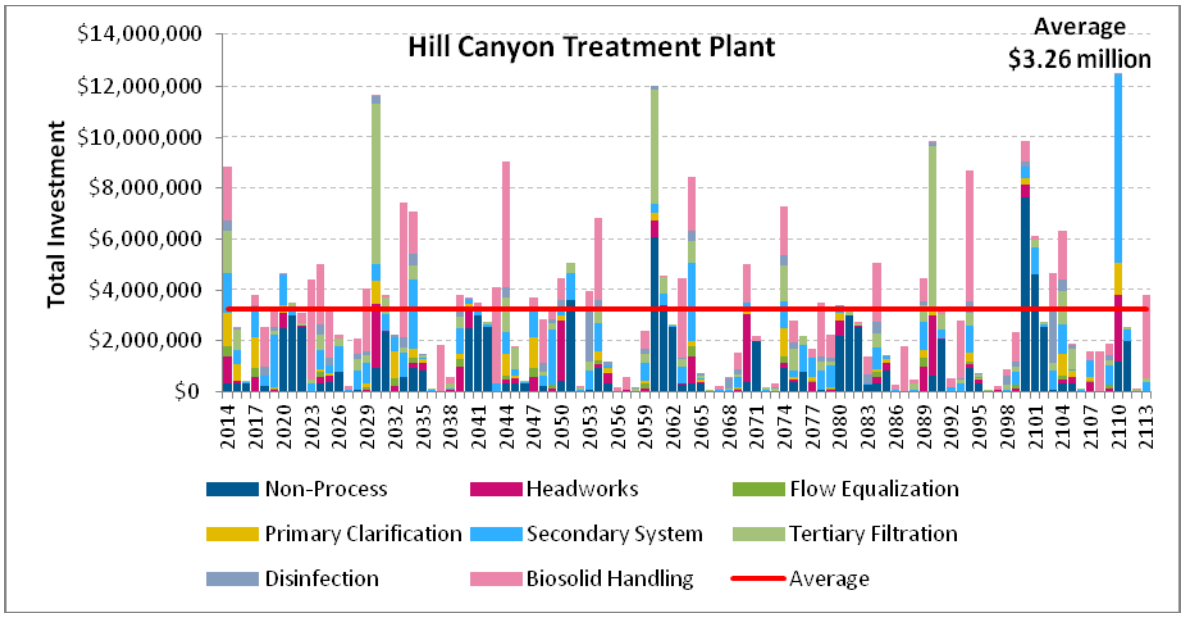


Figure 7-8 Long-Range Investment Needs Projection – HCTP

Figure 7-9 shows the long-range investment needs projection for fleet assets. With annual average investment needs of $241,000, fleet accounts for 2.5% of total renewal needs of water and wastewater systems. The 15-year cyclic pattern of investment reflects the average useful life of fleet assets.

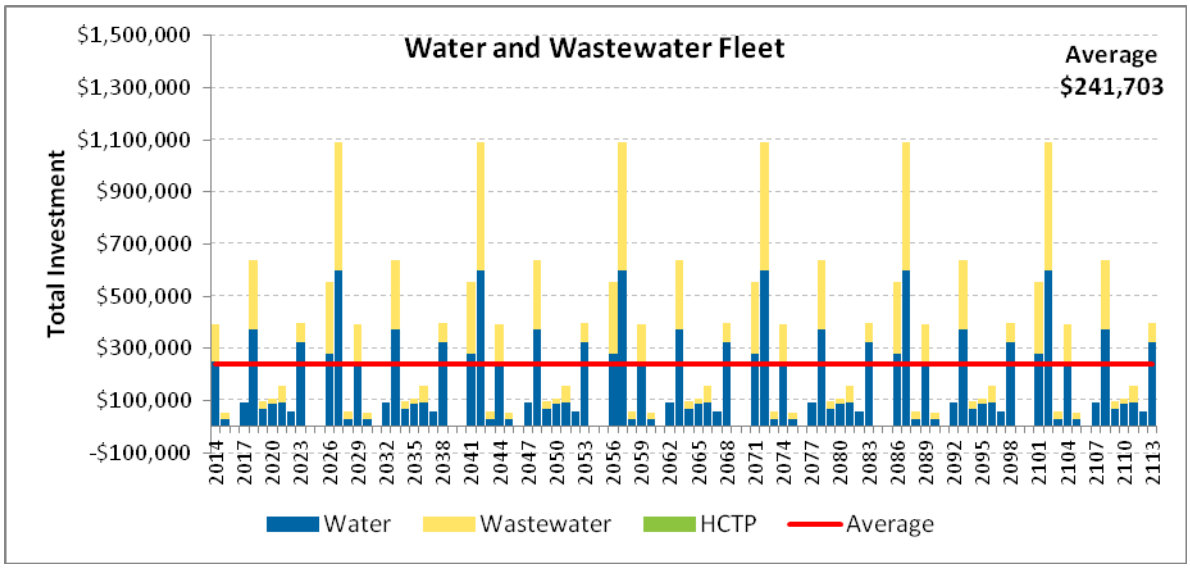


Figure 7-9 Long-Range Investment Needs Projection – Water and Wastewater Fleet

8. Improvement Plan

8.1 Confidence Level Rating

The Confidence Level Rating (CLR) provides a measure by which the City can track the improvement of the asset management plan and the associated management decisions. The confidence level rating is used not only to measure the current practice, but also to identify and prioritize future improvements.

In developing a first iteration asset management plan, an organization will seldom have perfect data to support the asset analysis. As illustrated in Figure 8-1, asset management is a process of continuous improvement. As the quantity and quality of data improves, the confidence level of the next iteration of the asset management plan will increase. Through the asset management plan development process, the City gained a better understanding of their data gaps and developed mitigation plans to improve the overall data quality. Any assumed data will be superseded by actual data when it becomes available.

The confidence level varies over the planning horizon and, as the planning period extends (short-range vs. long-range), the accuracy of the projection decreases. For example, the confidence level for a 10-year projection will be much higher than for an 80 to 100-year projection. It is important to have a high confidence level in early years (years 1 through 10), as the asset management plan will form the basis for future capital and operational investment plans.

Figure 8-1 Continuous Improvement Process

8.2 Methodology and Assessment

The confidence level rating is based on the following key elements. These key elements play a critical role in the accuracy of the future renewal funding projections and the acceptance of the asset management plan.

1. Asset Inventory – Measures the completeness of the asset data (*Did the asset register include all the assets the City owns?*)
2. Data Quality – Measures the quality and completeness of the data attributes used to develop the asset management plan (*How many data assumptions were used to complete the asset management plan?*)
3. Asset Valuation – Measures the accuracy of the estimated replacement costs of the assets and services (*How accurate is the estimated replacement cost of each asset?*)
4. Management Strategies – Measures the accuracy of the management strategies and renewal strategies used in the asset management plan (*How representative is the expected life? How many times does an asset get refurbished?*)
5. Business Risk Exposure – Measures the accuracy of the risk assessment methodology and results (*Is the risk assessment representative of the actual risks facing the organization?*)
6. Levels of Service – Measures the quality and efforts of developing the levels of service to track the performance of the asset management program (*Were the levels of service identified across all major asset services? Do the levels of service link to actual asset performance?*)
7. Future Demand – Measures the quality and completeness of the identified factors that can affect the future of the City (*Does the future demand identify factors that can influence the delivery of the levels of service for all major asset services?*)
8. Staff Participation – Captures the staff involvement in developing the asset management plan (*During the development phase, were key members of the City staff involved?*)
9. Staff Buy-In – Estimates the staff confidence in or acceptance of the quality of the asset management plan. For example, an asset management plan may have a low confidence level, yet have a high staff buy-in, or vice-versa (*Are the staff accepting the results of the asset management plan?*)

Each key confidence level element listed above is assigned a weighting factor. The weighting factor quantifies the criticality of the key element with respect to the overall accuracy and quality of the asset management plan. For example, the weighting of Future Demand is much lower than that of Data Quality, since Future Demand identifies the possible factors influencing the delivery of the levels of service and does not directly impact the accuracy of the future renewal projections. Table 8-1 presents the primary weighting for each of the key confidence level elements.

Table 8-1 Primary Weighting

Key Confidence Level Elements	Primary Weighting
Asset Inventory	20%
Data Quality	15%
Asset Valuation	15%
Management Strategies	20%
Business Risk Exposure	10%

Key Confidence Level Elements	Primary Weighting
Levels of Service	3%
Future Demand	3%
Staff Participation	5%
Staff Buy-In	10%
Total	100%

A secondary weighting adjusts the importance of different services (i.e., water and wastewater) with respect to one another. The tertiary weighting is applied among the different asset types (e.g., linear, network facilities) within each service. Table 8-2 shows the complete list of services and asset types with their associated secondary and tertiary weightings. These weighting is determined based on the relative importance between asset groups and their associated total replacement costs.

Table 8-2 Secondary and Tertiary Weighting

Services/Asset types	Secondary Weighting	Tertiary Weighting
Water System	50%	
Linear assets		50%
Network facilities assets		50%
Wastewater Systems	50%	
Linear assets		50%
Network facilities assets		15%
Hill Canyon Treatment Plant		35%

8.3 Confidence Level Rating Assessment Results

Table 8-3 presents the results of the confidence level rating assessment completed for the City's 2013 Asset Management Plan. The table provides the confidence level rating for each key element, its weighting, and the weighted confidence level rating. The table shows the ratings for each asset type (i.e., water linear, water network facilities, wastewater linear, wastewater network facilities, and Hill Canyon Treatment Plant). The CLR weighting by asset groups is calculated by multiplying the secondary and tertiary weightings shown in Table 8-2.

Table 8-3 2013 Asset Management Plan Confidence Level Rating

Key Confidence Level Elements	CLR by Asset Group				
	Water Linear	Water Network Facilities	Wastewater Linear	Wastewater Network Facilities	Hill Canyon Treatment Plant
	25%	25%	25%	7.5%	17.5%
Asset Inventory	90%	75%	90%	75%	60%
Data Quality	85%	70%	85%	70%	65%
Asset Valuation	75%	55%	75%	55%	50%
Management Strategies	60%	60%	60%	60%	65%
Business Risk Exposure	70%	70%	70%	70%	50%
Levels of Service	60%	60%	60%	60%	60%
Future Demand	80%	80%	80%	80%	80%

Key Confidence Level Elements	CLR by Asset Group				
	Water Linear	Water Network Facilities	Wastewater Linear	Wastewater Network Facilities	Hill Canyon Treatment Plant
	25%	25%	25%	7.5%	17.5%
Staff Participation	85%	85%	85%	85%	85%
Staff Buy-In	80%	80%	80%	80%	80%
CLR by Asset Group	77%	69%	77%	69%	63%

Table 8-4 shows the summary of weighted CLR scores for water and wastewater systems. The confidence level rating for the water system (73%) is slightly higher than wastewater system (71%).

Table 8-4 2013 Asset Management Plan Confidence Level Rating

Key Confidence Level Elements	Weighted CLR		Total CLR
	Water	Wastewater	
Asset Inventory	83%	77%	80%
Data Quality	78%	76%	77%
Asset Valuation	65%	63%	64%
Management Strategies	60%	62%	61%
Business Risk Exposure	70%	63%	67%
Levels of Service	60%	60%	60%
Future Demand	80%	80%	80%
Staff Participation	85%	85%	85%
Staff Buy-In	80%	80%	80%
Total CLR	73%	71%	72%

With the overall confidence level rating of 72%, the City's Water and Wastewater Asset Management Plant is above the expected range for a first iteration asset management plan. This can be attributed to the fact that data provided by the City's GIS system meets most of the basic data requirements for asset management plan development, especially for linear assets. However, for the network facilities and treatment plant, data are sparsely available in multiple sources (e.g., as built drawings, CMMS, Excel files, and hard copy).

Figure 8-2 presents the confidence level rating results for each key element of each service. This figure can be used to track the performance of each key element in future iterations of the asset management plan.

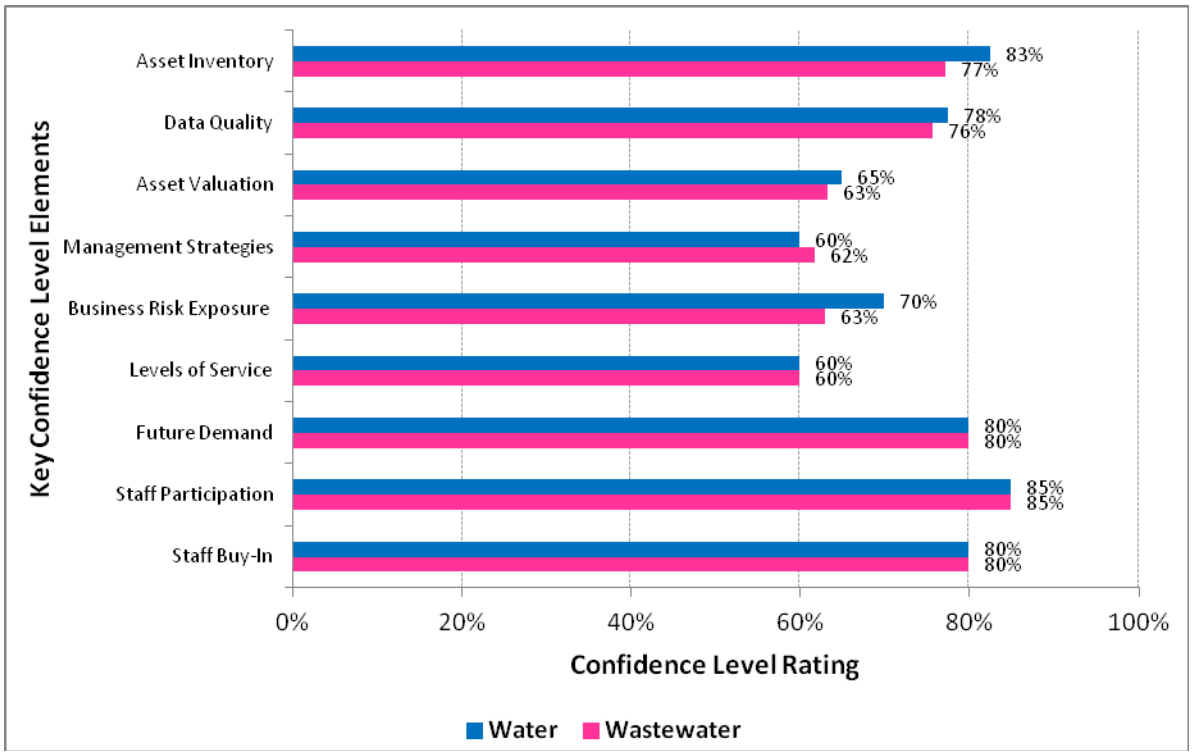


Figure 8-2 Asset Management Plan Confidence Level Rating

The highest ratings came in the staff participation element. Most key members of the work groups were closely involved in the development of the asset register and the management strategies. In contrast, the confidence level for the levels of service is the lowest. In this version of asset management plan, water and wastewater levels of service information is mainly compiled from the City's 2012 Mission Statement, Goals, Objectives, and Performance Measures. While this document provides the guideline and strategic direction, it is not specifically developed for water and wastewater services.

The improvement plan below highlights the specific areas that will increase the confidence level of the asset management program and future asset management plans.

8.4 Improvement Plan

In order to improve the asset management program and its associated processes, the City should focus on the following areas.

1. Asset Inventory

The City's asset inventory system for linear assets is mostly complete with high accuracy. However, water meters are not included in the current GIS system. It is recommended that the City include meters in the next GIS system upgrade. On the vertical side (i.e., network facilities and Hill Canyon Treatment Plant), the asset inventory system still needs a lot of improvement. It is recommended for the City to have a dedicated Computerized Maintenance Management System (CMMS) for network facilities. In addition to providing a work order tracking system, the CMMS can also be used as a central database to store the asset data attributes and historical maintenance and cost information. At Hill Canyon Treatment Plant, additional effort should be invested to ensure the current CMMS system is fully utilized beyond the work order tracking system. The current listing of assets in the

treatment plants should be reviewed and minimum asset attributes (e.g., install year, size/capacity, replacement cost) should be populated.

2. Data Quality

The current asset inventory for network facilities and Hill Canyon Treatment Plant is still missing several important asset attributes (i.e., size and install year). In this iteration of the asset management plan, some assumptions of size and install year were made to close the data gaps. In the future, the City needs to complete any missing data attributes in the asset register. In addition, a significant effort is required to continue data maintenance in order to keep the current information up-to-date (e.g., recording rehabilitation or replacement activities).

3. Asset Valuation

While the current valuation for linear assets (distribution and collection assets) has a high confidence level, the confidence level for vertical assets is not as good. The current total asset valuation for vertical assets, particularly treatment plants, is largely based on professional judgment. In the future, the City should develop a standard process to document asset valuation based on financial information gathered during asset commissioning. The business processes should assign this responsibility to individuals or groups to ensure that accurate engineering and construction cost information is recorded and readily available for asset management program development. Ideally, the replacement cost should be available at asset level. The financial information includes purchase order data for certain pieces of equipment and the cost to install the equipment (i.e., pumps, generators).

4. Management Strategies

Management strategies are used to drive the renewal decisions, and only some of the initial asset management strategies were developed with key members of the City staff. Numerous assumptions, including expected lives, were made based on perceptions of asset deterioration behavior. Further justification will need to take place for the management strategies in order to improve the accuracy of the projected renewal activities. In the next iteration of management strategies, the expected life information should be determined using historical work order data.

5. Business Risk Exposure

The business risk exposure analysis enables the City to assess and manage the risks the assets present to the organization. While the consequence of failure methodology was calculated using several layers of information, the probability of failure is simply determined using age. It is recommended that the City start collecting asset condition data, especially for the facility and treatment plant assets. Once condition assessment data becomes available, a condition-based analysis can be conducted to improve the probability of failure estimate.

Appendices

Appendix A - (Asset Register and Modeling File)

This Asset Management Plan Report is accompanied with a set of excel files containing the asset register and long-range investment needs model. The following table provides the description of each files and worksheets.

No.	File Name	Worksheets	Description
1.	00-Summary All Assets.xlsx	Valuation	The summary of asset valuation for all water and wastewater systems assets
		Install-Condition	The installation and consumption profiles for all water and wastewater systems assets
		Renewal	The 100-year investment graph for all water and wastewater systems assets
2.	01-Water Linear Model.xlsx	Asset Register	List of individual water linear assets with their associated data attributes
		Classes	List of asset class/management strategy for water linear assets
		Model	The renewal model for water linear assets
		Valuation	The summary of asset valuation for water linear assets
		Install-Condition	The installation and consumption profiles for water linear assets
		Renewal	The 100-year investment graph summary for water linear assets
3.	02-Water Network Facilities Model.xlsx	Asset Register	List of individual water network facilities assets with their associated data attributes
		Classes	List of asset class/management strategy for water network facilities assets
		Model	The renewal model for water network facilities assets

		Valuation	The summary of asset valuation for water network facilities assets
		Install-Condition	The installation and consumption profiles for water network facilities assets
		Renewal	The 100-year investment graph summary for water network facilities assets
4.	03-Wastewater Linear Model.xlsx	Asset Register	List of individual wastewater linear assets with their associated data attributes
		Classes	List of asset class/management strategy for wastewater linear assets
		Model	The renewal model for wastewater linear assets
		Valuation	The summary of asset valuation for wastewater linear assets
		Install-Condition	The installation and consumption profiles for wastewater linear assets
		Renewal	The 100-year investment graph summary for wastewater linear assets
5.	04-Wastewater Network Facilities Model.xlsx	Asset Register	List of individual wastewater network facilities assets with their associated data attributes
		Classes	List of asset class/management strategy for wastewater network facilities assets
		Model	The renewal model for wastewater network facilities assets
		Valuation	The summary of asset valuation for wastewater network facilities assets
		Install-Condition	The installation and consumption profiles for wastewater network facilities assets
		Renewal	The 100-year investment graph summary for wastewater network

			facilities assets
6.	05-Wastewater HCTP Model.xlsx	Asset Register	List of individual Hill Canyon Treatment Plant assets with their associated data attributes
		Classes	List of asset class/management strategy for Hill Canyon Treatment Plant assets
		Model	The renewal model for Hill Canyon Treatment Plant assets
		Valuation	The summary of asset valuation for wastewater network facilities assets
		Install-Condition	The installation and consumption profiles for Hill Canyon Treatment Plant assets
		Renewal	The 100-year investment graph summary for Hill Canyon Treatment Plant assets
7.	06-Fleet Model.xlsx	Asset Register	List of individual fleet (including portable equipment) assets with their associated data attributes
		Classes	List of asset class/management strategy for fleet (including portable equipment) assets
		Model	The renewal model for fleet (including portable equipment) assets
		Valuation	The summary of asset valuation for fleet (including portable equipment) assets
		Install-Condition	The installation and consumption profiles for fleet (including portable equipment) assets
		Renewal	The 100-year investment graph summary for fleet (including portable equipment) assets

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