City of Port Coquitlam | Asset Management Plan

2024

Water

Final Version
August 2024

Contents

Executive Summary 7

Approach and Methodology 12
- Developing the Asset Management Plan 13
  - Build a comprehensive asset inventory 13
  - Conduct asset-level risk assessments and build risk models 14
  - Compile lifecycle activity data 14
  - Compile levels of service data 14
  - Develop financial strategy 14
- Limitations and Constraints 15

State of the Infrastructure 16
- Asset Hierarchy and Data Classification 17
- Inventory and Valuation 18
  - Costing Methods 18
- Asset Condition 21
  - Source of Condition Data 21
  - Condition Assessment Guidelines 22
  - Condition Rating System 23
  - Projected Asset Conditions 24
  - Watermain Break History 26
- Age Profile 28
  - Historical Asset Expenditures 28
  - Serviceable Life vs. Current Asset Age 29

Lifecycle Management 32
- Current Lifecycle Framework 33
- Capital Reinvestment Rates 37
  - Reinvestment Rate Benchmarks 37
- Forecasted Long-term Replacement Needs 41

Risk Analysis 42
- Calculating Asset Level Risk 43
- Risk Models and Matrices 46
  - Risk Matrix: All Water Assets 46
  - Linear Assets 47
  - Facilities and Appurtenances 52

Levels of Service 55
- Defining Levels of Service 56
  - Levels of Service Framework 56
  - Levels of Service Analysis 61

Financial Strategy 63

Approach and Methodology 64
Current Financial Planning Framework 65
Capital Budget 65
Debt 65
Senior Government Support 67
Sustainability 67
Reserves 68
Development Cost Charges (DCC) Program 70
Achieving Reinvestment Rate Targets 71
Tax-Funded Service Areas 72
Levy-Funded Service Areas 78
Infrastructure Backlogs 83
Using Reserves 84
Leveraging Development Cost Charges (DCC) 85
Recommendations 86
Tax Funded Service Areas 86
Levy-Funded Service Areas 86
Next Steps 88

List of Figures

Figure 1: Number of Asset Records Before and After Inventory Refinements 13
Figure 2: Asset Hierarchy and Data Classification 17
Figure 3: Portfolio Valuation 19
Figure 4: Linear Asset Length by Pipe Material 20
Figure 5: Asset Condition: All Water Assets 24
Figure 6: Asset Condition: Water – Linear Assets 25
Figure 7: Asset Condition: Water System – Facilities and Appurtenances 25
Figure 8: Water System: Watermain Break History – By Installation Year 26
Figure 9:Historical Expenditures on Asset Acquisition 28
Figure 10: Average Asset Age vs. Estimated Useful Life: Linear Assets 29
Figure 11: Percentage of Estimated Useful Life Consumed: Linear Assets 30
Figure 12: Average Asset Age vs. Estimated Useful Life: Facilities and Appurtenances 31
Figure 13: Percentage of Estimated Useful Life Consumed: Facilities and Appurtenances 31
Figure 14: Summary of Capital, Maintenance, and Operations Expenditures 34
Figure 15: Forecasted Long-term Replacement Needs 41
Figure 16: Calculating Risk Ratings 43
Figure 17: Generic Risk Matrix 45
Figure 18: Detailed Risk Matrix – All Water Assets 46
Figure 19: Consolidated Risk Matrix – All Water System Assets 46
Figure 20 Probability of Failure – Linear Assets 47
Figure 21 Consequence of Failure – Linear Assets 49
Figure 22: Detailed Risk Matrix – Linear Assets 51
Figure 23: Consolidated Risk Matrix – Linear Assets 51
Figure 24: Probability of Failure – Facilities and Appurtenances 52
Figure 25: Consequence of Failure – Facilities and Appurtenances 53
Figure 26: Detailed Risk Matrix – Facilities and Appurtenances 54
Figure 27: Consolidated Risk Matrix – Facilities and Appurtenances 54
Figure 28: Historical MFA Lending Rates 66
Figure 29: Funding Flow 69
Figure 30: Annual Contributions to the LTGIR vs. Annual Capital Spending 73
Figure 31: Annual Contributions to the LTWIR vs. Annual Capital Spending 79
Figure 32: Annual Contributions to the LTSIR vs. Annual Capital Spending 79

List of Tables

Table 1: Methods for Establishing Replacement Costs 18
Table 2: Detailed Asset Inventory 19
Table 3: Source of Condition Data 21
Table 4: General Condition Rating Scale – All Assets 23
Table 5 Water System: Watermain Break History – By Material 27
Table 6: Components of a Lifecycle Framework 33
Table 7: Lifecycle Framework 35
Table 8: Current Reinvestment Rates 37
Table 9: System-generated Reinvestment Rates 38
Table 10: Comparing Port Coquitlam's Current Reinvestment Rate Against Benchmarks 39
Table 11: Purpose of Capital and Operating Budgets 40
Table 12: Types of Consequences of Asset Failure 44
Table 13 Defining Probability of Failure Ranges – Linear Assets 47
Table 14: Defining Consequence of Failure Ranges – Linear Assets 50
Table 15: Defining Probability of Failure Ranges - Facilities and Appurtenances 52
Table 16: Defining Consequence of Failure Ranges - Facilities and Appurtenances 53
Table 17: Components of a Levels of Service Framework 56
Table 18: Core Values and Service Statements 57
Table 19: Customer Levels of Service 58
Table 20: Technical Levels of Service 59
Table 21: Trends in Select Customer Levels of Service KPIs – Asset Condition and Performance 61
Table 22: Trends in Customer Levels of Service KPIs – Service Delivery 61
Table 23: Balancing Cost, Performance, and Risk 62
Table 24: Service Area Replacement Costs and Target Reinvestment Rates 64
Table 25: Long-Term Infrastructure Reserve Balances 68
Table 26: Capital Reserve Balances 69
Table 27: Comparing Average Annual Requirements Against Current Capital Reinvestments 72
Table 28: Comparing Average Annual Requirements Against Annual Contributions to the LTGIR 72
Table 29: Funding Levels and Resulting Funding Deficits 74
Table 30: Risks and Benefits of Funding Models 75
Table 31: Tax Rate Increase Required to Achieve Funding Levels 76
Table 32: Comparing Average Annual Requirements Against Current Capital Reinvestments 78
Table 33: Comparing Average Annual Requirements Against Annual Contributions to the LTWIR and LTSIR 78
Table 34: Funding Levels and Resulting Funding Deficits: Water Services 80
Table 35: Funding Levels and Resulting Funding Deficits: Sanitary Services 80
Table 36: Utility Rate Increase Required to Achieve Funding Levels: Water 81
Table 37: Utility Rate Increase Required to Achieve Funding Levels: Sanitary 81
Table 38: Age- and Condition-based Infrastructure Backlogs 83
Table 39: Long-Term Infrastructure Reserves vs. Backlogs 84
Table 40: Development Cost Charges (DCC) Program 85
Table 41: Overlap Between DCC Program and Assets in Backlog State 85

17,500	Number of assets on record in the Water asset database
$303.3 million	2023 replacement cost of these assets
1990s	Decade with the highest capital expenditures on the construction or acquisition of Water assets ($57.1M)
2030s	Decade with the first major forecasted asset replacement spike ($69M)
36%	Percentage of assets in poor or worse condition, or less than 40% service life remaining
$109.7 million	Current age- and condition-based infrastructure backlog
$29.9 million	Current replacement cost of assets with a very high risk rating
$3 million	Annual City spending on operations, maintenance, and capital works related to Water
1.5%	System-generated recommended capital reinvestment rate for Water System infrastructure ($4.5M per year)
0.7%	Port Coquitlam’s actual capital reinvestment rate ($2M per year)

Executive Summary

This asset management plan (AMP) for the City of Port Coquitlam provides a detailed cross-sectional analysis of the City's Water assets. It is a continuation of Port Coquitlam's efforts to build a formal and well-structured asset management program that began with the completion of an asset management strategy in 2019. The strategy identified the development of an AMP for each of the City's eight asset portfolios: Water, Sanitary, Drainage, Transportation, Parks, Facilities, Fleet & Equipment, and Information Services.

Asset management plans help agencies develop a detailed understanding of their community infrastructure and major capital assets that support daily operations. This data-rich knowledge can support better decision-making and help maintain high but affordable service levels.

Valuation and Condition

Port Coquitlam's Water portfolio includes 203 kilometers of distribution mains, 113 kilometers of service connections, two pump stations, and various water appurtenances, such as hydrants, valves, and water meters. The total current replacement cost of all Water assets was estimated at $303.3 million as of 2023, with distribution mains making up nearly 75% of the valuation.

Keeping assets in good condition allows the City to deliver services to residents safely and effectively. Condition data helps to prevent premature and costly rehabilitation or replacements, and ensures that lifecycle activities occur at the right time to maximize asset value and useful life while minimizing costs.

Typically, condition ratings can be established in two ways. The age-based approach simply uses an asset's age as a proxy for its condition: older assets have less service life remaining than newer ones, and are assumed to be in poorer shape. In contrast, in-field condition assessments rely on detailed inspections by qualified staff who assess each asset against robust, technical criteria.

As no in-field condition data was available for Water assets, age was used to approximate their condition. This is typical for water distribution systems. Unlike sanitary sewer and drainage mains, water distributions mains are pressurized, making their inspections a more complex task. While possible, assessments of watermains can be prohibitively expensive and may require service disruptions. Watermain break history and age are commonly used to identify problematic sections of water distribution networks.

Age-based condition analysis suggests that 64% of the City's Water assets are in fair or better condition; the remaining 36% of assets, with a current replacement cost of $109.7 million, are estimated to be in poor to very poor condition with less than 40% service life remaining. Assets in poor or worse condition may be candidates for replacement in the immediate or short term and should be monitored closely to avoid costly failures that may disrupt service and pose a risk to public health and safety. It is also more economical to keep assets in at least fair or better condition, with smaller and more frequent maintenance. Assets in fair condition may require rehabilitation or replacement in the medium term and should be monitored for further degradation in condition.

Lifecycle Management and Long-term Replacement Needs

As with most communities across Canada, Port Coquitlam is facing an aging infrastructure stock. Data suggests that the largest expenditures in Water assets were made between 1990 and 1999, totaling $57.1 million and dominated by installation of distribution mains. This coincided with the largest growth in the City's population—an increase of 28%.

New infrastructure is often funded or constructed by development, or partially funded by external partners. However, the ongoing maintenance and replacement costs are borne by the municipality as the asset owner. The initial cost for new assets is only a fraction of the entire lifecycle cost to operate, maintain and replace them. Consequently, the challenge for municipalities is the considerable lifecycle costs of many assets that now fall on taxpayers alone to fund.

As assets age, their performance diminishes, often more rapidly as they approach the final quarter of their design life. Assets require ongoing investments in operations, maintenance, and rehabilitation so that service level can be maintained and delivered consistently. The City's average annual budget for Water totals approximately $3 million. Of that, $2.8 million per year is spent on the inspection, maintenance, and replacement of Water assets. An additional $217k is allocated for operational expenditures that maintain acceptable levels of service and efficient operations, but have no direct impact on asset life.

Eventually, aging assets must be replaced. The City is expected to experience a rapid increase in asset replacement needs in the 2030s, peaking at nearly $69 million. Replacement forecasts remain relatively high through the 50-year horizon, averaging $47.5 million per decade between 2023 and 2072.

Deferring replacements can lead to infrastructure backlogs, which can cause a drop in the quality of service provided to residents. The City's current age-based backlog is $5.4 million, comprising assets that have exceeded their useful life but still remain in service. However, this figure increases to nearly $110 million when assets in poor or worse condition, or less than 40% service life remaining, are included in the backlog estimate.

Although not all assets forecasted for replacement will need to be replaced, having a multi-decade view of infrastructure needs is essential for financial planning. A long-term view allows staff to prepare ahead of time for major capital works, avoid unplanned expenditures, and minimize extreme fluctuations in tax and/or utility rates.

Applying a Risk-based Approach

Keeping up with replacement needs poses a substantial challenge for most local governments and public agencies across Canada. A risk-based approach to infrastructure spending can help prioritize capital projects, refine backlog and future needs, and channel funds to where they are needed most. Rather than taking the worst-first approach, a risk-based approach ranks assets based on their condition/performance as well as their criticality—providing a more complete rationale for project selection.

This AMP applies a quantitative approach to risk for all assets. Data that can best explain the probability of asset failures and help approximate the various consequences of these failure events has been modeled to develop asset risk matrices. As risk is a product of the probability of an asset's failure and the overall consequence of the failure event, a high risk-rating does not necessarily suggest that an asset is unable to safely perform its intended function. Even new assets can carry a high risk rating, given their strategic, financial, economic, and socio-political importance to the community.

This analysis indicates that 310 assets, with a current replacement cost of $29.9 million have a very high risk rating due to their potentially high probability of failure, and moderate to severe consequences of failure. An additional 813 assets, with a current replacement cost of $66 million, were classified with a high risk rating.

Delivering Affordable Levels of service

Together with risk assessments, levels of service offer another lever that the City can use to deliver high-quality but affordable infrastructure programs. Levels of service describe how well agencies deliver services and whether service quality meets the expectations of the community. They can be measured using key performance indicators (KPIs).

For Water, a total of 53 KPIs were selected to support performance tracking and monitoring. This included 19 KPIs to measure customer levels of service, and 34 to track the City's technical levels of service Technical levels of service can be thought of as the activities and steps (inputs) that an organization takes to deliver customer levels of service (outputs). KPI data can be used to inform decisions to maintain, increase or decrease levels of service. Investments in capital and/or maintenance related activities may be adjusted to reduce the frequency of requests and improve customer levels of service. However, adjusting levels of service must be considered in light of cost, performance, and risk.

Residents expect only the highest levels of service. However, as funds are limited, customer satisfaction must be balanced with the cost to deliver services and the risk posed to organization. Higher service levels come at a higher price, and can only be provided by diverting funds from one program to another (tradeoff), or by increasing tax or utility rates. Conversely, lower service levels may reduce funding needs, but can pose greater risk to the organization and the public.

Financial Strategy: Implementing the Asset Management Plan

The financial strategy provides a consolidated analysis for the City's eight service areas. They are grouped based on how assets within each service area are funded. Tax-funded service areas rely on property tax revenues, and include Drainage, Transportation, Parks, Facilities, Fleet & Equipment, and Information Services. Water and Sanitary services are funded directly through their respective utility levies.

Although senior government grants are used to supplement the City's infrastructure spending needs, these are not included in the financial strategy. The aim of the financial strategy is to allow the City to build a sustainable infrastructure program using its own permanent and predictable sources of funding, namely, property taxes and utility levies. It will position Port

Coquitlam to gradually eliminate annual funding deficits and achieve full, annual capital funding requirements for both tax- and levy-funded service areas.

Tax-Funded Service Areas

For tax-funded services, the annual average capital requirements total $33.8 million. The City currently contributes $7.9 million annually to its Long-Term General Infrastructure Reserve (LTGIR), creating a combined annual funding deficit of $25.9 million for these six service areas.

To close this gap for tax-funded assets, the City's property taxes would need to increase by 35%, based on 2023 revenues of $74.9 million. As this is not feasible, it is recommended that the City adopt a 15-year phase-in period, requiring a 1.00% annual increase to property taxes each year over this time period. This additional revenue would be fully allocated to the LTGIR. We note that the City already increases annual contributions to the LTGIR by 1% per year based on prior year's levy. As such, the recommended 1.00% increase would be over and above this existing annual increase, for a combined annual increase of 2.00% over the next 15 years.

Drainage Utility

Currently, drainage infrastructure is funded through property taxes. However, there is strong rationale for implementing a dedicated drainage utility levy, and municipalities across Canada have begun to implement this fee structure. Contributing factors include climate change impacts that are driving the need for new or upgraded drainage infrastructure and flood protection, and the higher relative lifecycle costs of drainage assets compared to water and sanitary infrastructure. These expenditures also reduce funds available for other tax-funded assets. If a drainage utility is established, a Long-Term Drainage Infrastructure Reserve (LTDIR) would be created, with annual contributions to this reserve funded through the levy rather than property taxes.

Levy-Funded Service Areas

Similar analysis was conducted for levy-funded services. For water and sanitary, average annual capital requirements total $4.5 million and $4.2 million, respectively. The City currently allocates $1.1 million to the Long-Term Water Infrastructure Reserve (LTWIR), generating an annual funding deficit of $3.4 million. Current allocations to the Long-Term Sewer Infrastructure Reserve (LTSIR) total $850 thousand, also resulting in an annual funding deficit of $3.4 million.

In 2023, Port Coquitlam's water and sanitary revenues totaled $13.1 million and $9.6 million, respectively. To eliminate the funding deficit for each service area, additional contributions are needed to the LTWIR and LTSIR. For water, this would require a one-time levy increase of 26%, specifically for the purpose of phasing in full funding for water. Similarly, achieving full funding for sanitary services would require a one-time levy increase of 35%.

Consistent with tax-funded service areas, it is recommended that the City adopt a 15-year phase-in period to gradually achieve full funding for water and sanitary services. Under this model, water rates would see an annual increase of 0.55% for each year over the phase-in period; sanitary rates would require an increase of 1.03% annually. As with tax-funded services, these increases are in addition to the existing 1% annual increase for each service area.

For both tax- and levy-funded services, these models seek to eliminate annual funding deficits and achieve full funding. Alternative models are also illustrated, with target funding levels set at 75% and 50% of annual capital requirements. While achieving these lower targets may reduce the impact on property tax rates and utility levies, they may perpetuate infrastructure challenges and reduce service levels. Additional financial, economic, social, reputational, and public health and safety risks may also increase as a result of inadequate funding.

As such, it is recommended that the City endeavour to achieve full funding for both tax- and levy-funded service areas. The recommendations presented do not account for inflation; staff should periodically consider the impacts of inflation on both annual capital expenditures, and additional contributions required to the LTGIR, the LTWIR, and the LTSIR to maintain fiscal strength. Further, addressing the infrastructure backlog requires the strategic use of reserves and the City's development cost charges. In addition, asset criticality and risk analysis should be used to prioritize projects.

As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. This periodic funding should not be incorporated into an AMP unless there are firm commitments in place. However, it can be used to help close the infrastructure gap more quickly, or lower the long-term impact on tax and utility levies. It should be noted that the above recommendations do not include the use of reserves or debt. Depending on the urgency of projects and the impact on levels of services, reserves and debt may be used as supplementary, viable options.

Approach and Methodology

This asset management plan (AMP) was developed as part of the City of Port Coquitlam's current engagement with PSD Citywide. Individual AMPs were developed for each of the City's eight service areas, requiring substantial effort and collaboration over three years.

Developing the Asset Management Plan

The contents in this document were developed in five steps, summarized below.

Build a comprehensive asset inventory

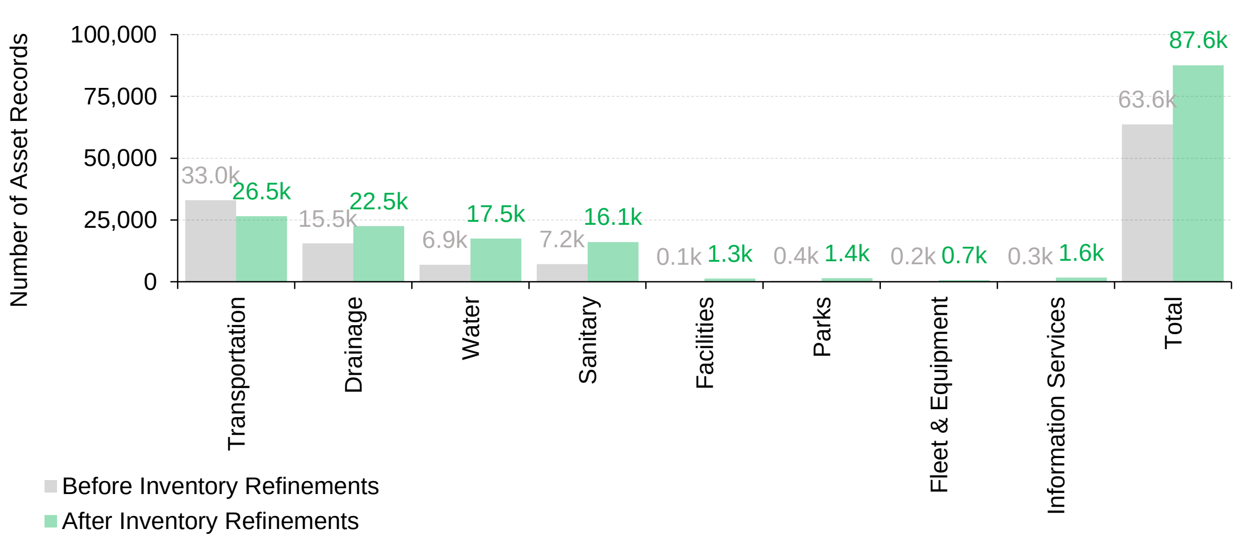
City staff manage multiple large-scale and complex infrastructure datasets, found across different departments and in multiple formats. These datasets contain primary and secondary asset data. Primary data includes asset valuations, such as historical and current replacement costs; in-service dates; useful life estimates; quantities; and condition data. It is virtually impossible to produce any asset management-related reporting without this prerequisite information.

Secondary data provides more contextual information about an asset, such as its location, failure history, size, type, material, etc. These fields are used to establish an asset's criticality and develop risk models.

Both datasets were analyzed, refined, and verified through rigorous staff reviews. Identified gaps were closed through desktop research and/or physical in-field data collection by City staff. All new and existing datasets were ultimately consolidated to build a single source of truth (SST). A sharp focus was placed on data accuracy and currency, in particular, asset replacement costs and useful life estimates. These are key inputs for long-term financial planning and are necessary for determining the magnitude and timing of investments.

This finalized data was then uploaded into Citywide, the City's primary asset management software application. The inventory refinements resulted in a 38% increase in the number of total assets on record for all service areas, from 63,603 asset records to 87,647. For Water, data refinement led to a sharp increase in asset records, from less than 7,000 to 17,490—a change of 153%.

Figure 1: Number of Asset Records Before and After Inventory Refinements



Conduct asset-level risk assessments and build risk models

Preliminary risk models were developed for each asset class to establish asset risk ratings based on their probability and consequence of failure. Staff reviewed all risk models and provided feedback on the parameters used, including the suitability of parameters and how they were ranked and weighted. Once finalized, these models were built in Citywide and applied to all relevant assets to generate risk matrices.

Compile lifecycle activity data

To better understand the total cost of ownership of all assets, annual operating, maintenance, and capital spends were analyzed. Staff provided feedback on various lifecycle interventions applied to major asset types; the triggers for each treatment and its impact; and typical budgets associated with each activity. Data in available service level sheets was also reviewed and aggregated.

In addition to identifying lifecycle interventions that may help extend the life of the asset (e.g., flushing of mains, break repairs, or hydrant repainting), activities meant to ensure delivery and continuity of acceptable service levels were also included. For example, water quality sampling and system pressure adjustments have no direct impact on assets, but they are part of providing water services to residents to ensure a safe and high quality water supply,

Compile levels of service data

Four core values were established across each of the City's eight asset portfolios to ensure that the delivery of services are reliable, safe, affordable, and practical. To track the performance of Water, technical and customer-oriented key performance indicators (KPIs) were selected and populated with data ranging from 2018 to 2021. For the Water System, 19 KPIs were selected for customer levels of service, and 34 for technical levels of service.

Develop financial strategy

The preceding content and information are used to develop a financial strategy. The strategy outlines the City's current funding position for each asset category and a path to reach sustainability by closing any identified funding gaps. Development of the strategy involves a comprehensive review of all pertinent financial documents, including audited statements, and collaboration with Finance staff.

Information from asset management plans can be used to determine appropriate levels of funding for capital and operational budgets. Reinvestment rates can be used to determine annual capital expenditure targets, or allocations to reserves, to ensure that asset replacement needs are met as they arise. Key performance indicators can be helpful in determining how much to allocate to operational budgets in order to maximize the life of assets while maintaining acceptable levels of service and efficient operations.

Limitations and Constraints

This AMP required substantial effort by staff. It was developed based on best-available data, and was subject to the following broad limitations, constrains, and assumptions:

1. The analysis in this AMP is highly sensitive to several critical data fields, including an asset's estimated useful life, replacement cost, quantity, and in-service date. Inaccuracies or imprecisions in any of these fields can have substantial and cascading impacts on all reporting and analytics.

2. User-defined and unit cost estimates, based typically on staff judgment, recent projects, or established through completion of technical studies, offer the most precise approximations of current replacement costs. When this isn't possible, historical costs incurred at the time of asset acquisition or construction can be inflated to present day. This approach, while sometimes necessary, can produce highly inaccurate estimates. It was not deployed in this AMP.

3. As no in-field condition data was available, age was used to estimate asset condition ratings. This is a typical approach for water distribution networks, given the cost and potential complexity of inspecting live watermains. Although age is an essential component of asset management planning, it can produce an over- or understatement of asset needs. As a result, financial requirements generated through age analysis can differ from those produced by staff using field observations.

4. The risk models are designed to support objective project prioritization and selection. However, in addition to the inherent limitations that all models face, they also require availability of important asset attribute data to ensure that asset risk ratings are valid, and assets are properly stratified within the risk matrix. Missing attribute data can misclassify assets.

5. The AMP is cross-sectional, offering a synopsis of the City's infrastructure up to a given time period. Some information may become outdated quickly. This can result from new condition assessments, or acquisition or disposal of assets that was not reflected at the time the AMP was developed.

It is quite common for municipalities to experience these limitations as they develop their first asset management plan. Although many data gaps were closed during this project, some may still persist. Closing these data gaps and overcoming limitations is an iterative process, requiring dedicated staff time and other resources. Staff will continue to refine the City's asset inventory to further enhance data quality and integrity for future iterations of this AMP and all asset management reporting.

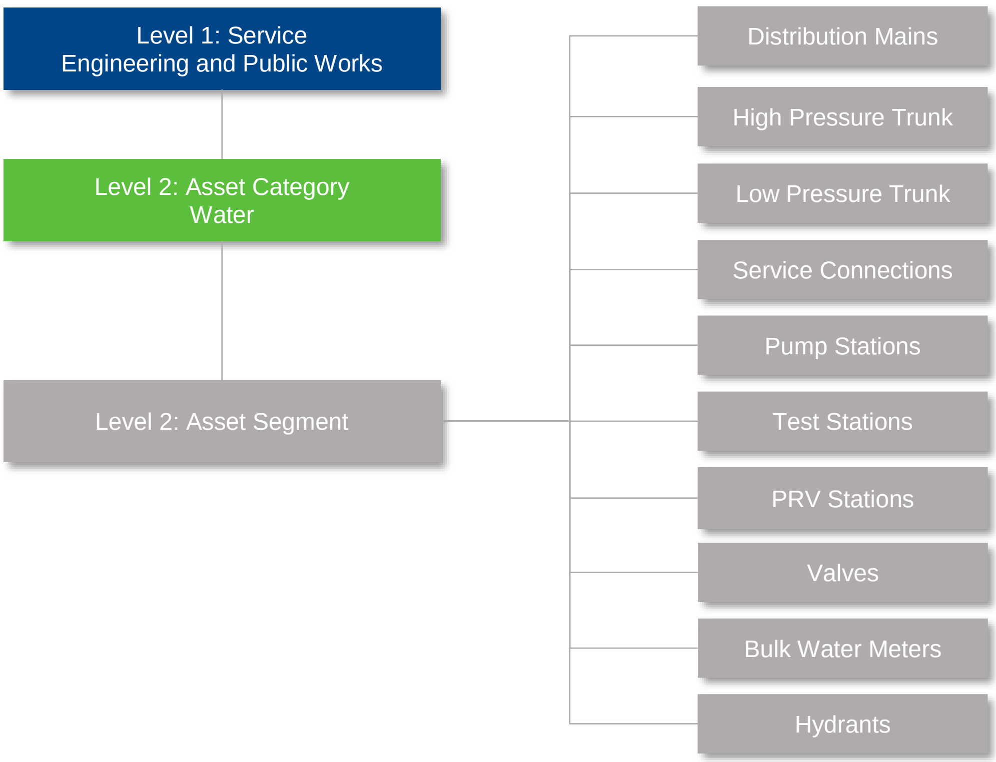
State of the Infrastructure

The state of the infrastructure (SOTI) provides a detailed overview of the City of Port Coquitlam's Water assets. It identifies how assets were classified as part of a larger network and system of assets; the current quantity and replacement value of all assets; and, a detailed age and condition profile.

Asset Hierarchy and Data Classification

Asset hierarchy illustrates the relationship between individual assets and their components, and a wider, more expansive network and system. How assets are grouped in a hierarchy structure can impact how data is reported and interpreted. Assets were structured to support meaningful, efficient reporting and analysis. Key details are summarized at the asset segment level.

Figure 2: Asset Hierarchy and Data Classification



Inventory and Valuation

The City of Port Coquitlam's Water database contains 17,500 unique asset records, comprising 203 kilometers of water distribution mains, more than 1,000 hydrants, two pump stations, 20 pressure reducing stations and various appurtenances, such as water meters and valves. The total current replacement cost of these assets was estimated at $303.3 million as of 2023.

Costing Methods

As part of compliance with PSAB 3150, municipalities across Canada were required to establish historical costs for all capital assets. However, asset management analysis and reporting require accurate current replacement costs. Several approaches can be taken to estimate the cost of replacing a like-for-like asset that offers identical or similar service levels. These are illustrated in Table 1.

Table 1: Methods for Establishing Replacement Costs

Costing Method	Description	Accuracy
CPI	Historical or acquisition costs are inflated to current day using available inflation indices. Given its tendency to provide inaccurate estimates for older assets, this approach is used when other methods cannot be applied with reasonable confidence.	Low
Cost Per Unit	Using procurement data from recent projects, including invoices, quotes, and/or tenders, the unit cost of an asset is applied to all asset types (segments) to establish total current replacement costs. This method is typically applied to all linear assets.	High
User-defined	Similar to the cost per unit approach, this method also requires procurement data and staff judgement to estimate an asset's current acquisition cost. This method is typically applied to non-linear or point assets.	High

Table 2 summarizes the quantity and current replacement cost of the City's Water assets as managed in its primary asset management register, Citywide. With a combined current replacement cost of $262.4 million, mains and service connections comprise nearly 90% of the portfolio.

The replacement costs outlined below were initially established by staff in 2021. They were then increased in 2023 by 10% to reflect prevailing market conditions and account for inflation over the last two years.

Table 2: Detailed Asset Inventory

Segment	Quantity	Replacement Cost	Primary Costing Method
Distribution Mains	202,889m	$217,044,875	Cost per unit
Service Connections	113,020m	$45,336,041	Cost per unit
High Pressure Trunk	6,922m	$9,103,887	Cost per unit
Low Pressure Trunk	2,446m	$3,224,439	Cost per unit
Hydrants	1,044	$9,761,400	Cost per unit
PRV Stations	20	$4,400,000	User defined
Pump Stations	2	$6,999,999	User defined
Valves	2,958	$6,395,500	Cost per unit
Bulk Water Meters	22	$906,873	User defined
Test Stations	14	$105,000	Cost per unit
Total		**$303,278,014**	

The City has 20 Pressure Reducing Valve (PRV) Stations containing 39 pressure reducing valves; some stations have multiple valves. There are approximately 3000 other valves in the Water system including air valves, blow off valves, gate valves, check valves, and zone valves.

Figure 3: Portfolio Valuation

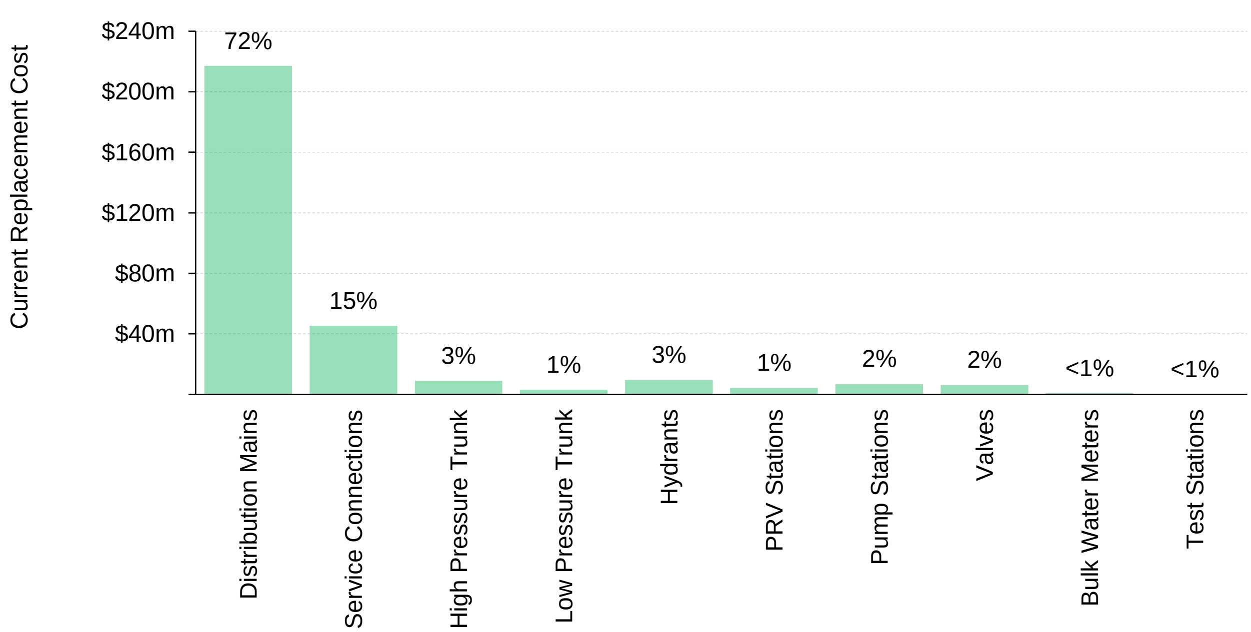
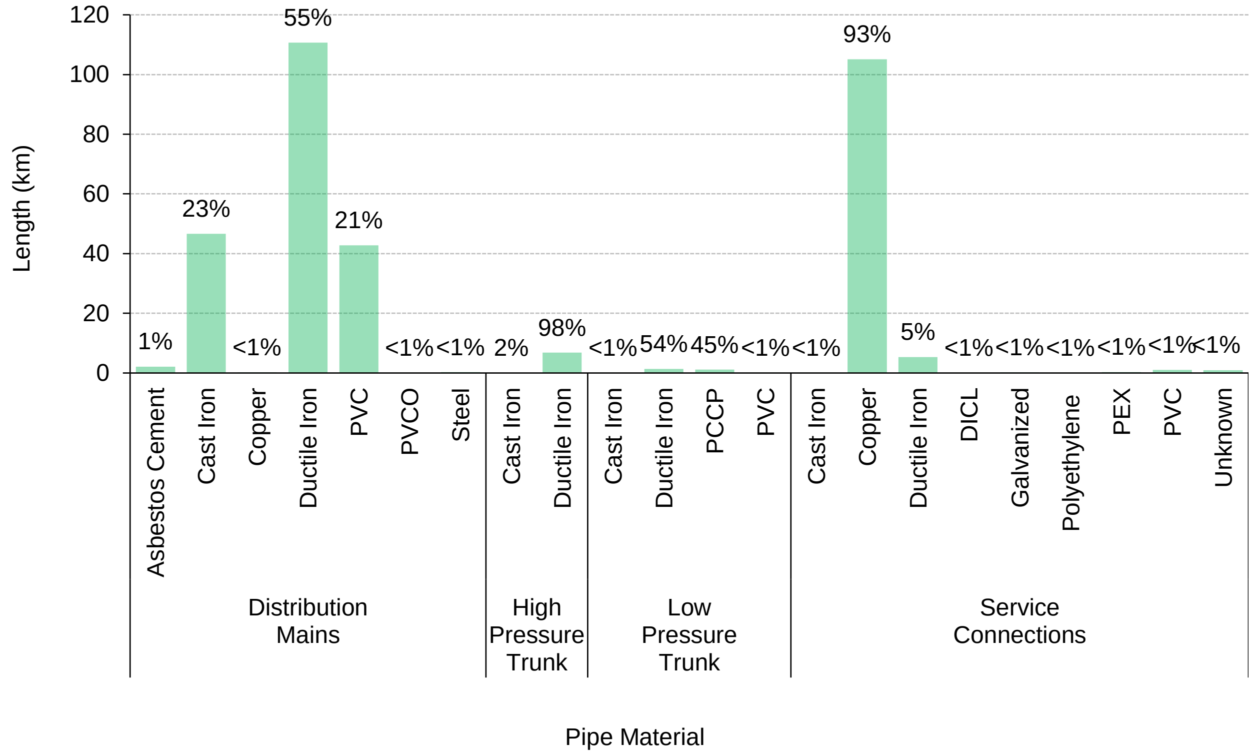


Figure 4 summarizes the length, in kilometers, of the various mains based on pipe material. The majority of distribution mains are ductile iron. Cast iron mains comprise nearly a quarter of distribution mains. However, the City is proactively replacing them due to water quality and other issues. Cast iron has a tendency to reduce the effectiveness of water treatment products, and is also prone to corrosion and breakage.

Figure 4: Linear Asset Length by Pipe Material



Asset Condition

Reliable long-term planning for asset replacements hinges on accurate current condition ratings. Condition data helps to prevent premature and costly rehabilitation or replacements, and ensures that lifecycle activities occur at the right time to maximize asset value and useful life while minimizing costs.

Source of Condition Data

Typically, condition ratings can be established in two ways. The age-based approach uses an asset's age as a proxy for its condition: older assets have less service life remaining than newer ones, and are assumed to be in poorer shape. In contrast, in-field condition assessments rely on detailed inspections by qualified staff who assess each asset against robust, technical criteria. Both age and in-field condition ratings provide useful data to refine long-term projections.

As no condition data was available for Water assets, age was used to approximate their condition. This is quite typical for linear water distribution networks. Although live watermain condition assessments can be conducted (acoustic leak detection, pressure testing, camera inspections), they can be prohibitively expensive or may require service disruptions. Asset age and break history are commonly used to identify potentially problematic sections of the water distribution system, and can assist in prioritizing main segments for any further, targeted inspection.

Table 3: Source of Condition Data

Asset Category	Asset Segment	% of Assets with Assessed Condition	Source of Condition Data
	Distribution Mains	0%	Age-based estimates
	Service Connections	0%	Age-based estimates
	High Pressure Trunk	0%	Age-based estimates
	Low Pressure Trunk	0%	Age-based estimates
	Pump Stations	0%	Age-based estimates
	Test Stations	0%	Age-based estimates
	Hydrants	0%	Age-based estimates
	Bulk Water Meters	0%	Age-based estimates
	PRV Stations	0%	Age-based estimates
	Valves	0%	Age-based estimates
Total		**0%**	

Condition Assessment Guidelines

Condition Assessment Guidelines were developed for Water assets to support the collection of condition data. It is recommended that the guidelines be used to complete some assessments each year, and the collected data be uploaded to Citywide, the City's asset management software.

Condition Rating System

A condition rating scale provides a standardized and descriptive framework that can be used to assign a condition score to all assets, typically on a range of 0-100. This AMP uses a general condition rating scale, aligned with the federal Canadian Core Public Infrastructure Survey.

Table 4: General Condition Rating Scale – All Assets

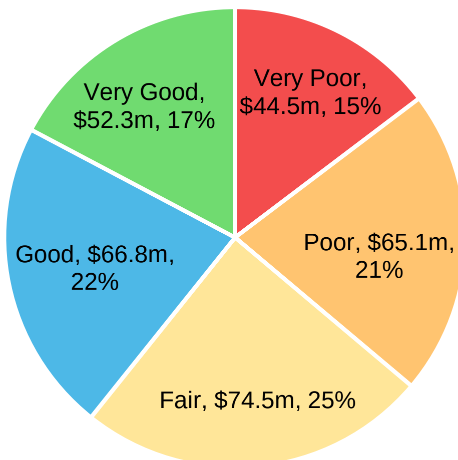
Condition Rating	Description	Criteria	Service Life Remaining (%)
Very Good (80-100)	Fit for the future	Asset is new or recently rehabilitated	80-100
Good (60-80)	Adequate for now	Asset is performing well; minor defects; only regular maintenance required	60-80
Fair (40-60)	Requires attention	Asset is operational, but signs of deterioration evident; some elements exhibit significant deficiencies; renewal upgrade, or replacement required in the medium term	40-60
Poor (20-40)	Increasing potential of service disruption	Asset approaching end of service life; condition below standard; significant deterioration; renewal, upgrade, or replacement in the short term	20-40
Very Poor (0-20)	Unfit for sustained service	Service life is fully consumed; asset remains in service beyond service life; widespread and advanced deterioration; may be unusable and requires immediate replacement	0-20

Projected Asset Conditions

Figure 5 summarizes the replacement cost-weighted condition of all Water assets. Based only on age data, although 64% of assets are in fair or better condition, the remaining 36%, with a current replacement cost of nearly $110 million, have less than 40% service life remaining and are estimated to be in poor to very poor condition. Additional detail is also provided in subsequent figures at the asset type or segment level.

Assets in poor or worse condition may be candidates for replacement in the immediate or short term and should be monitored closely to avoid costly failures that may disrupt service and pose a risk to public health and safety. Similarly, assets in fair condition may require rehabilitation or replacement in the medium term and should be monitored for further degradation in condition.

Figure 5: Asset Condition: All Water Assets

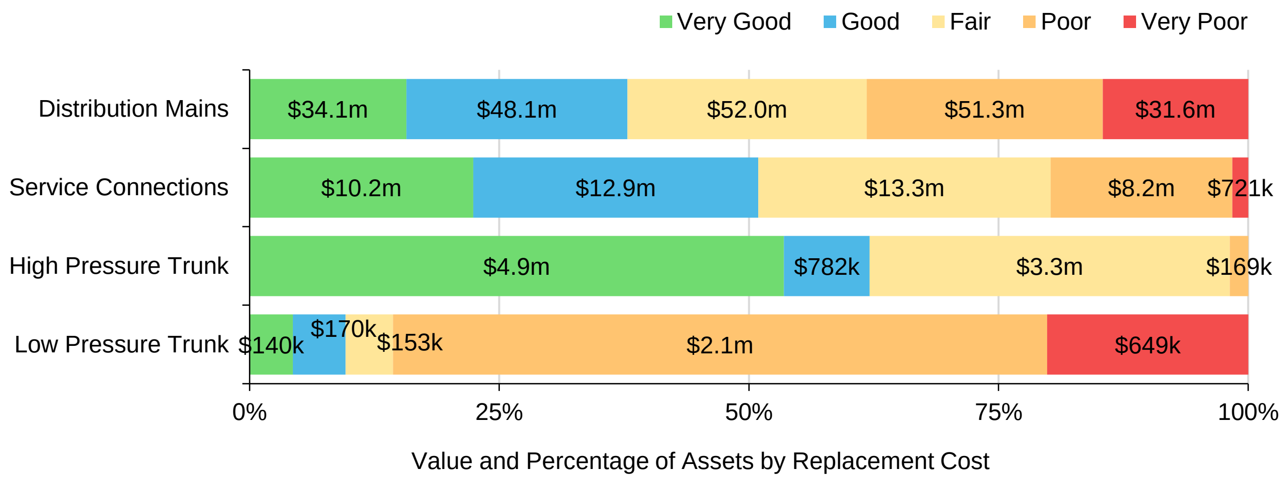


It is often more economical to keep assets in at least fair or better condition. Smaller and more frequent investments in asset maintenance can extend its serviceable life, minimize lengthy and unexpected service disruptions, and help avoid more expensive repairs and renewals in the future. This approach also helps deliver more consistent and predictable service levels.

Linear Assets

As illustrated in Figure 6, age data suggests that 62% of distribution mains, 80% of service connections, and 98% of high pressure trunks are in fair or better condition. The remaining 38% of distribution mains, with a current replacement cost of more than $78 million, were assigned an age-based condition rating of poor or very poor. These assets may begin to exhibit signs of deterioration and experience more frequent breaks.

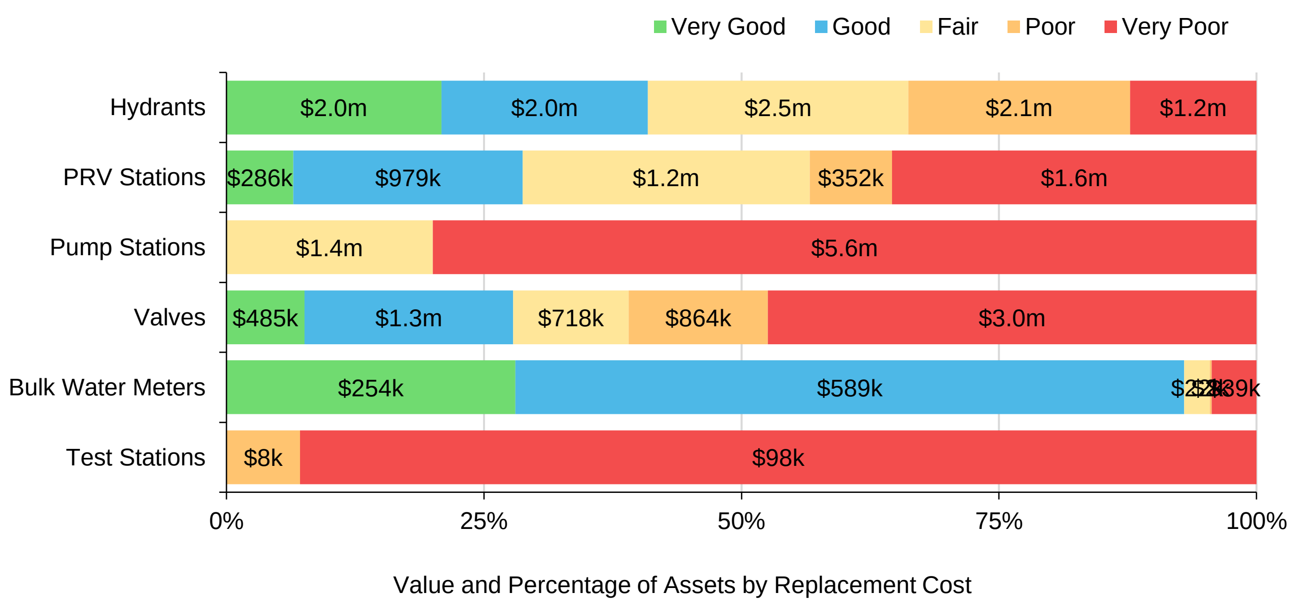
Figure 6: Asset Condition: Water – Linear Assets



Facilities and Appurtenances

Figure 7 provides age-based condition details for the various facilities and appurtenances that support the distribution of the City's water supply. Based on in-service dates of individual assets, the majority of assets within both of the City's two water pump stations (Citadel and Penny Place) are in poor or worse condition.

Figure 7: Asset Condition: Water System – Facilities and Appurtenances



Watermain Break History

Watermain condition assessments can require service disruptions and can be prohibitively expensive. In conjunction with age, watermain break history can also provide useful data for identifying problematic sections of the water distribution network. Figure 8 illustrates the break history for 122 water main sections based on their installation years.

These sections total 19 kilometers in length—a small portion of the overall distribution network. The analysis shows that watermains installed in the 1960s, particularly those placed into service in 1965, account for a disproportionate number of breaks.

Figure 8: Water System: Watermain Break History – By Installation Year

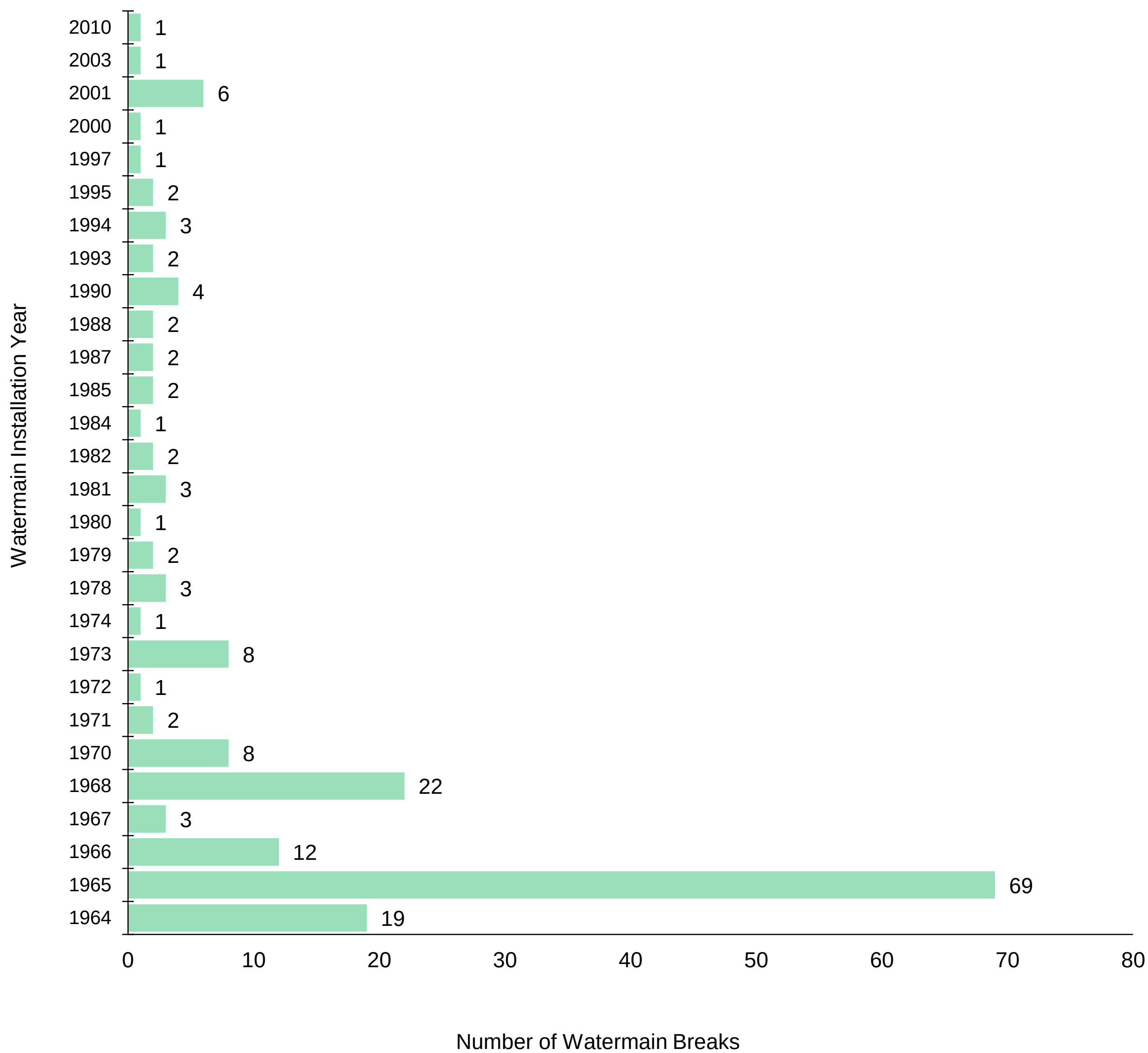


Table 5 summarizes the break history of the above segments. Of the 19km of mains with break history, cast iron makes up more than 14km, or 77% of the total affected pipe length, and also accounts for 75% of the 184 total break incidents recorded. The City's cast iron main replacement program is intended to address issues commonly associated with cast iron, e.g., break rates, corrosion, and adverse impacts on water quality.

Table 5 Water System: Watermain Break History – By Material

Pipe Material	Number of Breaks	Length (m)	Breaks per km	Percentage of Total Length	Percentage of Breaks
Cast Iron	141	14,369m	9.8	77%	75%
Ductile Iron	38	4,177m	9.1	21%	22%
PVC	5	489	10.2	3%	3%
Total	**184**	**19,036m**		**100%**	**100%**

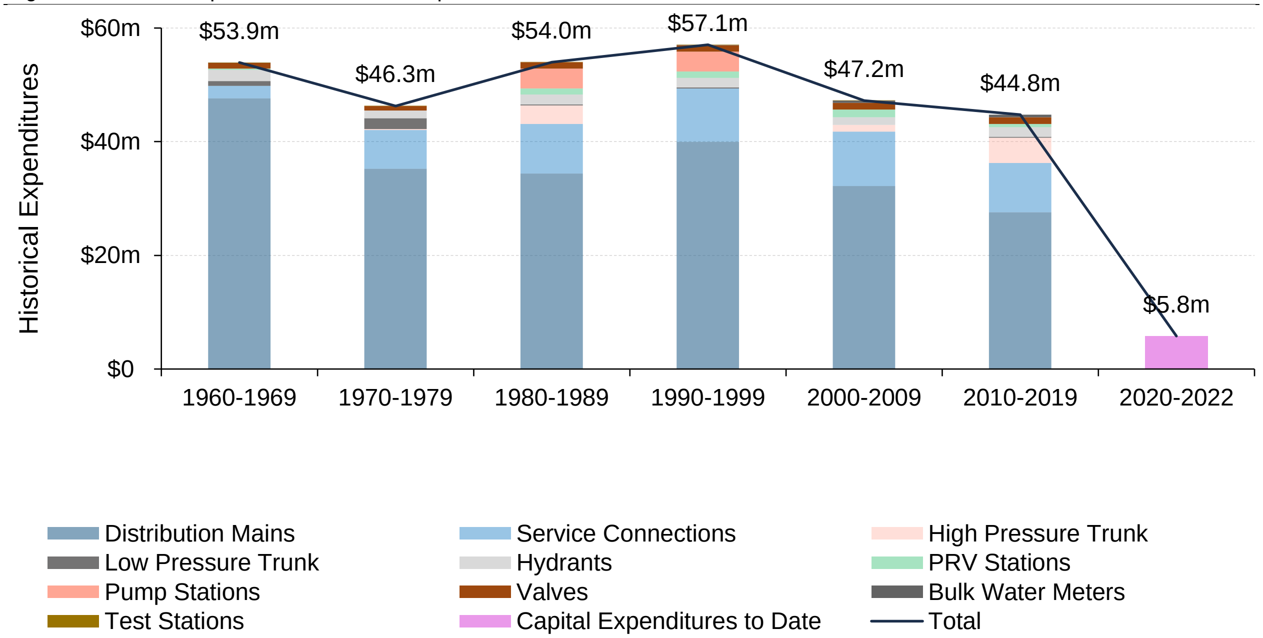
Age Profile

An asset's age profile provides valuable insights and can help identify assets that may be candidates for further evaluation through condition assessment programs; inform the selection of lifecycle strategies; and improve planning for potential replacement spikes. Although imperfect on its own, asset age can help triage asset needs when used in conjunction with other data points, including condition, asset criticality, planned upgrades, project bundling, and prior failure history.

Historical Asset Expenditures

Figure 9 illustrates historical expenditures on the construction or acquisition of Water assets since 1960. The data reflects the City's current or active inventory only; assets that have been disposed of or decommissioned over time are not included. Although community infrastructure needs and expectations can evolve significantly over decades, understanding past investment patterns can be informative in planning for future needs.

Figure 9:Historical Expenditures on Asset Acquisition



Expenditures on Water infrastructure averaged $46.4 million per decade over the last 60 years, remaining relatively steady between 1960 and the late 1990s, with distribution mains accounting for the vast majority of expenditures. The largest investments were made between 1990 and 1999, coinciding with the largest growth in the City's population—an increase of 28%. In the current decade, the City has made capital investments of $5.8 million between 2020 and 2022.

Historical spending, when combined with an asset's established design life, can be used to forecast upcoming replacement needs across long-term, often multi-decade time horizons.

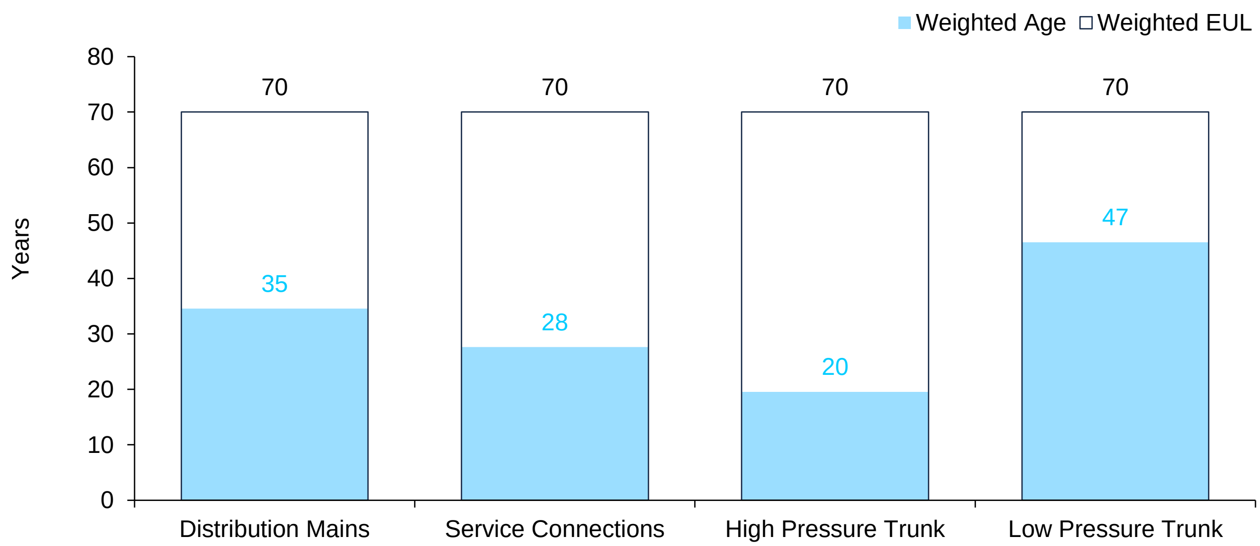
Serviceable Life vs. Current Asset Age

An asset's estimated useful life (EUL) is the serviceable lifespan of an asset during which it can be expected to deliver its intended function safely and effectively. As assets age, their performance diminishes, often more rapidly as they approach the final quarter of their design life.

Determining accurate EULs for all assets is essential for building reliable long-term forecasts and informing condition assessment programs. EULs for all assets were established and verified by staff to ensure they are aligned with broader industry standards, but also reflect typical asset performance and expectations in Port Coquitlam.

Figure 10 plots the average established useful life of distribution mains, trunk mains, and service connections against their current average age. Both values were weighted by the replacement cost of individual assets.

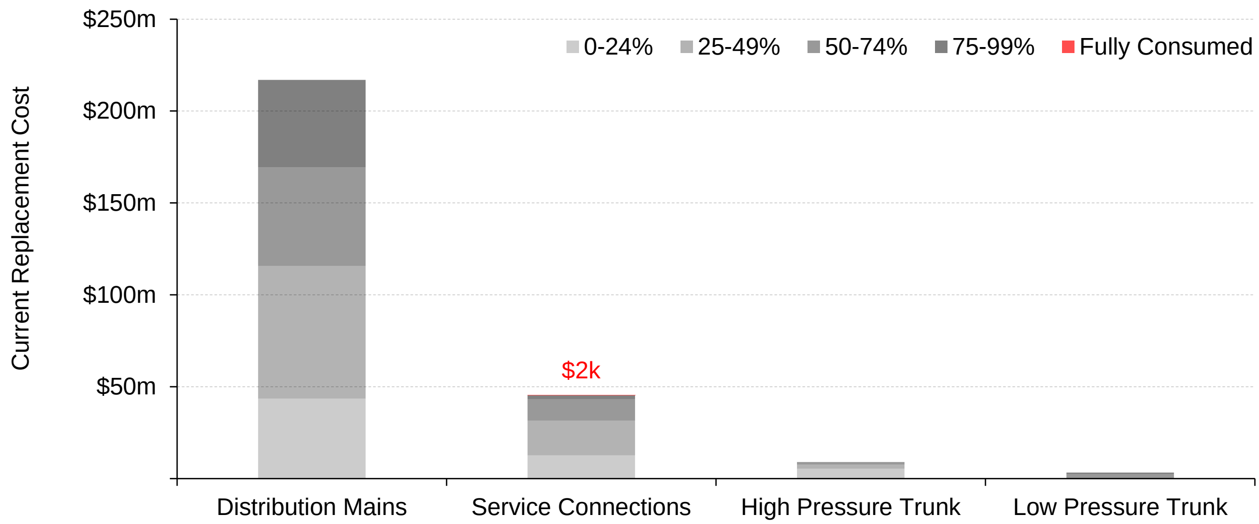
Figure 10: Average Asset Age vs. Estimated Useful Life: Linear Assets



Age analysis shows that with the exception of low pressure trunk mains, the City's water distribution network is still in the first half of its estimated lifespan. Distribution mains are on average 35 years old, and have reached the midpoint of their estimated design life.

Figure 11 shows a detailed distribution of the City's linear water distribution network based on the portion of useful life consumed to date. The analysis shows that although water distribution mains—the largest asset group within the City's water system—are still within their serviceable lifespans, 22% of them, with a current replacement cost of $47.6 million, have consumed at least 75% of their established useful life. These sections may be candidates for replacement in the short term.

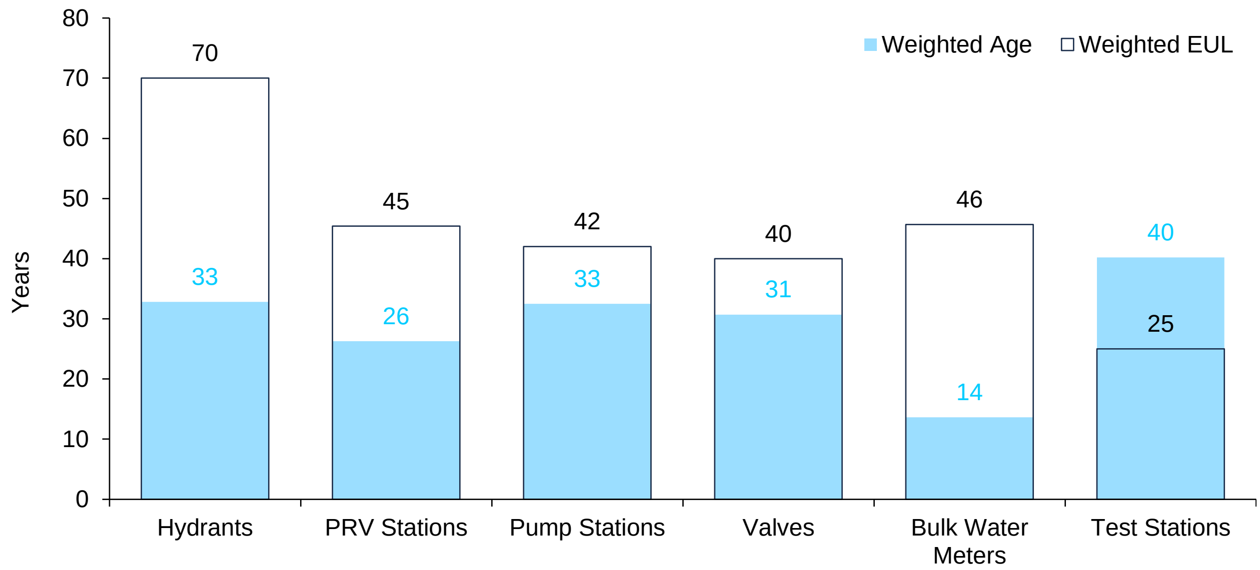
Figure 11: Percentage of Estimated Useful Life Consumed: Linear Assets



Although impacted by localized factors, watermains are designed to last many decades. PVC and ductile iron mains can last nearly a century when properly installed.

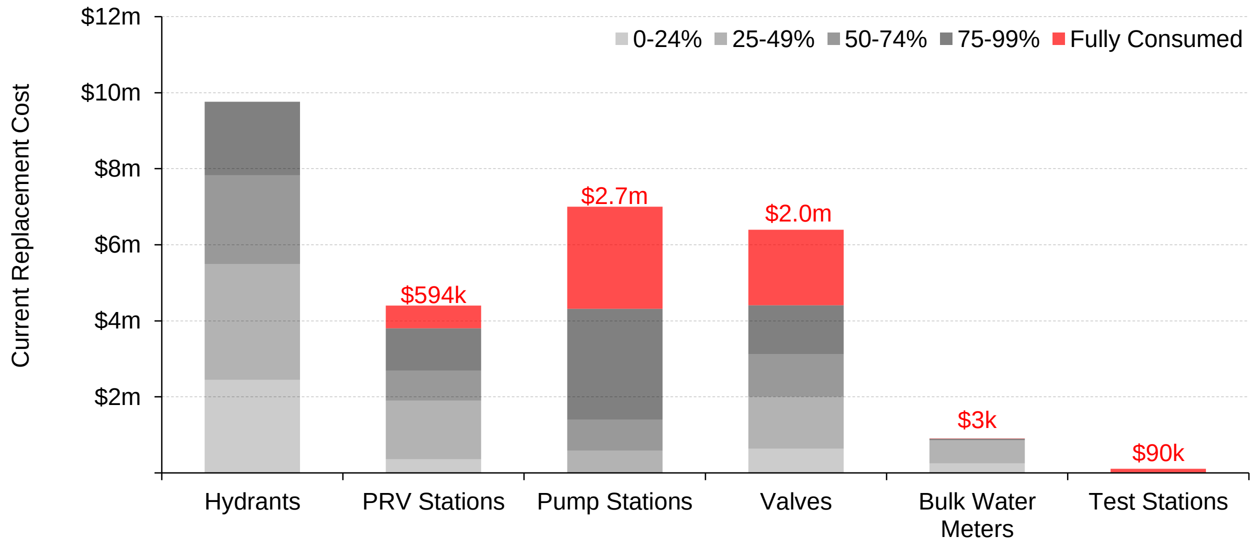
Figure 12 provides a similar analysis for Water facilities and appurtenances. The data shows that valves, hydrants, PRV station, and pump station assets are in the latter stages of their established useful life. On average, test stations remain in service well beyond their established useful life. However, based on replacement costs, these assets do represent only a minor portion of the overall Water portfolio.

Figure 12: Average Asset Age vs. Estimated Useful Life: Facilities and Appurtenances



Age and useful life consumption analysis shows that 38% of pump station assets and 31% of valves, with a current replacement cost of $2.7 million and $2 million, respectively, have fully consumed their established design-life.

Figure 13: Percentage of Estimated Useful Life Consumed: Facilities and Appurtenances



Lifecycle Management

The initial construction or acquisition of assets, particularly major infrastructure, represents only a fraction of the total cost of ownership that agencies can expect to incur. Assets require ongoing operations, maintenance, repair, and replacement to ensure they can continue to deliver their intended functions. These reinvestments back into infrastructure are necessary through the life of the asset.

Lifecycle activities and costs are those that have a direct and tangible impact on an asset's lifespan such as maintenance, repairs, and replacements. Additional operational costs are also needed to maintain customer-oriented service levels and efficient operations.

Current Lifecycle Framework

The City of Port Coquitlam's approach to asset lifecycle management is comprehensive. Maintenance, repair, and replacement activities are guided by inspections, asset age, and staff judgment through routine monitoring. Lifecycle activities are employed to maximize the serviceable life of assets while maintaining acceptable levels of service and efficient operations.

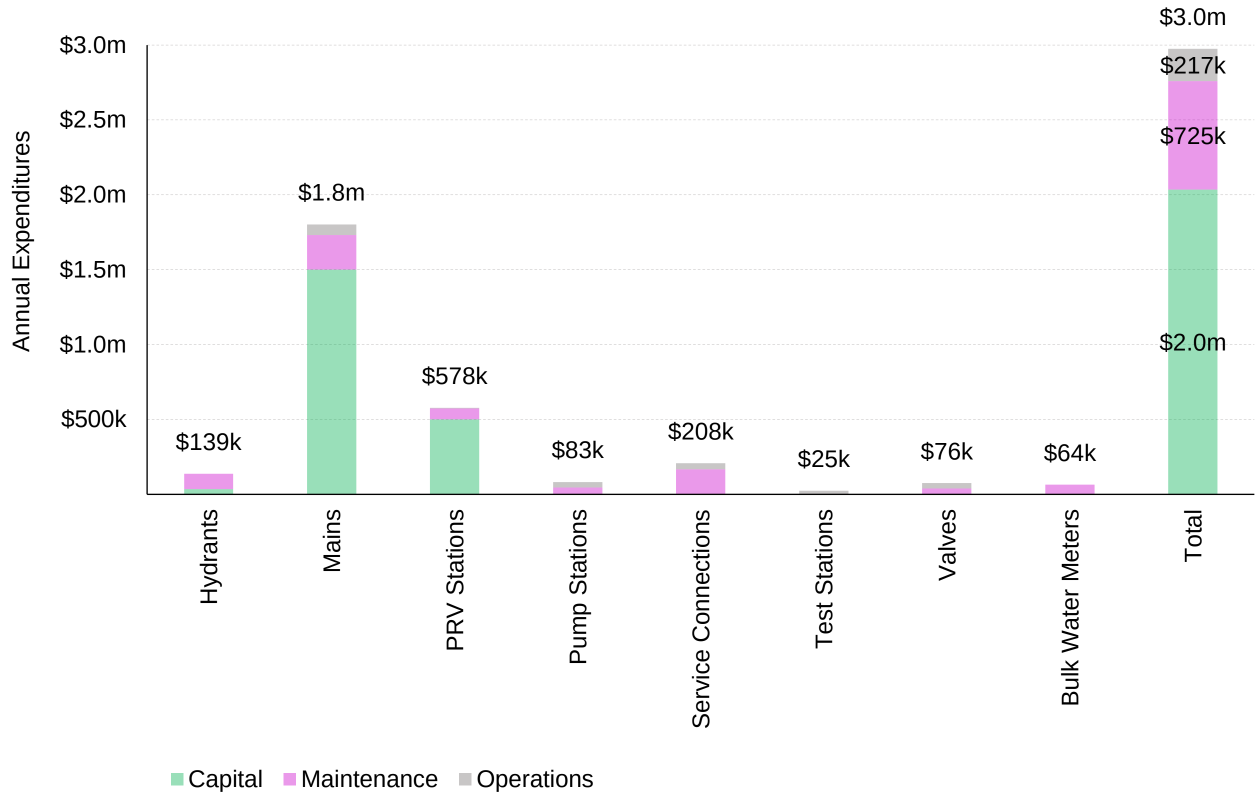
This section summarizes the City's lifecycle framework for each asset segment, modeled on Table 6.

Table 6: Components of a Lifecycle Framework

Component	Description		
Lifecycle Activity	The treatment, event, or intervention implemented,		
Activity Type	**Capital** Major repairs, renewals, rehabilitations, upgrades, and replacements	**Maintenance** Activities that have a direct and tangible impact on asset lifespan such as inspections, maintenance and minor repairs.	**Operations** Activities and costs needed to maintain acceptable service levels and efficient operations. No impact on asset lifespan.
Activity Trigger	This can include an asset's age and/or a minimum condition threshold. Other triggers may include priority levels, service request, and previously established frequency.		
Impact on Serviceable Life	Impact on an asset's serviceable lifespan resulting from the activity completed		
Annual Budget	Typical funding available (actual spending may vary from year to year)		
Reinvestment Rate	Annual capital budget of each activity as a portion of the total Water asset portfolio replacement cost of **$303,278,014**.		

Figure 14 summarizes total annual expenditures by asset segment and expenditure type. On average, the City allocates approximately $3 million annually on Water. Watermain replacements, including proactive replacements of cast iron segments, is the largest annual program, accounting for more than 60% of total expenditures.

Figure 14: Summary of Capital, Maintenance, and Operations Expenditures



Of the $3 million annual Water budget, approximately $2.8 million is spent on the inspection, maintenance, and replacement of assets. An additional $216,800 is allocated annually towards operational expenses that maintain acceptable levels of service and efficient operations, but have no direct impact on asset life (e.g., system adjustments, service locates, water quality testing).

The following table outlines the City's lifecycle framework for Water assets.

Table 7: Lifecycle Framework

Activity	Type	Activity Trigger	Impact on Serviceable Life	Budget
Cast Iron Replacement Program	Capital	Material	Extended by 70 years	$1,000,000
Water Main Replacements	Capital	Capacity, age, number of breaks	Extended by 70 years	$500,000
Fire Hydrant Replacement	Capital	Condition	Extended by 50 years	$34,200
PRV Station Replacement	Capital	Capacity or condition	Extended by 35 years	$500,000
Water Pump Station Replacements	Capital	Capacity or condition	Extended by 35 years	$0
Sub-Total Capital				**$2,034,200**
Flushing Mains & Blow Offs	Maintenance	Once per year	Extended by 5 years	$32,400
Uni-directional Flushing	Maintenance	Every 3 years	Extended by 5 years	$40,700
Watermain Repairs	Maintenance	Condition	Extended by 25 years	$158,250
Water Service Repairs	Maintenance	Condition	Extended by 25 years	$167,850
Air Valve Servicing	Maintenance	Once per year	Extended by 10 years	$14,300
Fire Hydrant Servicing	Maintenance	Every 2 years	Extended by 10 years	$87,400
Fire Hydrant Painting & Cleanup	Maintenance	Condition	Extended by 5 years	$17,000
PRV Inspection, Planned and Preventative Maintenance	Maintenance	Once per week	Extended by 10 years	$52,700
PRV SCADA/Alarms	Maintenance	Once per year	Extended by 10 years	$9,600
PRV Reactive Emergency Repairs	Maintenance	Condition	Extended by 10 years	$10,800
Water Valve Replacement & Repairs	Maintenance	Condition	Extended by 25 years	$24,000
Water Meter Repairs	Maintenance	Condition	Extended by 5 years	$64,200

Activity	Type	Activity Trigger	Impact on Serviceable Life	Budget
Water Pump Station Inspection, Planned and Preventative Maintenance	Maintenance	Once per week	Extended by 10 years	$29,900
Water Pump Station SCADA/Alarms	Maintenance	Once per year	Extended by 10 years	$2,900
Water Pump Stations Generator Servicing	Maintenance	Once per year	Extended by 10 years	$3,800
Water Pump Station Reactive Repairs	Maintenance	Condition	Extended by 10years	$8,800
Sub-Total Maintenance				**$724,600**
Water System Adjustments	Operations	Water quality, supply, or pressure	No impact	$17,600
Water Service Locating & Adjusting	Operations	Condition	No impact	$40,200
Water Quality Sampling and Testing	Operations	Once per week	No impact	$25,300
Soil Disposal	Operations	With paving or utility projects	No impact	$53,700
PRV Station Electricity and Communication Billings	Operations	Usage	No impact	$5,000
Water Valve Locating & Adjusting	Operations	Once per year	No impact	$37,600
Water Pump Station Electricity and Communication	Operations	Usage	No impact	$37,400
Sub-Total Operations				**$216,800**
Total				**$2,975,600**

Capital Reinvestment Rates

Capital reinvestment rates, expressed as a percentage of asset replacement costs, offer valuable information about the financial sustainability of infrastructure assets. Reinvestment rates can be used to determine annual capital expenditure targets, or allocations to reserves, to ensure asset replacement needs are met as they arise.

Maintenance and operational costs are not reflected in reinvestment rates, but are important considerations for operational budgeting in order to maximize the life of assets while maintaining acceptable levels of service and efficient operations.

Table 8 illustrates two types of reinvestment rates: segment and service area. The segment-level reinvestment is calculated by dividing the total capital expenditures of an asset segment by the replacement cost of that particular asset segment. The service area reinvestment rate is calculated by dividing capital expenditures for each asset segment over the total replacement cost of the service area as a whole. The overall, combined service area reinvestment rate can be used for long-term financial planning and strategic decision-making.

Table 8 shows that the City's annual Water capital expenditures of $2.0 million yield an overall, service area reinvestment rate of 0.7%.

Table 8: Current Reinvestment Rates

Segment	Annual Capital Budget	Segment Capital Reinvestment Rate	Service Area Capital Reinvestment Rate
Linear	$1,500,000	0.5%	0.5%
Non-linear	$534,200	1.9%	0.2%
Total	**$2,034,200**		**0.7%**

Reinvestment Rate Benchmarks

Although there is no scientific or industry consensus on how much an agency should spend or allocate to reserves each year for asset replacements, some benchmarking is available to provide guidance on adequate reinvestment levels, or target reinvestment rates (TRR).

Inconsistencies in methodologies and incomplete details make for imperfect comparisons but can still be very useful. Actual reinvestments also vary considerably across municipalities, and reflect many factors, including current asset conditions, financial capacity, and council priorities.

Canadian Infrastructure Report Card

In 2016, the Canadian Infrastructure Report Card (CIRC) produced an assessment of the health of municipal infrastructure as reported by cities and communities across Canada. The CIRC remains a joint project produced by several organizations, including the Federation of Canadian Municipalities (FCM), the Canadian Society of Civil Engineers (CSCE), the Canadian Network of Asset Managers (CNAM), and the Canadian Public Works Association (CPWA).

The 2016 version of the report card contained recommended reinvestment rates that can serve as benchmarks for municipalities. The report card contains both a range for reinvestment rates that outlines the lower and upper recommended levels, as well as actual municipal averages.

The CIRC reinvestment levels for non-linear assets includes water treatment plants, which are not part of the City's Water portfolio.

System Generated Reinvestment Rates

Using the City's inventory data, Citywide Asset Manager generates the average annual requirements (AAR) associated with each asset. The AAR is calculated by dividing the replacement cost of an asset by its established useful life. This can then be aggregated for all assets to derive reinvestment rates.

The AAR serves as a benchmark for annual infrastructure spending (or allocations to reserves) to ensure that asset replacement needs are met as they arise. AAR value is then divided by the total replacement cost of the service area or category to calculate target reinvestment rates.

Table 9: System-generated Reinvestment Rates

Segment	Type	AAR	System-generated TRR
Distribution Mains	Linear	$3,100,641	1.4%
Service Connections	Linear	$647,658	1.4%
High Pressure Trunk	Linear	$130,056	1.4%
Low Pressure Trunk	Linear	$46,063	1.4%
Hydrants	Non-linear	$139,449	1.4%
PRV Stations	Non-linear	$111,152	2.5%
Pump Stations	Non-linear	$179,966	2.6%
Valves	Non-linear	$159,888	2.5%
Bulk Water Meters	Non-linear	$21,965	2.4%
Total		**$4,541,037**	**1.5%**

For Water assets, the average annual requirements for linear assets total $3,924,418, for a system-generated target reinvestment rate of 1.4%. Similarly, for non-linear assets, the AAR total $616,619, for a reinvestment rate of 2.2%. Combined, the system-generated, service area target reinvestment rate is estimated at 1.5%.

Comparative Analysis

Table 10 compares the City's current reinvestment rates against CIRC's 2016 guidelines and the system-generated reinvestment rates as found in Citywide.

Table 10: Comparing Port Coquitlam's Current Reinvestment Rate Against Benchmarks

Benchmark	Assets Included	Target Reinvestment Range	2016 Municipal Average	Port Coquitlam Capital Reinvestment Rate (Segment)	Port Coquitlam Capital Reinvestment Rate (Service Area)
CIRC	Linear	1.0% - 1.5%	0.9%	0.5%	0.5%
CIRC	Non-linear	1.7% - 2.5%	1.1%	1.9%	0.2%
Citywide Asset Manager	Linear	1.4%	0.9%	0.5%	0.5%
Citywide Asset Manager	Non-linear	2.2%	1.1%	1.9%	0.2%
Citywide Asset Manager	All Water Assets	1.5%	-	-	0.7%

The analysis shows that, at the segment level, Port Coquitlam's reinvestment rate for non-linear assets is comparable to both the CIRC and system-generated targets: the City is reinvesting 1.9% of the total replacement cost of all non-linear assets back into these assets each year. At 0.5%, the reinvestment rate for linear assets, however, falls well below the targets recommended by both benchmarks. At the service area level, the City's overall reinvestment rate of 0.7% also remains below recommended ranges.

Maintaining adequate reinvestment rates –whether through actual spending on infrastructure programs or allocating funds to reserves for future investments—ensures that service levels are maintained, and replacement needs can be met as they arise.

Capital and Operational Budgeting

Information from asset management plans can be used to determine appropriate levels of funding for capital and operating budgets, which serve different purposes.

Table 11: Purpose of Capital and Operating Budgets

Budget	Role in Infrastructure Programs
Capital	The capital budget includes funds to replace existing assets and acquire new, non-growth related assets. Asset replacements are funded by taxpayers and can be determined by reinvestment rates. Growth-related assets and capacity upgrades are partially funded by Development Cost Charges or external parties, or constructed by development. These are determined by growth projects and infrastructure capacity assessments.
Operational	The operational budget includes funds to maintain assets and deliver services. Maintenance costs include activities and expenditures that have a direct impact on assets by prolonging and maximizing their service life or deferring their replacement. These expenditures are informed by asset management plans and key performance indicators. Operational costs include activities and expenditures that maintain acceptable levels of service and efficient operations but have no direct or tangible impact on asset lifespan.

Capital reinvestment rates can be used to determine annual capital expenditure targets, or allocations to reservices, to ensure asset replacements needs are met as they arise.

Key performance indicators can be tracked and used to determine how much to spend on maintenance and operational activities in order to maximize the service life of assets while maintaining acceptable levels of service and efficient operations.

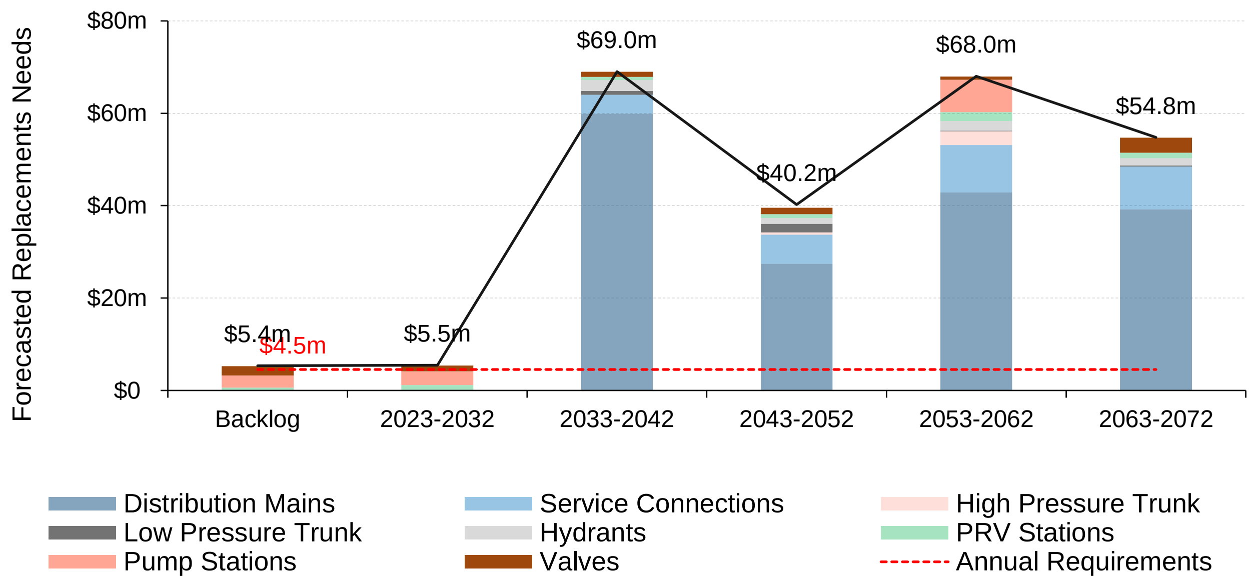
Forecasted Long-term Replacement Needs

In contrast to historical investments in infrastructure, Figure 15 illustrates the cyclical short-, medium- and long-term replacement requirements for Water assets over the coming decades. The City's average annual requirements for asset replacements total $4.5 million (red dotted line). Although actual spending may fluctuate substantially from year to year, this figure is a useful benchmark value for annual capital expenditure targets (or allocations to reserves) to ensure projects are not deferred and replacement needs are met as they arise.

The City's current capital expenditures of $2 million per year on Water asset replacements are less than half of the $4.5 million recommended to ensure that replacement needs are met.

The chart illustrates a sharp increase in capital needs beginning in the 2030s when substantial portions of the distribution network will reach the end of its serviceable lifespan. This spike, estimated at $69 million, comes approximately 70 years after the 1960s, when the largest number of distributions mains were installed. These replacement needs are expected to remain high, and relatively stable during the 50-year forecast period, averaging $47.5 million per decade.

Figure 15: Forecasted Long-term Replacement Needs



The chart also shows a Water age-based backlog of $5.4 million, comprising assets that have reached the end of their estimated useful life. However, this figure increases to $109.7 million when assets in poor or worse condition, or less than 40% service life remaining, are included. These assets may also already be candidates for immediate or short-term replacement because of their assumed condition.

Both age and condition should be used to forecast replacement needs and refine capital expenditure estimates. The magnitude of capital needs typically far exceeds what most agencies can afford to fund. A risk-based approach can be used to strategically address age- and condition-based backlogs.

Risk Analysis

The level of risk an asset carries determines how closely it is monitored and maintained, including the frequency of various lifecycle activities, and the investments it requires on an ongoing basis.

Some assets are also more important to the community than others, based on their financial and economic significance, their role in delivering essential services, the impact of their failure on public health and safety, and the extent to which they support a high quality of life for community stakeholders.

Although public health and safety is paramount, many factors other than an asset's age or condition must be considered when prioritizing investments in infrastructure and making the most of limited funds.

Keeping up with replacement needs poses a substantial challenge for most local governments and public agencies across Canada. A risk-based approach to infrastructure spending can help prioritize capital projects to channel funds where they are needed most. Rather than taking the worst-first approach, a risk-based approach ranks assets based on their condition/performance as well as their criticality—providing a more complete rationale for project selection.

Calculating Asset Level Risk

Risk is a product of two variables: the probability that an asset will fail, and the resulting consequences of that failure event. It can be a qualitative measurement, (low, medium, high) or quantitative measurement (1-5), that can be used to rank assets and projects, identify appropriate lifecycle strategies, optimize short- and long-term budgets, minimize service disruptions, and maintain public health and safety.

The approach used in this asset management plan relies on a quantitative measurement of risk associated with each asset. The probability and consequence of failure are each scored from 1 to 5, producing a minimum risk index of 1 for the lowest risk assets, and a maximum risk index of 25 for the highest risk assets.

Figure 16: Calculating Risk Ratings

Risk	=	Probability of Failure	x	Consequence of Failure

Probability of Failure

Several factors can help decision-makers estimate the probability or likelihood of an asset's failure. Typically, these can include the asset's condition, age, previous performance history, capacity challenges, and exposure to extreme weather events, such as flooding and ice jams—both a growing concern for municipalities in Canada. Each of these factors and individual attributes must also be weighted based on how well it can predict and explain the likelihood of asset failure.

Consequence of Failure

The consequence of failure describes the overall effect that an asset's failure will have on an organization's asset management goals. Consequences of failure can range from non-eventful to severe: a small diameter water main break in a subdivision may cause several rate payers to be without water service for a short time. However, a larger trunk water main may break outside a hospital, leading to severely detrimental consequences.

The parameters used to describe and measure an asset's consequence of failure will aim to align with the Triple Bottom Line (economic, social, environmental) approach to risk management as well as other considerations including regulatory, health and safety, and strategic.

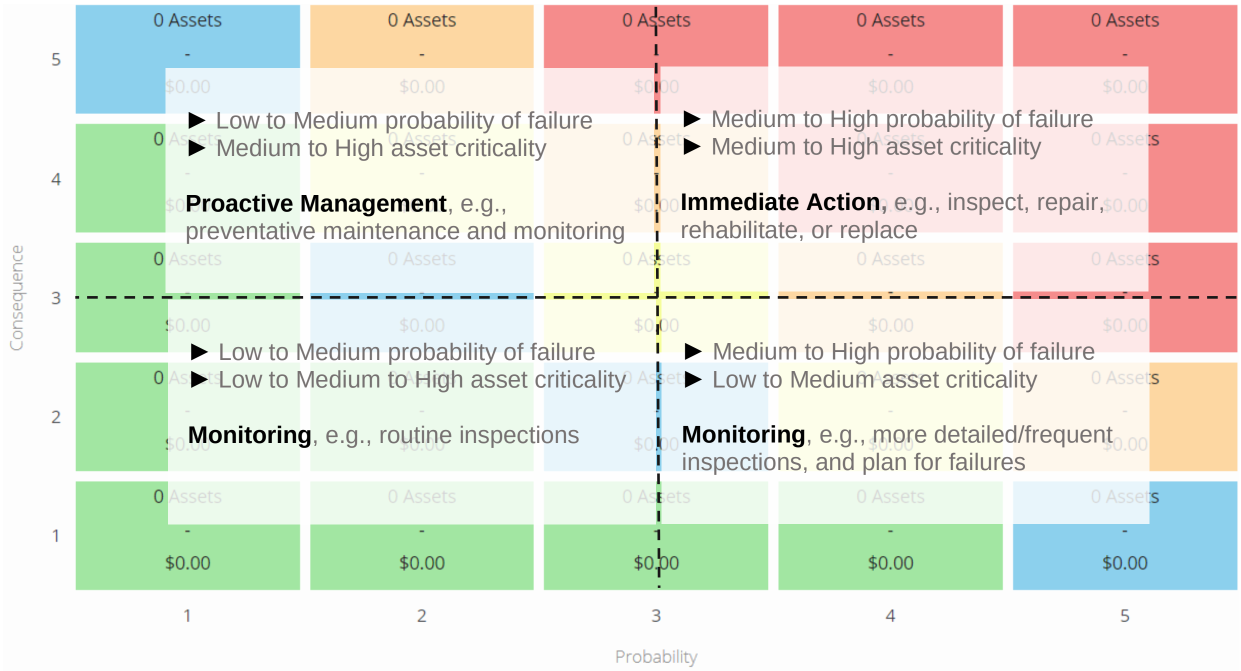
When various types of consequences that the organization and community may face from an asset's failure are identified and properly weighted based on their relative magnitudes, an asset's criticality can be approximated.

Table 12: Types of Consequences of Asset Failure

Type of Consequence	Description
Direct Financial	Direct financial consequences are typically measured as the replacement costs of the asset(s) affected by the failure event, including interdependent infrastructure.
Economic	Economic impacts of asset failure may include disruption to local economic activity and commerce, business closures, service disruptions, etc. Whereas direct financial impacts can be seen immediately or estimated within hours or days, economic impacts can take weeks, months and years to emerge, and may persist for even longer.
Socio-political	Socio-political impacts are more difficult to quantify and may include inconvenience to the public and key community stakeholders, adverse media coverage, and reputational damage to the community and the City.
Environmental	Environmental consequences can include pollution, erosion, sedimentation, habitat damage, etc.
Public Health and Safety	Adverse health and safety impacts may include injury or death, or impeded access to critical services.
Strategic	These include the effects of an asset's failure on the community's long-term strategic objectives, including economic development, business attraction, etc.

Individual risk models are developed for Water assets, and applied to the City's inventory within Citywide to establish asset risk ratings. These risk indices or ratings are then used to stratify assets within a risk matrix, as illustrated in Figure 17.

Figure 17: Generic Risk Matrix



Since risk ratings rely on many factors beyond an asset's physical condition or age, assets in a state of disrepair can sometimes be classified as low risk, despite their poor condition rating. In such cases, although the probability of failure for these assets may be high, their consequence of failure ratings were determined to be low based on the attributes used and the data available.

Similarly, assets in very good condition can receive a moderate to high risk rating despite a low probability of failure. These assets may be deemed as highly critical to the City based on their costs, economic importance, social significance, and other factors.

Continued calibration of an asset's criticality and regular data updates are needed to ensure these models more accurately reflect an asset's actual risk profile.

Risk Models and Matrices

This following section outlines the proposed risk models for Water assets. Factors and weights used in both the probability of failure and consequence of failures are outlined, along with the associated ranges that will be used to classify individual assets. Resulting risk matrices are also illustrated for each major asset type, as well as the Water portfolio as a whole.

Risk Matrix: All Water Assets

The following summary-level risk matrix show how all Water System assets are classified based on their risk ratings.

Figure 18: Detailed Risk Matrix – All Water Assets

Consequence of Failure	1	2	3	4	5
5	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0
4	7 Assets $3.4M	12 Assets $5.0M	6 Assets $2.3M	4 Assets $2.9M	6 Assets $2.7M
3	725 Assets $60.9M	561 Assets $44.1	404 Assets $33.5M	359 Assets $31.2M	7 Assets $1.0M
2	660 Assets $19.4M	506 Assets $19.7M	366 Assets $17.2M	235 Assets $9.6M	36 Assets $198.0K
1	4,875 Assets $21.0M	3,950 Assets $14.1M	2,827 Assets $10.0M	816 Assets $2.5M	1,126 Assets $2.4M

Probability of Failure

To provide a more simplified view, the matrix below consolidates assets into broader risk classifications. The figure illustrates that 310 assets, with a current replacement cost of $29.9 million have a very high risk rating due to their potentially high probability of failure, and moderate to severe consequences of failure. An additional 813 assets, with a current replacement cost of $66 million, were classified with a high risk rating.

Figure 19: Consolidated Risk Matrix – All Water System Assets

Very Low (1 - 4)	Low (5 - 7)	Moderate (8 - 9)	High (10 - 14)	Very High (15 - 25)
10,935 Assets	4,603 Assets	827 Assets	813 Assets	310 Assets
$81,552,362	$76,090,121	$49,754,929	$66,014,595	$29,866,008

Linear Assets

Since in-field condition data was not available, other attributes were used to explain the likelihood of failure for the City's linear water distribution system. These include age-based condition ratings, watermain break history, service life remaining, and pipe material. In the model below for probability of failure, age-based condition is the best proxy for estimating the likelihood of failure. Hence, it received a weighting of 65%.

Figure 20 Probability of Failure – Linear Assets

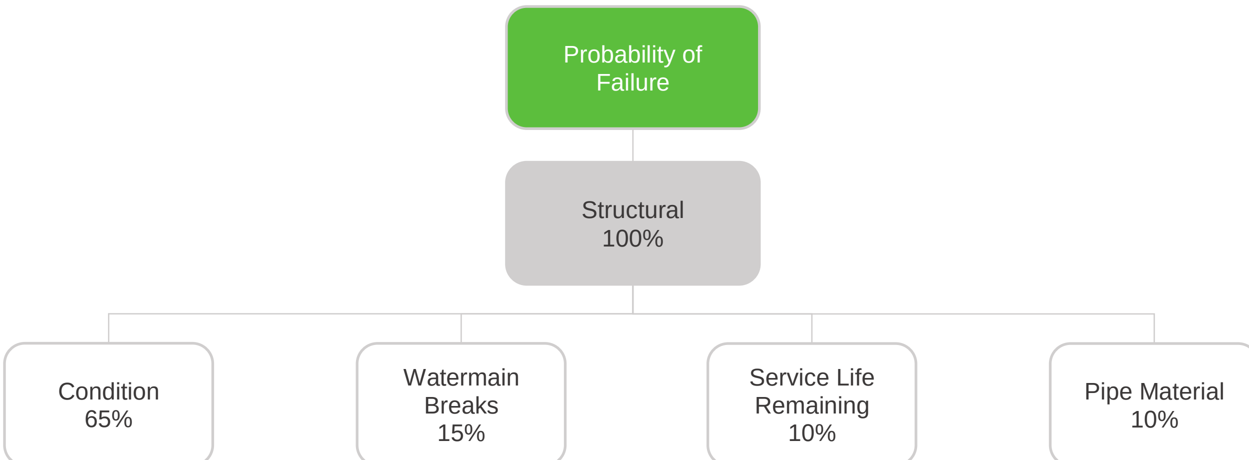


Table 13 outlines the relationship between the probability of failure and the ranges used for each of the above factors. Assets with a condition rating of 20% or less, or with a remaining service life of less than 10%, have the highest likelihood of failure, i.e., 'Almost Certain'.

Table 13 Defining Probability of Failure Ranges – Linear Assets

Factor	Range (0-100%)	Probability of Failure
Condition (%)	Greater than 80	1—Rare
	60 - 80	2—Unlikely
	40 - 60	3—Possible
	20 - 40	4—Likely or Probable
	0 – 20	5—Almost Certain
Service Life Remaining (%)	Greater than 40	1—Rare
	30 - 40	2—Unlikely
	20 - 30	3—Possible
	10 - 20	4—Likely or Probable
	0 - 10	5—Almost Certain
Number of Watermain Breaks	0	1—Rare
	1 – 2	2—Unlikely
	3 – 4	3—Possible
	5 – 6	4—Likely or Probable
	Greater than 6	5—Almost Certain
Pipe Material	PVC/PVCO/HDPE	1—Rare
	DI	2—Unlikely
	AC, CU, PCCP	3—Possible
	CI	4—Likely or Probable

The model in Figure 21 outlines the type of potential consequences that may result from failure of an asset within the City's linear Water distribution system, the relative weight of each consequence type, and the data (attributes) used to approximate that effect. Four types of consequences are accounted for: direct financial, economic, socio-political, and environmental.

The City's Water assets inventory includes the replacement cost, main type (e.g., distribution vs. trunk main) and diameter. Additionally, GIS data was used to identify service type (industrial, commercial, or institutional), and watermains located in dead ends, near watercourses, or in easements. If they fail, water mains located in easements have a greater chance of impacting properties than those located in roadways. These attributes are used to assist in measuring and quantifying the economic, socio-political, and environmental consequences of main failures.

In addition, GIS analysis was also conducted to append the appropriate road class to each main segment. This allowed for a more nuanced assessment and understanding of a main's economic consequence of failure—that is, a main failure along an arterial road would cause more disruption than one occurring beneath a collector or lane roadway.

Figure 21 Consequence of Failure – Linear Assets

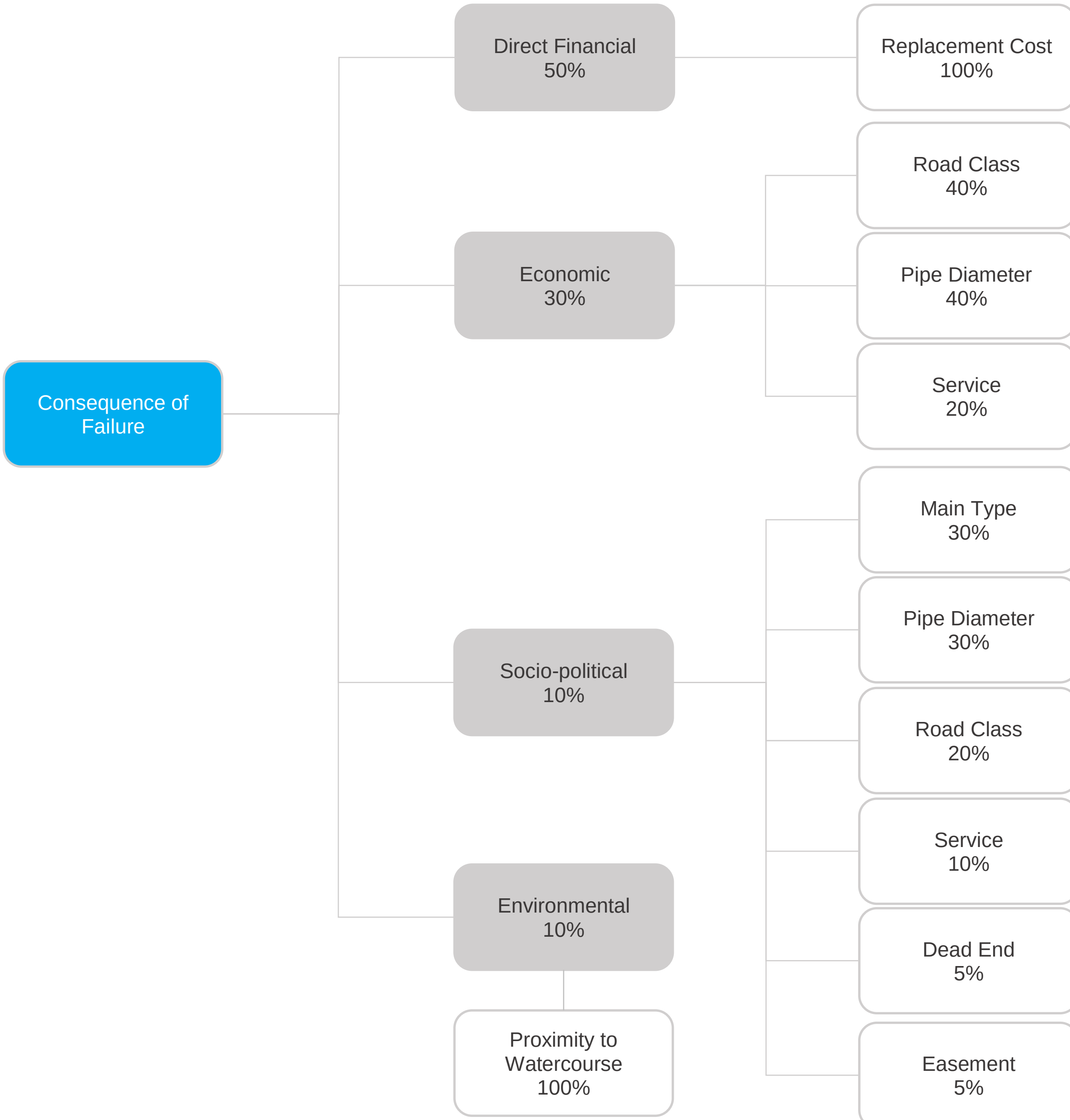


Table 14: Defining Consequence of Failure Ranges – Linear Assets

Type of Consequence	Measure	
Direct Financial	Replacement Cost	Consequence of Failure
	Less than $10,000	1—Insignificant
	$10,000 - $50,000	2—Minor
	$50,000 – $100,000	3—Moderate
	$100,000 - $500,000	4—Major
	Greater than $500,000	5—Severe
Economic	Road Class	Consequence of Failure
	Lane/Local	2—Minor
	Collector/Arterial	3—Moderate
	Highway	4—Major
	Pipe Diameter (mm)	Consequence of Failure
	Less than 100	2—Minor
	100 - 300	3—Moderate
	300 – 400	4—Major
	Greater than 400	5—Severe
	Service	Consequence of Failure
	Residential	3—Moderate
	Industrial/Commercial/Institutional	4—Major
Socio-political	Main Type	Consequence of Failure
	Distribution Mains	3—Moderate
	Low Pressure Trunk Mains	4—Major
	High Pressure Trunk Mains	5—Severe
	Pipe Diameter (mm)	Consequence of Failure
	Less than 100	1—Insignificant
	100 - 150	2—Minor
	150 - 200	3—Moderate
	200 - 450	4—Major
	Greater than 450	5—Severe
	Road Class	Consequence of Failure
	Lane/Local	2—Minor
	Collector/Arterial	3—Moderate
	Highway	4—Major
	Service	Consequence of Failure
	Residential	3—Moderate
	Industrial/Commercial/Institutional	4—Major
	At dead end:	Consequence of Failure
	No	1—Insignificant
	Yes	3—Moderate
	Presence of easement:	Consequence of Failure
	No	1—Insignificant
	Yes	3—Moderate
Environmental	Proximity to watercourse (m)	Consequence of Failure
	More than 30 m	1—Insignificant
	Within 30 m	3—Moderate
	Crossing Watercourse	4—Major

Risk Matrix: Linear Assets

The risk matrix below is based on the previous risk model developed for the linear Water system using available asset data.

Figure 22: Detailed Risk Matrix – Linear Assets

Consequence of Failure	1	2	3	4	5
5	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0
4	7 Assets $3.4M	8 Assets $3.6M	6 Assets $2.3M	0 Assets $0	0 Assets $0
3	342 Assets $57.1M	271 Assets $40.9M	197 Assets $31.2M	183 Assets $29.0M	0 Assets $0
2	597 Assets $18.4M	452 Assets $18.6M	344 Assets $17.0M	206 Assets $9.4M	0 Assets $0
1	4,245 Assets $19.3M	3,609 Assets $13.4M	2,439 Assets $9.2M	477 Assets $1.8M	8 Assets $32.9K
	1	2	3	4	5

Probability of Failure

The consolidated risk matrix in Figure 23 shows that 117 assets, with a current replacement cost of $21 million have a high risk rating. The majority of these assets are cast iron and ductile iron distribution mains.

Figure 23: Consolidated Risk Matrix – Linear Assets

Very Low (1 - 4)	Low (5 - 7)	Moderate (8 - 9)	High (10 - 14)	Very High (15 - 25)
9,725 Assets	2,480 Assets	508 Assets	561 Assets	117 Assets
$76,887,897	$68,506,367	$46,435,975	$61,852,335	$21,026,669

Facilities and Appurtenances

Figure 24: Probability of Failure – Facilities and Appurtenances

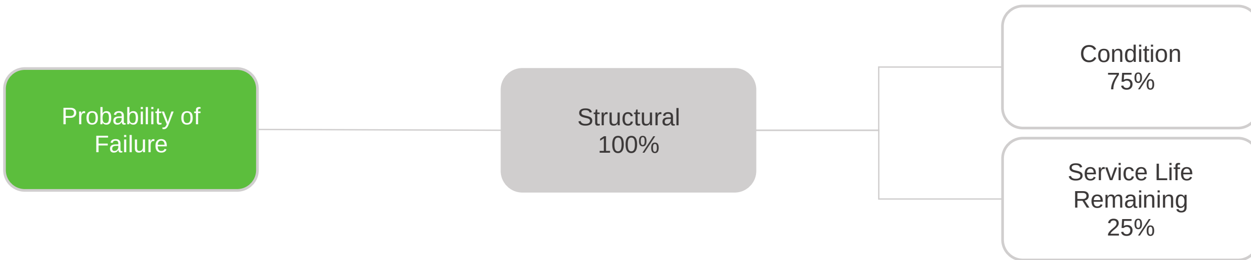


Table 15: Defining Probability of Failure Ranges - Facilities and Appurtenances

Factor	Range (0-100%)	Probability of Failure
Condition (%)	Greater than 80	1—Rare
	60 - 80	2—Unlikely
	40 - 60	3—Possible
	20 - 40	4—Likely or Probable
	0 – 20	5—Almost Certain
Service Life Remaining (%)	Greater than 40	1—Rare
	30 - 40	2—Unlikely
	20 - 30	3—Possible
	10 - 20	4—Likely or Probable
	0 - 10	5—Almost Certain

Figure 25: Consequence of Failure – Facilities and Appurtenances

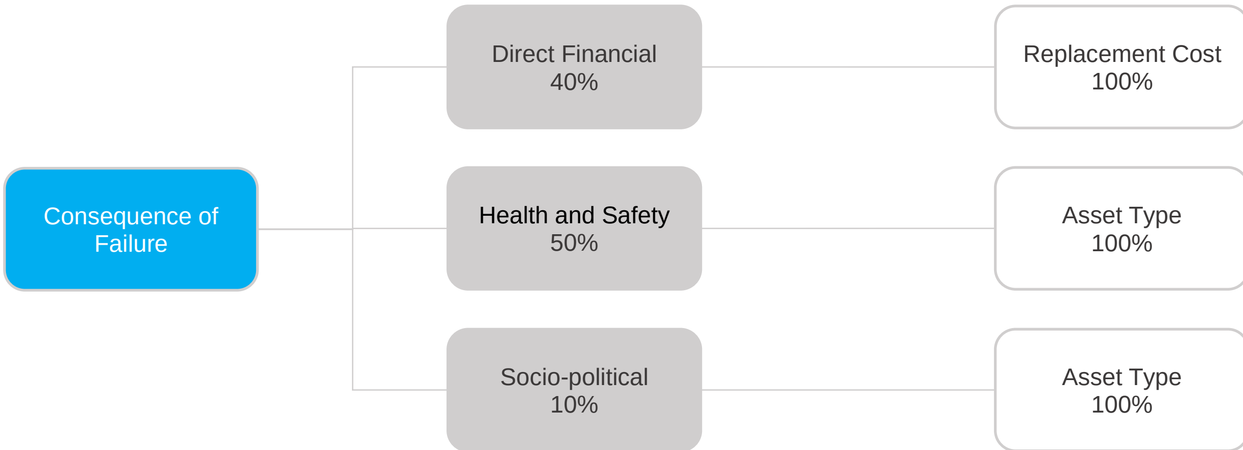


Table 16: Defining Consequence of Failure Ranges - Facilities and Appurtenances

Type of Consequence	Measure	
Direct Financial	Replacement Cost	Consequence of Failure
	Less than $5,000	1—Insignificant
	$5,000 - $10,000	2—Minor
	$10,000 - $100,000	3—Moderate
	$100,000 - $500,000	4—Major
	Greater than $500,000	5—Severe
Health and Safety	Asset Type	Consequence of Failure
	Bulk Water Meters	1—Insignificant
	Valves	2—Minor
	PRV Stations	3—Moderate
	Hydrants, Pump Stations, Test Stations	5—Severe
Socio-political	Asset Type	Consequence of Failure
	Bulk Water Meters	1—Insignificant
	Valves	2—Minor
	PRV Stations	4—Major
	Hydrants, Pump Stations, Test Stations	5—Severe

Risk Matrix: Facilities and Appurtenances

The risk matrix below is based on the previous risk model developed for the City's Water facilities and appurtenances.

Figure 26: Detailed Risk Matrix – Facilities and Appurtenances

Consequence of Failure	1	2	3	4	5
5	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0
4	0 Assets $0	4 Assets $1.4M	0 Assets $0	4 Assets $2.9M	6 Assets $2.7M
3	383 Assets $3.9M	290 Assets $3.1M	207 Assets $2.4M	176 Assets $2.2M	7 Assets $1.0M
2	63 Assets $1.0M	54 Assets $1.1M	22 Assets $236.5	29 Assets $225.5K	360 Assets $198.0K
1	630 Assets $1.6M	341 Assets $771.9K	388 Assets $738.6K	339 Assets $660.0K	1,118 Assets $2.3M

Probability of Failure

The consolidated risk matrix in Figure 27 shows that 193 assets with a current replacement cost of $8.8 million have a very high risk rating. The majority of these are pump station assets. An additional 252 assets, valued at $4.2 million, carry a high risk rating. Most are hydrants, which while carrying a moderate consequence of failure rating, but are aging and have a higher probability of failure.

Figure 27: Consolidated Risk Matrix – Facilities and Appurtenances

Very Low (1 - 4)	Low (5 - 7)	Moderate (8 - 9)	High (10 - 14)	Very High (15 - 25)
1,210 Assets	2,123 Assets	319 Assets	252 Assets	193 Assets
$4,664,465	$7,583,754	$3,318,954	$4,162,260	$8,839,339

Levels of Service

Levels of service (LOS) measure the quality and quantity of service provided, and offer direction for infrastructure investments. They are necessary for performance tracking and reporting. Many agencies attempt to deliver levels of service that cannot be sustainably funded by the existing tax base. This can lead to an eventual drop in quality of service, or increases to tax and utility rates to fund higher service levels.

LOS should be affordable and aligned with the community's long-term vision for itself and the service attributes it most values for different infrastructure programs.

Defining Levels of Service

Levels of service measure the quality, function, and capacity of an asset class or service area. LOS is an internationally recognized concept, employed across a variety of sectors, including public infrastructure. The International Standards Organization's ISO 55000 defines levels of service as the "parameters, or combination of parameters, which reflect the social, political, environmental, and economic outcomes that the organization delivers."

Levels of Service Framework

A typical levels of service framework includes several common components, as outlined in the table below.

Table 17: Components of a Levels of Service Framework

Component	Description and Purpose
Core Value	Typical core values that can be used for infrastructure programs include safety, reliability, efficiency, sustainability, and affordability.
Levels of Service Statement	The LOS statement expands on each core value and converts it into an objective for each service area.
Customer Levels of Service	CLOS are measurements or qualitative descriptions that help **describe the performance of the asset group or service area from an end-user perspective**. CLOS measure experiences, e.g., customer satisfaction with quality of recreational facilities; average travel times between major residential and commercial centres; watermain breaks; and, health and safety incidents.
Technical Levels of Service	TLOS are typically more operational in nature and are designed to measure the **various activities and steps that the organization takes to deliver the customer-oriented levels of service**. They can include data on maintenance activities and different condition assessment programs. TLOS are often seen as inputs whereas CLOS are viewed as outputs. Some KPIs can be both customer and technical oriented.
Key Performance Indicators	For both CLOS and TLOS, suitable key performance indicators (KPIs) must be selected to support reporting and tracking of each.

Core Values and Service Statements

Table 18 outlines the core values developed for service delivery across the City's eight asset portfolios. Service statements expand on the values to convert them into broader goals.

Table 18: Core Values and Service Statements

Core Value	Service Statement
Reliable	Service delivery is reliable and provided with minimal service disruption to meet agreed upon levels of service.
Safe	All safety standards and regulatory requirements are met to protect public health, safety, and the environment.
Affordable	Services are affordable, fair, and equitable, accounting for the full cost of service delivery at agree upon levels of service.
Practical	Resources are prioritized towards the delivery of basic infrastructure and services first.

Selecting Suitable KPIs

Given the complexity of infrastructure services, countless customer and technical levels of service KPIs can be used to monitor performance, and ultimately, adjust the cost, performance, and risk associated with different assets. For the purpose of asset management planning, KPIs selected should be higher-level in nature and summarize the performance of the asset group as a whole rather than enumerate hundreds of daily, operational indicators.

The KPIs should also be aligned with corporate goals and initiatives. This maintains a 'line of sight' between staff activities, end-user experiences, and council direction as typically illustrated in strategic planning documents, i.e., measuring what matters most to Port Coquitlam residents. In addition, rather than generating new metrics, the selected KPIs should first maximize data already available. Often, available data can be readily converted into meaningful KPIs.

For Water, a total of 53 KPIs were selected. This included 19 KPIs to measure customer levels of service, and 34 to track the City's technical levels of service. A practical way to distinguish between the two is to think of technical levels of service as the activities and steps the organization takes to deliver customer levels of service. Given their significance, historical data for the last four years was retrieved to illustrate performance trends for customer levels of service.

Table 19: Customer Levels of Service

KPI	2018	2019	2020	2021	Trend
Capital					
Average age of watermains (years)	NA	NA	NA	35	→
% of water assets in poor or worse condition	NA	NA	NA	34	→
% of mains in poor or worse condition	NA	NA	NA	38	→
% of pump station assets in poor or worse condition	NA	NA	NA	80	→
Maintenance					
# of water main flushing related calls	0	3	0	3	→
# of hydrant maintenance calls	23	26	27	33	→
# of pumpstation related calls	5	7	32	32	↗
# of watermain breaks	51	62	45	38	↘
# of waterbox maintenance calls	53	75	91	81	→
Operations					
# of water conservation calls	77	48	21	14	↘
# of water conservation violators tagged	NA	NA	NA	NA	→
# of water service locate requests	80	93	93	108	→
# of no-water low pressure complaints	54	78	66	68	→
# of water quality calls	66	88	71	110	↗
# of water service leak calls - emergency & city side service	140	182	184	212	↗
# of water service leak calls - private service	63	86	80	84	→
# of calls - turn on/off water service connection	145	184	202	236	↗
# of non-compliance incidents with water quality regulations	NA	NA	NA	4	→
Water consumption - million m3/year (per 61, 498 residents)	NA	NA	NA	10.68	→

Table 20: Technical Levels of Service

KPI	2021	Budget
Capital		
Meters of cast iron mains replaced	TBD	$1,000,000
Meters of watermains replaced	TBD	$500,000
# of pump stations replaced/upgraded	0	$0
# of PRV stations replaced	1	$500,000
# of fire hydrants replaced/repaired (per 978 city-owned hydrants)	2	$34,200
Average annual capital reinvestment	$2,034,500	
Maintenance		
# of air valves maintained (of 167) M	183	$14,300
# of fire hydrants serviced (of 1001 hydrants) - per Group A and Group B service levels	749	$87,400
# of fire hydrants painted and cleaned (per 1001 hydrants)	50	$17,000
# of hydrant valve installations	75	$0
# of dead-end watermains flushed (# dead ends)	222	$32,400
# kilometers of watermains flushed (unidirectional; per 213km of watermains)	80	$40,700
# of watermain break repairs (per 213km of watermains)	24	$158,250
# of PRV inspections completed (per 20 PRV stations)	366	$52,700
# of SCADA/alarm maintenance services completed (14 PRVs with SCADA)	14	$9,600
# of reactive PRV repairs completed (per 20 PRVs)	NA	$10,800
# of water services repaired or replaced (of 10,175)	108	$167,850
# of water valves repaired or replaced (of 2,240)	61	$24,000
# of water pump station inspections and maintenance (per 2 pump stations)	50	$29,900
# of water pump station SCADA/alarm maintenance services	2	$2,900

KPI	2021	Budget
# of water generators serviced (of 2 generators)	2	$3,800
# of unplanned pump station inspections and repairs	0	$8,800
# of water meters repaired or replaced (of 598 meters)	172	$64,200
Average annual maintenance expenditures	$724,600	
Operations		
# of watermain line valves inspected, adjusted, and exercised (of 2,240 valves)	1619	$37,600
# of annual water systems adjustments	5	$17,600
# of water samples taken per year (per 14 sample sites)	997	$25,300
# of kilowatt hours used for PRV station electricity communication (per 20 stations)	NA	$5,000
# of water services located or adjusted (of 10,175)	72	$40,200
# of water meters read annually (of 598 meters)	2469	$0
Kilowatt hours used for water pump station electricity and communication (per 2 PS)	NA	$37,400
Water Eco-initiative Outreach (# of household visits, events, social media)	200	$0
Volume of soil disposal - water	NA	$53,700
Average annual operating expenditures	$216,800	

Levels of Service Analysis

Table 21 provides the 3-year percentage change in service requests for KPIs that best align with asset condition and performance.

Table 21: Trends in Select Customer Levels of Service KPIs – Asset Condition and Performance

KPI	Percentage change between 2018-2021
# of watermain breaks	-25%
# of water service leak calls - emergency & city side service	+51%
# of pumpstation related calls	+540%

Table 22 shows the change in service requests for KPIs that best align with service delivery, but have no direct relationship with asset lifespans. These may be helpful indicators in determining if sufficient funding and resources are being allocated towards service delivery.

Table 22: Trends in Customer Levels of Service KPIs – Service Delivery

KPI	Percentage change between 2018-2021
# no-water low pressure complaints	+26%
# water service locates	35%
# water conservation calls	-82%
# water quality calls	+67%

KPI data can be used to support decisions to maintain, increase or decrease levels of service to reduce the frequency of requests and incidents. Trends should be considered in further detail with knowledgeable staff to understand potential influences and context before making decisions.

For example, service level performance may be affected in a given year by weather, material pricing, supply chain issues, staff absences or contractor availability. These factors should be taken into account to determine if the effects are temporary, or longer term and potentially warranting adjustment. Adjusting levels of service must also be considered in light of cost, performance, and risk, as further explained below.

Balancing Cost, Performance and Risk

Levels of service are fundamentally about balancing three key parameters: cost, performance, and risk. Any adjustment to one of these parameters will have a direct impact on the other two. High performance and low risk may require a substantial budget. In contrast, if constituents can tolerate lower performance from community assets, they incur a lower cost but assume a higher risk.

Table 23 briefly outlines how these parameters change when maintenance or capital related service levels are maintained, increased, or decreased. Such activities have a direct impact on assets by maximizing their service life or deferring their replacement.

Table 23: Balancing Cost, Performance, and Risk

Levels of Service Goal	Impact on Cost	Impact on Asset Performance	Impact on Risk
Maintain	Minimum impact on cost; possible escalation due to market conditions	No expected change beyond typical deterioration	No expected change in asset risk rating
Increase	• Costs increase due to more frequent maintenance, rehabilitation, and/or replacement cycles • Tax rates and utility rates may increase • Increasing asset capacity or enhancing functionality may further escalate costs	• Assets are maintained at a higher condition, delivering higher expected performance • User experience and quality of life may improve	• With a more robust lifecycle program, asset failure may be reduced, resulting in a lower risk rating • User safety and environmental protection may improve
Decrease	• Costs may decrease as lifecycle programs are reduced and services are eliminated	• Assts may deteriorate faster and fail earlier than expected due to deferral of maintenance needs • User experience and quality of life may worsen	• Deferred maintenance may lead to higher failure rates, resulting in higher exposure • User safety and environmental protection may decrease

A sustainable levels of service approach requires municipalities to periodically recalibrate these parameters. Ultimately, trade-offs must be made between different infrastructure programs based on demand, and between service quality and cost to constituents.

Financial Strategy

Each year, the City of Port Coquitlam makes important investments in its infrastructure to ensure assets deliver their intended function safely and efficiently. These efforts contribute to making Port Coquitlam a highly desirable place to live. The 2023 ranking of The 100 Most Livable Cities in Canada by the *Globe and Mail* placed the City at 17th.

Given the magnitude of infrastructure needs, it is common for municipalities, including Port Coquitlam, to experience annual shortages in funding. This creates annual funding deficits, requiring projects to be deferred to later years. This, in turn, creates long-term infrastructure backlogs.

Achieving full-funding for infrastructure programs is a substantial challenge for municipalities across Canada. Closing annual funding gaps and avoiding long-term backlogs can take many years.

This financial strategy provides a consolidated analysis of the City's eight service areas, and is designed to support the implementation of asset management plans and gradually eliminate gaps identified in the City's annual reinvestment rates.

The financial strategy also provides support for the development of 10-20 year capital plans for each asset group with the City's asset management program.

Approach and Methodology

The assets included in the City of Port Coquitlam's eight service areas have a combined 2023 replacement cost of $1.9 billion, as illustrated in Table 24 below. The table also summarizes the average annual requirements (AAR) for each service area, and the equivalent system-generated target, capital reinvestment rate (TRIR). The City's overall AARs total $42.5 million, generating an equivalent reinvestment rate of 2.2%. To put this differently, the City should invest, on average, 2.2% of the overall current replacement costs of its infrastructure portfolio back into these assets to remain current with replacement needs.

Table 24: Service Area Replacement Costs and Target Reinvestment Rates

Service Area	Replacement Cost	Average Annual Requirements (AAR)	System-generated Target Capital Reinvestment Rate (TRIR)
Transportation	$533,082,256	$15,648,055	2.9%
Drainage	$446,128,207	$7,406,986	1.7%
Water	$303,278,014	$4,541,037	1.5%
Sanitary	$266,373,836	$4,214,139	1.6%
Facilities	$262,262,312	$4,561,458	1.7%
Parks	$41,088,943	$1,682,841	4.1%
Fleet & Equipment	$33,488,624	$3,156,517	9.4%
Information Services	$9,580,473	$1,298,008	13.5%
Total	**$1,895,282,667**	**$42,509,042**	**2.2%**

The overall and individual, service area reinvestment rates serve as critical benchmarks, ensuring that asset replacements needs are met as they arise, and projects are not deferred. However, this 'full funding' is difficult to achieve for most municipalities across Canada, leading to annual infrastructure deficits, which can in turn accumulate to create long-term infrastructure backlogs.

The purpose of the financial strategy is to position Port Coquitlam to meet its target reinvestment rates as outlined above. This is done by examining the City's current funding levels for each service area, quantifying funding gaps, and identifying a roadmap to close these gaps. To ensure fiscal prudence, only those funding sources considered sustainable are integrated with the strategy. The concept of sustainable funding is discussed in more detail.

Current Financial Planning Framework

Port Coquitlam is a growing city. The community saw a growth rate of 4.9% between 2016 and 2021, and has a current population of more than 61,000 residents. Different funding and financing mechanisms are used to ensure that the City's infrastructure portfolio can continue to meet the needs of a growing and evolving population. The focus of the asset management plans and the financial strategy is the City's current asset portfolio.

Capital Budget

The City's capital budget is a forward-looking document that is used to plan for long-term investments, including infrastructure, that provide benefits to Port Coquitlam over time and support service delivery. The capital budget is traditionally funded from tax levies, user fees, senior government transfers and grants, development cost charges (DCCs), debt, and reserves. These funds are used to cover the expenses of maintenance, replacement, and expansion of the asset base which is tied to the level of services provided by the City.

The distinction must be made between the replacement of exiting assets and investments in new assets, including upgrades and expansions. Asset management plans and this financial strategy pertain to the replacement of existing assets. New assets are purchased, built, developed, or contributed to or by the City to specifically accommodate the growth of population or the expansion of services or service levels.

Debt

Debt can be used as a strategic funding source for major public works. The benefits of leveraging debt judiciously for infrastructure planning include:

- the ability to stabilize tax and user rates when dealing with variable and uncontrollable factors,
- equitable distribution of the cost and benefits of infrastructure over its useful life,
- a secure source of funding,
- the ability to proceed with projects sooner than waiting to save enough in cash or grants to pay for the project all at once and,
- flexibility in cash flow management.

Following an initial reduction in interest rates amid the Covid-19 pandemic, interest rates have risen steadily since. As a result, the cost of servicing the debt through interest payment has increased substantially, making its use for infrastructure projects less compelling. The following graph shows the historical changes to Municipal Finance Authority of BC (MFA) lending rates[1].

Figure 28: Historical MFA Lending Rates[2]

Port Coquitlam currently has $17.6 million (2023 opening balance) of net debt outstanding for the Coast Meridian Overpass. This debt has an annual principal and interest payments of $1.0 million, which are expected to continue until 2039. The City also has outstanding debt for the Port Coquitlam Community Centre which currently has $48.8 million outstanding and carries an annual principal and interest payment of $2.3 million, which expires in 2049.

The funding options outlined in this plan allow Port Coquitlam to fully fund the long-term infrastructure replacement requirements without further use of debt.

[1] https://mfa.bc.ca/clients/long-term-borrowing: “New Issues are often funded by issuing a 10 year bond, locking in a fixed interest rate for ten years. As clients may borrow for up to thirty years, loans longer than ten years a typically refinanced every five years, following the initial ten years.”
[2] The illustration does not consider actuarial adjustments.

Senior Government Support

Given the magnitude of investments needed in infrastructure, municipalities often rely on senior government programs to supplement their funding for capital projects and capacity building initiatives. These programs are subject to change with evolving federal and policy landscape, and therefore, create some vulnerability for municipalities that may rely heavily on these funding streams.

Of particular importance is the Canada Community-Building Fund (CCBF), formerly the federal Gas Tax Fund. In the past, municipalities have considered the CCBF a sustainable funding source used for infrastructure projects. Administered through a 10-year tripartite agreement (2014-2024) with the Government of British Columbia and the Union of British Columbia Municipalities (UBCM), the CCBF provides all municipalities with a permanent, predictable, and indexed source of infrastructure funding.

Port Coquitlam received $241k from the CCBF in 2022. Although historically stable, the City should actively monitor and evaluate the potential repercussions of a newly elected government on the CCBF and other senior government funding streams, considering the potential impact on funding priorities, allocations, and eligibility criteria.

While the structure of the transfers may evolve, both the province and federal governments continue to provide reliable sources of funding for asset management and infrastructure programs. When possible, transfers should be leveraged by the City to address the backlog of existing assets that have exceeded their service life.

Sustainability

Although senior government transfers—both recurring such as the CCBF, and one-time, project-specific grants and transfers—can be used to augment the City's fiscal capacity, this funding strategy relies only on the City's own-source revenues. These are limited to property taxes and utility levies. While a stable funding stream, the City typically earmarks the CCBF to fund new assets; as such, it was not integrated with the financial strategy. However, the City should consider allocating these funds to the replacement of existing assets, at least until the backlog has been addressed.

Reserves

Reserves play a critical, often primary, role in long-term financial planning for infrastructure investments. The benefits of having reserves available for infrastructure planning include:

- the ability to stabilize tax and user rates when dealing with variable and sometimes uncontrollable factors;
- financing one-time or short-term investments;
- accumulating the funding for significant future infrastructure investments;
- managing the use of debt; and,
- normalizing infrastructure funding requirement.

Long-Term Infrastructure Reserves

The City of Port Coquitlam's dedicated, long-term infrastructure reserves include the Long-Term General Infrastructure Reserve (LTGIR), the Long-Term Sewer Infrastructure Reserve (LTSIR), and the Long-Term Water Infrastructure Reserve (LTWIR). These reserves are funded through property taxes and utility levies. The current balance of these reserves totals $24.1 million.

Table 25: Long-Term Infrastructure Reserve Balances

Reserve	Balance
Long-Term General Infrastructure Reserve (LTGIR)	$15,688,227
Long-Term Water Infrastructure Reserve (LTWIR)	$4,816,463
Long-Term Sewer Infrastructure Reserve (LTSIR)	$3,619,233
Total	**$24,123,923**

Since 2010, the City has consistently made annual contributions, calculated as the prior year's amount plus an additional 1% of the prior year's taxation or utility levy. The intent of these reserves is to ensure the City can fund future asset replacement requirements in the short and long terms. This is accomplished through annual transfers to the Capital Reserves to complete work identified in the Annual Capital Programs.

Capital Reserves

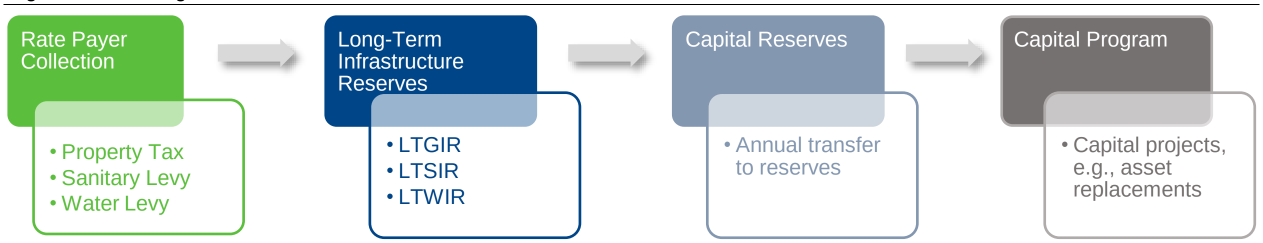
In addition to the long-term infrastructure reserves, Port Coquitlam also has other capital reserves used to implement the capital program. These reserves are funded by property taxation, utility levies, and the sale of land or assets. While these are predominately intended to support either new assets or the expansion of existing assets, the City can still draw from these reserves to address the backlog in the short term and support the reduction of any deficits over time. The forecasted balance of these reserves as of December 31, 2023, is $25.3 million.

Table 26: Capital Reserve Balances

Reserve	Balance
General Capital	$2,712,053
Sewer Infrastructure	$1,017,166
Water Infrastructure	$14,888,201
Land Sale	$3,326,828
Equipment Replacement	$2,079,097
Cart Replacement	$1,254,886
Total	**$25,278,231**

The figure below illustrates the flow of funding at the City, from collection of property taxes and utility levies, to implementation of the capital program.

Figure 29: Funding Flow



Since the annual capital program is funded through reserves, the aim of the financial strategy is to synchronize long-term infrastructure reserve contributions with the average annual requirements identified for the eight service areas, as illustrated in Table 24. As such, the recommendations focus on the incremental increases to the annual long-term infrastructure reserves contributions.

Development Cost Charges (DCC) Program

Port Coquitlam's DCC bylaws are regulated by the province through the *Local Government Act*. The City uses DCCs collected to finance a portion of upcoming infrastructure costs associated with the growth of new developments. The program is designed to ensure that the benefiters (new development) contribute to the installation costs.

The City's DCC Program encompasses infrastructure earmarked for both replacement and expansion. Recognizing that existing rate payers may receive benefit from the construction or expansion of infrastructure, the capital costs are partially reduced from DCC collections and supplemented by alternative funding sources. Because of this, the DCC contributions are limited to fund specified infrastructure projects used to establish the DCC fees in the in the Bylaws.

As such, whenever possible, the DCC contributions should be leveraged by the City to provide funding for assets slated for replacement and expansion when addressing the current asset backlog. This maximizes the value of the investment by achieving two goals with one asset replacement: replacement for condition/age and upgrading for additional capacity.

Achieving Reinvestment Rate Targets

This section identifies annual infrastructure and annual funding deficits for each of the City's eight service areas. The system-generated average annual requirements are contrasted against two figures. The first is the City's actual annual reinvestments into its assets, calculated by aggregating capital expenditures on various lifecycle programs for each service area. The second is its annual contributions to long-term infrastructure reserves (LTIRs).

We make a distinction between actual reinvestments on infrastructure each year which may be funded and financed through various streams, and annual contributions to the LTIRs funded only through sustainable sources, i.e., property taxation or utility levies . The recommendations in the financial strategy hinge on the latter, i.e., adjusting annual contributions to the LTIRs to achieve target reinvestment rates.

Separate analysis is presented for tax-funded and rate-funded service areas. Tax funded service areas are funded by property taxes and collected as general revenue. Rate funded service areas are those funded by the collection of utility fees. Tax-funded service areas include: Drainage, Transportation, Parks, Facilities, Fleet & Equipment, and Information Services. Utility Levy -funded service areas include: Water and Sanitary Services.

Tax-Funded Service Areas

As illustrated in Table 27, the City's average annual requirements for its six tax-funded service areas total $33.8 million. Annual capital expenditures total approximately $15 million for these assets, creating an infrastructure deficit of $18.8 million.

Table 27: Comparing Average Annual Requirements Against Current Capital Reinvestments

Service Area	Average Annual Requirements	Current Capital Reinvestments	Annual Infrastructure Deficit
Drainage	$7,406,986	$2,500,000	$4,906,986
Transportation	$15,648,055	$5,784,500	$9,863,555
Parks	$1,682,841	$2,150,000	$(467,159)
Facilities	$4,561,458	$583,112	$3,978,346
Fleet and Equipment	$3,156,517	$2,922,167	$234,350
Information Services	$1,298,008	$1,019,334	$278,674
Total	**$33,753,865**	**$14,959,113**	**$18,794,752**

The current capital reinvestments listed above are funded through both own-source revenues, e.g., property taxation, and other streams. Table 28, however, quantifies the City's contributions to the LTGIR. The City's ability to make consistent contributions to the LTGIR will determine how sustainable infrastructure programs are. These contributions will build up the LTGIR and are necessary for gradually eliminating the annual infrastructure deficit, as well as managing persistent backlogs.

LTGIR contributions are funded from the City's property taxation revenue—the primary, predictable, and sustainable (See the Sustainability section) source of funding for infrastructure needs.

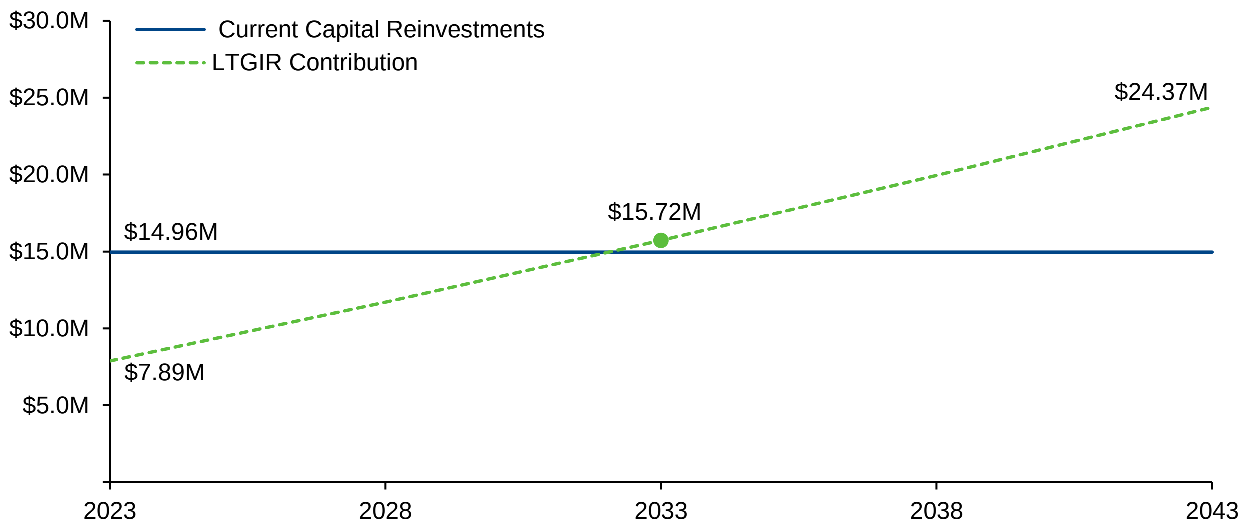
This analysis shows that based on its current annual contributions of $7.9 million to the LTGIR, an annual funding deficit of $25.9 million is generated each year. These annual contributions outpace the City's actual capital spending each year, illustrated in Table 27 above as $15 million.

Table 28: Comparing Average Annual Requirements Against Annual Contributions to the LTGIR

Service Areas	Total Average Annual Requirements	Annual Contributions to LTGIR	Annual Capital Funding Deficit	Funding Level
Tax-Funded	$33,753,865	$7,885,600	$25,868,265	23%

The City increases annual contributions to the LTGIR each year by an additional 1% of the prior year's tax levy. At this rate, contributions will total more than $24 million by 2043. However, under the current funding framework for existing assets, despite this judicial strategy, annual capital spending on tax-funded service areas will continue to outpace these annual contributions until 2033.

Figure 30: Annual Contributions to the LTGIR vs. Annual Capital Spending



This illustration does not account for inflationary increase to annual capital expenditures or other market pressures, which would increase the gap between annual contributions and current reinvestments, and extend the timeline of fully funding capital spends through annual contributions. Although infrastructure spending can be supplemented by other streams, a more sustainable funding framework would see the City increase its fiscal capacity through own-source revenues, i.e., property taxation.

Annual Deficits

The City currently faces two types of deficits. The infrastructure deficit is the gap between average annual requirements and current capital expenditures. This gap currently stands at $18.8 million, as illustrated in Table 27.

The second, the annual capital funding deficit, is the gap between average annual requirements and contributions to the LTGIR, calculated as $25.9 million as illustrated in Table 28. Before the annual infrastructure deficit can be addressed, the funding deficit must first be closed by increasing contributions to the LTGIR. As such, it is the target of the financial strategy.

Funding Models

The funding models presented below outline funding goals, and how the annual deficit decreases with reductions in these targets. These deficit figures are used to calculate resulting rate increases to allow the City to close the annual contribution deficit for LTGIR.

At the full-funding level, the City would need to meet the full $33.8 million annual requirements, and close a $25.9 million current funding gap. Understanding that the financial impact on rate payers may be difficult, options to reduce the annual funding to a level of 75% and 50% of the AAR are included.

Table 29: Funding Levels and Resulting Funding Deficits

Model	Funding Goal	Current Contributions to the LTGIR	Resulting Funding Deficit
Fully Funded	$33.8M	$7.9M	$25.9M
75%	$25.3M	$7.9M	$17.4M
50%	$16.9M	$7.9M	$9.0M

Each model has risks and benefits, as outlined below. The right model balances the burden placed between generations of residents while realizing the highest value from infrastructure assets.

Table 30: Risks and Benefits of Funding Models

Model	Potential Risks	Potential Benefits
Fully Funded	– Higher financial impact on taxpayers – Limited financial flexibility for other programs and services	– Avoid further accumulation of backlog – Potential long-term costs savings – High economic and social benefits, including ability to attract more investments and businesses – Less vulnerability to evolving provincial and federal policy and funding programs
75%	– Further accumulation of existing infrastructure backlog – Lower, overall levels of service – Potential safety implications – Higher indirect economic, social, and reputational risks resulting from infrastructure disrepair – Higher vulnerability to evolving provincial and federal policy and funding programs	– Lower impact on taxpayers – More budget flexibility for other programs and service
50%	– Further, more rapid accumulation of existing backlogs – Potentially high safety implications – Low service levels – Lower quality of life and potential loss of local economic activity – Higher reputational damage – High dependence on other sources of funding – High vulnerability to unexpected asset failures	– Lowest impact on taxpayers

Eliminating the Annual Deficit

In 2023, Port Coquitlam's property taxation revenues totaled $74,880,000. To eliminate the funding deficit, additional contributions are needed to the LTGIR. The following table outlines the tax increases required to support these additional contributions, depending on the funding model selected. In addition to these models, three phase-in periods are presented, allowing the City to achieve the desired funding goal between five and 20 years.

The City already increases annual contributions to the LTGIR by an additional 1% per year based on prior year's levy. As such, the rate increases presented for the three phase-in periods are over and above this preestablished mechanism.

Table 31: Tax Rate Increase Required to Achieve Funding Levels

Model	Overall Tax Rate Increase Required	5 Years	10 Years	15 Years	20 Years
Fully Funded	35%	↑5.11%	↑2.01%	↑1.00%	↑0.49%
75%	23%	↑3.27%	↑1.11%	↑0.40%	↑0.05%
50%	12%	↑1.29%	↑0.14%	↓0.24%	↓0.43%

As illustrated in Table 31, achieving full funding would require a one-time tax increase of 35%, or 5.11% per year over a five-year phase-in period, over and above the existing 1% annual increase. In contrast, a 50% funding model would see the City reduce tax rates over a 15-year phase in period. This option is not recommended.

As with funding models, phase-in periods also carry similar risk and benefits. Shorter time frames would reduce the pace of accumulating backlogs and help address infrastructure needs more quickly. However, they may place heavy burden on rate-payers. More protracted funding periods reduce rate-payer obligation, but may cause more rapid and further asset disrepair.

It is recommended that the City adopt the full-funding model over a 15-year phase-in period, with aim of meeting 100% of the $33.8 million annual requirements. This would require further increasing the LTGIR contribution by an additional 1.00% per year over the phase-in period, over and above the existing annual increase of 1%.

Drainage Utility Levy

The City should also consider the establishment of a drainage utility levy, coupled with the creation of a dedicated Long-Term Drainage Infrastructure Reserve Fund (LTDIR).

Several municipalities have established a drainage utility levy as the design and costs of drainage systems have changed significantly over the years. Contributing factors include:

i. climate change impacts (sea level rise, increased rainfall, higher intensity storms) driving the need for new or upgraded drainage infrastructure and flood protection;

ii. mitigation of environmental impacts and protection of watercourses driving the need for green infrastructure and enhancement projects;

iii. drainage infrastructure costing significantly more than water or sanitary infrastructure to construct and maintain;

iv. drainage assets currently being funded by General Revenue, which reduces the amount available for all of the other tax-funded assets.

If a Drainage Utility is established, a Long Term Drainage Infrastructure Reserve (LTDIR) would also be established with annual contributions funded through Drainage utility levies rather than property taxes.

Levy-Funded Service Areas

The analysis presented in this section includes Port Coquitlam's water and sanitary services, and is similar to the tax-funded service areas. The average annual requirements for the two levy -funded service areas total $8.8 million, against annual capital expenditures of $3.5 million. This creates an annual infrastructure deficit of $5.2 million.

Table 32: Comparing Average Annual Requirements Against Current Capital Reinvestments

Service Area	Average Annual Requirements	Current Capital Reinvestments	Annual Infrastructure Deficit
Water	$4,541,037	$2,034,200	$2,506,837
Sanitary	$4,214,139	$1,500,000	$2,714,139
Total	**$8,755,177**	**$3,534,200**	**$5,220,977**

As with tax-funded assets, the City contributes to long-term infrastructure reserves for both water and sanitary services, managed in the Long-Term Water Infrastructure Reserve (LTWIR) and the Long-Term Sanitary Infrastructure Reserve (LTSIR).

Based on the City's current contributions levels to the LTWIR and LTSIR, water services are currently meeting 25% of their average annual requirements, with sanitary at 20%. These funding levels create an annual capital funding deficit of $3.4 million each for water and sanitary services.

Table 33: Comparing Average Annual Requirements Against Annual Contributions to the LTWIR and LTSIR

Service Areas	Total Average Annual Requirements	Annual Contributions to LTWIR/LTSIR	Annual Capital Funding Deficit	Funding Level
Water	$4,541,037	$1,138,300	$3,402,737	25%
Sanitary	$4,214,139	$850,000	$3,364,139	20%
Total	**$8,755,177**	**$1,988,300**	**$6,766,877**	**23%**

As with the LTGIR, the City's contributions to both the LTWIR and LTSIR are increased each year by 1% of the prior year utility levy for each service area. At this growth rate, annual contributions to the LTWIR and LTSIR will become sufficient to fund current capital expenditures for each service area between 2029 and 2030. However, as current capital expenditures are below average annual requirements, the annual infrastructure gap will still persist beyond the 20-year horizon illustrated.

Figure 31: Annual Contributions to the LTWIR vs. Annual Capital Spending

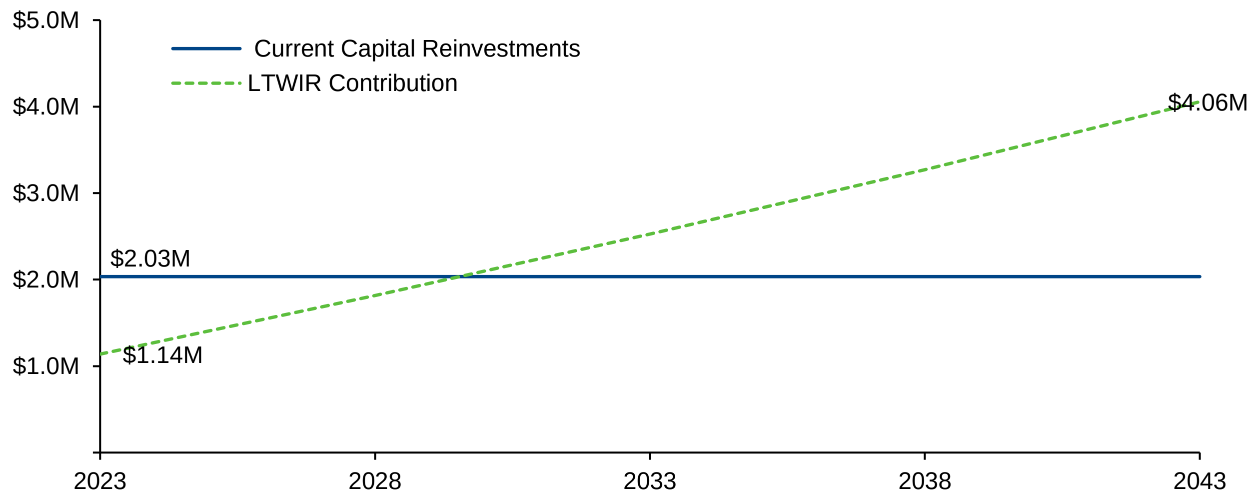
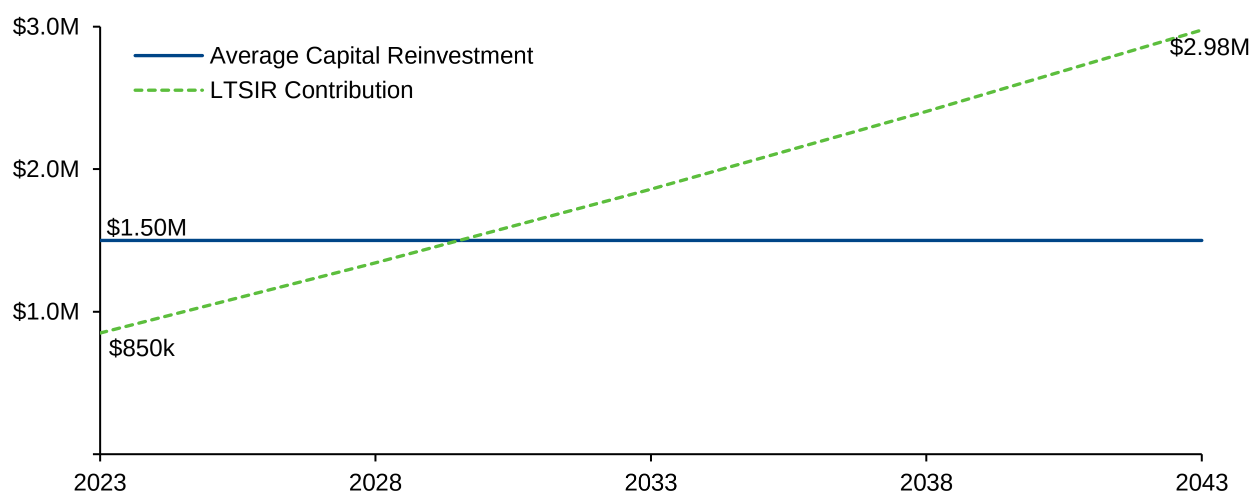


Figure 32: Annual Contributions to the LTSIR vs. Annual Capital Spending



These illustrations do not account for inflationary increase to annual capital expenditures or other market pressures, which would increase the gap between annual contributions and current reinvestments, and extend the timeline of fully funding capital spends through annual contributions. Similar to tax-funded assets, infrastructure spending can be supplemented by other streams; however, a more sustainable funding framework would see the City increase its fiscal capacity through own-source revenues, i.e., water and sanitary utility revenues.

Annual Deficits

Similar to tax-funded asset categories, the City faces two types of deficits. The first, illustrated in Table 32, is the gap between average annual requirements and actual current capital reinvestments.

The second, referred to as the annual capital funding deficit, is the gap between the same average annual requirements and annual contributions to the Long-Term Water Infrastructure Reserve and the Long-Term Sanitary Infrastructure Reserve. This gap, totaling $6.8 million, is illustrated in Table 33 for both water and sanitary services, and is the target of the financial strategy.

Funding Models

The funding models presented below outline funding goals, and how the annual deficit decreases with reductions in these targets. These deficit figures are used to calculate resulting levy increases to allow the City to close the annual contribution deficit for LTWIR and LTSIR.

At the full-funding level, the City would need to meet the full $8.8 million annual requirements for water and sanitary, and close the combined funding deficit of $6.8 million. Understanding that the financial impact on levy payers may be difficult, options to reduce the annual funding targets to a level of 75% and 50% of the AAR are included for both water and sanitary.

Table 34: Funding Levels and Resulting Funding Deficits: Water Services

Model	Funding Goal	Contributions to the LTWIR	Resulting Funding Deficit
Fully Funded	$4,541,037	$1,138,300	$3,402,737
75%	$3,405,777	$1,138,300	$2,267,478
50%	$2,270,518	$1,138,300	$1,132,219

Table 35: Funding Levels and Resulting Funding Deficits: Sanitary Services

Model	Funding Goal	Contributions to the LTSIR	Resulting Funding Deficit
Fully Funded	$4,214,139	$850,000	$3,364,139
75%	$3,160,604	$850,000	$2,310,605
50%	$2,107,069	$850,000	$1,257,070

In selecting the appropriate funding target, careful consideration of the risk and benefits of each need to be evaluated. See Table 30: Risks and Benefits of Funding .

Eliminating Annual Deficits

In 2023, Port Coquitlam's water and sanitary revenues totaled $13,120,000 and $9,560,000, respectively. To eliminate the funding deficit for each service area, additional contributions are needed to the LTWIR and LTSIR.

The following tables outlines the water and sanitary levy increases required to support these additional contributions, depending on the funding model selected. Similar to tax-funded assets, three phase-in periods are presented, allowing the City to achieve its desired funding levels between five and 20 years.

The City already increases annual contributions to each utility reserve by an additional 1% per year based on prior year's levy. As such, the rate increases presented for the three phase-in periods are over and above this preestablished goal.

Table 36: Utility Rate Increase Required to Achieve Funding Levels: Water

Model	Overall Water Levy Increase Required	5 Years	10 Years	15 Years	20 Years
Fully Funded	26%	↑3.72%	↑1.33%	↑0.55%	↑0.16%
75%	17%	↑2.24%	↑0.61%	↑0.07%	↓0.20%
50%	9%	↑0.67%	↓0.17%	↓0.45%	↓0.59%

Table 37: Utility Rate Increase Required to Achieve Funding Levels: Sanitary

Model	Overall Sanitary Levy Increase Required	5 Years	10 Years	15 Years	20 Years
Fully Funded	35%	↑5.22%	↑2.06%	↑1.03%	↑0.52%
75%	24%	↑3.42%	↑1.19%	↑0.45%	↑0.09%
50%	13%	↑1.50%	↑0.24%	↓0.17%	↓0.38%

As illustrated in Table 36, achieving full funding for water would require a one-time levy increase of 26%, or 3.72% per year over a five-year phase-in period, over and above the existing 1% annual increase. Similarly, achieving full funding for sanitary would require a one-time levy increase of 35%, or 5.22% per year over a five-year phase-in period, over and above the existing 1% annual increase.

In contrast, a 50% funding model would see the City reduce water levies over a 20-year phase-in period, and sanitary levies over the 15-year phase-in period. This option is not recommended.

Consistent with the approach for tax-funded service areas, it is recommended that the City adopt the full-funding model for both water and sanitary, with the aim of achieving 100% of the $8.8 million combined annual requirements over a 15-year phase-in period.

For water services, this would require further increasing contributions to the LTWIR by an additional 0.55% annually, over and above the existing annual increase of 1%. Similarly, for sanitary services, the LTSIR would see annual contributions increase by an additional 1.03%, over and above the existing 1% annual increase.

Infrastructure Backlogs

The models presented above would allow the City of Port Coquitlam to gradually increase its annual contribution to long-term infrastructure reserves for both tax- and levy -funded service areas. This strategy would address annual infrastructure deficits.

In addition to these deficits, most communities in Canada also have persistent infrastructure backlogs, accumulated over many decades. As projects are deferred, assets requiring replacements continue to remain in service beyond their design life and despite their poor condition ratings. Table 38 summarizes the infrastructure backlog for each service area.

Table 38: Age- and Condition-based Infrastructure Backlogs

Service Area	Infrastructure Backlog
Drainage	$162.1M
Transportation	$160.2M
Parks	$25.6M
Facilities	$29.8M
Fleet & Equipment	$24.2M
Information Services	$6.4M
Water	$109.7M
Sanitary	$99.5M
Total	**$617.4M**

Using Reserves

Addressing existing backlogs requires strategic use of funding sources and a risk-based prioritization of projects, to channel funding where they are needed most. Theoretically, the City can use existing long-term infrastructure reserves to partially tackle a portion of this backlog. However, Table 39 shows that even if long-term infrastructure reserves were fully depleted, less than 4% of the total infrastructure backlog would be eliminated. Of note, backlogs should be refined through regular in-field condition assessments and prioritized through risk and asset criticality assessments.

Table 39: Long-Term Infrastructure Reserves vs. Backlogs

Reserve	Forecasted Closing Balance, December 31, 2023	Infrastructure Backlog	Reserves to Backlog Ratio
General (Tax Funded)	$15.7M	$408.3M	3.8%
Water (Rate Funded)	$4.8M	$109.7M	4.4%
Sanitary (Rate Funded)	$3.6M	$99.5M	3.6%
Total	**$24.1M**	**$617.4M**	**3.9%**

To put this in perspective, a typical homeowner with a property value assessed at $969,000 would have $37,800 on hand for major home repairs. Although there is no scientific consensus on optimal reserve levels, whether a 3.9% ratio is sufficient will depend on individual (council) risk appetite, current asset conditions, and forecasted future needs.

Leveraging Development Cost Charges (DCC)

Port Coquitlam is also a growing city, and there is an opportunity to strategically leverage the City's DCC program to address existing asset backlogs. The City's current DCC program totals nearly $219 million, distributed over 20 years. Given their benefits to existing residents, the City would be required to contribute $117.8 million, or 53% of the total project cost estimates. This figure includes a 1% municipal assist factor for growth-related projects.

Table 40: Development Cost Charges (DCC) Program

Service Area	Total DCC Project Value	Port Coquitlam Contribution	DCC Recoverable
Drainage	$74,494,000	$47,196,403	$27,297,598
Transportation	$100,400,000	$43,283,930	$57,116,070
Water	$16,467,760	$9,478,459	$6,989,301
Sanitary	$27,547,840	$17,811,128	$9,736,712
Total	**$218,909,601**	**$117,769,920**	**$101,139,680**

Analysis shows that there is a significant overlap between projects slated to be completed as part of the DCC program (capacity upgrades to support growth) and assets that are currently in a backlog state (beyond their service life and due for replacement due to age/condition). As illustrated below, 56% of projects, by current cost estimates, will result in the replacement of assets currently considered in a backlog state. These replacements are designed to meet higher demand and usage, and will result in capacity upgrades and or higher functionality—resulting in higher overall service levels.

Table 41: Overlap Between DCC Program and Assets in Backlog State

Service Area	Total DCC Project Value	Projects Addressing Backlog ($)	Projects Addressing Backlog (%)	Port Coquitlam Contribution	DCC Recoverable
Drainage	$74,494,000	$39,636,026	53%	$23,748,706	$15,887,320
Transportation	$100,400,000	$60,900,000	61%	$30,107,040	$30,792,960
Water	$16,467,760	$11,407,760	69%	$7,522,109	$3,885,651
Sanitary	$27,547,840	$10,957,151	40%	$6,723,966	$4,233,185
Total	**$218,909,601**	**$122,900,937**	**56%**	**$68,101,820**	**$54,799,117**

Recommendations

Given the risks and benefits associated with different funding levels and phase-in period, the following approach is recommended to address annual infrastructure deficits.

Tax Funded Service Areas

- The City should endeavour to achieve full-funding for its tax-funded service areas, requiring $33.8 million on an annual basis to meet the replacement needs of its existing asset portfolio.
- To achieve this, a 15-year phase-in period is recommended to allow for an equitable distribution of financial burden between current and future residents.
- This would require further incrementally increasing the LTGIR contribution by an additional 1.00% of the budgeted prior year's taxation levy each year over the 15-year phase-in period, solely for the purpose of phasing in full funding for the tax funded assets. This is in addition to the existing annual increase of 1%.

This would increase individual property taxes by a further $21.30, based on a home assessed at $969,000. This increase would be over and above the higher taxes resulting from the 1% annual increase already implemented, and estimated at $21.35.

- The recommendations presented do not account for inflation. Staff should consider the impacts of inflation on both annual capital expenditures, and additional contributions required to the LTGIR to maintain fiscal strength.
- Should the City establish a drainage utility levy, the creation of a dedicated Long-Term Drainage Infrastructure Reserve Fund (LTDIR) should also be established. Annual contributions towards the LTDIR should then be funded through the newly established utility levy equivalent to the amount funded through property taxes. This would reduce the average annual requirements for tax-funded assets by 22%.

Levy-Funded Service Areas

- The City should endeavour to achieve full-funding for its water and sanitary service areas, requiring $8.8 million on an annual basis to meet the replacement needs of its existing asset portfolio.
- To achieve this, a 15-year phase-in period is recommended for both water and sanitary, consistent with tax-funded phase-in period, allowing for an equitable distribution of financial burden between current and future residents.

- For water services, this would require further incrementally increasing contribution to the LTWIR by an additional 0.55% of the budgeted prior year's utility levy each year over the 15-year phase-in period, solely for the purpose of phasing in full funding for water. This is in addition to the existing annual increase of 1%.

  This would increase individual water levies by a further $2.73. This increase would be over and above the higher water levies resulting from the 1% annual increase already implemented, and estimated at $4.98

- For sanitary services, the 15-year, full-funding model would require further incrementally increasing contribution to the LTSIR by an additional 1.03% of the budgeted prior year's utility levy each year over the 15-year phase-in period, solely for the purpose of phasing in full funding for water. This is in addition to the existing annual increase of 1%.

  This would increase individual sanitary levies by a further $3.71. This increase would be over and above the higher sanitary levies resulting from the 1% annual increase already implemented, and estimated at $3.60.

- The recommendations presented do not account for inflation. Staff should consider the impacts of inflation on both annual capital expenditures, and additional contributions required to the LTWIR and LTSIR to maintain fiscal strength.

- Addressing the infrastructure backlog requires the strategic use of reserves and the City's DCC program. In addition, asset criticality and risk analysis should be used to prioritize projects.

As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. This periodic funding should not be incorporated into an AMP unless there are firm commitments in place. However, it can be used to help close the infrastructure gap more quickly, or lower the long-term impact on tax and utility levies. It should be noted that the above recommendations do not include the use of reserves or debt. Depending on the urgency of projects and the impact on levels of services, reserves and debt can be viable, supplemental options.

Next Steps

Asset management does not stop with the completion of asset management plans. An asset management program is an ongoing effort to responsibly manage City assets from procurement, through their full lifecycle, to replacement. The work completed with the asset management plans sets a strong foundation for the City to move forward in this regard, and is intended to be refined and built on with future work.

Future work includes items outlined in the City's asset management strategy, such as:

- Developing 10-20 year capital plans for each asset portfolio using the high risk assets identified in each plan to prioritize projects
- Reconciling assets updated in the Citywide asset register with the PSAB asset register used for financial reporting
- Training staff on the Citywide asset management software and keeping the database up to date
- Working with staff in each asset group to update asset inventories, complete condition assessments, update replacement value estimates, refine risk assessments, and periodically review lifecycle activities and service levels
- Considering natural assets and climate change in the City's asset management program