RICHMOND HILL

2021 Asset Management Plan

Richmond Hill, where people come together to build our community.

Acknowledgements

The Corporate Asset Management team would like to thank City staff across the City's Service Areas for their continued support and collaboration in the development of this comprehensive and robust plan. The successful development of this Asset Management Plan by Corporate Asset Management was also made possible through the guidance and support provided by Paolo Masaro (Executive Director, Infrastructure & Engineering Services) and Bob Levesque (Director, Infrastructure Delivery Division). As Manager, I want to thank my team, Andrew, Thomas and Dilan for developing and authoring this plan and their commitment to excellence.

In addition to the contributions of City Staff, the Corporate Asset Management team thanks GM BluePlan Engineering Limited for their assistance in working with us and City Staff over the past year in continuing to advance our asset management practices.

Corporate Asset Management Team

Steve Tsenis – Manager, Corporate Asset Management
Andrew Nichols – Project Manager, Corporate Asset Management
Thomas Uda – Project Manager, Corporate Asset Management
Dilan Somanader – Asset Management Coordinator, Corporate Asset Management

The 2021 Asset Management Plan was received by Richmond Hill Council in June 2021.

Click on the page numbers in the Contents index below to advance to the section.

C O N T E N T S

Executive Summary

Introduction

Richmond Hill's asset management planning process plays a key part in moving the City's Strategic Priorities forward. Implementing and sustaining the City's vision requires a thoughtful and long-term process and plan to manage Richmond Hill's infrastructure assets and the services that they deliver. This Asset Management Plan (AMP) is the result of the City's robust asset management planning process that has come about through recent improvements as part of best business practice. It provides a set of practical tools to understand, plan, and communicate how the investments in assets that the City is making today and in the future will support a balance between growth and the environment, a strong sense of belonging, getting around the City, and fiscal responsibility.

The City owns and manages a wide range of assets across multiple services. This AMP describes the City's assets, how the City manages those assets, how well those actions are working, and how much it will cost to maintain those assets to provide City services. By bringing all of this information together, strengths and opportunities in the City's processes can be identified and strategies created to improve tomorrow's outcomes.

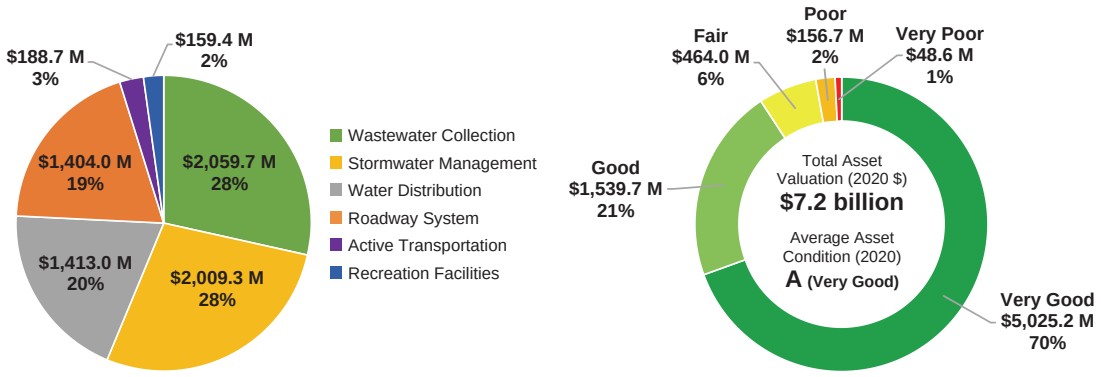
This AMP achieves compliance with the July 1, 2022 requirements set out in O.Reg. 588/17.

The scope of this AMP pertains to the assets that the City classifies as Core+, which encompasses the definition of "core municipal infrastructure assets" outlined in O. Reg. 588/17 (Road, Bridge, Culvert, Water, Wastewater, and Stormwater Management assets), as well as Active Transportation (within the Right-of-Way) and the City's Recreation Facilities (community centres and arenas).

State of the Infrastructure

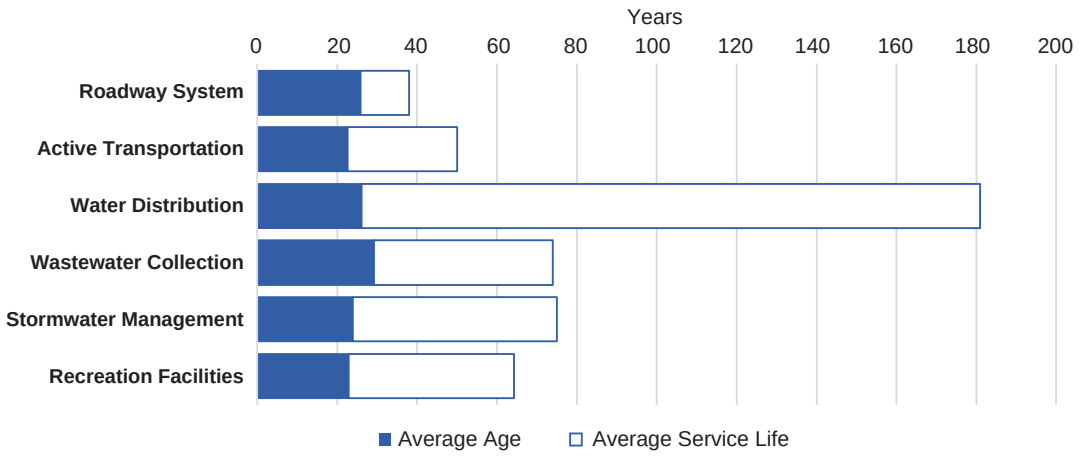
The City's current Core+ infrastructure has an estimated replacement value of $7.2 billion, and is in Very Good condition (Letter Grade of A). The City also has on-going initiatives to enhance its condition assessment approaches to improve the quality of asset condition data.

Figure E-1: Asset Value and Condition Profile for Core+ Assets



The majority of Richmond Hill's growth has occurred over the last four decades, with the average asset age across all Sub-Services generally between 20 and 30 years old.

Figure E-2: Asset Average Age and Remaining Service Life for Core+ Assets



Although the majority of City assets are relatively new and in good condition, expenditures are required for lifecycle strategies to address Poor and Very Poor assets, prevent other assets from reaching Poor condition, and maintain service levels.

Levels of Service

Levels of service are key business drivers which influence all asset management decisions, and are used to inform the lifecycle strategies to deliver targeted service levels. They provide a Line of Sight by aligning higher-level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems and the technical details and performance measures of managing that infrastructure.

In addition to the measures required by O. Reg. 588/17, the City has developed other foundational measures which will assist the City in understanding its performance levels and identifying areas of improvement. The Levels of Service inform the planned actions required to deliver the expected service levels, and this link enables the City to gain an understanding of the costs associated with delivering its services to the community.

The service levels and performance reporting in this AMP is compliant with O. Reg. 588/17. Through each update of the AMP, the City will continue to develop service levels, performance measurements and targets. The City will also consider impacts of external factors affecting Levels of Service, such as changing regulations, population growth and demographic changes, and climate change impacts.

This AMP summarizes the City's **current service levels and performance**, which establishes a **benchmark** for setting future performance targets that are **appropriate and financially sustainable** for the City.

Asset Management Strategy

Asset management strategies are the planned lifecycle-based actions that Richmond Hill uses to manage its infrastructure to meet service levels. There are thousands of different scheduled inspections, maintenance actions, and repair responses that occur every year to ensure that Richmond Hill's infrastructure performs reliably. These actions help to maintain infrastructure so they do not fail prematurely and continue to perform well throughout their estimated life.

Lifecycle activities also include rehabilitation and replacement of assets which are funded through the City's Capital Budget. The City has developed lifecycle models to describe the behaviour or deterioration of assets over time, which enables forecasting of required capital interventions and their impacts on levels of service, risk, and funding levels. The City's Risk Management Strategy is a framework for quantifying the criticality and risk exposure of the City's assets and enables the prioritization of projects across asset classes.

The Risk Management Strategy allows the City to **minimize its risk exposure** by focusing the limited available funding on critical assets that have high financial, social, and/or environmental consequences.

The Capital Budget also funds growth and service improvement activities required to extend services to new areas or expand existing services to meet growth demands. Richmond Hill has a comprehensive and collaborative process to plan for future growth. Documents which guide the City's growth such as the Council's Strategic Priorities 2020-2022, Official Plan, Development Charges Background Study, and service-specific Master Plans are developed and being updated through the lens of servicing options analysis and risk mitigation to best serve the residents of Richmond Hill currently and into the future.

Climate change is expected to continue to impact City operations and asset lifecycle activities. In 2018, the City conducted a Climate Change Risk Scan which determined that the climate change conditions which had the greatest frequency and severity of risk for the City were more intense rainfalls, more heat waves, and more ice-storms and freeze-thaw cycles. These risks can represent significant implications for the City's infrastructure. An increase in extreme weather events will likely accelerate the deterioration of certain assets, necessitating more time and resources to be invested in maintaining, repairing, and replacing them.

As part of the City's Climate Change Framework, the City will be determining the possible climate events and impacts for each infrastructure asset type and incorporating possible changes to asset management processes. The City currently has on-going initiatives to both mitigate and adapt to climate change, including for example, converting streetlights to energy-efficient LED technology and developing a Stormwater Network Model that will assess the City's resiliency to extreme storm events.

This AMP reports the lifecycle strategies for the City's assets to provide a Line of Sight from service levels to timely and strategic investment needs, which also satisfies the reporting requirements of O. Reg. 588/17.

Investment and Financing Strategy

The Investment and Financing Strategy combines Richmond Hill's state of infrastructure, levels of service, and asset management strategies with financial planning and budgeting to assess the long-term management of the City's assets. The State of the Infrastructure Section summarizes the life expectancy of the City's assets, their condition, and replacement cost. The Levels of Service and Asset Management Strategy Sections outline what the City needs to do to maintain its assets in a condition that meets the needs of the community. Finally, the Financing Strategy identifies considerations for how the City will fund the asset management actions that it needs to take and impacts of those decisions on the City's assets.

The City has well-established financial processes to manage infrastructure including the annual Operating and Capital Budgets, Capital Forecasts, and Financial Sustainability Strategy, which complement and implement direction from the longer-term perspective of the AMP.

Richmond Hill's Council and Executive Leadership Team (ELT) identified the need to establish a Capital Sustainability Steering Committee (CSSC). A long-term investment strategy (Financial Sustainability Strategy) was brought forward by the CSSC in October 2020 that included a higher annual Capital Asset Sustainability Levy and considerations of drawing down reserve funds and acquiring debt. The Strategy will be re-evaluated as required to correspond to the changing priorities of the Capital Budget and Forecast process. The Strategy represents an increased level of funding compared to the Status Quo though still not to the funding levels identified to maintain service levels for certain Sub-Services. For Roadway and Active Transportation assets within the ROW, an estimated average funding shortfall of $12.5 million per year has been identified in this AMP assuming no drawdown of reserve fund balances and no utilization of debt to reduce the gap. The gap is expected to increase beyond the ten-year outlook. A more comprehensive analysis of the funding gap for the overall Tax-Supported Capital Program will be completed in the next AMP update with the inclusion of non-Core+ assets.

The **Capital Sustainability Steering Committee**'s mandate is to evaluate opportunities to deliver long-term capital investments that are in line with **community expectations** and **fiscal sustainability**.

Water and Wastewater rate-supported assets are financially sustainable over the next ten years. The Status Quo for the stormwater rate is not sufficient to maintain service levels resulting in an estimated average funding gap of $2.7 million annually over the next 10 years.

Table E-1 summarizes the 10-year financial analysis for the various scenarios across the Core+ Sub-Services.

Table E-1: 10-Year Scenario Analysis Summary by Sub-Service (Average Annual Expenditures $ million/yr)

Scenario	Roadway System and Active Transportation	Water Distribution and Wastewater Collection	Stormwater Management	Recreation Facilities
Unconstrained: 2021 Backlog	$47.7	$41.2	$19.8	$11.6
Unconstrained	$13.5	$6.8	$5.5	$3.3
Scenario 1: Status Quo	$6.0*	$6.8	$1.1	Not assessed
Scenario 2: Financial Sustainability Strategy	$7.3*	$6.8	$3.8	Not assessed
Scenario 3: Maintain Current LOS	$18.5	$6.8	$3.8	$3.3
Funding Gap (to Status Quo)	**$12.5***	-	**$2.7**	**Not assessed**

*tax-supported contributions and gas tax only; does not include drawdown of reserves or utilization of debt

The financial impacts of deferring earlier interventions are further compounded beyond the ten-year outlook, resulting in increased expenditures to maintain LOS, particularly for Roadway System and Active Transportation assets. Table E-2 summarizes the average annual expenditures for the various scenarios over years 11 to 25 of the estimated forecast.

Table E-2: Scenario Analysis Summary for years 11 to 25 by Sub-Service (Average Annual Expenditures $ million/yr)

Scenario	Roadway System and Active Transportation	Water Distribution and Wastewater Collection	Stormwater Management	Recreation Facilities
Unconstrained	$32.0	$5.1	$5.4	$4.4
Scenario 1: Status Quo*	$6.3*	$6.8	$1.3	Not assessed
Scenario 2: Financial Sustainability Strategy*	$10.3*	$6.8	$5.7	Not assessed
Scenario 3: Maintain Current LOS	$56.0	$6.8	$5.7	$4.4
Funding Gap (to Status Quo)	**$49.7***	-	**$4.4**	**Not assessed**

*tax-supported contributions and gas tax only; does not include drawdown of reserves or utilization of debt

As the City implements non-Core+ assets into its asset management planning processes and refines the overall funding gap analysis, asset management and finance departments will **work collaboratively** to develop **long-term financial sustainability** strategies that balance service levels, costs, and risks.

Improvement Work Plan Moving Forward

The Improvement Work Plan includes practical next steps, timing and a preliminary high-level work plan to address the opportunities identified through development of the AMP, as well as continuing the City's initiatives set out in its Asset Management Strategy document. Actions are focused on strengthening existing asset management processes as well as specific tasks to increase the maturity of Core+ data, develop non-Core+ data and strategies, and implement them into the City's Enterprise Asset Management (EAM) system.

These continuous improvement initiatives are the basis for the City's on-going asset management journey to not only to meet legislated requirements, but also bring added value to the City by improving efficiencies, balancing service levels with costs, managing risks, and realizing the best value from its infrastructure.

1. Introduction

1. Introduction

Infrastructure assets are key to Richmond Hill's mandate to deliver an array of services to its community. Ensuring the City's road network is connected, clean, and safe for all users in both winter and summer requires maintenance of the road surface, the underlying base, sidewalks, street lighting, signs, and traffic signals. Supplying clean drinking water, and managing stormwater and wastewater requires an extensive network of pipes, valves, and pumps. Providing a broad range of recreation opportunities requires community centres, arenas, and associated equipment.

The City undertakes asset management planning as a means to deliver sustainable services to the community, and to ensure asset-related decision making and investments are approached in a coordinated manner, informed by evidence and guided by the City's overall strategic direction.

The City's robust asset management planning process has been achieved through recent advancements as part of best business practice, and has enabled completion of this Asset Management Plan (AMP) in compliance with the requirements set out in O. Reg. 588/17. Through this comprehensive plan, strengths and opportunities in the City's asset management processes can be identified and strategies created to improve tomorrow's outcomes.

This Asset Management Plan describes:

- the City's assets;
- how the City manages those assets;
- how well those actions are working; and
- how much it will cost to maintain those assets to provide City services.

1.1 The City of Richmond Hill and Growth at a Glance

The City of Richmond Hill is a lower-tier municipality in the Regional Municipality of York, which is located north of Toronto. Richmond Hill is located in the south-center of the Region and bordered by five other municipalities: the City of Vaughan; the City of Markham; the Township of King; the Town of Aurora; and the Town of Whitchurch-Stouffville. The City covers a total land area of 101.11 square kilometres.[1]

Richmond Hill is a community with strong historical roots and a diverse population. The 2019 population of the City was estimated at 205,537, with employment numbers of approximately 62,142.[2] Due to its proximity to Toronto, Richmond Hill has experienced significant development – particularly, since the 1980s.

The City's approach to growth conforms to the targets set out in the Province's Greater Golden Horseshoe Growth Plan. The Growth Plan directs the City to designate urban growth centres, and establish intensification corridors and major transit station areas; protect its employment lands for employment purposes over the long term; and identify and protect natural systems and encourage the establishment of an urban open space system within the built-up area. The latest Growth Plan came into effect on August 28, 2020 and provides that regional planning forecast growth to 2051 rather than 2041 to enable better long term planning for major infrastructure.

As a lower-tier municipality within York Region, alignment with the Growth Plan is achieved through both the Region's and the City's Official Plans. York Region's Official Plan provides direction for where the City must direct growth by identifying Regional Centres and Regional Corridors, and directing the City to accommodate a variety of business uses in a diversity of locations. The Region's Official Plan is currently being updated and expected to be released later in 2021. The City's Official Plan ensures Richmond Hill is in alignment with both Provincial and Regional land use planning policies by conforming to and building on the concept of complete communities and growth management established by the Growth Plan. The City's Official Plan is currently being updated. For more information on the City's update of its Official Plan, refer to Section 1.3.

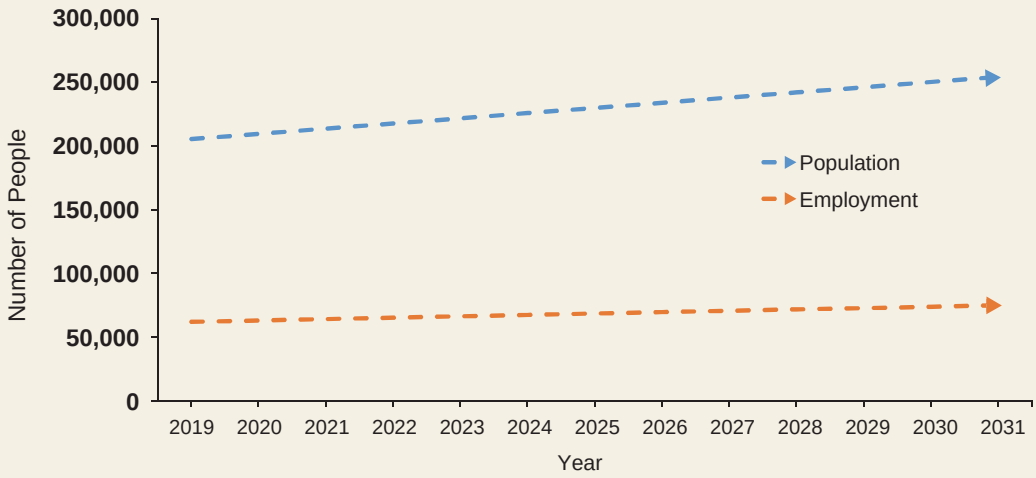
Figure 1: Map of the City of Richmond Hill

[1] Statistics Canada, 2016 Census

[2] 2019 DC Background Study. Note: Richmond Hill's 2021 Economic Fact Sheet indicates a population estimate of 210,371 as of December 2020.

Schedule 3 of the Growth Plan forecasts that the population and employment in York Region will increase to 2.02 million and 990,000 by 2051, respectively.[3] It is estimated that by 2031, Richmond Hill's population and employment numbers will reach approximately 254,320 and 75,109, respectively.[4] The City's growth forecast will be outlined in York Region's and the City's Official Plan updates and any revisions to the forecast will be incorporated into the next AMP.

Figure 2: City of Richmond Hill Population and Employment Forecast



The City's Development Charges Background Study plans for these forecasts contained within the Official Plans, with updates identified through the annual Capital Budget process. Preliminary capital expenditures for new or upgraded infrastructure forecasted to support the City's population and employment growth are identified in Section 5.2.2. It is important to note that the population and employment forecast and the estimated growth-related capital forecast satisfies O. Reg. 588/17 reporting requirements.

1.2 Asset Management Planning at the City

Asset management is practiced at Richmond Hill to improve efficiencies, increase service levels, manage risks, and realize the best value from its infrastructure to deliver City services to the community. The City recognizes and undertakes asset management as a best business practice.

In 2014, the City began its formal asset management journey, which resulted in the development of its first AMP in 2016. This AMP was completed in response to the requirement that municipalities in Ontario needed to have a comprehensive AMP in order to access major grant funding from the Province and receive Federal Gas Tax funding. It was developed in alignment with Ontario's *Building Together: Guide for Municipal Asset Management Plans.*

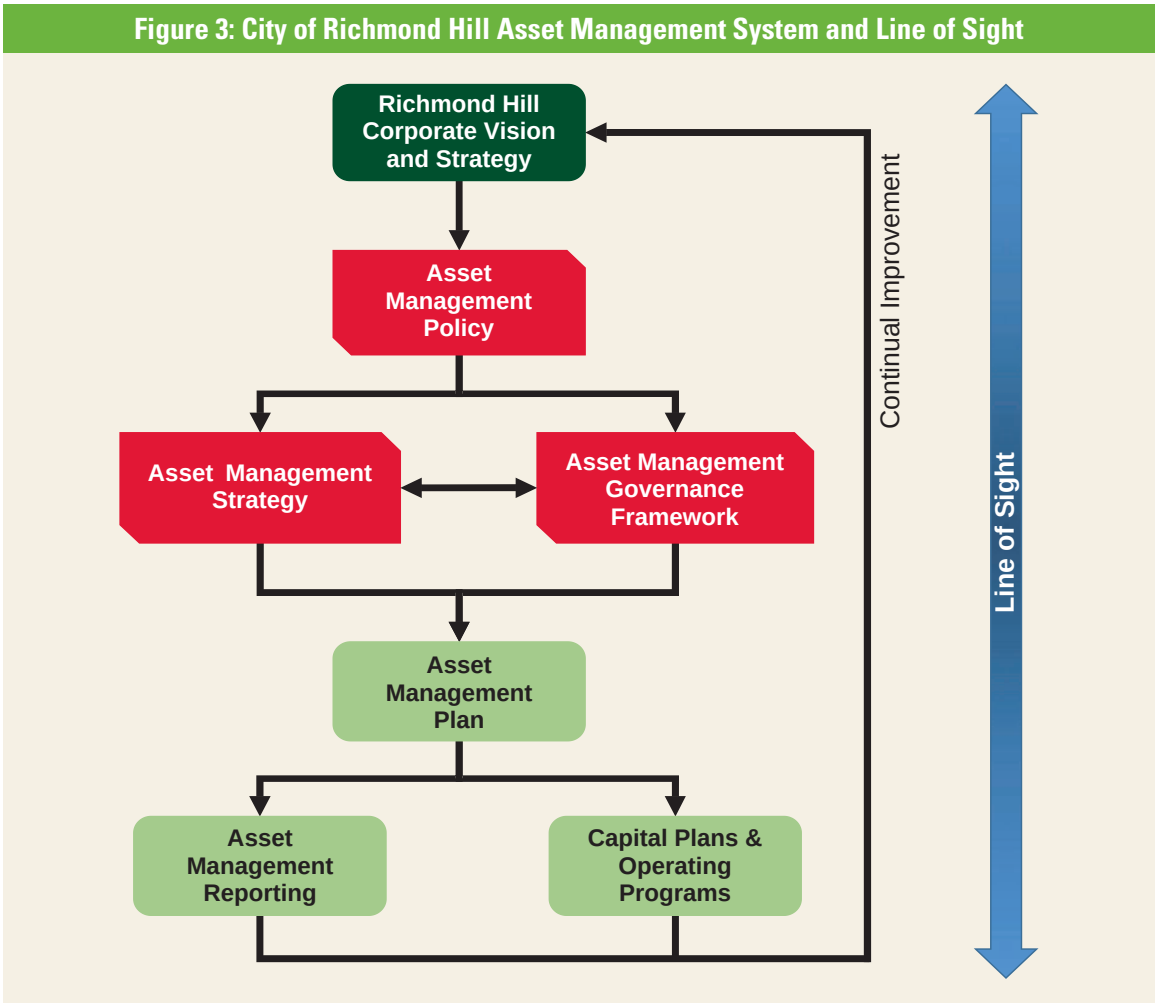
[3] A Place to Grow: Growth Plan for the Greater Golden Horseshoe (August 2020)
[4] 2019 DC Background Study

Over the past few years, the City has undertaken significant efforts and has rapidly improved asset management planning in accordance with industry best practices. In 2019, in response to the introduction of O. Reg. 588/17, the City's Corporate Asset Management (CAM) Section completed the development of key foundational components of its Asset Management System including:

- The **Asset Management Policy**, which outlines the City's principles and commitments to asset management planning (approved by Council in May 2019);
- The **Asset Management Strategy**, which outlines specific business processes and practices required to implement the Policy and deliver sound asset management planning (presented to Council in May 2019);
- The **Asset Management Governance** Framework, an internal document which identifies the roles and responsibilities of staff groups within the City's Asset Management System; and
- The development and implementation of an **Enterprise Asset Management (EAM) System**, which is an internal Decision Support System.

The remainder of Section 1.2 describes these key foundational components in further detail. Figure 3 illustrates the components of the City's AM System.

Figure 3: City of Richmond Hill Asset Management System and Line of Sight



1.2.1 Asset Management Policy

The Asset Management Policy outlines the City's commitments and principles that will be considered in corporate asset management planning. It ensures alignment and integration of AM into the strategic planning processes outlined in Section 1.3.

The Policy provides a foundation to identify and prioritize investments in existing and future infrastructure assets, and to ensure each investment is capable of supporting the quality of life desired in the community. As per the Policy, the City of Richmond Hill shall:

1. **Integrate with the City's Strategic Priorities 2020-2022, Official Plan and Master Plans** to ensure alignment between asset decision making and the City's Strategic Priorities, as well as growth and service demand forecasts.
2. **Manage municipal infrastructure assets using an integrated business approach** that delivers desired service results by planning and investing in infrastructure within the context of City-wide responsibilities.
3. **Enable residents, businesses and other interested parties** to provide input in asset management planning.
4. **Coordinate planning for management of assets shared with other governmental agencies,** including the Regional Municipality of York, neighbouring municipalities and the Conservation Authorities.
5. **Align asset management planning activities to water and wastewater financial plans** to ensure that these critical municipal services are appropriately funded over the long term.
6. **Commit to consider the Asset Management Plan recommendations** when developing municipal budgets and long-term financial plans.
7. **Commit to consider risks, including those related to climate change**, when reporting asset management planning needs.

1.2.2 Asset Management Strategy

The purpose of the Asset Management Strategy is to provide the specific approaches that the City will enact to achieve the objectives of the AM Policy, and ultimately, link infrastructure decisions to the City's overall vision and goals.

The AM Strategy document details the framework of AM at the City, which defines the key components of Richmond Hill's AM System. The City's AM framework is comprised of six (6) major categories:

1. Asset Management Strategy and Planning

This category relates to the high-level functions at the City, which dictate the overall City strategy, as it pertains to AM. In particular, this category relates to processes in place that align the City's AM activities and its overall corporate and strategic objectives. This alignment (i.e. Line of Sight) enables staff to link their day-to-day activities to the strategic direction of the City.

2. Asset Management Decision Making

This category relates to decision-making activities pertaining to the City's infrastructure assets from a Corporate AM System perspective. This category is essential to enable the processes that allow the City to maximize the value realized from its assets.

3. Lifecycle Delivery Activities

This category relates to the specific approach to the acquisition, operation, maintenance, and disposal of assets. These activities pertain to the tactical-level practices and the day-to-day activities of managing assets.

4. Asset Information Enablers

This category includes systems and processes in place related to the collection, management, and use of data associated with assets. These processes are considered key enablers to all AM activities. Asset information supports other key AM activities such as AM decision making, lifecycle delivery and risk processes.

5. Organization and People

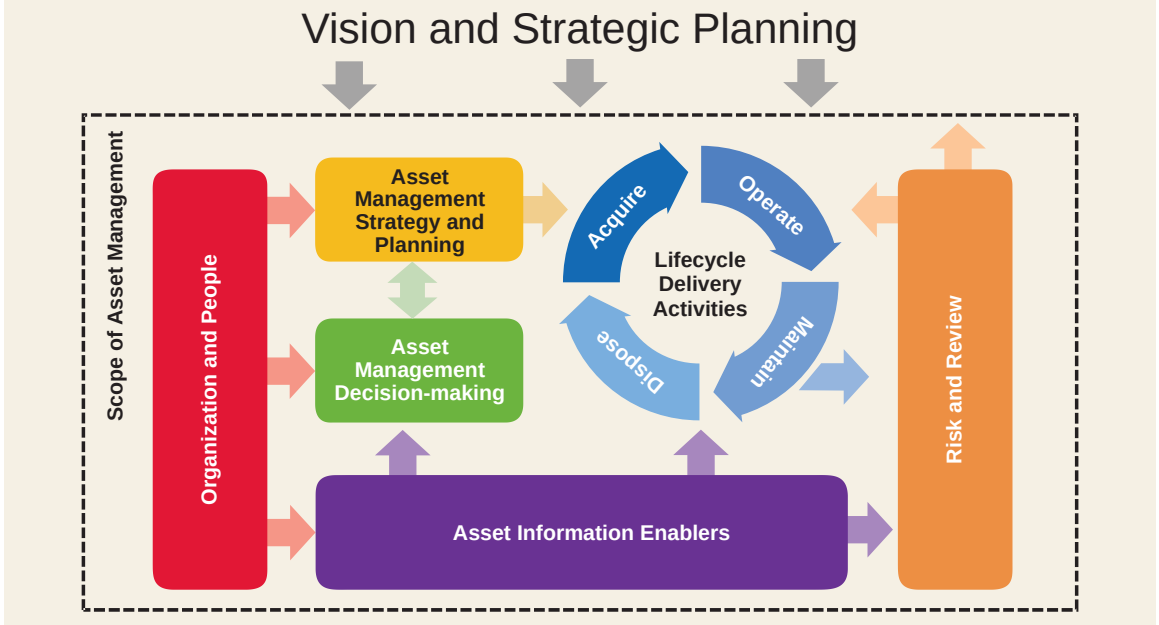
This relates to the systems and personnel in place to deliver AM at the City. It also includes processes in place to ensure the ongoing operation of AM through organizational or internal changes.

6. Risk and Review

This category includes systems and tools at the City that are used to define risk and implement processes to measure risk as part of an overall AM System. Furthermore, this category also pertains to metrics used to measure and review the AM System at the City, which will inform continual improvement of AM and strategic initiatives

Figure 4 illustrates the six categories of the AM framework, including their coordination and function as part of the City's overall AM System.

Figure 4: City of Richmond Hill Asset Management Strategy Framework



An Implementation Plan was produced which identified high priority activities that are focused on meeting regulatory requirements, and additional medium and low-priority activities that are focused on moving from regulatory compliance to achieving a competent maturity rating in all processes in the City's AM System. While most of these activities have been completed, outstanding long-term actions from the implementation plan are summarized in Section 6: Monitoring and Improvement.

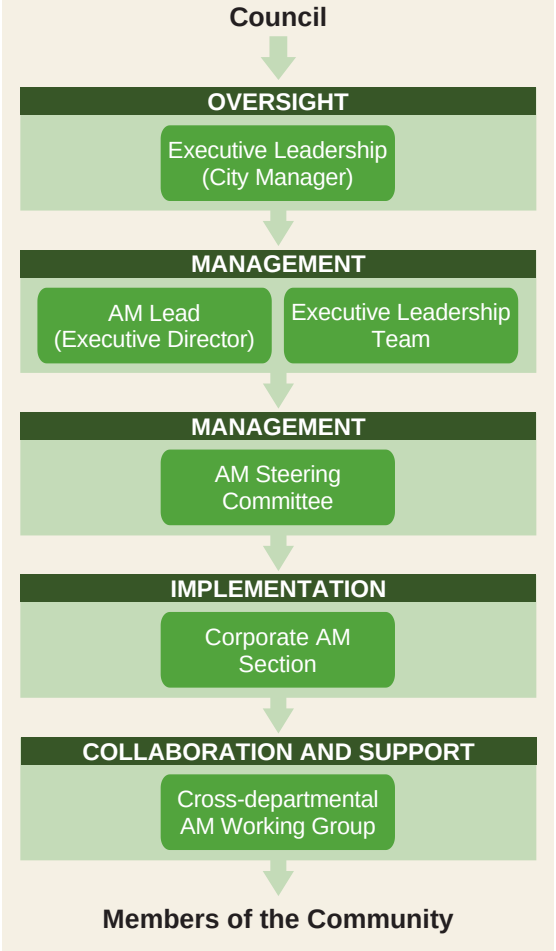
1.2.3 Asset Management Governance

The AM Governance Framework governs the actions and processes that create consistent and stable AM practices and policies across the organization. This ensures a robust, transparent, and accountable approach to managing assets and promotes the long-term sustainability of service delivery.

This document also details the corporate structure that is responsible for implementing and delivering AM, providing guidance and transparency to City staff with respect to their relation to each AM process. Responsibilities for each key role are described as follows, and illustrated in Figure 5:

- **Council** – Responsible for approving an AM Policy and future AMPs;
- **Executive Lead (City Manager)** – Accountable for the AM System and the development of an AMP;
- **AM Lead (Executive Director)** – Accountable as executive Sponsorship for the AM System;
- **Executive Leadership Team** – Responsible to endorse future AMPs and advise the AM Steering Committee on strategic issues related to corporate decision making;
- **AM Steering Committee** – Responsible to provide direction, operational resourcing and support for the implementation of the AM Program;
- **Corporate Asset Management (CAM) Section** – Responsible to lead coordinated AM initiatives within the City, including authoring the AMP, and produce AM reporting; and,
- **Cross-Departmental AM Working Group** – Responsible to provide technical input and support for the implementation of the AM Program. The AM Working Group will participate in key projects and assume team roles within the Implementation Plan.

Figure 5: City of Richmond Hill Asset Management Governance Structure



1.2.4 Enterprise Asset Management System

The Enterprise Asset Management System (EAM) is the latest evolution in the City's Asset Management journey. The EAM is an internally-hosted web-based software application that uses models developed as part of the City's technical strategies (Levels of Service, Lifecycle, and Risk strategies) and completes analyses on the City's asset data to provide current and forecasted information to support asset investment decision making.

The EAM provides information on the current and future condition of assets, as well as the associated funding needs. Details on how the EAM leverages the City's asset data and technical strategies are covered in Section 1.4.3.

1.3 Alignment with City Vision and Strategic Priorities

Richmond Hill's AMP is a key part of moving the City's Strategic Priorities forward. In light of the ongoing COVID-19 pandemic, Richmond Hill's Council developed Strategic Priorities (2020-2022) with input from the community to set the City on a solid path to recovery – minimizing the financial impact on residents while continuing to emphasize environmental initiatives, community building, and transportation. Four Strategic Priority areas are identified as shown in Figure 6. This AMP is a key component of Fiscal Responsibility, by ensuring continued and sustained asset and infrastructure health through long-term financial sustainability planning. The AMP provides a set of practical tools to understand, plan and communicate how the asset investments that the City is making today and in the future will support a balance between growth and the environment, a strong sense of belonging, getting around the City, and fiscal responsibility.

Figure 6: Council Strategic Priorities, 2020-2022

Richmond Hill

Council Strategic Priorities | 2020-2022

Developed with input from the community, Richmond Hill's Council Strategic Priorities 2020-2022 set the City on a solid path to recover from the COVID-19 pandemic, minimizing the financial impact on residents while continuing to emphasize environmental initiatives, community building and transportation.

Balancing Growth and Green

Recognizing the critical balance between economic development and environmental protection, this includes stewardship of green spaces such as wetlands, parks and trails and longer-term sustainability planning and climate action initiatives, alongside decisions that promote responsible economic intensification and prosperity.

Examples of major projects:

- Official Plan Update
- Parks, Recreation and Culture Master Plans
- Urban Forest Management Plan
- Resilient Richmond Hill
- Comprehensive Zoning By-law
- Climate Change Framework
- City Transformation Project
- Single-use Plastics Reduction

Strong Sense of Belonging

This placemaking priority combines a desire for everyone to feel welcome in Richmond Hill and a commitment to community building in places like the downtown core, Lake Wilcox and the Richmond Hill David Dunlap Observatory.

Examples of major projects:

- Diversity, Equity and Inclusion Initiative
- Age Friendly Community Initiative
- Recover Richmond Hill Action Plan
- Affordable Housing Strategy
- Official Plan Update
- myRichmondHill community e-newsletter

Getting Around the City

Council will prioritize ease of movement around the city by promoting Richmond Hill's multiple transportation interconnections, being well-positioned for the Yonge subway extension and improving active transportation networks for cyclists and pedestrians.

Examples of major projects:

- Richmond Hill Centre Secondary Plan
- Yonge North Subway Extension project
- Transportation Master Plan
- Official Plan Update

Fiscal Responsibility

Council will endeavour to keep tax increases below the cost of inflation and will avoid unnecessary expenditures in order to emerge from COVID-19 in a strong financial position.

Examples of major projects:

- Financial Sustainability Strategy
- Revenue Generation Initiative
- Asset Management Plan
- City Transformation Project
- Investment Attraction Strategy

RichmondHill.ca/StrategicPlan

In addition to the Strategic Priorities, the City's AMP aligns with and complements other strategic objectives which may have implications for the City's assets. The City is currently updating its Official Plan to guide land use and development to 2041. This update implements any changes to provincial policies, conforms with policies in the York Region Official Plan, responds to current urban issues and conditions, and considers new opportunities for shaping the City. New or updated plans and strategies for the City's services will continue to be brought forward that align with the residents' vision for the community. Implementing and sustaining this consolidated vision requires a thoughtful and long-term plan to manage Richmond Hill's infrastructure assets and the services that they deliver.

Table 1 summarizes how this AMP aligns with other City strategic and master planning documents. The alignment is continually improved upon and maintained in an iterative way to support the interdependencies between the AM System and the City's strategic planning processes.

Table 1: Other AMP Strategic Alignments

City Document	Alignment with AMP
Official Plan (2010)	The Official Plan focuses on land use and contains policies for the physical, social and economic growth of the community. Together with the Master Plans and Development Charges Studies, the Official Plan informs the future demands on the City's infrastructure and resources considering growth, which are necessary inputs for the AMP. The City is currently updating its Official Plan to guide land use and development to 2041.
Financial Sustainability Strategy (2020)	The Financial Sustainability Strategy outlines the City's approach to managing its capital program and service levels, as well as maintaining sufficient balances in the capital related reserve funds to provide funding to sustain the infrastructure while utilizing debt. The AMP leverages this strategy to determine how the City's infrastructure needs will be funded over the next 10 years.
Tangible Capital Assets (TCA) Policy (2017)	The TCA Policy sets out how the City complies with sections 294.1 of the Municipal Act, 2001, and 3150 of the Public Sector Accounting Board (PSAB) Handbook that require the City to account for and report tangible assets (TCA) on financial statements. The Policy defines a capitalization threshold at or above which a resource is considered a capital asset.
Development Charges (DC) Background Study (2019)	The DC Background Study was prepared in accordance with the Development Charges Act, 1997. This study directly informs the City's growth needs and associated funding strategies discussed in the AMP. An update to the DC Background Study is currently underway.
Water and Wastewater Financial Plan (2018)	Financial Plans for Water and Wastewater services are a requirement under the Safe Water Drinking Act, and provide details on the financial self-sustainability of the systems. The Financial Plan informs the development of the operating budget and capital forecast for Water and Wastewater assets, along with associated funding strategies. The most recent 10-Year Water and Wastewater Financial Plan was adopted by Council in 2018.

Table 1: Other AMP Strategic Alignments	
City Document	**Alignment with AMP**
Climate Change Framework (2020)	The Climate Change Framework focuses Richmond Hill's climate change mandate and ensures a coordinated approach to taking climate action. Among the six climate goals outlined in the framework is one which pertains to applying a 'climate change lens' to AM. The AMP will integrate the actions associated with this goal into its implementation plan.
Service area-specific Master Plans and Strategies	Additional plans and strategies such as the Transportation Master Plan, Urban Master Environmental Servicing Plan (MESP), Recreation Plan, Culture Plan, and Environment Strategy outline strategic objectives specific to the City's various services, and inform investment decisions for infrastructure assets in those areas. Updates to the plans and strategies mentioned are currently underway.

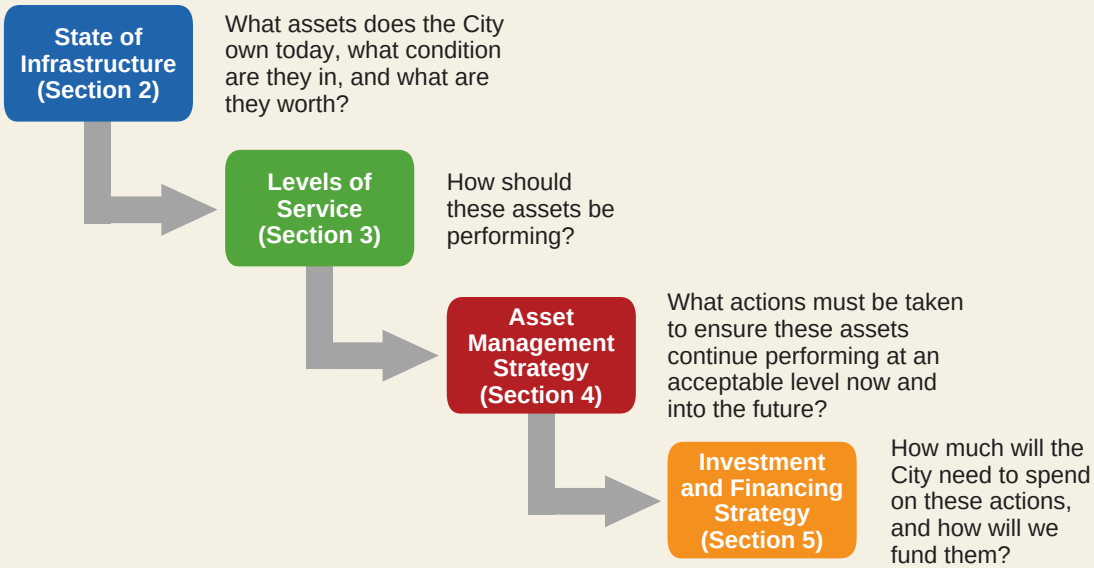
1.4 Asset Management Plan Methodology

At its core, the AMP aims to answer a single, overarching question:

How does the City make the best possible investment decisions for its infrastructure assets to meet the service needs of the community and maximize their value at lowest risk, now and into the future?

As shown in Figure 7, the overarching question guiding the AMP is addressed in the following four Sections. Before the City can make any investment decisions, it needs to understand the **State of the Infrastructure** – what assets the City has, what condition they are in, and what they are worth. Next, the City needs to determine the **Levels of Service** its infrastructure must meet; in other words, how should the City's assets be performing to meet the needs of the community and stakeholders? Once the City has determined how its assets should be performing, it needs to determine a set of actions that should be undertaken on the right assets at the right times to ensure they continue meeting their levels of service for current and future generations; the types and timing of these actions are detailed in the City's **Asset Management Strategy**. Last, the City needs to forecast how much it needs to spend to perform these actions, and determine how it will fund and prioritize these actions while ensuring the long-term sustainability of its financial resources; this requires the development of an **Investment and Financing Strategy**.

Figure 7: Structure of the AMP



Addressing the questions posed by each Section of the AMP is made possible through three separate, but interrelated components that enable effective asset management planning at the City: **asset data, technical strategies**, and a **decision support system (or DSS), which is the EAM**.

Asset data is crucial to developing a foundational understanding of the assets the City currently owns. Technical strategies are structured around the asset inventory and establish the "logic engine" which defines:

- how assets should perform (LOS Strategy);
- what asset management actions are typically performed on different types of assets and how much these actions cost (Lifecycle Strategy); and
- how to determine which assets have a high risk and therefore must be prioritized (Risk Management Strategy).

The DSS (EAM) enables the successful integration of the asset data and technical strategies. The system functions by feeding asset information into the "logic engine", and completing analyses to produce reporting outputs that promote data-driven and evidence-based decision making that is cost effective and aligned with corporate goals and priorities. The development and implementation of the three components are described in the following subsections.

1.4.1 Asset Data

Asset information is at the core of enabling all asset management processes. Without information, evidence-based decision making cannot be undertaken. Asset data that is complete and of good quality leads to reporting which depicts an accurate representation of the State of the Infrastructure, gives reliable accounts of asset value and supports the identification of priorities for infrastructure investment and determining a long-term view of infrastructure needs.

1.4.1.1 Asset Register and Attributes

The City currently maintains its inventories in various systems specific to the different asset types and the business units that manage them. The data in these sources is consolidated in a centralized repository of information relating to all assets, known as the **Asset Register.** Each record in the asset register is assigned to its appropriate location in the asset hierarchy, thereby allowing for the consistent application of technical strategies to the appropriate hierarchy level to support the City's DSS (EAM).

Asset data sources include:

- the City's Geographic Information System (GIS);
- Maximo (Work Management System);
- ReCAPP (Renewal Capital Asset Planning Process); and
- standalone sources like Microsoft Excel spreadsheets and Access databases.

In order to ensure any analysis can be applied across asset types, the Asset Register tracks common and asset type-specific attributes. Common asset attributes, such as Asset ID, Construction or Install Date, and Condition, are meant to apply to most or all assets and provide asset information in a standard format. Other attributes such as Size (e.g. Length, Width) and Material are key to the specific asset types with which they may be associated. For example, linear assets require information on lengths so that current replacement value can be assigned based on the most recent unit costs. This information, however, would not be applicable to vertical assets such as buildings.

1.4.1.2 Data Confidence

Data confidence is an evaluation of the reliability of the data that is being used for asset management decisions. Generally, asset managers have high confidence in the data for assets that have complete and reliable inventories (including condition information). Lower data confidence reflects uncertainty in one or more aspects of the asset data and an opportunity to improve the City's understanding as the asset management processes mature.

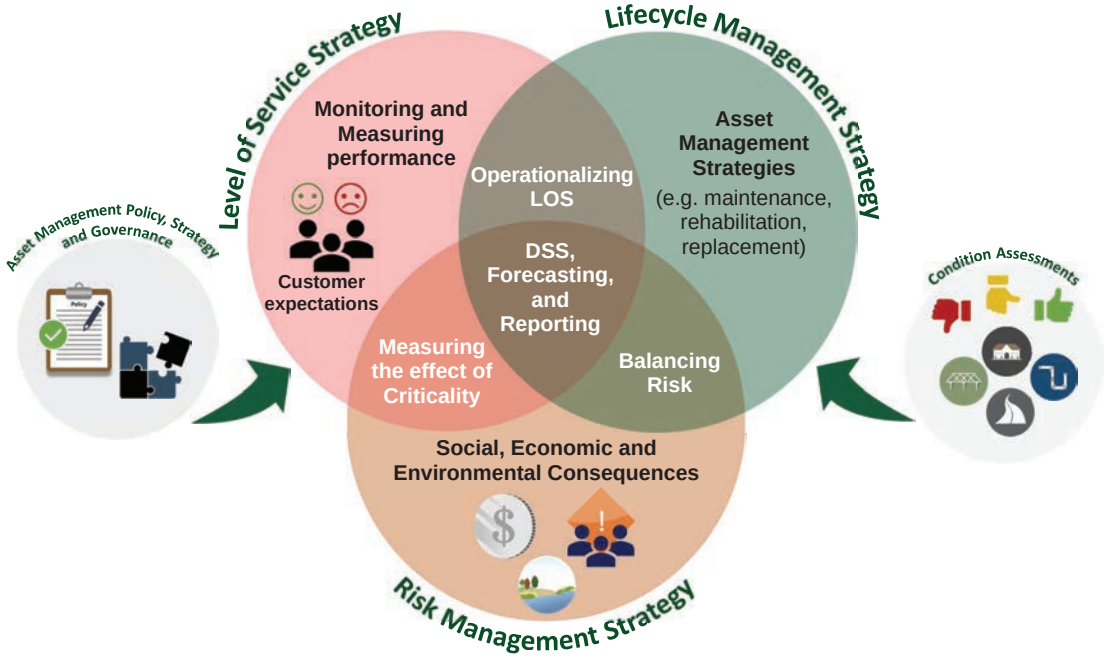
Though it is not necessary to have advanced data capabilities for all assets, improved data confidence translates into more effective decision making. Future actions to continually improve the maturity of the City's data are discussed in Section 6: Monitoring and Improvement.

1.4.2 Technical Strategies

In alignment with the City's AM Strategy summarized in Section 1.2.2, and to increase the maturity of its AM system, the City developed AM technical strategies. The strategies include the City's **Levels of Service (LOS) Strategy; Lifecycle Strategy**, and **Risk Management Strategy**.

Each strategy is an essential component to enable the City to confidently inform asset expenditure and condition forecasting and reporting. The integration of the three Strategies provide the foundation or 'logic engine' for the EAM, which is a Decision Support System (DSS) that will help the City make optimal asset investment, renewal, and rehabilitation decisions. Figure 8 illustrates the integration between the City's technical strategies and how, together, they enable the DSS.

Figure 8: Technical Strategies Interactions



To develop the three technical strategies, working sessions were held with subject matter experts (SMEs) in each major asset grouping to discuss the criteria used to make decisions about assets. These workshops were instrumental in gaining an understanding of the organization's existing approach to asset management, and these insights informed the development of the strategies. The CAM team will continue to leverage the knowledge of the City's SMEs to review, refine, and improve the strategies as required.

The City's **Levels of Service (LOS) Strategy** is the first of the three strategies developed. It formalizes the City's AM goals, as documented in its AM Policy and Strategy. The LOS strategy provides the building blocks to articulate the Line of Sight from the City's AM goals to the individual actions that are performed on assets (the Lifecycle Strategy) and the risks that influence and prioritize those actions (the Risk Management Strategy).

The City's **Lifecycle Strategy** is the second of the three strategies developed. It models and understands the behaviour of assets over their life, and the types of activities that are performed to assets, which serve to meet the City's LOS.

The City's **Risk Management Strategy** is the third of the three strategies developed. It models and understands the likelihood of failure, consequence of failure (criticality) and risk exposure of assets. It helps to prioritize lifecycle asset investment decisions which ultimately balance the City's LOS with lifecycle costs and budget constraints.

Ultimately, these combined strategies provided the City with the information needed to make the best possible decisions regarding the management of its assets, by achieving the appropriate balance between LOS, asset interventions and treatments, risk, and costs.

1.4.3 Decision Support System (EAM)

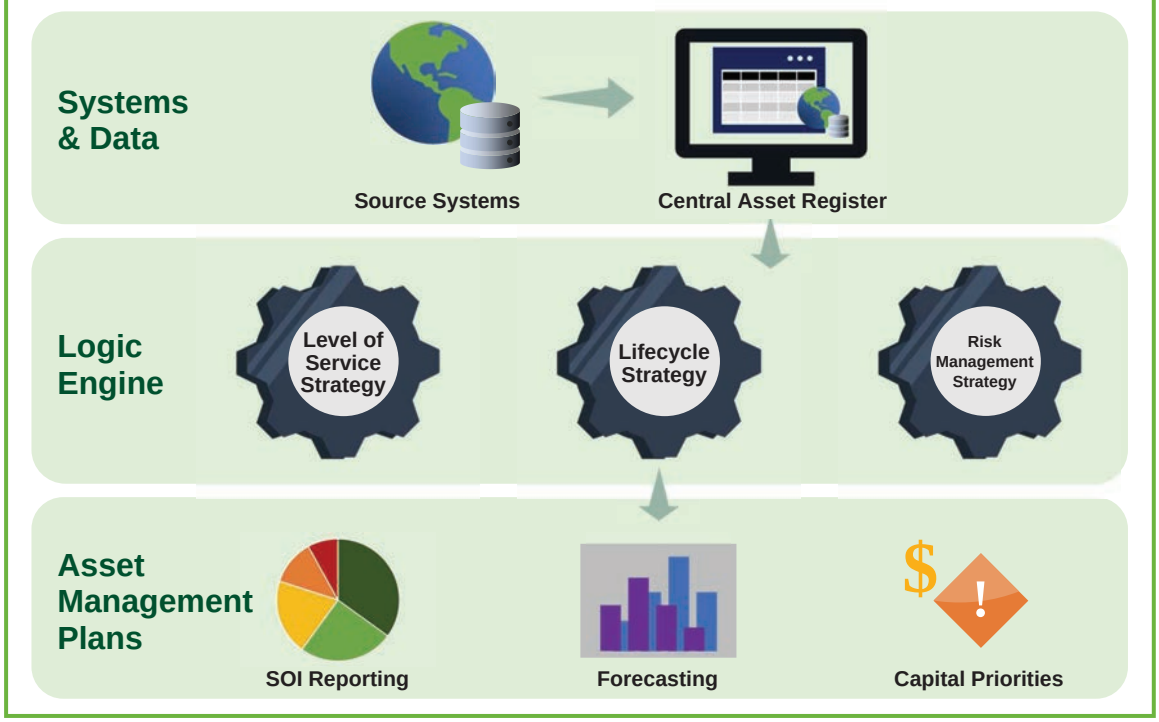
The City's EAM system leverages the three asset technical strategies described in the previous section to understand the current and future state of assets. The outputs of the EAM system form the foundation of this AMP (see Figure 9).

The general process for utilizing the technical strategies within the EAM is as follows:

- Determine current asset condition, performance, and age using the Asset Register;
- Apply a deterioration model to the asset, as defined in the City's Lifecycle Strategy;
- Establish intervention thresholds, considering LOS thresholds (as per the City's LOS Strategy); planned lifecycle activities (as per the City's Lifecycle Strategy); and asset criticality (as per the City's Risk Management Strategy).
- Use the appropriate deterioration model to advance the asset in age annually and apply actions to the asset when intervention thresholds are reached, as per the City's Lifecycle Strategy.
- Establish the cost of each applied action.
- Determine the Likelihood of Failure, Consequence of Failure and subsequent Risk Score for each asset, as per the City's Risk Management Strategy.
- Analyze multiple budget scenarios to determine the associated impact on condition.
- In budget-constrained scenarios where expenditures are limited, use risk scores to prioritize asset interventions.

The outputs generated by the EAM system assist the City in determining if current funding is adequate to maintain or improve asset performance in the future and supports the development of financial strategies that make the most efficient use of available funding.

Figure 9: City of Richmond Hill's Enterprise Asset Management System



1.5 Scope of the Asset Management Plan

The City owns and manages a wide range of assets across multiple services. The scope of this AMP pertains only to the assets that the City classifies as **Core+**.

Core+ encompasses the definition of "core municipal infrastructure assets" outlined in O. Reg. 588/17 (Road, Bridge, Culvert, Water, Wastewater, and Stormwater Management assets), but also includes Active Transportation assets within the Right-of-Way (ROW) and the City's Recreation Facilities (community centres and arenas). Recreation Facilities constitute the largest share of the City's facilities portfolio by asset value; including them in this AMP offers an opportunity to demonstrate that the approach to asset management planning developed for Phase 2 of the regulation can sufficiently address vertical assets as well as linear.

Core+ Assets:

- Roads
- Bridges & Road Culverts
- Water Distribution
- Wastewater Collection
- Stormwater Management
- Active Transportation
- Recreation Facilities

As per the regulation, the remaining non-Core+ assets will be covered in the next AMP. Non-Core+ assets includes Active Transportation infrastructure outside the ROW; other City facilities such as Office Buildings, Libraries, Theatres, Fire Stations, and Heritage Buildings; Parks; Outdoor Recreation; Environmental Assets; fleet and equipment; and Information Technology.

The services the City delivers are organized by the asset hierarchy, which details the relationship between each individual service and the infrastructure assets that support it. The hierarchy provides the baseline asset information that is used to tie all assets to their services and is the foundation that links together the technical strategies of LOS, Lifecycle, and Risk. It also provides a standardized framework for identifying and tracking asset data and information in a consistent manner across all services over the asset lifecycle.

Table 2 summarizes the City's asset hierarchy, and indicates which Services, Sub-Services, and Asset Classes have been included in this 2021 AMP, and which are to be included in the next AMP.

It is important to note that York Region owns assets and provides services in Richmond Hill. The Regional assets are part of the York Region AMP and include most arterial roads, major bridges, public transit assets, affordable housing, and police services. Further, the water and wastewater treatment facilities that service the City are owned and operated outside of Richmond Hill and are not included in this AMP.

Table 2: AMP Scope

Asset Class	Asset Class Summary	Phase
Transportation Services *(Service)*		
Roadway System *(Sub-Service)*		
Roads	Assets that enable vehicular travel throughout the City.	**2021**
	Ancillary assets which support the road network, such as *traffic signals, **streetlights, and **traffic signs.	**2021*** Future**
Municipal Structures	Bridges and major culverts that have a span exceeding 3 metres, and are inspected every two years.	**2021**
Active Transportation		
Active Transportation within the Right-of-Way	Assets that enable "human-powered" modes of transport like walking and cycling, within the road right-of-way. Includes sidewalks, bicycle lanes, and multi-use paths.	**2021**
Active Transportation outside the Right-of-Way	Assets that enable "human-powered" modes of transport outside the road right-of-way and are not found in parks. Includes pathways and bicycle parking facilities.	Future
All Sub-Services		
Operations Fleet & Equipment	Vehicles and equipment that support Transportation Services.	Future
Environmental Services		
Water Distribution		
Water Supply Network	Assets that deliver drinking water to residents and businesses. Includes watermains and ancillary assets like valves and hydrants.	**2021**
Wastewater Collection		
Sanitary Sewer Network	Assets that deliver wastewater services to residents and businesses. Includes gravity sewers, sewage pumping stations, and ancillary assets like maintenance holes and service connections.	**2021**
Stormwater Management		
Stormwater Conveyance	Assets that convey (drain) stormwater runoff. Includes a network of sewers, culverts and channels.	**2021**
Stormwater Controls	Assets that manage stormwater runoff to prevent flooding and erosion. Includes Stormwater Management Facilities (SWMF) and Low Impact Development (LID).	**2021**
All Sub-Services		
Operations Fleet & Equipment	Vehicles and equipment that support Environmental Services.	Future

Table 2: AMP Scope		
Asset Class	**Asset Class Summary**	**Phase**
Recreation & Culture Services		
Recreation Facilities		
Community Centres, Arenas	Buildings that provide a venue for community involvement and recreation.	**2021**
Operations Fleet & Equipment	Vehicles and equipment that support Recreation Facilities.	Future
Cultural Services		
Heritage Buildings, Theatre	Buildings that promote cultural life and preserve the City's heritage.	Future
Libraries		
Libraries	Buildings that provide access to a curated collection of physical and electronic information sources for residents and visitors.	Future
Other Facilities		
Other Facilities	Buildings which are not classified under the other facility categories.	Future
Parks and Outdoor Recreation		
Parks, Outdoor Recreation, Environmental Assets	Includes parks, trails, outdoor sports facilities, and environmental assets like trees.	Future
Protection Services		
Fire Services		
Fire Stations, Fleet, Equipment	Buildings, vehicles, and equipment used to respond to emergencies.	Future
Administration Services		
Municipal Offices		
Office Buildings, Fleet	Buildings and vehicles that enable City administration.	Future
Information Technology	Assets required to operate and manage the City's information technology systems, including hardware, software, and telecom assets.	Future

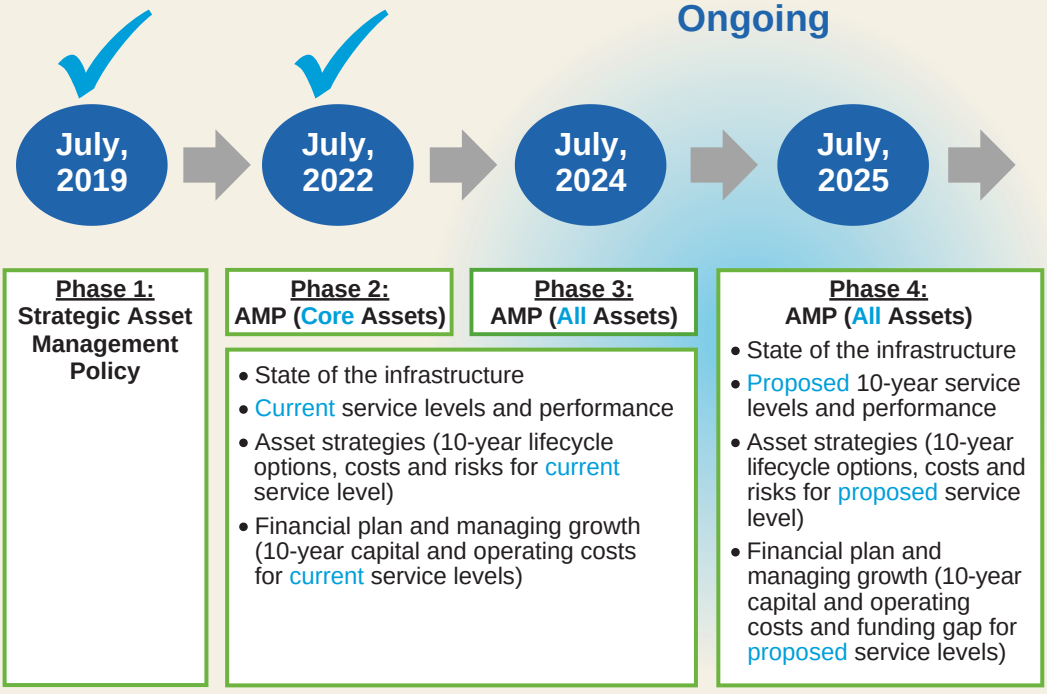
1.6 Public Availability of the Asset Management Plan

The City of Richmond Hill is committed to transparency and open communication with its residents and stakeholders. As such, the AMP can be accessed through the Richmond Hill website (RichmondHill.ca). Supporting documents may be made publicly available as per O. Reg. 588/17. Copies of either the AMP or the Policy will be provided upon request.

1.7 Achievement of Asset Management Regulatory Requirements

Two major legislative requirements have given rise to the requirement for the development of an AMP by municipalities in Ontario. The first, enacted in 2015, was the *Infrastructure for Jobs and Prosperity Act.* The second, *O. Reg. 588/17 – Asset Management Planning for Municipal Infrastructure,* came into effect on January 1, 2018. The regulation was recently amended by the Ontario Government (March 15, 2021), by extending the reporting deadlines by one year. O. Reg. 588/17 defines the following requirements for municipalities in asset management planning and reporting to be phased in over four stages, as illustrated in Figure 10.

Figure 10: Overview of O. Reg. 588/17 Timeline



As described previously, the City's asset management approach and planning as part of best business practices has also allowed the City to produce this AMP in full compliance with all Phase 2 requirements of the regulation one year in advance of the July 1, 2022 timeline. The City's AMP also ensures continued compliance with the requirements for receipt of Federal Gas Tax funding.

2. State of the Infrastructure

2. State of the Infrastructure

As Richmond Hill has grown over the past few decades, roads and community centres were built, and underground networks that carry drinking water, stormwater and wastewater were expanded. As this infrastructure aged, it needed more attention to ensure that it continued to reliably serve the community. Some of this infrastructure is easy to see, like the surface of roads or buildings. Other infrastructure is largely below ground, like the pipes and valves that provide drinking water.

There is more to Richmond Hill's infrastructure than meets the eye. For example, a typical community centre contains numerous complex systems that operate behind the scenes, such as heating, cooling, or security, in addition to the bathrooms, windows, doors, flooring and wall finishes. Given the complexity of the infrastructure that supports the quality of life in Richmond Hill, the first step of asset management planning is understanding what infrastructure the City has and its condition. This is the 'State of the Infrastructure'.

This Section provides an overview of the City's total Core+ assets: the types and quantities of assets, their value, their condition, as well as their age distribution. The State of the Infrastructure is the beginning of the story of asset management in Richmond Hill, describing the current state of the City's assets.

The State of the Infrastructure answers:

- what assets does the City own?
- what is the condition?
- what are their age and remaining service life?
- what are they worth?

In compliance with O. Reg. 588/17, the following information is outlined for each asset category with further details provided in the Appendices:

- a summary of the assets in the category **(2.1: Inventory Overview)**
- the replacement cost of the assets in the category **(2.2: Asset Valuation)**
- the information available on the condition of the assets in the category **(2.3: Asset Condition)**
- a description of the City's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate. **(2.3: Asset Condition)**
- the average age of the assets in the category, determined by assessing the average age of the components of the assets **(2.4: Asset Age)**

2.1 Inventory Overview

The City's current Core+ infrastructure has a replacement value of approximately **$7.2 billion**. The average condition of the City's Core+ assets is Very Good (Letter Grade A).

Figure 11: Asset Condition Distribution and Valuation for Core+ Assets

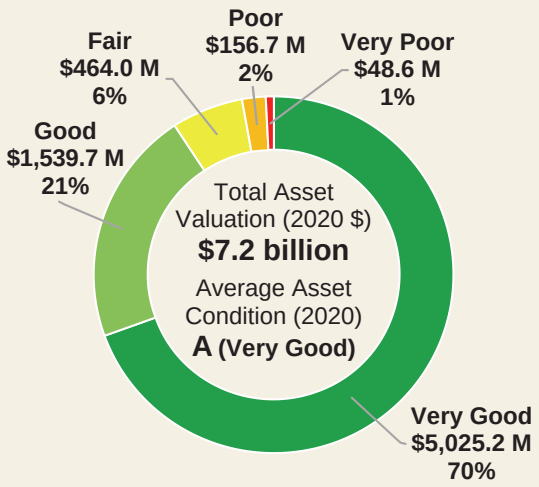


Table 3 provides an overview of the state of the infrastructure of the City's inventory of Core+ assets.

Table 3: Inventory Overview for Core+ Assets

Sub-Service	Quantity	Replacement Cost ($ millions)	Average Age*	Average Condition*
Transportation Services				
Roadway System	572 km of roads 63 municipal structures 132 traffic signal components	$1,404.0	26	**Good (B Grade)**
Active Transportation	679 km of sidewalks 9 km of multi-use paths 152 km of bicycle lanes	$188.7	23	**Good (B Grade)**
Environmental Services				
Water Distribution	638 km of watermains	$1,413.0	26	**Very Good (A Grade)**
Wastewater Collection	586 km of sewers 6 pump stations	$2,059.7	29	**Very Good (A Grade)**
Stormwater Management	586 km of sewers 90 Stormwater Mgmt. Facilities 97 Storm culverts 63 Low Impact Development	$2,009.3	24	**Very Good (A Grade)**
Recreation & Culture Services				
Recreation Facilities	11 community centres 5 arenas	$159.4	23	**Good (B Grade)**
	TOTAL	$7,234.1	26	**Very Good (A Grade)**

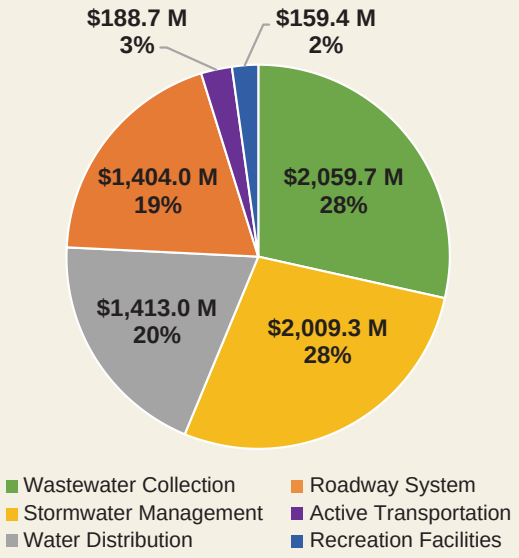
*weighted by replacement cost

2.2 Asset Valuation

The method for determining the replacement costs for the City's assets varies based on the asset class. For linear assets like roads and pipes, the replacement cost will be dependent on asset size (length, diameter, etc.), type, as well as material. The length of a linear asset segment is multiplied by a unit cost associated with its replacement; these unit costs are estimated based on recent construction contract pricing. The costs for other assets, like facilities, can be derived from appraisals of asset value.

Figure 12 provides a summary of the City's Core+ assets based on their asset valuation.

Figure 12: Asset Valuation for Core+ Assets by Sub-Service



2.3 Asset Condition

Determining the condition of assets is critical for asset management planning, enabling a detailed analysis of the appropriate type and timing of asset management strategies and when eventual replacement of an asset will achieve the lowest lifecycle cost.

The City uses condition assessment methods that involve directly measuring the condition of the asset against a technical standard where appropriate. While direct measurement of asset condition is necessary for implementing asset management strategies, the use of asset age enables comparison between assets where detailed condition information may not be available. As such, the evaluation of condition is supplemented with age-based condition where necessary.

In order to provide a baseline of asset performance, a numerical representation of performance must be developed. For the purposes of this AMP, this performance modelling is limited to the physical condition of assets. In the future, it may be possible to model other types of asset performance, including asset capacity or functionality.

A typical best practice in asset management is to group the condition of assets into five (5) categories: Very Good, Good, Fair, Poor, and Very Poor. A Letter Grade (from A to F) that represents each of the five condition categories has also been applied. For condition-based performance modelling, each of these categories represents a different condition state of an asset over its life. These performance-based condition categories provide a common understanding of condition states so that condition performance can be compared, analysed and reported consistently across asset classes.

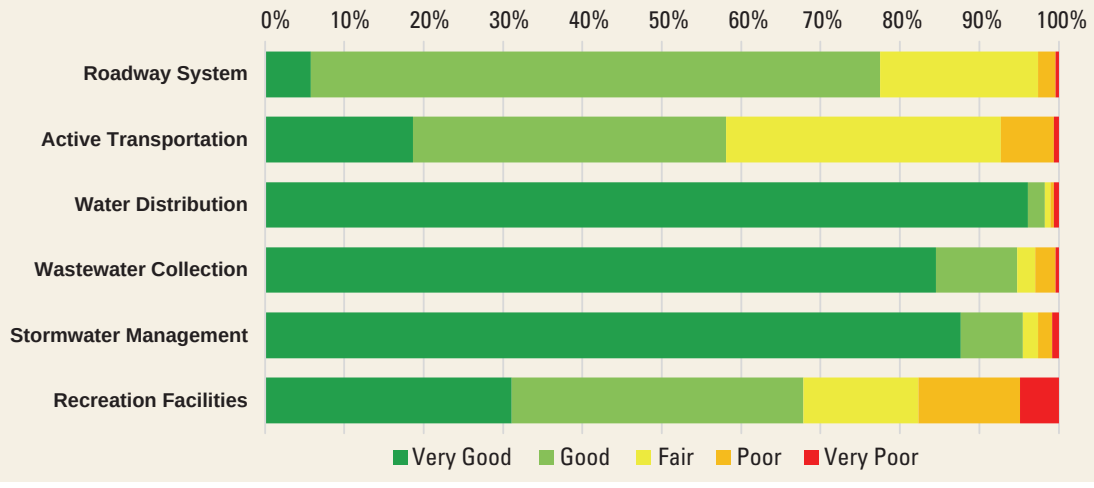
The information that represents asset condition for each individual asset is based on its unique characteristics and can vary among asset classes. For example, watermain condition is represented by number of breaks, and the condition of a road segment is represented by a Pavement Quality Index (PQI) rating, which is a score that ranges from 0 to 100. A condition rating system (Table 4) was created to align the individual asset condition assessment rankings to an overall common scale.

Table 4: Asset Condition Rating System		
Performance Category	**Letter Grade**	**Asset Condition Characteristics**
Very Good	**A**	"Fit for the Future": New or recently rehabilitated. Very low risk of failure. Low capital maintenance needs. Scheduled maintenance reduces the probability of premature failure.
Good	**B**	"Adequate for Now": Some signs of deterioration. Low risk of failure. Some unplanned maintenance is required.
Fair	**C**	"Requires Attention": Additional signs of deterioration. LOS may be affected. Some failures occur. Rehabilitation is possible.
Poor	**D**	"At Risk": Failures will increasingly occur. Reduced ability to provide the service. Maintenance costs will likely increase. Rehabilitation may become impossible.
Very Poor	**F**	"At Risk": Assets have exceeded their service life and require careful monitoring and maintenance. Most assets in this category are considered to be part of the "Infrastructure Backlog".

Overall, infrastructure in Richmond Hill is considered to be in Very Good condition (Letter Grade A) based on the condition rating system in Table 4. As shown in Figure 11, more than 90% of the City's Core+ assets by value are considered to be in Good (Letter Grade B) or Very Good condition (Letter Grade A). A further 6% are considered to be in Fair condition (Letter Grade C), and the remaining 3% are in Poor (Letter Grade D) or Very Poor condition (Letter Grade F) and require careful monitoring and maintenance.

Looking further into the individual asset Sub-Services (Figure 13), the Water, Wastewater, and Stormwater networks each have more than 90% of assets considered to be in Very Good or Good condition. For Roadway System, Active Transportation, and Recreation Facilities assets, between 50% and 80% of assets are considered to be in Good or Very Good condition. Although the majority of City assets are relatively new and in good condition, expenditures are required for lifecycle strategies to address Poor and Very Poor assets, prevent other assets from reaching Poor condition, and maintain service levels. Asset condition also varies within each Sub-Service by asset type. A more detailed analysis of each of the Sub-Services is provided in the Appendices.

Figure 13: Condition Profile for Core+ Assets by Sub-Service



2.4 Asset Age

Richmond Hill's assets are newer, with most having been constructed during a period of substantial growth from the mid-1980s to the mid-2000s.

Figure 14: Asset Installation Year Profile (2020 Dollars)

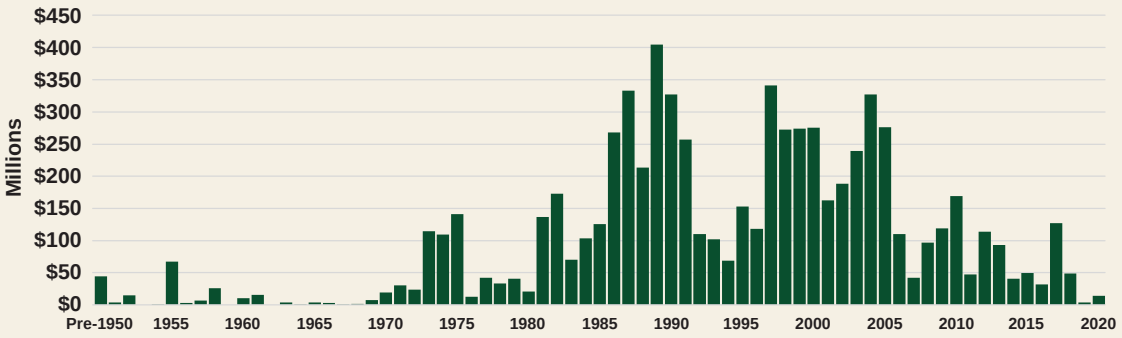
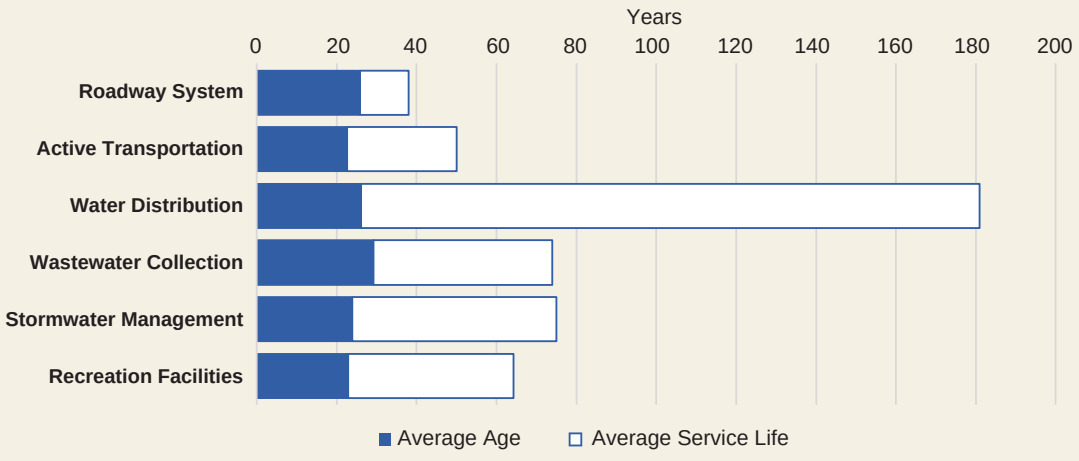


Figure 15 shows the average age of the City's Core+ assets by Sub-Service (weighted by replacement cost), compared with their average service life. As shown, the average asset age across all Sub-Services is generally between 20 and 30 years old; this is consistent with Figure 14 which shows that most assets were constructed during that time period. The underground linear infrastructure assets have the longest expected service lives (e.g. Water Distribution assets). Continued improvement in the City's inspection data and break history data will enable the City to refine service life expectations based on observed trends in asset deterioration. Asset types within each Sub-Service may have differing service lives and are averaged by replacement value for each Sub-Service in Figure 15. A more detailed analysis of each of the Sub-Services is provided in the Appendices.

Figure 15: Average Asset Age vs. Average Service Life for Core+ Assets by Sub-Service



3. Levels of Service

3. Levels of Service

In the State of the Infrastructure Section, the value and condition of Richmond Hill's infrastructure assets were presented. The Levels of Service (LOS) Section builds on this by defining levels of service and the minimum performance that assets should deliver during their estimated lifespan. For example, the estimated lifespan of the surface of a local street may be 20 years, but this estimated life is only meaningful if the driving surface remains in an acceptable condition over that timeframe. That acceptable condition, or performance, is an example of the Level of Service.

Levels of Service (LOS) are key business drivers which influence all AM decisions, and are used to inform the lifecycle strategies to deliver the expected service levels.

The LOS provide a Line of Sight by aligning higher-level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measures of managing that infrastructure (the Technical LOS). LOS inform the planned actions (which include lifecycle strategies) required to deliver the expected service levels. This link enables the City to gain an understanding of the costs associated with delivering its services to the community.

This Section provides an overview of the City's approach to developing and tracking LOS for Core+ assets. It answers the question, 'how are the City's assets performing?'

It is important to note that the LOS and performance reported in Section 3.2 are in compliance with the O. Reg. 588/17 reporting requirements for Core assets due by July 1, 2022.

3.1 Overview

The City's LOS strategy establishes a series of performance measures that represent the overall strategic objectives and goals of service delivery at the City. These performance measures are defined at a level that can be applied to assets, or groupings of assets. There are three types of LOS:

- **Strategic LOS:** statements or qualitative descriptions of service levels that describe the main vision or objective of service provision and align to the strategic goals and vision of the City.
- **Customer LOS:** service measures that are expressed in non-technical terms that describe the general public's understanding of services being provided by infrastructure systems. Note that customer performance measures are referred to as "community" performance measures in O. Reg. 588/17.
- **Technical LOS:** technical measures applied against assets and overall systems that define the performance requirements to support Customer LOS. Technical LOS are used to drive asset investment decisions.

The linkages between Strategic LOS and the City's other strategic initiatives are summarized in Table 5.

Table 5: Strategic LOS Alignment for Core+ Assets		
Strategic LOS	**Strategic Priorities Themes (2020-2022)**	**Climate Change Framework Goals**
Roadway System		
Provide a safe, efficient and connected roadway system for all users	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Land-use Planning • Asset Management • Community Risk Mitigation • Natural and Engineered Green Infrastructure
Active Transportation		
Provide connected, comfortable, and reliable options for active transportation that support the use of sustainable modes of travel	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Land-use Planning • Asset Management • Community Risk Mitigation • Natural and Engineered Green Infrastructure
Water Distribution		
Provide a safe and consistent supply of drinking water through proactive planning and preventative measures	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Asset Management • Community Risk Mitigation
Wastewater Collection		
Provide a reliable and efficient Wastewater Collection system that reduces environmental and health risks	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Asset Management • Community Risk Mitigation
Stormwater Management		
Plan for and build sustainable stormwater infrastructure that improves water quality and provides erosion and flood protection; reduces environmental, property and human risks; and complements the community	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Land-use Planning • Asset Management • Community Risk Mitigation • Natural and Engineered Green Infrastructure
Recreation Facilities		
Provide equitable access to affordable, high-quality recreation and culture programs in order to facilitate healthy lifestyles for individuals, enhance community vibrancy and promote well-being	• Balancing Growth and Green • Fiscal Responsibility • Strong Sense of Belonging	• Asset Management • Community Risk Mitigation

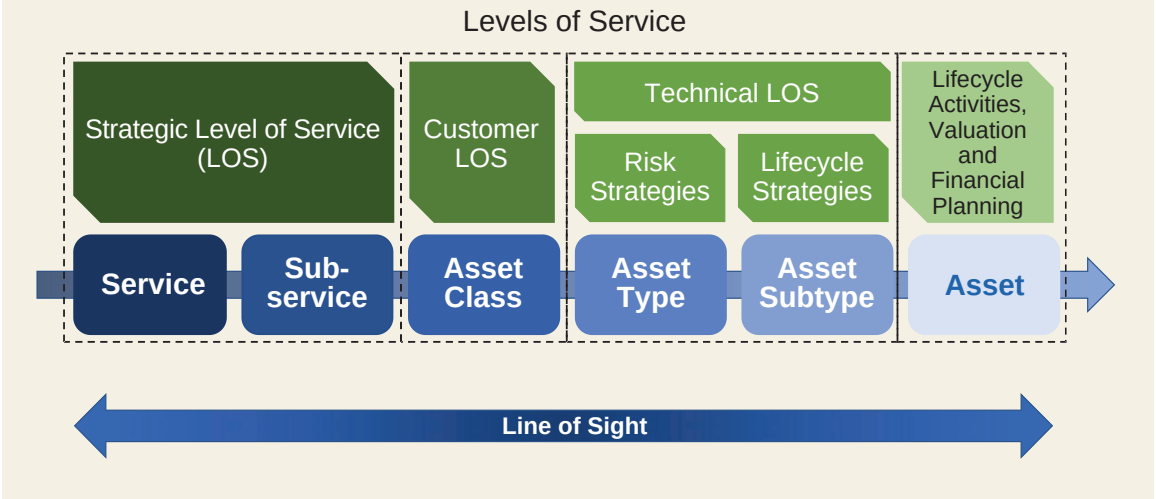
The establishment of a LOS Strategy provides a link between high-level strategic objectives and detailed asset-level service objectives, which should be in place to support informed, evidence-based decision making and support the sustainability of service provision in the longer term. LOS measures are quantifiable and measurable. As a result, they can be used to define asset failure, which is defined as the point at which each asset is no longer meeting its specified LOS target. By defining failure in this manner, this target (or threshold) can be used within lifecycle and risk strategies; this concept is described further in Section 4: Asset Management Strategy.

3.2 Levels of Service Framework and Performance

The City developed a LOS framework that describes the LOS that the City intends to deliver to its customers and other stakeholders. The LOS framework forms the basis for consistent application of decision-making methodologies and enables meaningful reporting. The integrated LOS framework establishes a Line of Sight between the organization's strategic objectives and vision, through to the day-to-day activities carried out by the City's staff to manage assets and deliver services. The Line of Sight allows staff that are responsible for service delivery to understand the purpose of their work, as it relates to service delivery and strategic corporate goals, and how their actions contribute to achieving success.

Figure 16 illustrates the different levels of the City's hierarchy and the service and asset-centric attributes and decision-making parameters which generally apply to each level.

Figure 16: LOS Framework



3.2.1 Current and Proposed Performance

O. Reg. 588/17 requires municipalities to report current LOS performance in the AMP for Core assets by July 1, 2022, and for non-Core assets by July 1, 2024. The regulation requires the City to report on certain mandated LOS for Core assets, as well as other LOS that the City has established for its assets.

The regulation also requires municipalities to report proposed LOS performance in the AMP for all assets by July 1, 2025, for each of the 10 years following the year in which current LOS is reported. As such, proposed LOS are not included in this AMP and will be further developed and determined over time.

O. Reg. 588/17 is the primary driver behind the structure and format of the City's LOS framework in this AMP. The tables include mandatory customer and technical performance measures from the regulation, as well as documentation on current performance.

Table 6: Structure and format of LOS Framework Tables

Heading	Description
Service Attribute	A phrase that describes an important area of focus for each service area. Examples of Service Attributes include Accessible, Quality, Safe, and Reliable.
Performance Measure	A specific area of focus that can be measured to support each Service Attribute. One or multiple performance measures can be listed for each Service Attribute.
Measure Type	**O. Reg. 588/17 ('O. Reg.')**: required in the regulation for core assets (water, wastewater, stormwater, roads, bridges, and culverts).
	Foundational ('Fnd.'): these are central to the City's decision-making process and generally can be measured using the City's available data.
Current Performance	A value that indicates the current performance for each performance measure for the most recent complete calendar year (2020); due to the timeline for capturing performance data, as well as impacts from the COVID-19 pandemic, 2018 or 2019 performance was reported for some measures.

The City also developed advanced measures to assist with future decision making. The City is evaluating the ability to track these measures or are currently implementing the processes to collect the necessary information for reporting in future AMPs. Further discussion on advanced measures is provided for each Sub-Service in the Appendices.

Table 7 and Table 8 summarize the City's performance on measures that are required in the regulation for core assets, as well as selected foundational measures for Active Transportation and Recreation Facilities. Full LOS tables for the Regulatory and Foundational measures for each subservice are provided in the Appendices. The reported performance is based on currently available information, and future AMPs will incorporate the City's continuous improvements in its reporting sources.

3.2.2 Customer Levels of Service

In setting customer performance measures, the focus is on measuring how the customer receives the service and ensuring that the City is providing customer value. These may be qualitative or quantitative measures. O. Reg. 588/17 refers to Customer LOS as "Community LOS", and outlines these LOS as qualitative descriptions. In this AMP, the Regulation's Community LOS for Core+ assets are used as Customer LOS and summarized in Table 7. For Active Transportation and Recreation Facilities which are not Core assets per the Regulation, a foundational Customer LOS is included in the table. The detailed Customer LOS descriptions and performance are provided in the Appendices for each Sub-Service.

Table 7: Customer LOS for Core+ Assets

Sub-Service	Service Attribute	Customer LOS
Roadway System	Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.
		Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).
	Quality	Description or images that illustrate the different levels of road class pavement condition.
		Description or images of the condition of bridges/culverts and how this would affect use of the bridges/culverts.
Active Transportation	Accessible	**Number of kilometres of trails, sidewalks, and cycling routes.
Water Distribution	Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system.
		Description, which may include maps, of the user groups or areas of the municipality that have fire flow.
	Quality/ Reliable/ Safe	Description of boil water advisories and service interruptions.
Wastewater Collection*	Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system.
	Reliable	Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes.
		Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid sewage overflow into streets or backup into homes.
Stormwater Management	Scope	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system.
Recreation Facilities	Accessible	**Percentage of customers who are satisfied/highly satisfied with programs

*O.Reg. measures related to combined sewers and sewage treatment plants are not applicable to the City. **Foundational Measure developed by the City.

3.2.3 Technical Levels of Service

Technical LOS translate customer expectations and legislative requirements into technical objectives, performance measures, and targets. They define what the City must do to deliver services that meet the Customer LOS. Similar to Customer LOS, O. Reg. 588/17 outlines specific Technical LOS for Core assets, summarized in Table 8.

For the Roadway System, condition measures are used to report asset health for roads and municipal structures. These condition-related measures drive investment decisions related to asset maintenance, rehabilitation, and replacement to improve condition where necessary. To align with these condition measures for Core assets per the Regulation, for Active Transportation and Recreation Facilities, the City's condition-related foundational measures are included in Table 8.

For Water Distribution and Wastewater Collection, measures are focused on the quality and reliability of the networks, and therefore performance is reported on watermain breaks, boil water advisories, wastewater backups and effluent violations. The Technical LOS for Stormwater Management assets focuses on the resiliency of the network to extreme storm events, and this drives asset lifecycle decisions such as upgrading sewer sizes for deficient areas of the system. A more detailed discussion on regulatory and foundational LOS is provided in Appendices A to F for each Sub-Service.

Table 8: Technical LOS for Core+ Assets

Sub-Service	Service Attribute	Technical LOS	2020 Performance
Roadway System	Scope	Number of lane-kilometres of arterial roads as a proportion of square kilometres of land area of the municipality.	0.25
		Number of lane-kilometres of collector roads as a proportion of square kilometres of land area of the municipality.	2.97
		Number of lane-kilometres of local roads as a proportion of square kilometres of land area of the municipality.	8.88
		Percentage of bridges in the municipality with loading or dimensional restrictions.	1.6%
	Quality	Average pavement condition index value for paved roads.	76.4
		Average surface condition (e.g. Excellent, Good, Fair, or Poor) for unpaved roads.	Fair
		For bridges in the municipality, the average bridge condition index value.	73.0
		For structural culverts in the municipality, the average bridge condition index value.	74.5
Active Transportation	Reliable	**Percentage of assets in Fair or better condition.	92.7%
Water Distribution	Scope	Percentage of properties connected to the municipal water system.	93.0%
		Percentage of properties where fire flow is available.	93.0%
	Quality/ Reliable/ Safe	Number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.	0
	Reliable	Number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.	0.00038*
Wastewater Collection	Scope	Percentage of properties connected to the municipal wastewater system.	93.0%
	Reliable	The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system.	0.0011
		The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.	0.00122

Continued...

Table 8: Technical LOS for Core+ Assets			
Sub-Service	**Service Attribute**	**Technical LOS**	**2020 Performance**
Stormwater Management	Scope	Percentage of properties in municipality resilient to a 100-year storm.	99.6%
		Percentage of the municipal stormwater management system resilient to a 5-year storm.	79.0%
Recreation Facilities	Reliable	**Average Facility Condition Index (FCI)	7%

*2019 performance reported. **Foundational Measure developed by the City.

3.3 External Trends and Issues

The City's ability to achieve its intended service levels can be impacted by external trends and issues. As these changes occur, updates to the AMP will consider their impacts on LOS, which may also affect lifecycle strategies and asset investment costs.

- **Demographic and Social Factors:** Population and employment changes (i.e. due to growth) can impact the intensity and frequency of infrastructure use, resulting in assets that could deteriorate more quickly or reach capacity sooner than expected. Shifts in customer expectations for City services as a result of changing demographics can further impact patterns of infrastructure use. These could require additional and more frequent asset management strategy-based investments.

  Increases in environmentally conscious behavior and attitudes among residents and businesses (e.g. LEED-certified buildings, reductions in vehicle use, water and energy conservation) can lead to infrastructure that lasts longer and is more efficient.

- **Technological Factors:** Changes in technology or asset construction, operation, or maintenance methods may lead to the replacement of obsolete equipment, provide longer or shorter asset life, and/or achieve higher quality and greater efficiencies.
- **Economic Factors:** Changes to the cost of input variables (e.g. cost of power, fuel, materials) can impact the costs to deliver services.
- **Regulatory Factors:** As a lower-tier municipality, the City is subject to the various policies, programs, and legislative decisions issued by other levels of government (i.e. federal, provincial, and regional). Legislative changes or downloading of services to the municipal level can impact the City's strategic direction. Legislative decisions may also impact the availability of external funding (e.g. federal and provincial infrastructure programs), which can in turn affect the infrastructure improvement activities that can be undertaken.
- **Environmental Factors:** Climate change is arguably the most pressing external factor facing municipal asset management planning today. Municipalities like Richmond Hill are already experiencing the impacts of climate change, which in most cases leads to infrastructure failing prematurely and requiring repair or replacement much earlier than the estimated life of the asset; this is discussed further in Section 4.4.

The ongoing COVID-19 pandemic plays a role in many of the factors described in this section, and the City will need to consider the possible impacts on its service levels and asset management strategies as the longer term impacts of the pandemic are better understood.

4. Asset Management Strategy

4. Asset Management Strategy

Asset management strategies are the planned lifecycle-based actions that Richmond Hill uses to manage its infrastructure to meet its defined LOS. These strategies include actions such as crack sealing and asphalt patching in roads, filter changes and annual maintenance of building heating and cooling systems, and regular inspections of stormwater management ponds. When combined together there are thousands of different scheduled inspections, maintenance actions, and repair responses that occur every year to ensure that Richmond Hill's infrastructure performs reliably. These actions help to maintain infrastructure so they do not fail prematurely and continue to perform well throughout their estimated life.

All infrastructure assets go through a series of stages called a lifecycle. Asset management strategies need to consider each stage of the asset lifecycle when determining how to best manage that asset. In particular, sound asset management strategies consider the overall cumulative lifecycle options and costs when determining what actions to take to manage that asset. For example, it is not financially responsible to purchase an inexpensive asset if the extra operation and maintenance requirements of that asset, or its shortened life expectancy, will cost more than purchasing a more durable or reliable asset over its entire life. It is also not effective to continue to maintain and repair an asset when it would be less costly to replace the asset. Determining the optimum set of management strategies requires the analysis of a number of options and the risks associated with each one. This is particularly relevant when it comes to making a decision to replace an asset.

This Section provides an overview of the City's asset management strategies for Core+ assets, and identifies what actions to take and when.

4.1 Overview

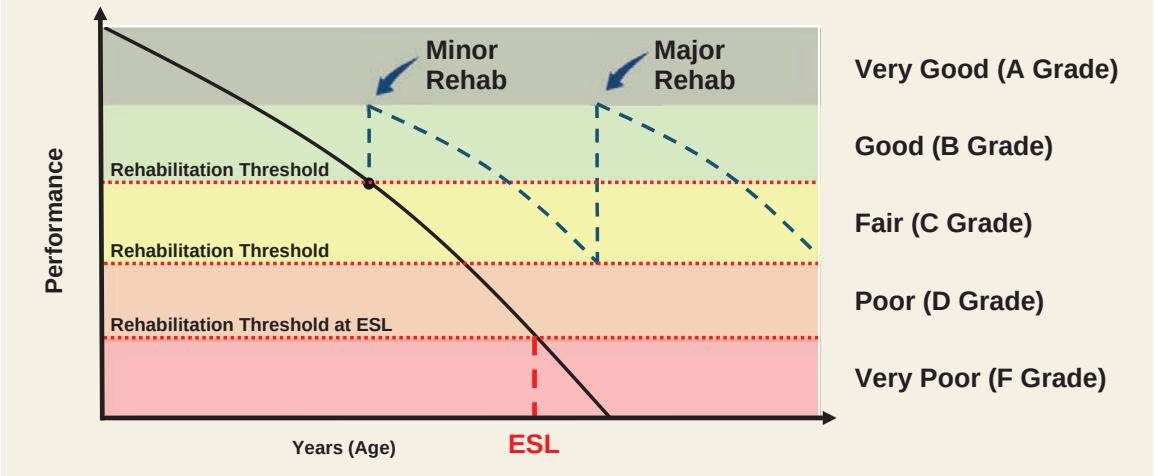
The City's Lifecycle Strategy describes the set planned actions that the City undertakes that will sustain LOS, while managing risk at the lowest possible lifecycle cost, in alignment with the City's LOS and Risk Management strategies. This enables the City to establish and report on possible options for which lifecycle activities could potentially be undertaken to maintain the current service levels and balance the associated risks and costs.

The City has developed lifecycle models to describe the behavior and deterioration of assets over time, in order to provide the City with the ability to forecast required asset lifecycle activities and their impacts on LOS, risk, and funding levels.

The term threshold (or 'trigger') is used to describe a point in a lifecycle model when a particular action or treatment is applied. These treatments, also referred to as 'interventions', typically represent common lifecycle management activities that would be applied to an asset over its life. The term "intervention threshold" is also commonly used to refer to the time when a particular treatment is applied.

When an asset degrades along a deterioration curve and an intervention threshold is reached, the asset will require treatment (i.e. repair or rehabilitation). After the treatment is applied, the performance (condition) of that asset will increase to a higher value, after which point it will continue to degrade. Interventions are applied to extend the overall estimated service life (ESL) of the asset, as shown in Figure 17.

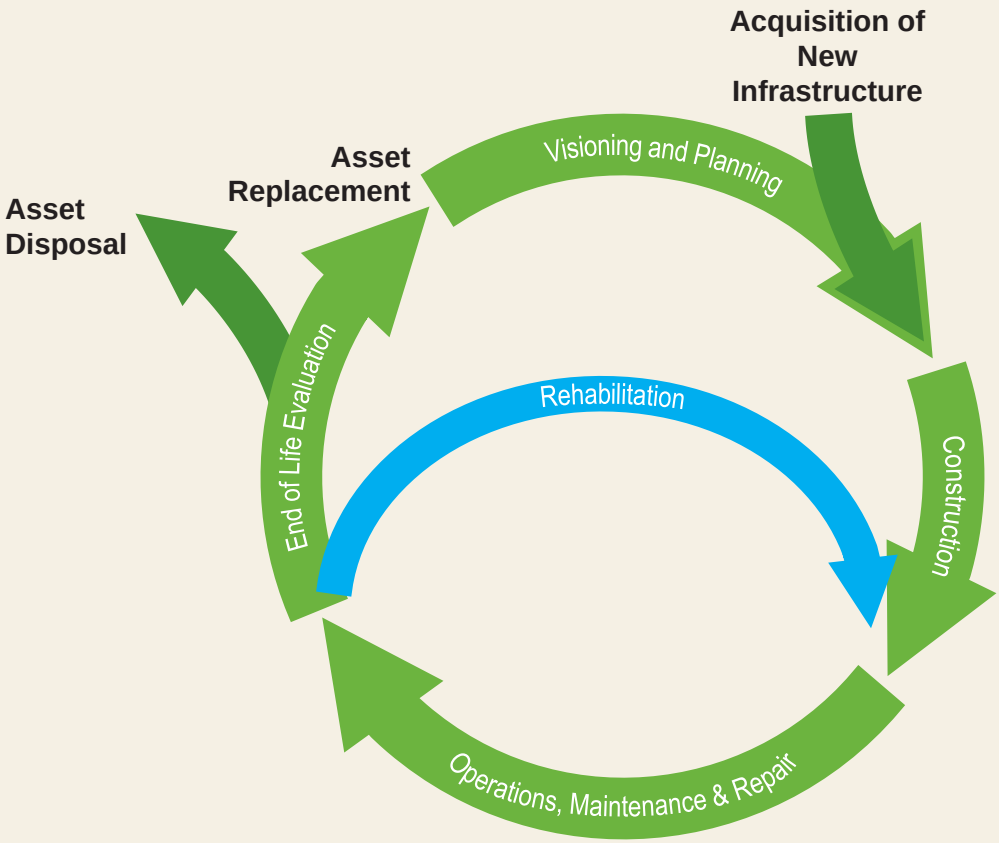
Figure 17: Intervention Thresholds and Treatments



4.2 Lifecycle Strategies

The following subsections provide details on the general types of lifecycle strategies that are applied to assets to maintain LOS while lowering total lifecycle cost. These strategies are applied over the lifecycle of the asset, from initial design and construction to replacement. The typical asset lifecycle stages are shown in Figure 18. The Appendices include specific lifecycle strategies applicable to each asset type and service category.

Figure 18: Asset Lifecycle Stages



4.2.1 Non-Infrastructure Solutions

Non-infrastructure solutions are actions or policies that can lower costs or extend asset life. Non-infrastructure solutions can include better integrated infrastructure planning and land use planning, demand management reduction programs (like water and energy conservation), public education, and process optimization. For example, educating residents on the Sewer Use By-law and discouraging the disposal of fats, oils, and grease (FOGs) down the drain can prevent backups and extend the life of the City's sanitary sewer infrastructure.

A non-infrastructure solution that the City has incorporated into its asset management strategies is the use of the Procurement By-law, Policies, and Procedures. The City acquires assets directly through the by-law to meet City standards and specifications, including the opportunity to evaluate vendors on financially sustainable and environmentally responsible options. The majority of Richmond Hill's procurement activities are undertaken competitively to ensure that costs are balanced with meeting City specifications and standards. The consideration and application of total lifecycle cost as a criteria in the procurement process will be strengthened as part of future improvement.

During **procurement**, a key question to be considered is whether a different type of asset can result in lower costs or achieve service levels more efficiently.

4.2.2 Operations and Maintenance Activities

A critical asset management strategy is the inspection, assessment, and preventative maintenance of assets to identify existing and potential problems before a failure occurs or before more significant maintenance would be required.

In Richmond Hill, these activities include a range of routine planned actions such as street sweeping, catchbasin cleaning, quarterly and annual equipment servicing, aeration and fertilization of playing fields, flushing of sewers and watermains, and winterization of fire hydrants. Key questions to be considered during the operations and maintenance stage are whether the asset can be operated in a way that reduces day-to-day costs or whether additional inspection, assessment and maintenance could reduce costs due to unexpected failures and minimize service interruptions.

4.2.3 Rehabilitation Activities

Some infrastructure assets can be restored to near-new condition and have their estimated life extended through planned rehabilitation actions. This may be more cost effective than allowing assets to reach their end of life. A condition assessment study often provides the detailed information needed to determine the scope of the rehabilitation. Examples of rehabilitation of Richmond Hill's assets are sewer re-lining where a smaller diameter pipe is inserted into the existing sewer, and the asphalt overlay program where several kilometres of roads are milled and resurfaced each year.

Rehabilitation options consider:

- Is it more economical to repair or replace the asset given the expected frequency of future repairs?
- Will rehabilitation restore performance to acceptable service levels?
- Have interconnected components degraded to a point where full replacement is more cost effective?

4.2.4 Replacement Activities

There comes a time in the lifecycle of most infrastructure assets when the most cost-effective strategy is to replace the asset. This may be when it no longer makes sense to repair or rehabilitate the asset, such as when a road is in poor condition and its underlying water and sewer systems are experiencing frequent failures. In such examples, the City considers coordinating multiple asset replacements through project bundling to reduce total costs where possible. Replacement may also be due to the asset no longer meeting other service levels such as older windows at a recreation facility that do not meet energy efficiency objectives. A key consideration at the replacement stage is to evaluate whether the original design and the LOS associated with the asset need to be updated. There is an opportunity in reviewing and improving the asset acquisition standards and policies to reduce total lifecycle costs and more effectively meet service levels.

4.2.5 Disposal Activities

Some assets result in a substantial cost at their end of life which may include demolition costs and land restoration. Disposal and decommissioning costs should be included in the total lifecycle costs and asset management practices for municipal assets. A key question at this stage is how the financial, environmental and social costs can be minimized during the disposal of an asset.

4.2.6 Growth and Service Improvement Activities

Growth and service improvement activities are planned activities required to extend services to areas not previously serviced or expand services to meet growth demands. Richmond Hill has a comprehensive and collaborative process to plan its future growth. Documents which guide the City's growth such as the Council's Strategic Priorities 2020-2022, Official Plan, Development Charges Background Study and service-specific Master Plans are developed through the lens of options analysis and risk mitigation to best serve the residents of Richmond Hill currently and into the future. The expansion of services to new areas or expansion of existing services to meet future demands is coordinated through the Capital Forecast. The forecast strives to balance funding allocations amongst the growth needs of all of the strategic plans, and between growth projects and rehabilitation and replacement of existing assets.

4.3 Risk Management Strategy

The City's Risk Management Strategy develops the framework for quantifying the criticality and risk exposure of the City's assets to support a system for the prioritization of projects across asset classes. The Strategy defines quantitative descriptions and definitions to enable the assessment of the likelihood and consequence of an asset failure. Asset failure refers to a scenario where the condition, capacity, or function of an asset has degraded to a point where the asset is no longer able to provide service as intended to meet a target LOS.

The Risk Management Strategy is applied to individual assets and will be used to provide information that informs the prioritization of completing a capital intervention (such as replacing, rehabilitating, or constructing new assets) within the City. The Risk Management Strategy can provide information to guide decisions at both the asset level (i.e. within service areas), and at a program level (i.e. across service areas).

The ability to quantify and standardize asset risk across asset classes enables the City to more confidently evaluate its program by answering questions such as:

- What are the consequences (or additional risks) of deferring a required intervention on an asset?
- How can two (or more) capital interventions be objectively evaluated against one another?
- For different scenarios, how can the most risk be mitigated considering funding constraints?
- Across proximal asset classes (e.g. roads, watermains, sewers), what asset interventions can be aligned to provide cost and implementation efficiencies?

By answering these questions, the City will be able to more effectively balance LOS, risks, and costs and make evidence-based and informed asset investment lifecycle decisions.

4.3.1 Failure Events

In the City's current risk framework, two failure events were considered to evaluate risk: a condition failure event, and a capacity (non-condition) failure event.

The condition failure event considers a physical failure of the asset due to condition. This failure is aligned with the City's Lifecycle Strategy, as well as its condition-based LOS. For example, in the case of watermains, watermain failure due to breaks is the condition-based failure event, and interventions are applied when the watermain reaches a certain threshold, or number of breaks.

The capacity failure event considers a situation where growth or other external factors have caused the asset to no longer meet capacity requirements. An example of a capacity failure event for sanitary sewers is an under-capacity sewer, resulting in overflows, flooding, and/or backups.

4.3.2 Likelihood and Consequence of Failure

Asset risk is the product of the likelihood of failure and the consequence of failure. In other words, what are the chances that an asset will fail, and what harm or damage might arise from the asset failing?

Asset likelihood of failure (LoF) is determined by expressing the probability that an asset will fail under each of the given failure events. For condition failures, the likelihood that an asset has a condition failure is ideally estimated using observed asset condition data, gathered through surveys and/or inspections. If condition information is not available, age is used as a proxy for condition. For capacity failure, the likelihood of failure is ideally estimated using results from capacity analysis. If model data is not available, known growth areas can be used to identify assets which may be subject to capacity pressures.

Consequence of Failure (CoF) provides an understanding of asset criticality and the impact of asset failure. The CoF analysis was developed using the concept of a "triple bottom line" framework, which is commonly used in asset risk management evaluations. The triple bottom line framework refers to the evaluation of the three following aspects of risk:

- Direct Financial: the direct costs that the City would incur in the event of failure;
- Social: the direct and indirect impacts to the community; and,
- Environmental: impacts to the local natural environment or the City's environmental objectives.

Within each category, sub-categories that represent areas of focus for the consequence analysis are identified (see Table 9).

Table 9: Consequence Framework Categories and Sub-categories

Direct Financial	Social	Environmental
1. Capital Expenditure (Replacement of assets) 2. Revenue loss due to service closure or other direct cost not related to asset repair (Operating)	1. Health and Safety 2. Legal Liability 3. City Reputation 4. Service Disruption 5. Customer Impact	1. Environmental Compliance 2. Environmental Impact

Key asset attribute data and information is used to evaluate risk for each of the sub-categories. The risk framework is built into the EAM, and the risk rating for each asset enables the prioritization of interventions in the constrained budget scenarios discussed in Section 5.2.1

4.4 Climate Change Considerations

In 2018 the City conducted a climate change risk scan in order to better understand the impacts of climate change on municipal operations. The exercise determined that the climate change conditions which had the greatest frequency and severity of risk for the City were more intense rainfalls, more heat waves, and more ice-storms and freeze-thaw cycles.

Within the context of asset management planning, these climate change risk sources can have sizeable implications for the City's infrastructure. An increase in extreme weather events will likely accelerate the deterioration of certain assets, necessitating more time and resources to be invested in maintaining, repairing, and replacing them. For example, more frequent heat waves could mean a decrease in the service life of road services, which in turn increases maintenance frequency; more freeze-thaw cycles could lead to more watermain breaks; and more intense rainfalls could lead to failures in stormwater management facility capacity. Consequently, climate impacts will increase the likelihood of asset failure, thereby increasing the City's total risk exposure (e.g. the flooding caused by the failure of a stormwater management facility could pose a risk to public safety). With these implications in mind, it becomes increasingly clear that adapting the City's asset management planning approach to consider the effects of climate change is a best practice, and a critical step towards maintaining the continued wellbeing of the community infrastructure.

Top Climate Change Risks Identified for the City:

Climate Change Risk Sources

- More intense rainfalls
- More heat waves
- More ice storms / freeze-thaw cycles
- High wind speeds

Climate Change Impacts/Considerations

- Flooding
- Heat stress
- Dangerous road conditions, tree and power line damage
- Potholes, damage to pipes
- Power outages, roof damage, tree damage

Consequences to municipality

- Increased financial costs
- Business continuity
- Staffing constraints
- Health and safety risk to public and staff
- Infrastructure damage

(from 2020 Climate Change Risk Framework)

As a starting point, the City has committed, through its AM Policy, to consider the impacts of climate change when reporting asset management needs. More specifically, the Risk Management process that informs infrastructure investment decision making should ensure infrastructure is designed to be resilient to the effects of climate change, by:

- Identifying the vulnerabilities of the City's assets caused by climate change,
- Considering the costs and means to address those vulnerabilities,
- Considering adaptation opportunities that may be undertaken to manage the vulnerabilities,
- Considering mitigation approaches to limit the magnitude or rate of long-term climate change (such as greenhouse gas emission reduction objectives), and
- Considering disaster planning and contingency funding.

In 2020, the City developed a Climate Change Framework outlining Richmond Hill's corporate approach to addressing climate change. One of the six climate goals outlined in the framework is to apply a 'climate change lens' to asset management. For example, new technologies and designs to most effectively meet climate change objectives should be considered at each applicable stage of an asset's lifecycle.

The City's Climate Change Framework aims to focus Richmond Hill's climate change mandate and ensure a coordinated approach to taking climate action.

Specific actions related to integrating climate change considerations into the City's asset management planning approach are summarized in Section 6: Monitoring and Improvement. This integrated approach recognizes the critical balance between economic development and environmental protection, and supports Council's Strategic Priority of Balancing Growth and Green.

The following list highlights a few existing and ongoing actions aimed to mitigate the effects of climate change:

Existing Actions

- The annual Capital Budget is determined using a risk-based approach to ensure key priorities are met, and considers climate change impacts on asset lifecycle as well as on the environment.
- The City has an Environmental Policy which articulates Richmond Hill's vision for achieving an environmentally sustainable community. As outlined in the Policy, a key element of this vision involves mitigating the impacts of climate change by transitioning Richmond Hill to a low-carbon, resilient future.
- The City is registered to the ISO 14001:2015 Standard for Environmental Management Systems, which is an internationally recognized set of processes and practices aimed at reducing environmental impacts and improving environmental performance. The standard includes a clause requiring organizations to consider the lifecycle impacts of the activities, products, and services they provide. Proper asset management can reduce these impacts.

- The LEED Silver or Alternative New Construction Standard requires all new City buildings greater than 500 square feet to be built to a minimum LEED silver or equivalent alternative standard.
- The City's 2019-2023 Corporate Energy Plan proposes to implement a number of capital, operational and organizational energy conservation projects. One project example is converting the majority of City-owned streetlights to more energy efficient LED fixtures. Using LED lights reduces energy consumption, costs and associated GHG emissions. This initiative has now converted 11,828 of the 16,285 total City street lights, and as a project is substantially complete.

Ongoing Actions

- The Stormwater Network Model Project will consider climate change by modeling predicted changes in precipitation and analyzing the impacts on the City-wide stormwater network.
- The Water and Wastewater Modeling Project will map and model these systems across the City. One focus of the wastewater model is to minimize the impact of inflow and infiltration which will increase capacity and efficiency of the network.
- Installing new Supervisory Control and Data Acquisition (SCADA) systems in some of the City's sanitary pumping stations will help achieve greater efficiency of resources, lowering machine runtime and energy usage, while extending the life of these assets.
- The City is currently updating its Environment Strategy, *Greening the Hill: Our Community, Our Future*, which outlines policy direction and actions to reduce Richmond Hill's impacts on the environment and make improvements for a more resilient and sustainable community. The Strategy sets a course to enhance and restore Richmond Hill's green spaces, improve air and water quality, manage waste reduction and diversion, and helps lay the foundation for the City's climate change initiatives.

5. Investment and Financing Strategy

5. Investment and Financing Strategy

The Investment and Financing Strategy combines Richmond Hill's State of the Infrastructure, LOS, and Asset Management Strategy with financial planning and budgeting scenarios to assess the long-term management of the City's assets. Each Section of the AMP discussed thus far is essential to understanding the current and future state of the City's assets. The State of the Infrastructure summarizes the condition, replacement cost, and age of the City's assets. The LOS and Asset Management Strategy outline what the City needs to do to maintain its assets in a condition that meets the needs of the community. Finally, the Investment and Financing Strategy identifies asset investment needs and considers how the City will fund the asset management actions that it needs to take and the impacts of those decisions on the City's assets.

In Richmond Hill, financial strategies revolve around the annual budget processes and are aligned with the City's Strategic Priorities and other approved plans. Through Richmond Hill's budget process, funding sources are confirmed and forecasting is undertaken including the management of reserves. The budgets ultimately authorize spending and identify the funding sources for projects and programs.

This Section identifies asset investment needs and describes how the City could meet its capital investment needs for Core+ assets to maintain service delivery over the next 10 years, and how this approach aligns with broader efforts to ensure the City's long-term financial health and sustainability. A longer-term 25-year outlook is also provided.

Though O. Reg. 588/17 does not require municipalities to outline their financial strategies until 2025, the City has achieved compliance with certain elements of this requirement in advance to demonstrate its commitment to fiscal responsibility. Further information required by the regulation, such as funding strategies required for achieving proposed LOS, will be covered in the next iteration of the AMP.

5.1 Annual Budget Process

The City of Richmond Hill's budget is guided by the City's budget principles and involves the Operating Budget and the Capital Budget.

Richmond Hill's Operating Budget consists of expenses that cover day-to-day activities or operations, including items such as utilities, rent, insurance, staff wages and benefits, program supplies, transportation, and repairs.

Richmond Hill's Capital Budget and Capital Forecast is a comprehensive financial plan that addresses the financial requirements of growth and the renewal and replacement of existing infrastructure, including community centres, fire stations, pools, parks, trails, arenas, roads, and sidewalks, to name a few.

Richmond Hill's 2021 Operating and Capital Budgets reflect the City's focus on:

- Supporting Council priorities
- Maintaining important services for the community
- Minimizing the tax rate impact

The annual Operating Budget is subdivided into the 'rate supported budget' and 'tax supported budget'. The rate supported budget allocates funds for the operation, maintenance and repair lifecycle stages of water, wastewater and stormwater assets. Users of these assets or services are billed directly and the revenue collected can only be used to operate, maintain, and repair these assets. Tax supported assets include all other infrastructure assets such as roads, parks, buildings, fleet, and information technology and similar to rate supported assets, collected revenue is allocated for the operation, maintenance, and repair lifecycle stages of these assets.

The Capital Budget is divided into the annual Capital Budget and the Capital Forecast. The annual Capital Budget allocates funds each year for new growth assets, primarily funded from development charges, and for the rehabilitation and replacement lifecycle stages of existing infrastructure assets funded primarily from tax levy and user rates. The Capital Forecast is a long term comprehensive plan identifying priority projects for growth, rehabilitation, and replacement over the next ten years.

In 2020-2021, the City undertook a "Lean" review of its Capital Budgeting process. A key outcome of the review was the integration of the City's asset management planning function into the budget process. Moving forward, the outputs of the City's AMP will benefit the Capital Budget Process by enabling better definition of project priorities, producing infrastructure needs to inform fiscal sustainability analyses, and forecasting condition service levels for different funding scenarios.

5.2 Capital Forecast

This AMP provides a capital expenditure forecast for the rehabilitation and replacement (R&R) of Core+ assets. A more complete analysis will be provided in the next AMP when all assets are included.

Growth expenditures are discussed in Section 5.2.2. A funding gap analysis on growth is not provided, as these projects are predominantly funded by Development Charges and it is assumed they will be completed to accommodate actual growth as it occurs to meet required service levels. All forecasts in this AMP are reported in current year dollars (2020) and do not consider inflation.

5.2.1 Renewal (R&R) Investment Forecast

By implementing the LOS, Lifecycle, and Risk Strategies described in previous Sections, the City can determine its capital renewal needs for Core+ assets over the next 10 years.

The following sections outline the required R&R investments for existing assets forecasted under an unconstrained scenario and three constrained funding scenarios, as applicable to each Sub-Service. The objective of the scenario analysis is to determine the impact of unconstrained and constrained budgets on assets and determine a level of funding suitable to maintain current LOS. A 25-year planning horizon is considered in addition to the 10-year forecast to demonstrate a more complete picture of asset needs and better understand the longer-term lifecycle of assets and the financial strategies that may be required beyond 10 years. A detailed analysis of investment needs by Sub-Service is provided in the Appendices.

Table 10: Overview of Investment Forecast Scenarios	
Scenario	**Description**
Unconstrained	The Unconstrained Scenario forecasts how much the City would need to spend each year in order to complete all projects when they are required and clear the infrastructure backlog without any financial or practical constraints. The backlog consists of current year needs as well as overdue rehabilitations or replacements. This scenario is 'optimal' in the sense that it addresses interventions at their optimal timing. The Unconstrained Scenario typically improves condition service levels over time because the infrastructure backlog is cleared immediately while also meeting upcoming R&R needs. Given the significant funding needs under this scenario, it is usually required to evaluate lower funding levels and understand the associated impacts of deferring lifecycle activities.
Constrained Scenarios:	The constrained scenarios described in Section 5.2.1 apply budget constraints and show the impacts of decreased funding availability. All three constrained scenarios analyse a given constrained funding level and prioritize investment decisions to ensure that assets with the highest criticality are addressed on a timely basis. The analysis leverages the risk modelling outlined in Section 4.3 to prioritize lifecycle asset investment decisions which ultimately balances the City's LOS (condition-based) with lifecycle costs and budget constraints. Each scenario prioritizes work on the higher risk assets throughout each year of the forecast to minimize the overall risk to the City at that given funding level. The risk of deferring intermediate treatments is that if deferred too long, the asset may deteriorate to a state where the treatment is no longer possible, and a more expensive replacement is required sooner than previously scheduled, increasing the asset's overall lifecycle cost. Operating and maintenance costs also increase when assets are allowed to deteriorate past their optimal intervention points.
Scenario 1: Status Quo	This scenario applies budget constraints according to the status quo – the recently approved budgets with nominal increases in the future years. It does not consider reserve fund balances, utilization of debt, or the higher increases identified in the Financial Sustainability Strategy (refer to Scenario 2).
Scenario 2: Financial Sustainability Strategy	Scenario 2 is based on the Financial Sustainability Strategy and the associated Ten Year Capital Forecast. This scenario assumes that the increased contributions for the Tax-Supported Capital Program from the Financial Sustainability Strategy (1.5% annual Capital Asset Sustainability Levy increase), presented to Council in October 2020, are implemented, as well as assumptions for increased Water Quality Protection Reserve contributions based on a new stormwater rate structure by 2022. As in Scenario 1, this scenario does not include the consideration of reserve fund balances and utilization of debt that were presented as part of the Financial Sustainability Strategy as additional tools to fully fund the tax-supported program of the Ten Year Capital Forecast.
Scenario 3: Maintain Current LOS	The previous scenarios will show that for some Sub-Services, the City's ability to meet its condition LOS decreases over time. This third and final scenario uses the insights gained from the previous scenarios to identify a level of investment required to maintain or return to the current LOS (asset condition) over the next 10 and 25 years, assessed at the overall Service or Sub-Service level.

The R&R funding gap is assessed as the difference between the average annual expenditure for Scenario 3 (Maintain Current LOS) and Scenario 1 (Status Quo). Based on currently available data, a funding shortfall has been identified for Roadway System and Active Transportation and Stormwater Management assets. The funding shortfall assessments will be re-examined for the next AMP update when data improvements such as more complete sewer condition assessment (PACP) scores and non-Core+ asset needs are incorporated into the forecast analysis.

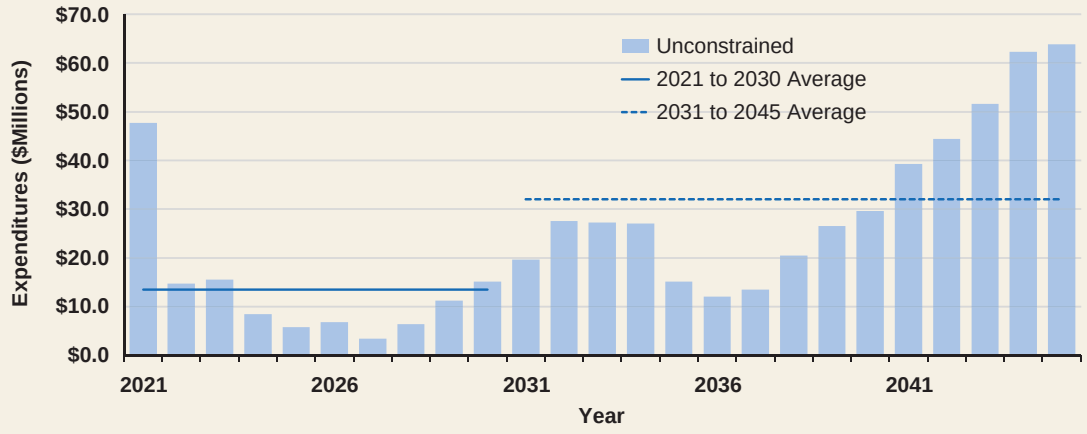
The R&R forecast analysis by Sub-Service is described in the following sections.

5.2.1.1 Roadway System and Active Transportation

R&R of Roadway System and Active Transportation assets are primarily funded through the tax levy, federal gas tax grant and occasionally local improvement charges and other grant reserves. As the main funding sources are the same for these two Sub-Services, the financial forecasting scenarios are combined into one analysis in this subsection. For further details on the Roadway System and Active Transportation scenario analysis, refer to Appendix A and B.

As seen in Figure 19, the unconstrained forecast indicates that the City would need $47.7 million in the first year to clear the infrastructure backlog, and an average expenditure per year of $13.5 million over the first 10 years. Beyond the 10-year unconstrained forecast in years 11 to 25, the needs more than double to $32.0 million annually. For road assets, detailed condition surveys are conducted every three years and therefore support a robust foundation for the forecast. For assets such as sidewalks, multi-use paths, and traffic signals, condition is based on age and is expected to be refined as actual condition data is incorporated in the future.

Figure 19: Unconstrained Scenario for Roadway System and Active Transportation*



*Does not include non-Core+: streetlights, traffic signs, active transportation outside ROW

*Does not include construction of sidewalks that are not true R&R (new sidewalks connecting existing segments)

The City does not have sufficient funding to meet the Unconstrained Scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS (refer to Table 11).

The Status Quo (Scenario 1) provides an available average funding level of $6.0 million per year over the next 10 years and $6.3 million annually through to 2045. This is based on a prorated amount (30% for R&R of Roadway and Active Transportation assets) of the tax-supported contributions associated with the City's annual 1% Capital Asset Sustainability levy increase to 2025. It also includes an additional annual amount of Gas Tax typically directed toward the annual resurfacing of road segment asphalt. The annual amount starts at $4.9 million in 2021 and increases to $6.3 million over the first five years and then remains at that amount for the remainder of the 25-year forecast.

Scenario 1 and 2 Common Principles:

- Debt and reserve fund balances are not considered
- Assumes 30% of the tax-supported contributions are allocated to roadway system and active transportation assets
- Assumes federal gas tax funding of $470,000 per year

Scenario 1 and 2 Difference:

- Scenario 1: contributions based on annual CAS levy increase of 1% to 2025
- Scenario 2: contributions based on annual CAS levy increase of 1.5% to 2030

In the Financial Sustainability Strategy (Scenario 2), the annual amount of funding for Roadway System and Active Transportation assets is based on the same 30% prorated amount (for R&R of Roadway and Active Transportation assets) of the tax-supported contributions associated with a higher annual 1.5% CAS levy increase to 2030. This Scenario includes the same annual amount of Gas Tax typically directed toward the annual resurfacing of road segment asphalt. Under this scenario, funding starts at $4.9 million in 2021 and increases to $9.9 million over the first ten years and then remains at that amount for the remainder of the 25-year forecast.

The Scenario 1 and 2 constrained budget analysis in this AMP focuses only on funding from federal gas tax and the tax-supported reserve contributions associated with the Financial Sustainability Strategy. As indicated in Table 10, they do not include the consideration of reserve fund balances and utilization of debt that were presented as additional tools in the Financial Sustainability Strategy.

Table 11: Scenario Analysis Summary for Roadway System and Active Transportation (Average Annual Expenditures, $ million/yr)

Scenario	Average Annual Expenditures ($M/yr) 2021 to 2030	2031 to 2045
Unconstrained: 2021 Backlog	$47.7 (2021)	-
Unconstrained	$13.5	$32.0
Scenario 1: Status Quo	$6.0* ($4.9 - $6.3)	$6.3
Scenario 2: Financial Sustainability Strategy	$7.3* ($4.9 - $9.9)	$9.9
Scenario 3: Maintain Current LOS	$18.5 ($5.0 - $32.0)	$56.0 ($35.0 - $77.0)

*tax-supported contributions and gas tax only; does not include drawdown of reserves or utilization of debt

An understanding of the funding levels required to maintain LOS is determined through an analysis of the impact of constrained Scenarios 1 and 2 on LOS, as demonstrated in Figure 20. With Status Quo funding, the Roadway System and Active Transportation asset portfolio deteriorates significantly over time, and LOS cannot be maintained. The value of Very Poor assets rises from $7.4 million in 2020 to $277.5 million by 2045.

At the increased funding level in Scenario 2 associated with the higher CAS levy, overall condition for the Roadway System and Active Transportation asset portfolio is slightly improved over the Status Quo, with the value of Very Poor assets reduced by $41 million by 2045 compared to the Status Quo. In the Ten Year Capital Forecast, there is no dedicated funding set aside for municipal structures. As municipal structures are critical assets, funding is prioritized for bridges and road culverts at the expense of lower critical assets such as sidewalks (refer to Appendices A and B for a more detailed discussion by asset type).

As indicated earlier in this subsection, in both Scenario 1 and 2 analysis, debt and the balance in reserves is not considered. Both cases show that the tax-supported contributions are not sufficient to maintain current LOS, and that debt or alternative sources may need to be considered to maintain reserves and service levels.

To maintain current LOS, Scenario 3 identifies expenditures that increase steadily over the next 10 years ($18.5 million annual average, starting at $5 million in 2020 and increasing by $3 million each year to $32 million in 2030). This ensures that structures are properly funded and maintains LOS in terms of the Very Poor assets remaining at a minimal percentage of the overall portfolio. In Scenario 3, the additional funding is mainly directed towards Poor condition roads that were not able to be funded under Scenario 2.

Beyond ten years, expenditure increases of $3 million per year are maintained and funding levels increase from $35 million in 2031 to $77 million in 2045; this consistent, but significant increase is due to the increasing R&R needs of the two Sub-Services over years 11 to 25, as well the impact of previously deferred treatments, such as those identified in the $47.7 million backlog. In the first ten years, deferrals of road treatments have a direct impact on increased lifecycle costs due to missed opportunities to complete mid-life treatments that extend asset life, and this results in increased costs over the longer term forecast.

Impacts of Deferrals:

The deferral of intermediate interventions due to a constrained budget can increase the overall lifecycle cost of an asset, resulting in higher investment needs and a larger funding gap over the long term.

At a $56 million annual average in years 11 to 25, Figure 20 for Scenario 3 shows a much improved condition over time compared to Scenarios 1 and 2, though there is still a slight increase in the value of Very Poor assets. A significant portion of these Very Poor assets are lower critical sidewalks. It is anticipated that the sidewalk needs currently being projected may decrease once the City's sidewalk inspection data is incorporated into the analysis, and therefore the forecast of year 11 to 25 needs will be better understood in the next AMP update.

Figure 20: Projected LOS for Roadway System and Active Transportation (Condition of Asset Portfolio over Forecast Period)

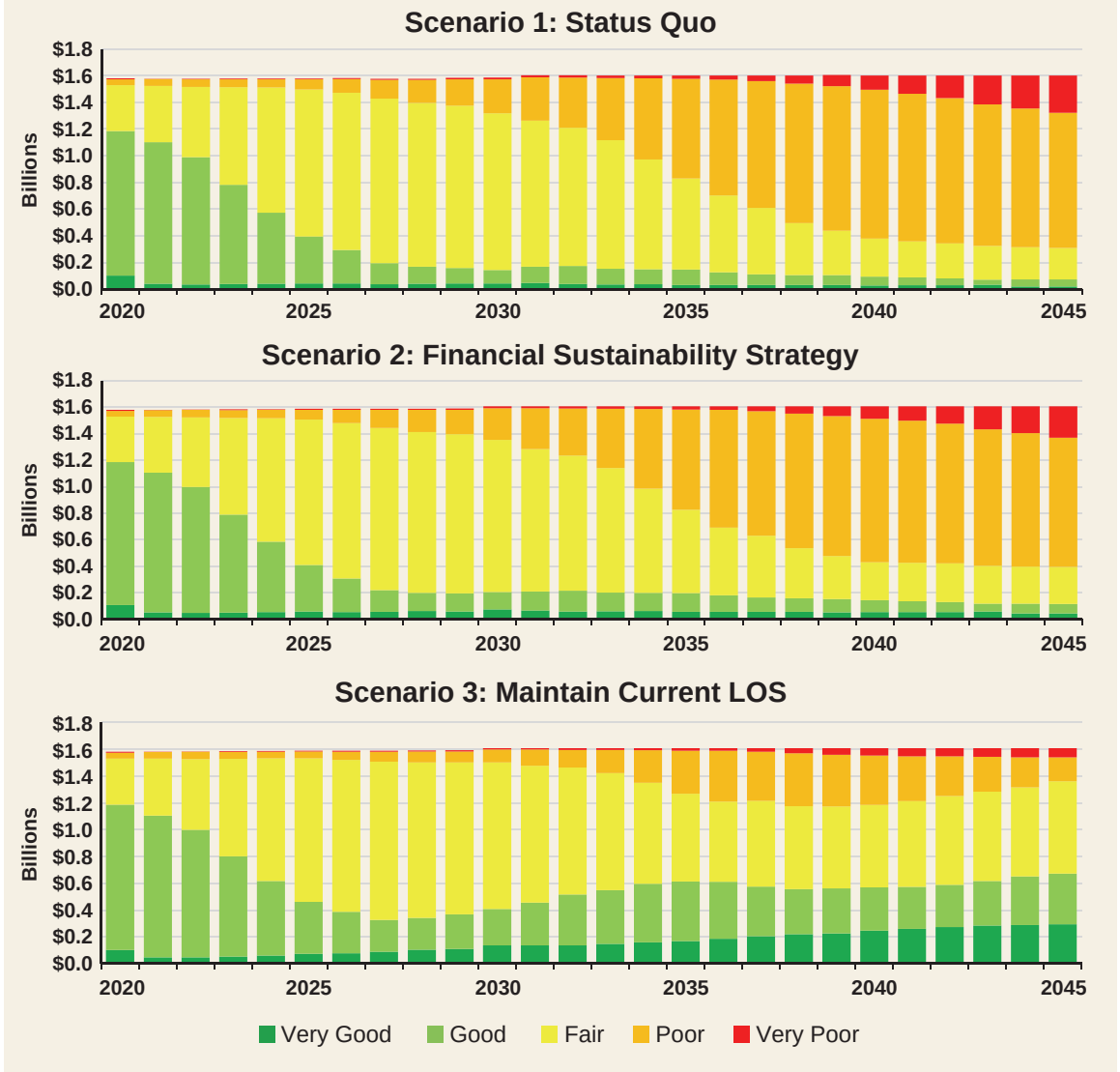
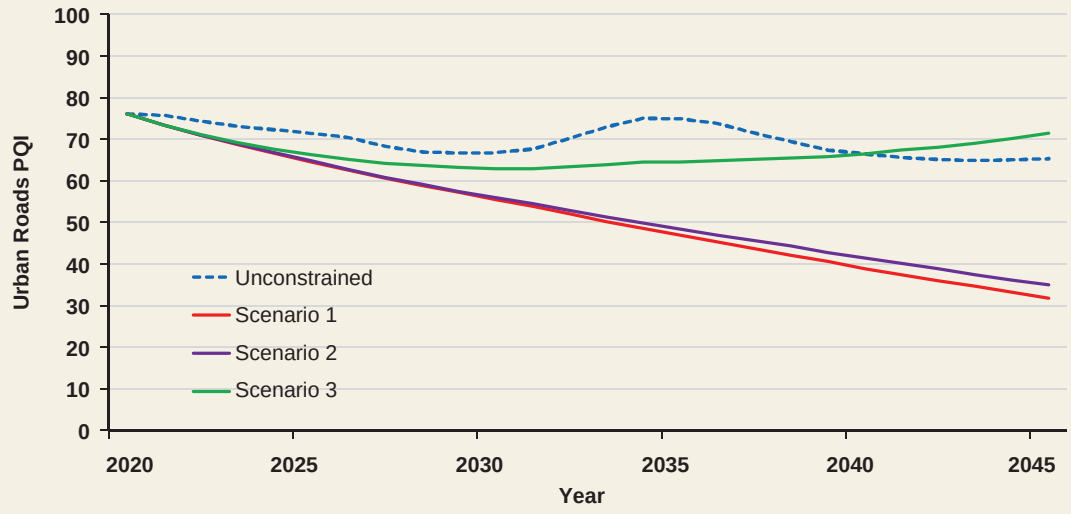


Figure 21 shows the average condition (PQI) of urban road assets, which make up 80% of the total value of the Roadway and Active Transportation assets. It demonstrates that in Scenario 3, the average condition is actually maintained close to the 2020 condition profile by year 2045.

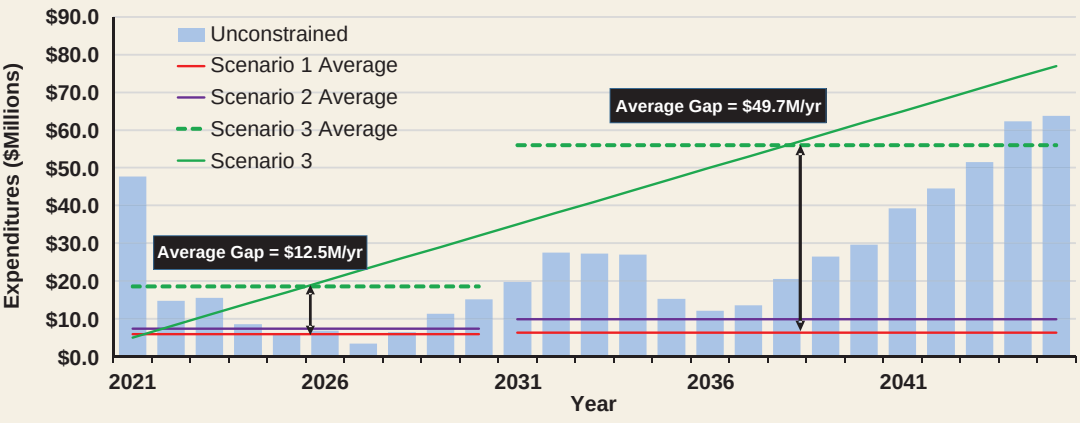
Figure 21: Urban Road PQI over the Forecast for All Scenarios



Under Scenario 3, the AMP identifies $18.5 million per year to maintain LOS, which results in an average funding gap of $12.5 million per year over the next ten years compared to the Status Quo (Scenario 1), assuming no drawdown of reserve fund balances and no utilization of debt to reduce the gap. The funding gap is estimated to be significantly higher in years 11 to 25, and emphasizes that the funding gap will only increase over the longer term.

A summary of the three funding scenarios for the Roadway System and Active Transportation assets is shown in Figure 22. As noted earlier in this section, the assumption in Scenario 1 is that 30% of the tax-supported contributions is directed to the R&R of Roadway System and Active Transportation assets. In the recently approved 2021 Capital Budget, the allocation to these assets was lower than 30%; if the allocation is lower than 30% in the future, the gap identified in Figure 22 would be higher.

Figure 22: Scenario Summary and Funding Gap for Roadway System and Active Transportation*



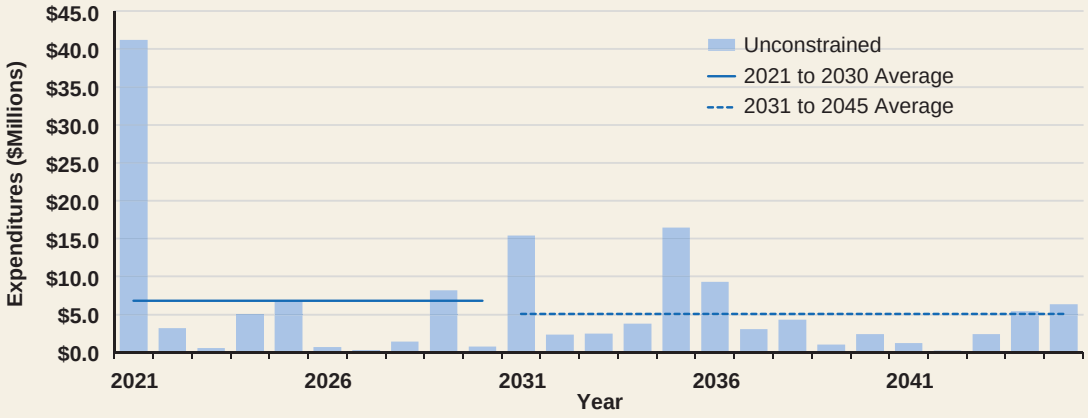
*Does not include non-Core+: streetlights, traffic signs, active transportation outside ROW
*Does not include construction of sidewalks that are not true R&R (new sidewalks connecting existing segments)

5.2.1.2 Water Distribution and Wastewater Collection

Rehabilitation and replacement of water and wastewater assets are both funded through the Water/Wastewater Reserve Funds, and therefore the financial forecasting scenarios for these two Sub-Services are combined into one analysis (refer to Table 11). For details of the analysis at the Sub-Service level, refer to Appendix C and D.

As seen in Figure 23, the unconstrained forecast indicates that the City would need $41.2 million in the first year to clear the infrastructure backlog, and an average expenditure per year of $6.8 million over the next 10 years. The average expenditure decreases slightly over the 2031 to 2045 period, but is expected to increase as more comprehensive data becomes available, such as condition data from CCTV inspections. Due to the long lifecycle of watermains and sewers, a considerable increase in R&R needs is anticipated beyond 2045 as these assets reach their end of life. Currently, approximately 60% of the sanitary sewer network is forecasted based on observed condition (actual PACP scores). The remaining pipes are forecasted for treatment based on age, but a significant portion will have PACP condition ratings available on the next AMP update. The next update will also account for the process equipment within wastewater pumping stations, which is not included in the analysis shown in Figure 23.

Figure 23: Unconstrained Scenario for Water Distribution and Wastewater Collection*



*Does not include water meters, process equipment within pumping stations

The City does not have sufficient funding available in 2021 to meet the immediate backlog, and the following constrained scenario evaluates the impact of addressing this work over several years.

The Ten Year Capital Forecast associated with the Financial Sustainability Strategy designates Water and Sanitary R&R Reserves to pay for the R&R of watermains and sanitary sewers. These reserves are funded by contributions from the currently approved water and wastewater user rates. Therefore, the Financial Sustainability Strategy (Scenario 2) also represents the City's Status Quo (Scenario 1).

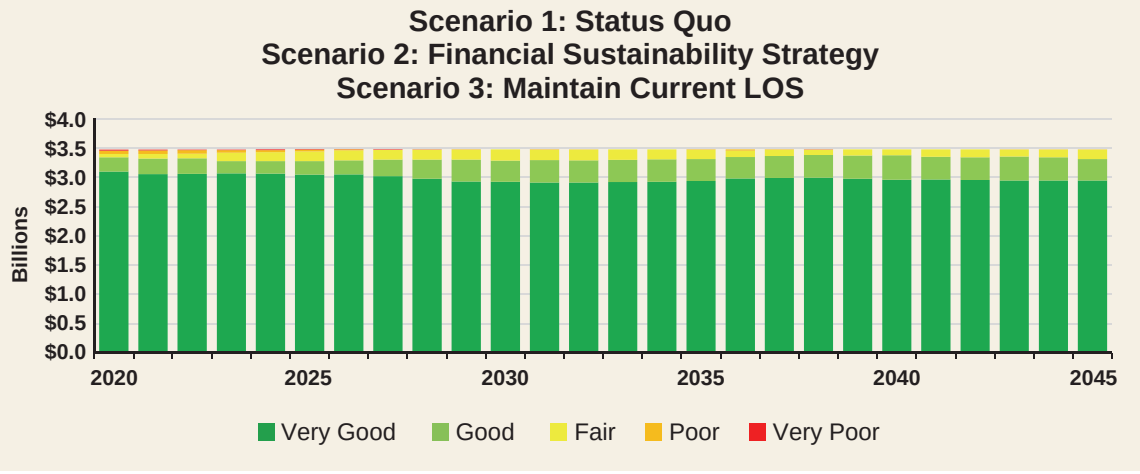
In the Ten Year Capital Forecast, there is an annual average of $6.8 million for Water Distribution and Wastewater Collection R&R projects, and for the 25-year forecast, it is assumed that this average funding level will be maintained. The $6.8 million per year budget is a constraint in the first few years of the forecast due to the initial 2021 backlog of $41.2 million.

Table 12: Scenario Analysis Summary for Water Distribution and Wastewater Collection (Average Annual Expenditures, $ million/yr)

Scenario	Average Annual Expenditures ($M/yr) 2021 to 2030	2031 to 2045
Unconstrained: 2021 Backlog	$41.2	-
Unconstrained	$6.8	$5.1
Scenario 1: Status Quo	$6.8	$6.8
Scenario 2: Financial Sustainability Strategy	$6.8	$6.8
Scenario 3: Maintain Current LOS	$6.8	$6.8

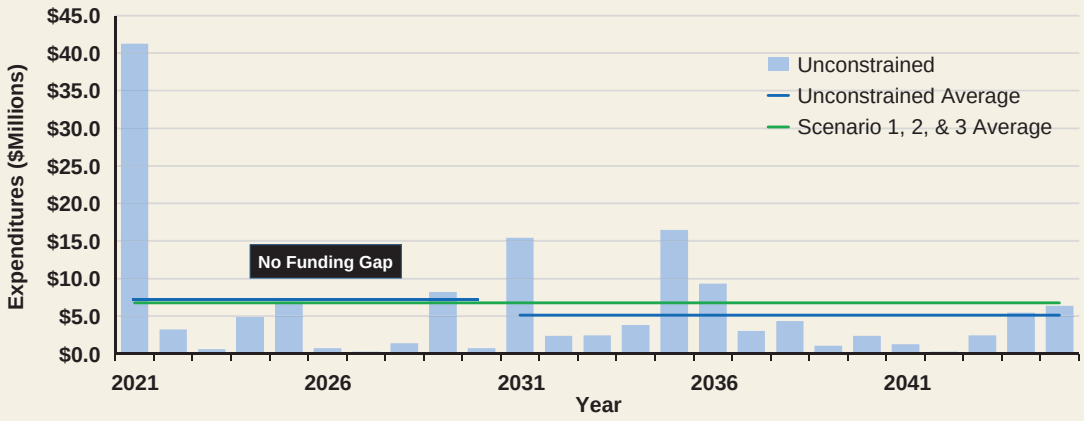
The initial constraint means that the $41.2 million backlog of Poor and Very Poor assets cannot be addressed in the first year. However, as shown in Figure 24, at the funding of $6.8 million per year, a significant portion of the Poor and Very Poor assets are addressed by the end of the 10-year outlook.

Figure 24: Projected LOS for Water Distribution and Wastewater Collection (Condition of Asset Portfolio over Forecast Period)



Over the next 10 years, to maintain current LOS (Scenario 3), the $6.8 million per year average from Scenarios 1 and 2 is adequate based on currently available data. Therefore, as shown in the following figure, there is no funding shortfall between maintaining current LOS (Scenario 3) and the Status Quo (Scenario 1). As this analysis does not include process equipment for pumping stations, this assessment will be reevaluated in the next AMP. The slightly lower expenditures expected in years 11 to 25 will be balanced by higher needs beyond the next 25 years, when increased R&R needs are forecasted to return. O.Reg. 453/07 requires that the City's Water and Wastewater Financial Plan balance capital needs with user rates to maintain full cost recovery solely from the Water and Wastewater rate, and this requirement is supported by the analysis in this AMP.

Figure 25: Scenario Summary for Water Distribution and Wastewater Collection*



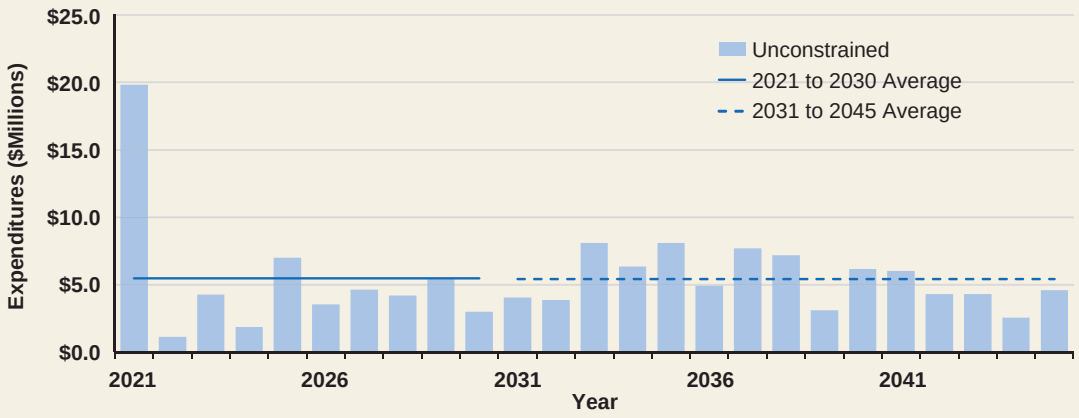
*Does not include water meters, process equipment within pumping stations

5.2.1.3 Stormwater Management

Rehabilitation and replacement of stormwater assets are funded through the Water Quality Protection Reserve Fund.

As seen in Figure 26, the unconstrained forecast indicates that the City would need $19.8 million in the first year to clear the infrastructure backlog, and an average expenditure per year of $5.5 million over the next 10 years. The unconstrained needs remain relatively the same at $5.4 million annually over the 25-year outlook. These expenditures include an average of $2.3 million annually to fund stormwater pond rehabilitation upgrades in addition to the typical R&R of stormwater assets and sediment removal for stormwater ponds. This forecast is based on currently available data and is expected to improve in accuracy as condition data from CCTV inspections are completed. Currently, approximately 15% of the storm sewermain inventory is forecasted based on observed condition (actual PACP scores); the remaining pipes are forecasted for treatment based on age.

Figure 26: Unconstrained Scenario for Stormwater Management*



*Does not include open channels, plunge pools

The City does not have sufficient funding to meet the Unconstrained Scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS (refer to Table 13). The Status Quo (Scenario 1) funding assumes a nominal 2.9% annual increase to the stormwater management rate corresponding to the anticipated water and wastewater rate. The contributions to the Water Quality Protection Reserve Fund for R&R averages $1.1 million per year of available capital funding over the next 10 years, and $1.3 million annually thereafter. As the City requires an average of $2.3 million annually just to fund stormwater pond rehabilitations, no funding is left available for sediment removal or renewal of sewers, culverts, or LID assets in the Status Quo.

In the Ten Year Capital Forecast (Scenario 2), increases in lifecycle contributions are incorporated to preserve the Water Quality Protection Reserve Fund to 2029, which relies on stormwater rate increases approved by Council in 2020. With these increased contributions, there is an annual average of $3.8 million of funding available. For the 25-year period, it is assumed that the higher level of funding attained by 2030 through the increased contributions is maintained at an estimated average of $5.7 million per year.

Table 13: Scenario Analysis Summary for Stormwater Management (Average Annual Expenditures, $ million/yr)

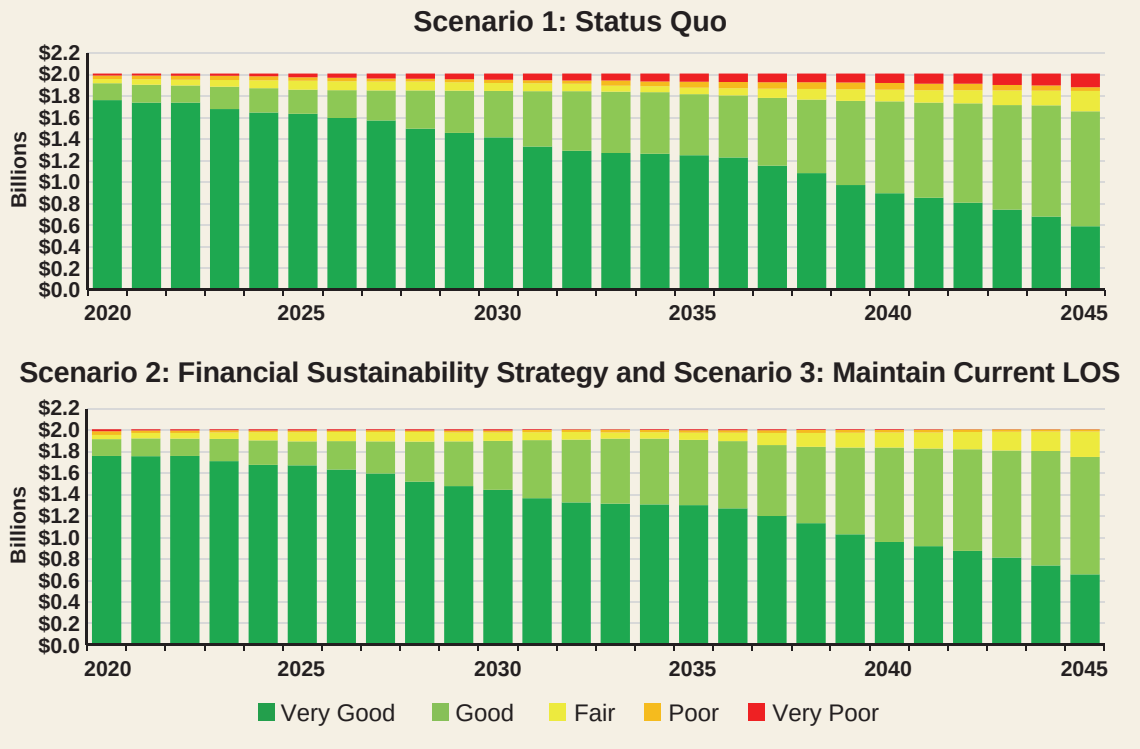
Scenario	Average Annual Expenditures ($M/yr) 2021 to 2030	2031 to 2045
Unconstrained: 2021 Backlog	$19.8	-
Unconstrained	$5.5	$5.4
Scenario 1: Status Quo	$1.1*	$1.3*
Scenario 2: Financial Sustainability Strategy	$3.8	$5.7
Scenario 3: Maintain Current LOS	$3.8	$5.7

*As $2.3 million/yr is required for storm pond rehabilitations, Scenario 1 does not leave any funding for the R&R forecasted needs

The impact of constrained Scenarios 1 and 2 on LOS is demonstrated in Figure 27. With Status Quo funding, the stormwater asset portfolio deteriorates significantly over time, and LOS cannot be maintained. The value of Poor and Very Poor assets rises from $52.4 million in 2020 to $160.6 million by 2045.

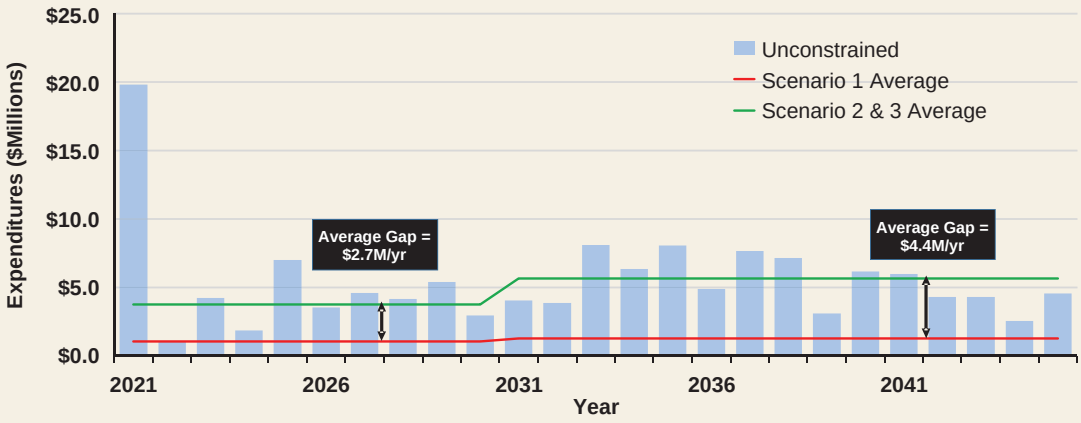
At the increased level of funding in Scenario 2, overall condition for the stormwater asset portfolio is maintained over the 25-year period. However, there is no dedicated funding currently set aside for LID or storm culverts in the Ten Year Capital forecast, and therefore, some funding could be potentially directed from sewers to these other assets, as well as stormwater ponds which are deemed more critical assets. This results in an increased LOS for ponds but a decreased LOS for the Stormwater Conveyance Network (refer to Appendix E for a more detailed discussion by asset type). The funding available for Scenario 2 is close to maintaining current LOS for the overall Stormwater Management system asset portfolio, and thus aligns with Scenario 3 as well.

Figure 27: Projected LOS for Stormwater Management (Condition of Asset Portfolio over Forecast Period)



Scenarios 2 and 3 result in an average funding gap of $2.7 million per year compared to the Status Quo (Scenario 1). The funding gap is even higher in years 11 to 25, and emphasizes that the funding gap will only increase over the longer term. A summary of the funding scenarios and associated gap is shown in the following figure.

Figure 28: Scenario Summary and Funding Gap for Stormwater Management*



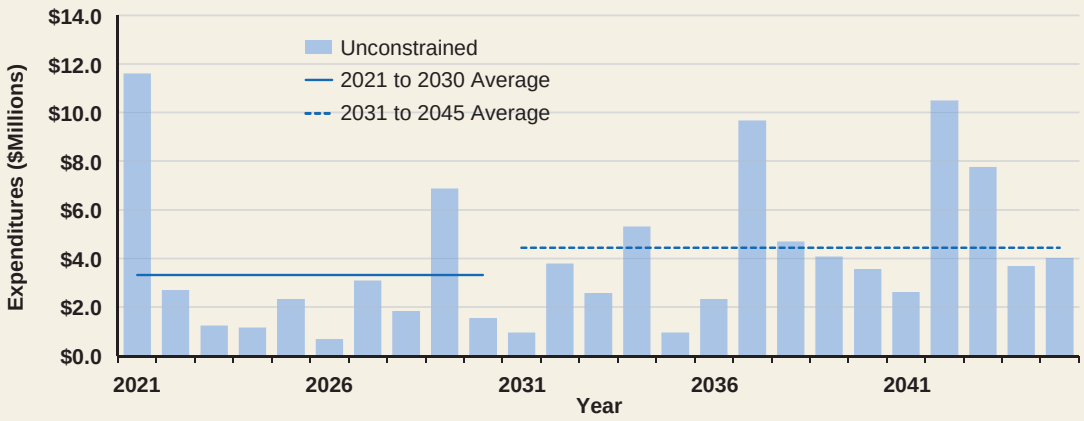
*Does not include open channels, plunge pools

5.2.1.4 Recreation Facilities

Rehabilitation and replacement of recreation facility assets associated with the building envelope are funded through the tax levy, federal gas tax grant, and other grant reserves.

As seen in Figure 29, the unconstrained forecast indicates that the City would need $11.6 million in the first year to clear the infrastructure backlog across recreation facilities, and an average expenditure per year of $3.3 million over the next 10 years. This average need increases to $4.4 million in years 11 to 25.

Figure 29: Unconstrained Scenario for Recreation Facilities*



*Does not include site assets (e.g. parking lots, landscaping) or non-Core+ facilities

The City does not have sufficient funding available in 2021 to meet the immediate backlog, and the following constrained scenario evaluates the impact of addressing this work over several years.

The Status Quo (Scenario 1) and Financial Sustainability Strategy (Scenario 2) budgets are not easily determined specific to Recreation Facility building envelope assets. The available budget will be more accurately defined with the addition of non-Core+ assets (libraries, cultural facilities, municipal offices, etc.) in the next AMP in 2023. Therefore, an assessment of a funding shortfall for Recreation Facilities is not provided in this AMP.

To maintain LOS over the next 25 years, Scenario 3 identifies an average expenditure of $3.3 million per year over the next 10 years, and $4.4 million over years 11 to 25, in line with the Unconstrained Scenario. This represents an average annual expenditure of $4.0 million over the 25-year forecast.

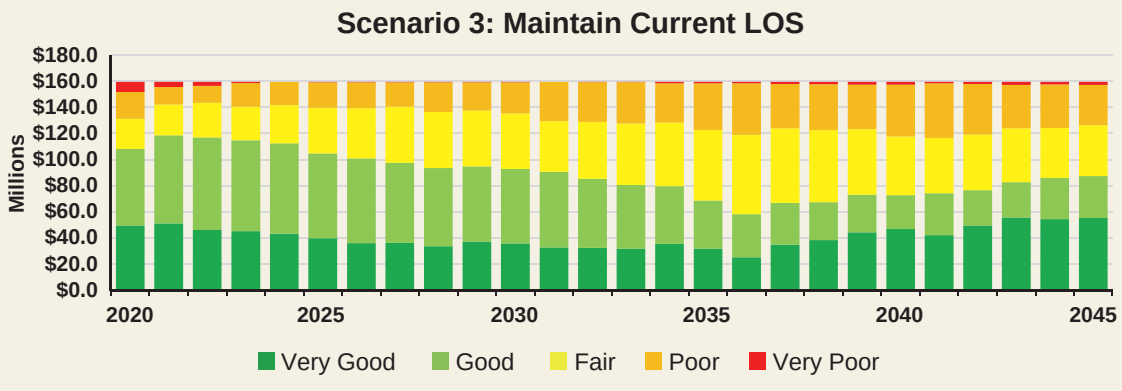
Table 14: Scenario Analysis Summary for Recreation Facilities (Average Annual Expenditures, $ million/yr)

Scenario	Average Annual Expenditures ($M/yr) 2021 to 2030	2031 to 2045
Unconstrained: 2021 Backlog	$11.6	-
Unconstrained	$3.3	$4.4
Scenario 1: Status Quo	Not assessed	Not assessed
Scenario 2: Financial Sustainability Strategy	Not assessed	Not assessed
Scenario 3: Maintain Current LOS	$3.3	$4.4

Scenario 3 accounts for a $7.6 million expenditure in 2021 per the approved 2021 Capital Budget. Due to the current backlog, this increased 2021 expenditure is required to address the current needs for Recreation Facilities and supports the City in maintaining an average FCI of 7%. The funding still represents an initial constraint in that not all Very Poor assets are replaced immediately, but as shown in Figure 30, a significant portion of the Very Poor assets are addressed by the end of the ten year outlook. In 2031 to 2045, an increased annual average expenditure of $4.4 million is required as another cycle of assets reach end of life. At this level of funding, the percentage of assets in Very Poor condition is minimized at the end of the forecast similar to the current 2020 condition profile.

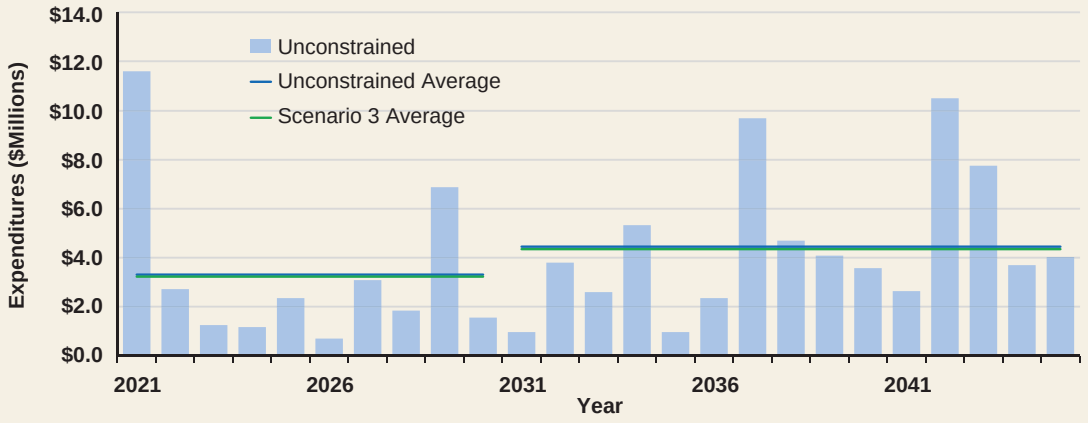
The projected condition profile shown in Figure 30 does not consider the needs of planned growth projects, which will put additional pressures on the budget. As facilities are constructed and added to the portfolio, funding will need to be increased to account for the replacement of shorter life span assets in these new facilities.

Figure 30: Projected LOS for Recreation Facilities (Condition of Asset Portfolio over Forecast Period)



The funding to maintain current condition LOS (Scenario 3), in line with the unconstrained scenario, is shown in the following figure. As previously discussed, the next AMP will provide a shortfall analysis that will include a comprehensive assessment including non-Core+ facilities.

Figure 31: Scenario Summary for Recreation Facilities*



*Does not include site assets (e.g. parking lots, landscaping) or non-Core+ facilities

5.2.2 Preliminary Growth Investment Forecast

The previous section outlined the investments required to maintain the City's *existing* assets. With Richmond Hill's population expected to grow over the next decade, it is equally as important to ensure that the City has planned to build additional or upgraded assets to meet the ever-increasing demand for services.

As mentioned in the Official Plan, the City is nearly built out to its urban boundary after decades of rapid urbanization. As a result, future growth will focus on more compact, pedestrian-oriented, mixed-use forms of development. These factors are being considered in the update of the Official Plan that is currently underway, and will be necessary inputs to the City's asset management planning process in the coming years.

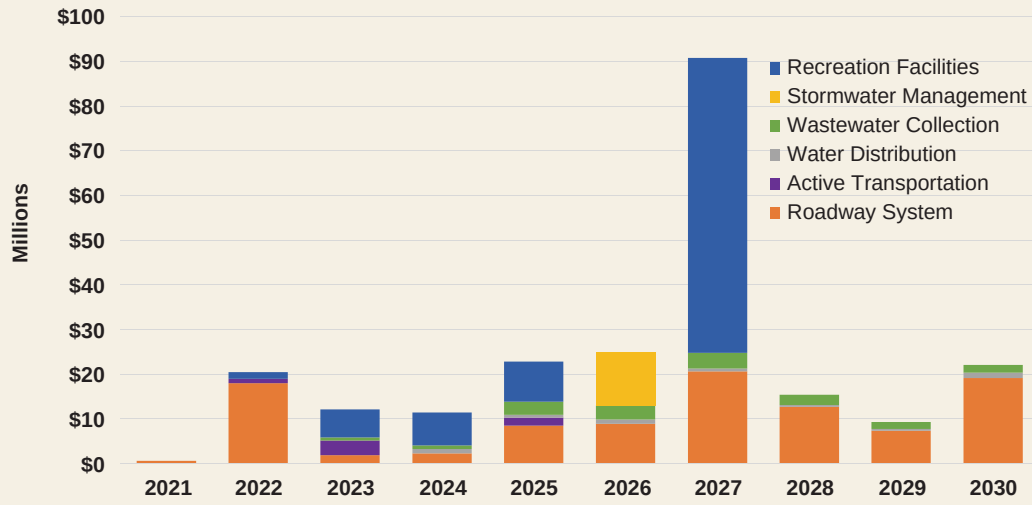
Figure 32 shows approximately $230 million in investments in Core+ assets that are planned for the next 10 years to meet growth, and was informed by various plans and studies that take into account the City's future population and employment conditions. The growth projects are outlined in the Ten Year Capital Forecast associated with the Financial Sustainability Strategy. Planned growth investments include road widenings and intersection improvements, new roads and active transportation linkages, the construction of additional Recreation Facilities such as indoor sports facilities, and a flood remediation project. Growth projects related to the City's Water Distribution and Wastewater Collection systems are informed by technical analyses, which recommend infrastructure upgrades to serve the City's intensification areas and maintain adequate LOS for current and future customers. Regarding assets to be assumed in the future, the forecast only includes assets that are proposed to be funded under the Development Charges By-law.

Richmond Hill is currently updating its water, wastewater, and stormwater models, as well several plans and studies which will further inform the need for growth projects in the next AMP. A detailed breakdown of the growth investment forecast by Sub-Service can be found in the Appendices.

Richmond Hill's growth will be further informed by upcoming updates to the City's:

- Official Plan
- Transportation Master Plan
- Urban Master Environmental Servicing Plan
- Recreation Plan
- Development Charge Background Study

Figure 32: Preliminary Growth Investment Forecast for Core+ Assets



The funds raised from Development Charges cover the majority of the cost for these growth assets, and are accounted for in the Ten Year Capital Forecast. Other times, the Development Charges are used to partially pay for upgrades to existing infrastructure, where growth has created the need for the upgrade, or where replacing the old asset would not meet current demands due to growth. For more information on future infrastructure projects funded by Development Charges, refer to the 2019 Development Charges Background Study. This Study is also currently being updated.

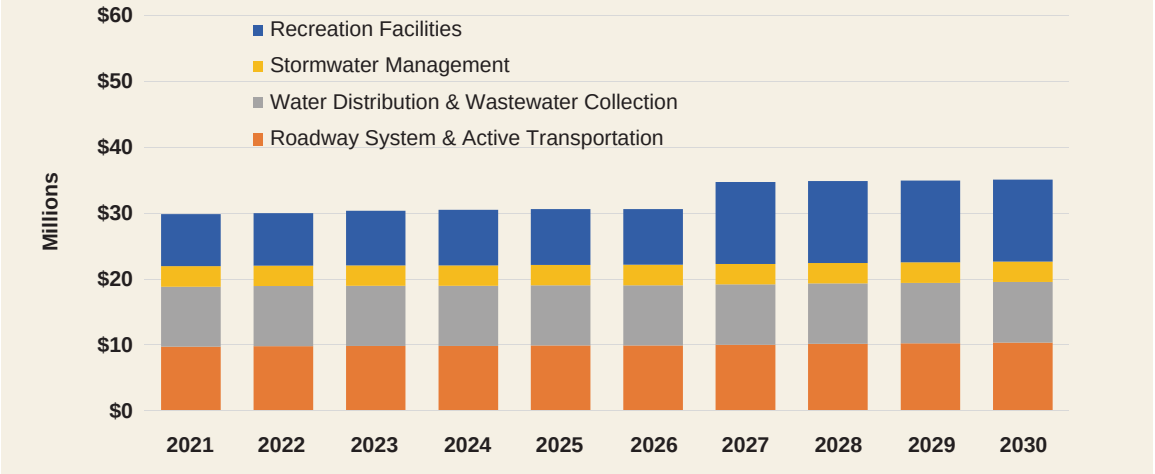
As the primary funding source for growth assets (DC funding) is not discretionary, and there are no asset management strategies applied to the assets until they are owned by the City, funding of growth assets is not covered in detail in Section 5.4 (Infrastructure Gap Assessment and Financial Plan Considerations). It is assumed that funding for growth is available per the resources set out in the Ten Year Capital Forecast and are incurred as actual growth is realized.

5.3 Preliminary Operating Forecast

Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments will place cumulative, additional pressures on the annual operating budget. This includes an increase in personnel, operating, and maintenance costs of all new and upgraded infrastructure.

The estimated preliminary operating budget forecast for expenditures related to asset operations and maintenance activities is provided in the Figure 33. The preliminary operating forecast in this AMP assumes growth based only on the value of new growth related capital projects outlined in Section 5.2.2 as they are completed and start providing service. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process. The expected growth in the City's asset portfolio and its associated impact on the Operating Budget will also further increase as on-going initiatives such as the water, wastewater, and stormwater models, Recreation Plan update, and Transportation Master Plan update are completed.

Figure 33: Operating Budget Forecast (Asset-Related Expenditures)



The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. Legislation changes may also impact future operating and maintenance costs.

5.4 Infrastructure Gap Assessment and Financial Plan Considerations

5.4.1 Infrastructure Gap Assessment

As indicated by Scenario 3 (Maintain Current LOS) in Section 5.2, an average shortfall of $12.5 million per year over 2021 to 2030 was identified for Roadway System and Active Transportation assets, assuming no drawdown of reserve fund balances and no utilization of debt to reduce the gap. An average funding shortfall of $2.7 million per year was identified for Stormwater Management system assets over the next 10 years. Table 15 summarizes the 10-year financial analysis for the various scenarios across the Core+ Sub-Services. Similar to many other municipalities in North America, the City of Richmond Hill is facing the challenge of the "infrastructure funding gap" – the difference between the funding needed to keep assets in a state of good repair and the revenue from available sources.

Table 15: 10-Year Scenario Analysis Summary by Sub-Service (Average Annual Expenditures $ million/yr)				
Scenario	**Roadway System and Active Transportation**	**Water Distribution and Wastewater Collection**	**Stormwater Management**	**Recreation Facilities**
Unconstrained: 2021 Backlog	$47.7	$41.2	$19.8	$11.6
Unconstrained	$13.5	$6.8	$5.5	$3.3
Scenario 1: Status Quo	$6.0*	$6.8	$1.1	Not assessed
Scenario 2: Financial Sustainability Strategy	$7.3*	$6.8	$3.8	Not assessed
Scenario 3: Maintain Current LOS	$18.5	$6.8	$3.8	$3.3
Funding Gap (to Status Quo)	**$12.5***	-	**$2.7**	**Not assessed**

*tax-supported contributions and gas tax only; does not include drawdown of reserves or utilization of debt

The financial impacts of deferring earlier interventions are further compounded beyond the ten-year outlook, resulting in increased expenditures to maintain LOS, particularly for Roadway System and Active Transportation assets. Table 16 summarizes the average annual expenditures for the various scenarios over years 11 to 25 of the estimated forecast.

Table 16: Scenario Analysis Summary for years 11 to 25 by Sub-Service (Average Annual Expenditures $ million/yr)				
Scenario	**Roadway System and Active Transportation**	**Water Distribution and Wastewater Collection**	**Stormwater Management**	**Recreation Facilities**
Unconstrained	$32.0	$5.1	$5.4	$4.4
Scenario 1: Status Quo*	$6.3*	$6.8	$1.3	Not assessed
Scenario 2: Financial Sustainability Strategy*	$10.3*	$6.8	$5.7	Not assessed
Scenario 3: Maintain Current LOS	$56.0	$6.8	$5.7	$4.4
Funding Gap (to Status Quo)	**$49.7***	-	**$4.4**	**Not assessed**

*tax-supported contributions and gas tax only; does not include drawdown of reserves or utilization of debt

The Status Quo tax levy revenue and stormwater user rates allocated to capital repair and replacement reserve funds provided through the annual Operating Budget is estimated as inadequate to cover future asset repair and replacement responsibilities. However, addressing the funding gap must be balanced against the desire for low levels of taxation and other urgent priorities that the City may face. Section 5.4.2 summarizes the City's available funding sources, and Section 5.4.3 discusses approaches to the development of budgets that consider the infrastructure gap.

5.4.2 Funding Sources

5.4.2.1 Revenue Sources

Richmond Hill has a wide range of revenue sources to support the ongoing management of infrastructure assets (Table 17). A number of these revenue sources are restricted to the acquisition of growth assets, which are usually acquired or funded through the development process. There is a smaller range of funding sources available to operate, maintain, repair, rehabilitate, and replace existing infrastructure. As indicated in Section 1.7, completion of this AMP ensures continued compliance with the requirements for receipt of Federal Gas Tax funding. The AMP can also support the City's eligibility and prospects on other grant funding applications.

Table 17: City of Richmond Hill's Revenue Sources

Funding Source	Description
Property Tax	Residential and commercial property owners pay an annual tax to the City, which pays for many of the services used by the residents and owners.
User Fees for Water, Wastewater and Stormwater	Directly billed for residential or business use of the water, wastewater and stormwater systems.
User Fees and Charges	Funds collected for the use of City services or infrastructure. Examples include fees for recreation programs and business licenses.
Sale of Assets	This includes, but is not limited to the sale of surplus land, vehicles and equipment that have reached end of life, and sale of older books.
Interest on Reserve Fund Balances	The City holds reserve funds for regulated and discretionary reasons. These funds earn interest that is a revenue stream.
Cash in Lieu of Parkland	Funds collected from developers, as prescribed in the Planning Act, are used to purchase and develop new parkland. This funding source is not relevant to Core+ Infrastructure.
Development Charges	Contributions from developers used to fund growth related infrastructure.
Local Improvement Charges	Fees charged to property owners for local upgrades, such as upgrading the road network from a rural to urban profile.
Federal Gas Tax	A long-term grant agreement with the Association of Municipalities of Ontario (AMO), on behalf of the Federal government that provides a portion of the Federal gas tax revenues to municipalities for revitalization of infrastructure that achieves positive environmental results.
Grants	Grants are contributions from parties external to the organization. This typically comes from grants from other levels of government.
Debt	Normally used to purchase an asset outright. Repayment of debt must be offset with new future revenue or a reallocation of revenue.
Alternative Financing and Procurement	An agreement with a private company for the construction and long-term operation of an asset, which the municipality may own all, a portion or none of the asset.

Asset management activities to operate and maintain existing infrastructure are funded through the Operating Budget. The majority of these activities are funded by the property tax and the water or wastewater rate.

Asset management activities involving major repair, rehabilitation and replacement of existing infrastructure assets have funding allocated through the Capital Budget. The funding sources for the Capital Budget are typically reserve funds which have accumulated revenue over the years from property tax, user fees, gas tax, or sales of assets (see Section 5.4.2.2). The Capital Budget allocated to asset management strategies of existing assets may vary from year to year depending upon the assets that are nearing their end of life that have been prioritized for reinvestment, and the number of growth asset projects that need to be undertaken in that year. The biggest funding source for rehabilitation or replacement of existing assets are the Repair & Replacement Reserve funds.

5.4.2.2 Reserve Funds

The Capital Budget describes and authorizes spending of funds on infrastructure growth, replacement, rehabilitation and major repairs, and the sources of funds are different than the Operating Budget (Table 18). All Capital Budget items are funded from reserve funds, each of which holds money for specific purposes. Some reserves are intended to accumulate money to pay for future asset maintenance. Others are used to stabilize the revenue demands where there is volatility in the amount of money needed each year, with the reserve growing in low demand years and being drawn-down in higher cost years.

The use of reserves for growth assets are highly regulated with clear definitions of allowable uses. A small number of reserve funds can be used for building new assets associated with growth or for rehabilitation and replacement of existing assets, based on direction from Council. As growth reserve funds cannot be used for capital maintenance, rehabilitation, or replacement of existing assets, only the funds that can be used for existing assets are considered in the renewal forecasts in Section 5.2.1.

Table 18: Capital Reserve Funds and Financing Tools		
Reserve Fund or Financing Tool	**Allowed Uses**	**Description**
Repair & Replacement Reserve	Existing Assets	To provide for repairs and infrastructure replacement to maintain existing capital facilities and structures in full service and safe operating condition.
Cash to Capital Reserve Fund	Existing Assets and Service Expansion	To provide funds for capital projects considered new items not eligible for funding from Development Charges nor Repair & Replacement Reserve Funds.
Water Quality Protection Reserve Fund	Existing Assets and Service Expansion	To be used on rehabilitation of Stormwater Management system and to add environmental systems to ensure continued flood protection, erosion control, downstream watercourse and habitat quality protection, and the protection of drinking water sources.
Water/Wastewater Reserve Funds	Existing Assets	To provide for full cost recovery for repairs and infrastructure replacement to maintain existing water and wastewater facilities and structures in full service and safe operating condition.
Federal Gas Tax Reserve Fund	Existing Assets and Service Expansion	To be used to make strategic investments across project categories identified by Infrastructure Canada such as local roads and bridges, wastewater infrastructure, drinking water, and recreation.
Ecological Legacy Reserve Fund	Council Discretion	To be used on community-based projects for furthering ecological initiatives.
Development Charges Reserve Funds	Growth	Contributions from developers are used to fund eligible growth related infrastructure.
Cash in Lieu of Parkland Reserve Fund	Growth	Funds collected from developers, as prescribed in the Planning Act, are used to purchase and develop new parkland.
Community Enhancement and Economic Vitality Reserve Fund	Growth and Service Expansion	Funding of projects that enhance the quality of life or enrich the economic vitality of the community.
Strategic Rapid Transit Reserve Fund	Growth	To be used for funding long range strategic rapid transit projects which are multi-jurisdictional in nature. Funding committed by the City would be used to leverage and attract significant funding from other levels of government and or public-private partnerships.

5.4.3 Potential Funding Strategies

In response to the anticipated growth in annual capital expenditure requirements and the funding gap, Richmond Hill's Council and Senior Management identified the need to establish a Capital Sustainability Steering Committee (CSSC). The CSSC's mandate is to evaluate opportunities to deliver long-term capital investments that are in line with community expectations and fiscal sustainability. A long-term investment strategy (Financial Sustainability Strategy) was brought forward in October 2020. The Strategy will be re-evaluated as required to correspond to the changing priorities of the Capital Forecast process.

As the City implements non-Core+ assets into its asset management planning processes and refines the overall funding gap analysis, asset management and finance departments will **work collaboratively** to develop **long-term financial sustainability** strategies that balance service levels, costs, and risks.

Moving forward, potential funding strategies to address asset needs will be updated and refreshed for future consideration as part of the development of budgets.

6. Monitoring and Improvement

6. Monitoring and Improvement

The final Section of the AMP outlines recommended actions, next steps and a work plan that will advance Richmond Hill's asset management system and planning capabilities. It will also ensure the City will achieve the next phase of O. Reg. 588/17 regulatory reporting requirements by the July 1, 2024 deadline. Throughout the development of the AMP, opportunities for improvement to the existing system were identified. The recommended actions in this Section include practical steps to address these opportunities, and are grouped into two main categories: **Improving Confidence in Data, Strategies, and Decision Support; and Strengthening AM Processes.**

This Implementation Plan is the roadmap for continual improvement – a cornerstone of AM best practice.

6.1 Improving Confidence in Data, Strategies, and Decision Support

Throughout the development of the AMP, the City's data was leveraged in addition to industry standards to define the analyses that supported each strategy. Data is used to understand asset behaviour and to complete evidence-based asset management analyses.

For the City's Core+ assets, an implementation plan has been developed to increase the maturity of the data used, and ultimately improve the accuracy and confidence of the City's technical strategies and forecasts. These recommendations will be supported by the City's Corporate Asset Management (CAM) team where appropriate to collaboratively make improvements with City subject matter experts.

Table 19: Implementation Plan for Data, Strategies, and Decision Support Improvements			
	Action	**Timeline (2021-2024)**	**Priority**
1	Increase maturity of the Core+ asset register, state of infrastructure data, and lifecycle strategies which will increase confidence in the Decision Support System and in turn improve accuracy of AMP reporting and forecasting.	On-going	Medium
2	Improve completeness and maturity of the asset register and state of infrastructure data for non-Core+ assets, and incorporate into the EAM.	Short	High
3	Implement the lifecycle and risk strategies for non-Core+ assets into the EAM in preparation for next AMP.	Short	High
4	Increase maturity of existing LOS reporting and collect additional data to report on advanced LOS measures. Set appropriate performance targets while balancing costs and risks.	Medium	Medium
5	Develop a hydraulic model for underground infrastructure to enable reporting on additional LOS measures, and increase maturity of technical strategies.	Short	High
6	Update replacement costs for assets using tender analysis to ensure unit rate replacement costs of linear assets are reflective of most recent information.	Medium	Medium
7	Incorporate historical treatment history into the Decision Support System to better inform forecasting of lifecycle activities.	Short	Medium
8	Improve and increase maturity of the Risk Framework. Consider collecting additional inputs for consequence of failure (CoF) scoring, such as revenue lost due to asset failure, impacted customers per watermain segment, and bus routes. Re-examine non-Core+ asset risk with the addition of non-Core+ assets to the EAM. Review and increase consideration of climate change related impacts with the Risk Framework.	Medium	Medium
9	Improve understanding of operations and maintenance needs through analysis of available data, such as in City's Maintenance Management Software.	Short	Medium

6.2 Strengthening Asset Management Processes

As indicated in Section 1, most of the activities from the City's AM Strategy have been completed. Outstanding actions from the AM Strategy implementation plan are summarized and updated in Table 20, as well as additional opportunities to advance the City's asset management system. Some of the recommended actions include opportunities for all asset classes and other actions require work on specific asset classes.

Table 20: Implementation Plan for Strengthening Asset Management Processes

	Action	Timeline (2021-2024)	Priority
	Asset Management Strategy and Planning		
1	Incorporate corridor planning (grouping assets in a similar location or common 'corridor') and project bundling considerations into the EAM to enhance forecasting outputs and the capital budgeting process.	Short	High
2	Seek opportunities to enhance coordinated infrastructure planning and renewal activities with York Region, neighbouring municipalities and other government agencies.	Long	Low
3	Improve the funding shortfall analysis with alignment between asset needs and associated funding available in capital and operations budgets, as well as other scenarios.	Short	High
	Asset Management Decision Making		
4	Establish ongoing State of the Infrastructure reporting for Key Performance Indicators (CLOS and TLOS) and public reporting.	Short	Low
	Lifecycle Delivery Activities		
5	Create a data protocol as part of a formal corporate-wide Condition Assessment Framework, including type of inspection/assessment, frequency, resource requirement, and expected output.	Short	High
6	Define better links between Design Standards and asset lifecycle analyses.	Medium	Medium
7	Develop cross-organizational data capture processes related to the City's asset commissioning and decommissioning procedures. This would include the updating of critical asset information attributes, as well as the cycle and currency of updates.	Short	Medium
8	Improve the link between established capital costs (refurbishments/replacement) and operational costs (operations and maintenance) to advance the whole-lifecycle costing approach.	Medium	Medium
9	Improve asset growth forecasts and associated impacts on operating budget forecasts.	Short	Medium
	Climate Change Considerations		
10	For each asset type, per the City's Climate Change Framework, create a standard list of possible interactions with climate events and impacts. Determine where the consideration of the list (and by extension climate change) could/should be contemplated in the overall AM process.	Medium	Medium

6.3 Asset Management Work Plan

As per O. Reg. 588/17, progress in implementing this AMP will be reviewed on an annual basis on or before July 1 each year. This annual review will address any factors impeding the City's ability to implement the AMP, and will include a strategy to address these impeding factors. The City will develop an updated AMP that will include all City assets, including non-Core+ assets to ensure compliance with the next phase of O. Reg. 588/17 reporting requirements.

Figure 34: City of Richmond Hill Asset Management Work Plan

Work Plan Tasks	2021	2022	2023	2024	2025
State of Infrastructure	Condition Assessment Framework, Improve Core+, Develop Non-Core			Updates and Improvements	
Service Levels		Develop Non-Core		Confirm Proposed LOS	Updates and Improvements
Lifecycle Strategies and Operations & Maintenance		Improve Core+, Develop Non-Core, Analyze O&M activity costs		Align with Proposed LOS	Updates and Improvements
Risk Strategy		Updates and Improvements			
Climate Change Considerations		Assess climate change considerations		Integrate into AM Processes	Updates and Improvements
Financing Strategy		Assess funding gap for all assets		Align with Proposed LOS	Updates and Improvements
Corridor Planning and Project Bundling		Develop Framework	Updates and Improvements		
Enterprise Asset Management System	Updates, Implement Non-Core Assets and Corridor Planning			Updates and Improvements	
AMP & Progress Updates - Council	AMP	Progress & SOI* Update	AMP	AMP	Progress & SOI* Update

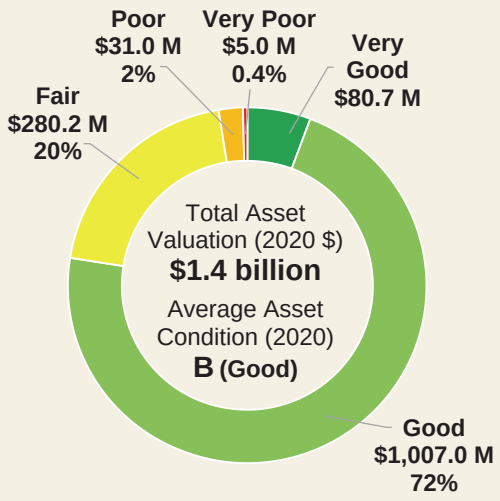
*SOI (State of Infrastructure)

Appendices

Appendix A: Roadway System

The City's Core+ Roadway System infrastructure consists of urban and rural roads, municipal structures (bridges and culverts), and traffic signals. Other roads and bridges that connect Richmond Hill to its surrounding municipalities are owned and maintained by York Region and are not included in this AMP. The Roadway System enables the safe and efficient movement of vehicular travel around the City, and helps to create stronger connections and offer better choices to the community.

Figure 35: Asset Condition Distribution and Valuation for Roadway System



A1 State of the Infrastructure

A1.1 Overview

The total estimated value of the City's Roadway System infrastructure is $1.4 Billion. The average condition of all Roadway System assets is Good (Letter Grade B).

The inventory for the City's Roadway System is summarized in Table 21. Local roads account for the majority of the road network.

Table 21: Inventory Overview for Roadway System

Asset Type	Asset Sub-Type	Quantity	Replacement Cost ($ millions)	Average Age	Average Condition
Urban Roads	Arterial Collector Local	4 km 116 km 446 km	$1,293.1	26	Good (B Grade)
Rural Roads	Arterial Local	4 km 2 km	$10.6	44	Fair (C Grade)
Bridges		18 bridges	$49.0	24	Good (B Grade)
Road Culverts		45 culverts	$47.8	27	Good (B Grade)
Traffic Signals		132 signal components	$3.6	17	Good (B Grade)
		TOTAL	$1,404.0	26	Good (B Grade)

The City has recently re-categorized some of the storm culverts as road culverts and added these structures to the inspection program based on asset criticality. The inventory will be updated in future AMPs to reflect the improved categorization between road and storm culverts.

A1.2 Asset Valuation

Replacement costs for urban and rural roads are determined by multiplying the area of the road by a unit cost associated with reconstruction, and includes estimated soft costs for items such as design and engineering. Bridge and road culvert replacement costs were provided in municipal structure inspection reports. Traffic Signal replacement costs are derived from the City's Tangible Capital Assets (TCA) database.

A1.3 Asset Condition

The condition rating system for Roadway System assets is summarized in Table 22. The metric used to report on the overall condition of roads is the Pavement Quality Index (PQI). This value is calculated based on a visual survey of the number and types of distresses on the pavement, and is conducted every three years. The surveying and calculation methods are standardized by the American Society for Testing and Materials (ASTM). The PQI value ranges from 100 to 0. A PQI value of 100 represents a new road with no deficiencies immediately following construction.

The City retains a consultant every two years to complete municipal structure inspections in compliance with the current legislation. The most recent inspections were completed in 2020, and provide an overall condition of each bridge and road culvert, the bridge condition index (BCI). The BCI value for each structure is calculated based on the Ministry of Transportation's (MTO's) "Bridge Condition Index (BCI) – An Overall Measure of Bridge Condition" (July 30, 2009), updated as required for new element types and materials. The BCI ranges from 100 to 0. A BCI value of 100 represents a new structure with no deficiencies immediately following construction.

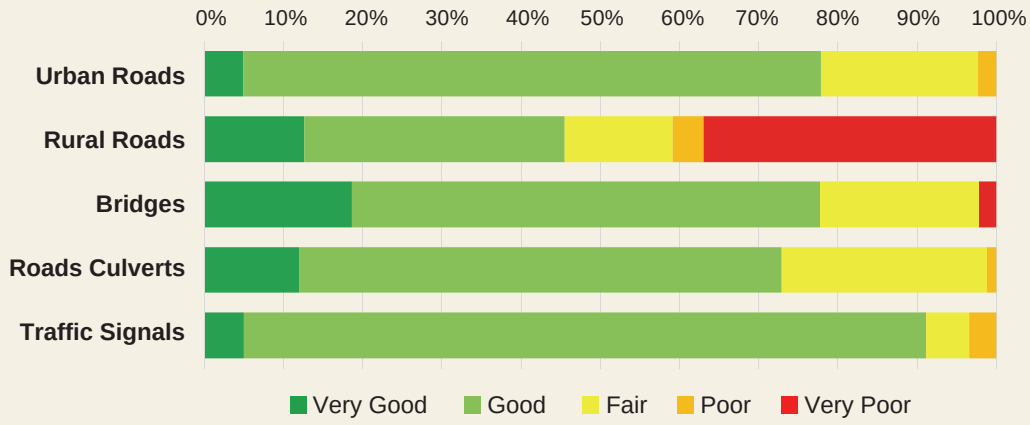
Condition for Traffic Signals is based on preliminary condition assessment data and is supplemented with age where needed.

Table 22: Asset Condition Rating System for Roadway System

Performance Category	Letter Grade	Urban Roads/Rural Roads Pavement Quality Index (PQI)	Bridges/Road Culverts Bridge Condition Index (BCI)	Traffic Signals Condition Rating and/or Service Life Remaining
Very Good	A	>90 to 100	>80 to 100	>80% of life remaining
Good	B	>70 to 90	>70 to 80	"Good" or 60-80% of life remaining
Fair	C	>45 to 70	>50 to 70	"Fair" or 40-60% of life remaining
Poor	D	>20 to 45	>35 to 50	"Poor" or 20-40% of life remaining
Very Poor	F	0 to 20	0 to 35	"Bad" or <20% of life remaining

As shown in Figure 36, Urban Roads, Bridges, Road Culverts, and Traffic Signals each have more than 70% of assets in Good or Very Good condition. Rural Roads have the lowest portion of assets in Good or Very Good condition at less than 50%.

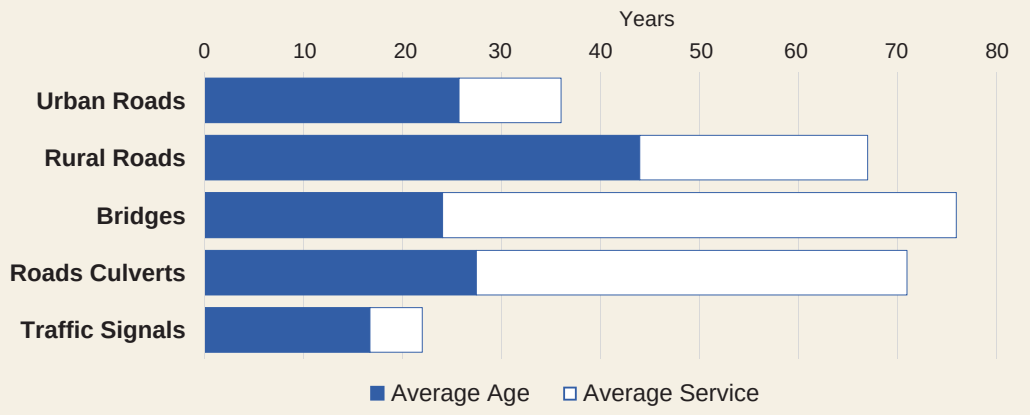
Figure 36: Condition Profile for Roadway System



A1.4 Asset Age

Figure 37 shows the average age and estimated service life of Roadway System assets, which have mainly been constructed within the last 30 years.

Figure 37: Average Asset Age vs. Average Service Life for Roadway System



A2 Levels of Service

The Strategic LOS for the Roadway System is to provide a safe, efficient, and connected roadway system for all users, and aligns with the City's strategic priorities as outlined in Table 23.

Table 23: Strategic LOS Alignment for Roadway System

Strategic LOS	Strategic Priorities Themes (2020-2022)	Climate Change Framework Goals
Provide a safe, efficient, and connected roadway system for all users	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Land-use Planning • Asset Management • Community Risk Mitigation • Natural and Engineered Green Infrastructure

As discussed in Section 3, the LOS provide a Line of Sight by aligning higher level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measures of managing that infrastructure (the Technical LOS).

A2.1 Customer Levels of Service

The City's Customer LOS are summarized in Table 24. The O. Reg. 588/17 qualitative LOS are described in further detail below.

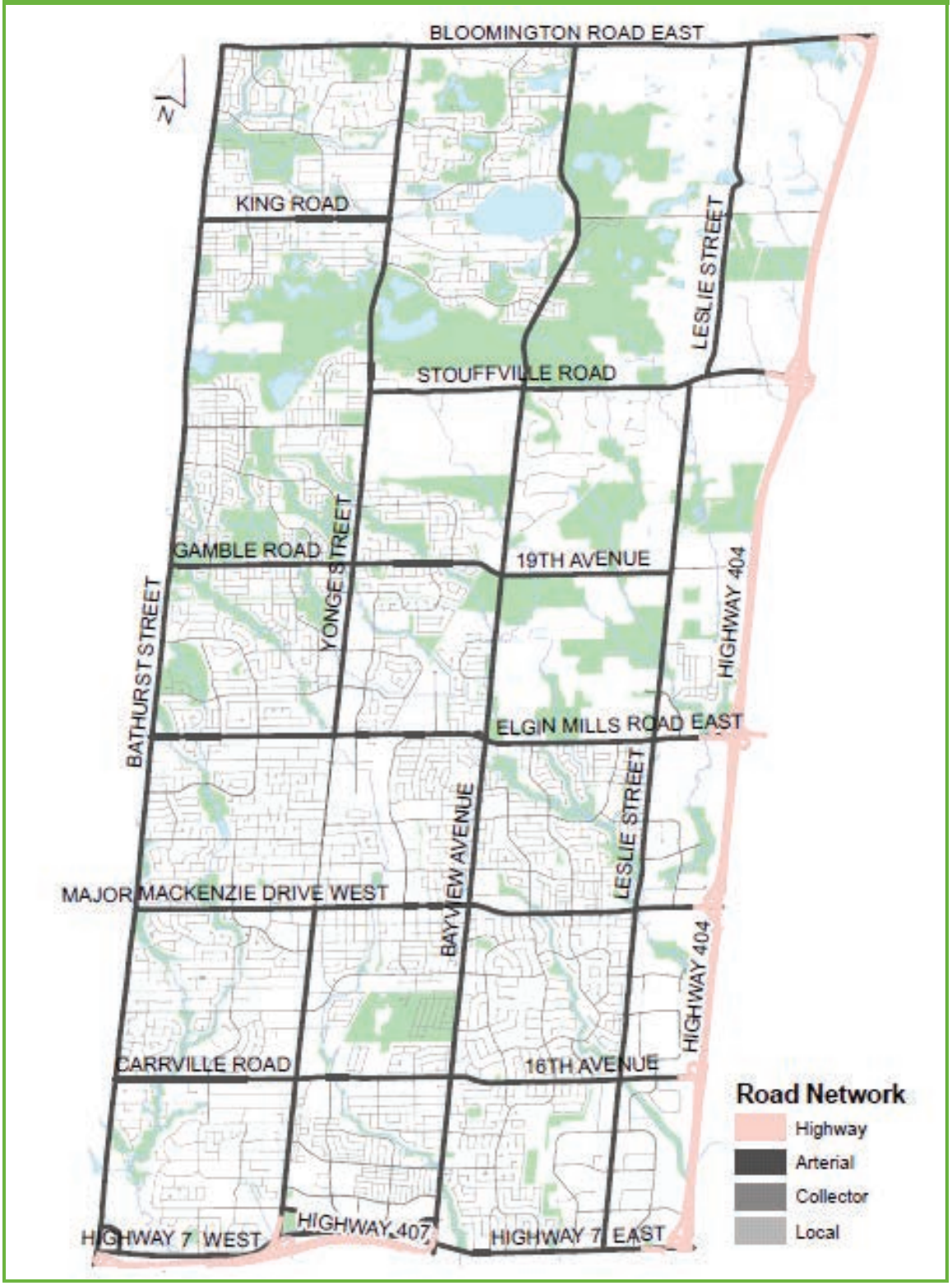
Table 24: Customer LOS for Roadway System

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity.	O. Reg.	See "Road Network Description" below
	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	O. Reg.	See "Traffic supported by municipal bridges" below
Quality	Description or images that illustrate the different levels of road class pavement condition.	O. Reg.	See "Road Class Pavement Condition" Below
	Description or images of the condition of bridges/ culverts and how this would affect use of the bridges/culverts.	O. Reg.	See "Bridge and structural culvert condition" below
	Percentage of complaints or issues resolved in compliance with Access Richmond Hill Service Levels	Fnd.	91% - excluding streetlights and signs
Efficient	Timely delivery of infrastructure (% of planned sq.m. of roads completed; % of planned structures completed)	Fnd.	100%

Road Network Description and its Connectivity

The City manages an extensive network of roads that serve a variety of purposes including local access, regional travel, and access to provincial highways (Figure 38). The City is serviced by a grid-based road network comprised of provincial highways, regional arterial roads, and the City's system of arterial, collector, and local roadways. The majority of these roads, being local and City-owned, provide connections to and within neighbourhoods, city centres, commercial sites, industrial lands, and to the Regional road network. Provincial Highways 404 and 407 border the east and south sides of the City, and are owned and regulated by MTO. Development and access in close proximity to these highways are subject to provincial permitting and approval.

Figure 38: City of Richmond Hill Road Network



Road class pavement condition

As discussed in Section A1.3, pavement condition data is collected on the entire road network every three years. An overall PQI is calculated from all collected data and is used as an input into the annual road overlay and reconstruction program. The index is scaled from zero to 100 and has been divided into ranges to assess condition. Examples of roads in each of the PQI rating categories are provided in the following table.

Table 25: Examples of PQI Condition Rating Categories

Condition Grade	Typical Road Example
Very Good (PQI = >90 to 100)	
Good (PQI = >70 to 90)	
Fair (PQI = >45 to 70)	
Poor (PQI = >20 to 45)	
Very Poor (PQI = 0 to 20)	

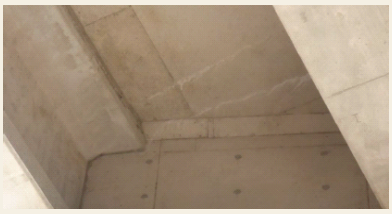
Traffic supported by municipal bridges

The City's bridges have been designed in accordance with the Bridge Design Code current at the time of construction to carry heavy transport vehicles, motor vehicles, emergency vehicles, cyclists, and pedestrians. There is one structure in the City with load restrictions.

Bridge and structural culvert condition

In accordance with O. Reg. 104/97: Standards for Bridges, the City conducts detailed inspections of all of its municipal structures every two years to ensure that they are maintained in a state of good repair. All inspections are supervised by a trained, professional engineer following industry standards for the visual inspection and condition rating of bridges and their elements. The inspector records suspected performance deficiencies and recommends maintenance and renewal activities, with costs. An overall Bridge Condition Index (BCI) is calculated from all collected data and informs the annual bridge and structural culvert rehabilitation and reconstruction program. The index is scaled from zero to 100 and has been divided into ranges to categorize each structure's condition. Condition grade and defect area examples are provided in the following table:

Table 26: Examples of BCI Condition Rating Categories

Condition Grade	Typical Bridge Example
Very Good (PQI = >80 to 100)	
Good (PQI = >70 to 80)	
Fair (PQI = >50 to 70)	
Poor (PQI = >35 to 50)	
Very Poor (PQI = 0 to 35)	

A2.2 Technical Levels of Service

To deliver services that meet customer and strategic LOS, several technical measures are tracked to demonstrate that roadway assets are maintained in a state of good repair. Based on the 2020 performance on condition measures such as PQI and BCI, Roadway System assets are in overall Good condition. To support environmentally sustainable goals, the City is currently completing an LED conversion project, and it is estimated that 72.6% of street lights have been converted to LED. As indicated in Section 1, the streetlight inventory will be updated and included in the next AMP. Salt usage is also monitored during the winter season to understand consumption levels. In the 2019-2020 winter months, a significant volume of salt was used due to the new snow windrow clearing program, as well as the number of snowfall events and the number of passes trucks needed to complete in each event. Salt usage may also be high in drawn out events in mild weather, where salt usage is used extensively because the lower accumulation does not warrant snow removal services.

Table 27: Technical LOS for Roadway System

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Number of lane-kilometres of arterial roads as a proportion of square kilometres of land area of the municipality.	O. Reg.	0.25
	Number of lane-kilometres of collector roads as a proportion of square kilometres of land area of the municipality.	O. Reg.	2.97
	Number of lane-kilometres of local roads as a proportion of square kilometres of land area of the municipality.	O. Reg.	8.88
	Percentage of bridges in the municipality with loading or dimensional restrictions.	O. Reg.	1.6%
Quality	Average pavement condition index value for paved roads.	O. Reg.	76.4
	Average surface condition (e.g. Excellent, Good, Fair or Poor) for unpaved roads.	O. Reg.	Fair
	For bridges in the municipality, the average bridge condition index value.	O. Reg.	73.0
	For structural culverts in the municipality, the average bridge condition index value.	O. Reg.	74.5
Reliable	Percentage of roads in Fair or better condition.	Fnd.	97.4%
	Percentage of vertical assets in Fair or better condition.	Fnd.	96.6% (Signals)
	Percentage of bridges and culverts in Fair or better condition (based on BCI score).	Fnd.	98.3%
Environmentally Sustainable	Volume of salt applied to road per lane km.	Fnd.	9.2 tonnes / lane-km*
	Percentage of streetlights with LED or low energy fixtures.	Fnd.	72.6%

*2019-2020 winter season

A2.3 Advanced Levels of Service

To assist in understanding asset performance for the Roadway System, the City intends to improve data collection and report on additional measures in the future, including those related to Minimum Maintenance Standards (MMS) and collisions. These additional measures will assist the City in understanding areas of potential improvement and providing additional data to support asset investment decisions.

A2.4 External Trends and Issues

The Roadway System is highly integrated with the other infrastructure located under the road surface, such as Water Distribution, Wastewater Collection, and Stormwater Management assets. The LOS for the roadway can therefore affect the condition and longevity of these other assets. For example, water infiltration from the road surface into the road bed can damage the underground assets. Conversely, failure to meet the LOS for Water Distribution, Wastewater Collection, and Stormwater Management assets can damage the roadway itself, with the potential for water leaking from pipes and undermining the road bed.

Climate change is another influence on LOS. An increased risk of flooding of the roadway may require changes to design specifications, and freeze-thaw events will increase the deterioration rate and decrease the road's estimated remaining life.

A3 Asset Management Strategy

Asset management strategies are the planned lifecycle actions that Richmond Hill uses to manage its infrastructure to meet the service levels described in the previous section. Table 28 summarizes the lifecycle strategies for Roadway System assets.

Table 28: Lifecycle Strategies for Roadway System

Lifecycle Activity	Description of Activities Practiced by the City
Non-Infrastructure	• Load restrictions are used to reduce wear on some roads. • The City makes continuous improvements in operations as well as initiatives related to employee capabilities, communications, training, etc.
Maintenance	• The City performs routine maintenance such as street sweeping, pothole patching, utility cut repairs, expansion joint cleaning, annual routine municipal structure maintenance, and snow and ice removal. • The City performs regular signal inspections and maintenance on failed signal components.
Rehabilitation	• Roads rehabilitation is based on the assets' current condition and projected deterioration. Treatments include patching, crack sealing, micro-surfacing, and resurfacing. • Bridge and culvert rehabilitation is based on inspection recommendations. • Traffic signal asset rehabilitation is based on age and remaining service life. • Refer to discussion below this table for additional details.

Continued...

Table 28: Lifecycle Strategies for Roadway System	
Lifecycle Activity	**Description of Activities Practiced by the City**
Replacement	• Roads replacement activities are considered for bundling with interventions on different assets that share the same space to minimize costs. Once rehabilitation options are exhausted, roads are replaced, which helps ensure that overall lifecycle costs are minimized. • Traffic signal asset replacement is based on age and remaining service life. • Bridge and culvert replacements are generally based on observed condition, age, and ESLs. • Refer to discussion below this table for additional details.
Disposal	• Roadway, bridge, and culvert material disposals are in line with best practices and regulations. • Traffic signal assets are disposed at the end of their service life.
Growth/Service Improvement	• Improvement activities may include technologies such as pavement material alternatives and new pavement design processes. • The City's next Transportation Master Plan update will provide recommendations to upgrade the road network based on an analysis of future population and employment conditions resulting from anticipated growth. The City will balance its prioritized roads needs with recommendations from the Master Plan to ensure that growth and reliability needs can be serviced at the lowest possible cost. • Expansions to the Roadway System are identified through technical analysis as part of servicing plans completed to service new development. • Assets are identified for replacement to meet current standards and implement operational improvements. Street lights are converted to LED or low energy fixtures. • Conversion of rural roads to urban roads is considered and balanced against the needs for growth and renewal.

Focus on Rehabilitation and Replacement Activities

Roads assets are maintained in a state of good repair through regular rehabilitation and replacement efforts. Pavement Management Analysis (using a specialized truck equipped with sensors that scan road condition) is conducted every three years on Richmond Hill's roads. The output Pavement Quality Index (PQI) for each road segment is based on a combination of factors such as surface distress (SDI), roughness (IRI), and structural adequacy (SAI). Appropriate rehabilitations are applied to extend the assets' lifecycles and maintain a state of good repair, while deferring more costly road reconstruction works until they are absolutely necessary. The following rehabilitation strategies are typically applied to roads:

- Crack Sealing (all road types)
- Micro Surfacing (Rural and Urban, Arterial/Collector only)
- Full Mill and Overlay (Urban)
- Full Depth Reclamation (Rural)
- Pulverize and Overlay (Rural)

Road construction is completed based on balancing condition with other needs such as infrastructure repairs of different assets that share the same space, conversion of rural and semi-urban roads, and growth (which could require road widening). As the Region owns and operates arterial roads, transit, and some street lighting, an extra level of coordination is required when roadwork is necessary on a road that connects to a Regional road.

The estimated rate of deterioration, timing for the various interventions (the triggers), and their resets are summarized in Figure 39 and Figure 40 for an example of an urban and rural road, respectively. The models are based on three characteristics of roads assets: the surface thickness (thin, medium or thick), the base strength (strong or weak) and the traffic volume (low, medium or high). The different triggers determine the expected timing of rehabilitation and replacement interventions.

Figure 39: Urban Road Interventions

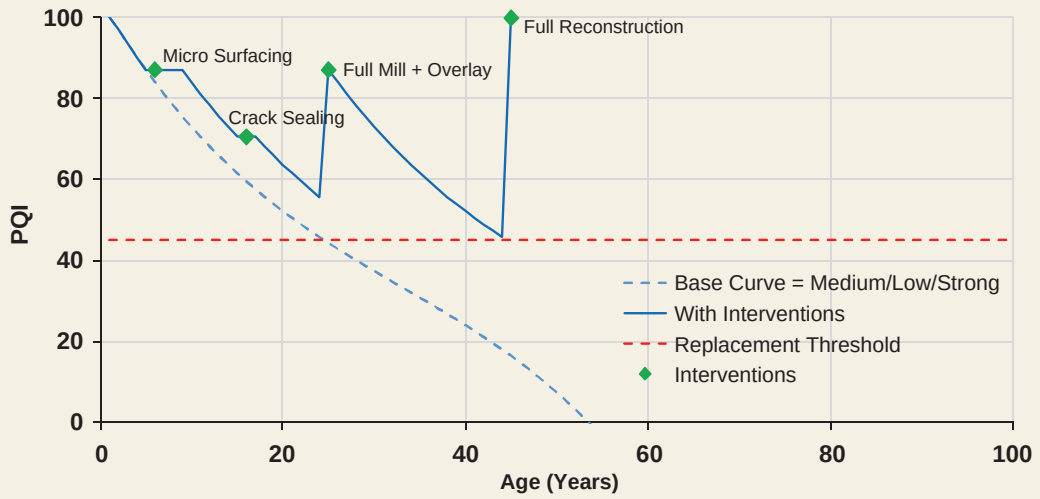
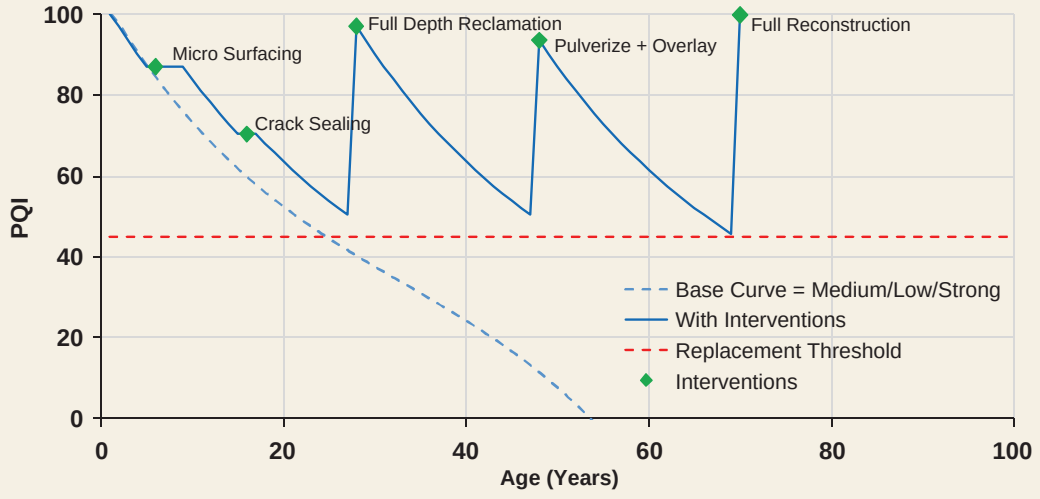


Figure 40: Rural Road Interventions

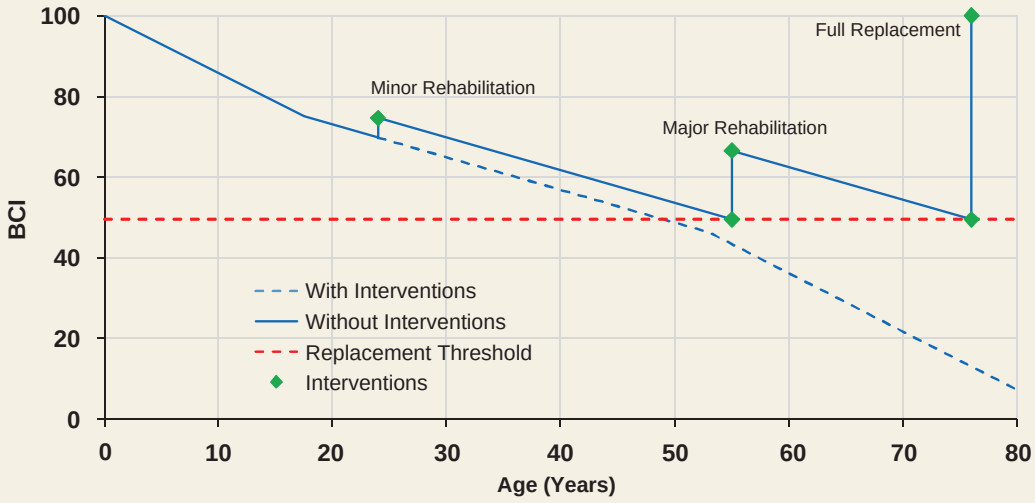


Traffic Signals have regular inspection and maintenance programs, but fewer options to correct or rehabilitate malfunctioning components. Typically, malfunctioning components are replaced to restore their function, and end of life replacement occurs when an intersection is being reconstructed as part of a road project. The different deterioration rates for signal components are represented through the different ESL values assigned to each asset subtype. The ESL is established in consideration of the need to meet service levels and lower lifecycle costs.

The City completes inspections of its bridges and culverts on a 2-year cycle per regulatory requirements. Capital works, including both rehabilitation and repairs are identified based on the findings from these inspections. These projects are generally identified to ensure public safety by keeping these assets in a state of good repair. Bridges and culvert lifecycle models were developed based on professional judgment and industry best practices, to enable forecasting of funding requirements over the longer term. The models are based on structure type, which consists of vehicular bridges, concrete culverts, and corrugated steel pipe (CSP) culverts. The models include planned interventions at various points within the structures' lifecycles, such as the replacement of various structure elements.

The estimated rate of deterioration and timing for rehabilitations and replacement at the various triggers is summarized in Figure 41. Most municipal structures are expected to have a minor rehabilitation, major rehabilitation, and then be reconstructed between 70 and 80 years based on its material and/or type. Steel culverts are an exception and are replaced at the end of life after approximately 55 years. As shown in Figure 41, there are three distinct rates of deterioration over the lifecycle. The current model for municipal structure assets is designed to guide the need for general capital investment with regards to timing and costs of major interventions. For detailed maintenance and renewal recommendations, the City relies on the expert opinion and results contained within the biennial inspections.

Figure 41: Deterioration Curve and Interventions for Vehicular Bridges



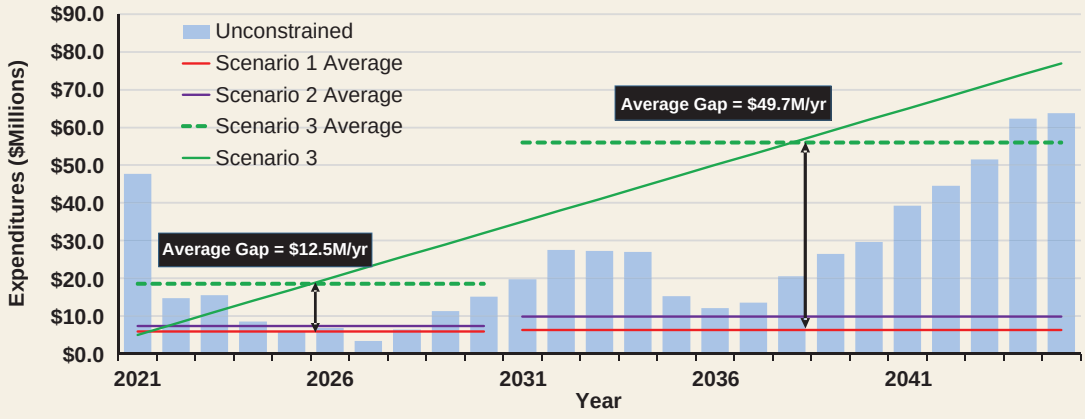
A4 Investment Needs and Financial Assessment

A4.1 Renewal Investment Forecast

Rehabilitation and replacement of Roadway System assets are primarily funded through the tax levy, federal gas tax grant and occasionally local improvement charges and other grant reserves. As discussed in Section 5.2.1.1, the assets within the Roadway System share the same funding sources as Active Transportation assets within the ROW, and therefore, the scenario analysis considers a consolidated overall funding envelope for the two Sub-Services. The City does not have sufficient funding to meet the Unconstrained Scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS. This Appendix restates the funding gap provided in Section 5.2.1.1 for the overall funding envelope and also discusses in more detail how the overall funding is distributed between Roadway System and Active Transportation Sub-Services and across asset types based on risk.

The analysis in Section 5.2.1.1 showed that the increased funding in Scenario 3 is able to maintain LOS compared to the Status Quo (Scenario 1). Scenario 3 identified expenditures that increase steadily over the next 10 years ($18.5 million annual average, starting at $5 million in 2021 and increasing by $3 million each year to $32 million in 2030). As shown in Figure 42, the funding gap was identified as $12.5 million per year on average over the next 10 years, assuming no drawdown of reserve fund balances and no utilization of debt to reduce the gap. The funding gap is expected to increase considerably in years 11 to 25.

Figure 42: Scenario Summary and Funding Gap for Transportation Services*



*Does not include non-Core+: streetlights, traffic signs, active transportation outside ROW

*Does not include construction of sidewalks that are not true R&R (new sidewalks connecting existing segments)

The difference in Status Quo (Scenario 1) and Maintaining LOS (Scenario 3) is demonstrated in more detail by Asset Type in this Appendix. The Status Quo (Scenario 1) funding averages $6.0 million per year of available capital funding over the next 10 years, and $6.3 million annually thereafter. Therefore, in the Status Quo scenario, limited funding is available to address the initial backlog as well as the increasing R&R needs for roads, bridges, culverts, and traffic signals, and the condition deteriorates as shown in Figure 43.

In the Financial Sustainability Strategy (Scenario 2), the average annual amount of funding for Roadway System and Active Transportation assets is $7.3 million over the first ten years and $9.9 million in years 11 to 25. This funding is based on the tax-supported contributions associated with a higher annual 1.5% CAS levy increase to 2030. Utilization of debt or drawdown of reserve fund balances are not considered in this AMP. In the Financial Sustainability Strategy scenario, although tax-supported contributions are higher than the Status Quo scenario and more critical assets are addressed for interventions, funding is still insufficient and the condition deteriorates over the forecast period.

Scenario 1 and 2 Common Principles:

- Debt and reserve fund balances are not considered
- Assumes 30% of the tax-supported reserve contributions are allocated to roadway system and active transportation assets
- Assumes federal gas tax funding of $470,000 per year

Scenario 1 and 2 Difference:

- Scenario 1: contributions based on annual CAS levy increase of 1% to 2025
- Scenario 2: contributions based on annual CAS levy increase of 1.5% to 2030

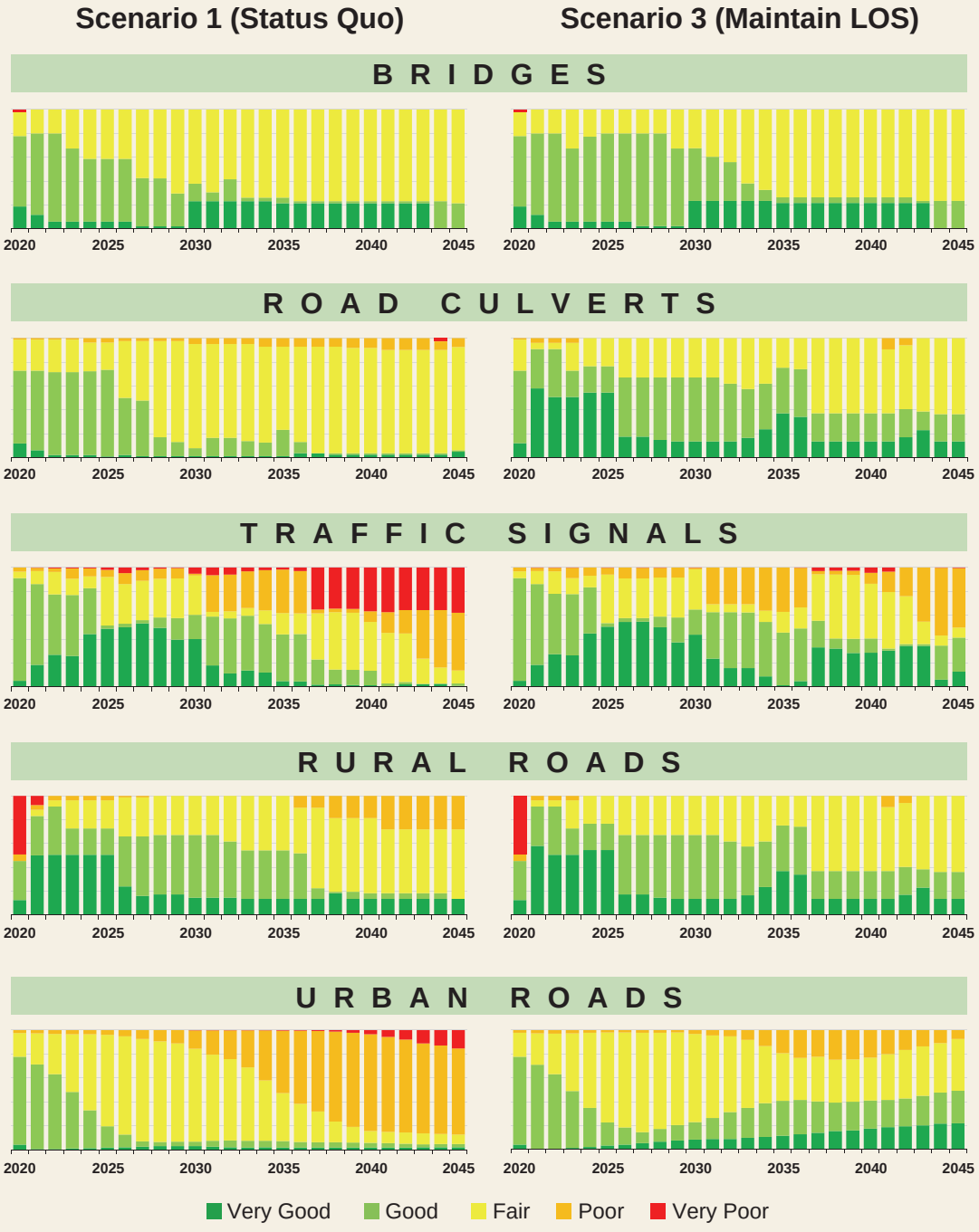
At any given constrained funding level, the EAM prioritizes investment decisions to ensure that assets with the highest criticality are addressed on a timely basis to minimize the overall risk to the City. Funding is generally prioritized for bridges, road culverts and roads in all constrained scenarios at the expense of lower critical assets such as sidewalks on lower traffic roads.

To maintain condition LOS, Scenario 3 identifies an increased average funding level of $18.5 million annually for Roadway System and Active Transportation asset needs over the first ten years. The funding is still constrained in that the $47.7 million backlog cannot be cleared immediately while still addressing upcoming needs.

Maintaining current LOS (Scenario 3) will cost more than either Scenario 1 or 2, but it maintains the condition of roads and more efficiently manages the whole life of the assets as mid-life interventions are deferred to a lesser extent for the more expensive end-of-life replacements. To address higher risk assets, much of the annual average expenditure is directed toward Roadway System assets at the expense of Active Transportation assets (refer to Appendix B for discussion on Active Transportation).

Figure 43 compares the Status Quo (Scenario 1) and Maintain LOS (Scenario 3) by Asset Type to clearly illustrate the impact of the funding gap on asset condition, and in particular the improved condition of road assets in Scenario 3.

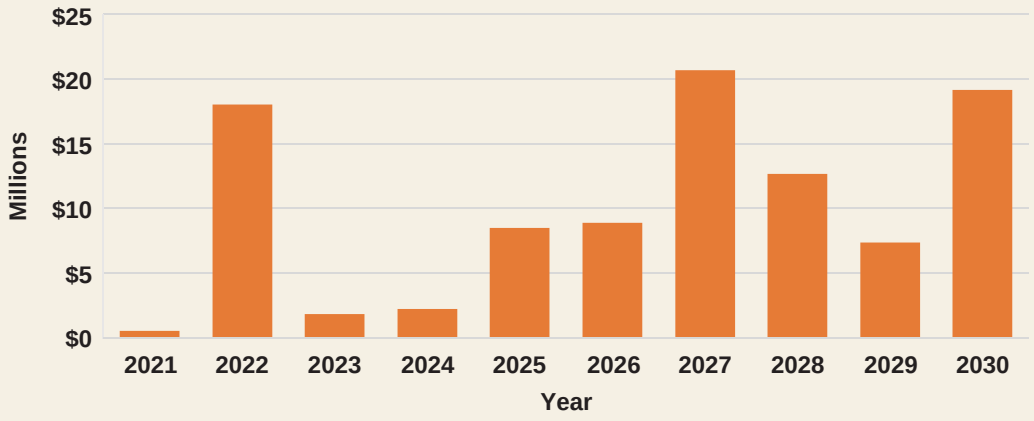
Figure 43: Projected LOS Comparison for Roadway System



A4.2 Preliminary Growth Investment Forecast

Figure 44 shows the investments in the Roadway System that are planned for the next 10 years to meet growth needs. Forecasted growth projects are identified for the road network based on analysis of future population and employment conditions from anticipated growth in the City. The network improvement proposals are outlined in the Ten Year Capital Forecast associated with the Financial Sustainability Strategy and include improvements to existing roads (i.e. road widening, turning lane improvements, signalization), as well as constructing new roads and bridges. Project timing is informed by the City's Ten Year Capital Forecast. Regarding assets to be assumed in the future, the forecast only includes assets that are proposed to be funded under the Development Charges By-law.

Figure 44: Growth Investment Forecast for Roadway System



A4.3 Preliminary Operating Budget Forecast

As the City's Operating Budget considers Roadway System and Active Transportation Sub-Services together, the estimated operating budget forecast for expenditures related to asset operations and maintenance activities for both Sub-Services is provided in Figure 45. Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments can place cumulative, additional pressures on the annual operating budget.

The estimated preliminary operating budget forecast for expenditures related to asset operations and maintenance activities for Roadway System and Active Transportation assets (Figure 45) assumes growth based only on the value of new capital projects outlined in Section A4.2 and B4.2. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process.

Figure 45: Operating Budget Forecast for Roadway System and Active Transportation

The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. Legislation changes may also impact future operating and maintenance costs.

Appendix B: Active Transportation

Active Transportation refers to assets that enable "human-powered" modes of transportation – mainly walking and cycling. This AMP only considers Active Transportation assets that are located within the road right-of-way (ROW), namely sidewalks, multi-use paths, and bicycle lanes. The Active Transportation Sub-Service as a whole is focused on providing connected and sustainable modes of travel, which is dependent on the accessibility of these assets to the public.

B1 State of the Infrastructure

B1.1 Overview

The total estimated value of the City's Active Transportation infrastructure within the ROW is **$188.7 million**. The average condition of all Active Transportation assets is **Good (Letter Grade B)**.

The inventory for the City's Active Transportation system is summarized in Table 29. The bicycle lanes included in the table are part of roads and therefore their replacement value is accounted for in the Roadway System (refer to Section A1).

Figure 46: Asset Condition Distribution and Valuation for Active Transportation

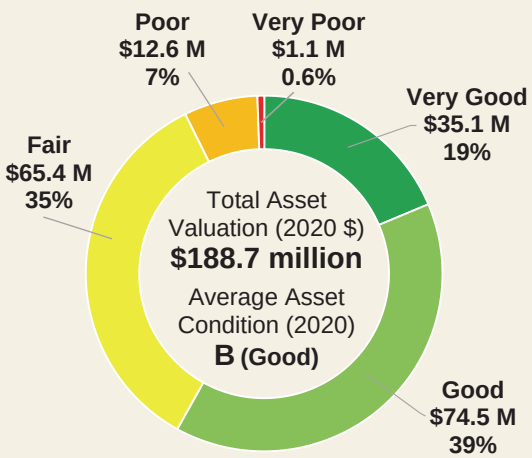


Table 29: Inventory Overview for Active Transportation

Asset Type	Quantity	Replacement Cost ($ millions)	Average Age	Average Condition
Sidewalks	679 km	$186.7	23	Good (B Grade)
Multi-Use Paths	9 km	$2.1	3	Very Good (A Grade)
Bicycle Lanes	152 km	N/A*	29**	Fair (C Grade)
	TOTAL	$188.7	23	Good (B Grade)

*Bicycle Lanes are part of the Roadway System, so they are not valuated separately.

** Average age and condition of bicycle lanes were weighted by length, not cost.

B1.2 Asset Valuation

Replacement costs for sidewalks and multi-use paths are determined by multiplying their length by a unit cost associated with replacement. Unit costs are estimated from recent construction contract pricing.

B1.3 Asset Condition

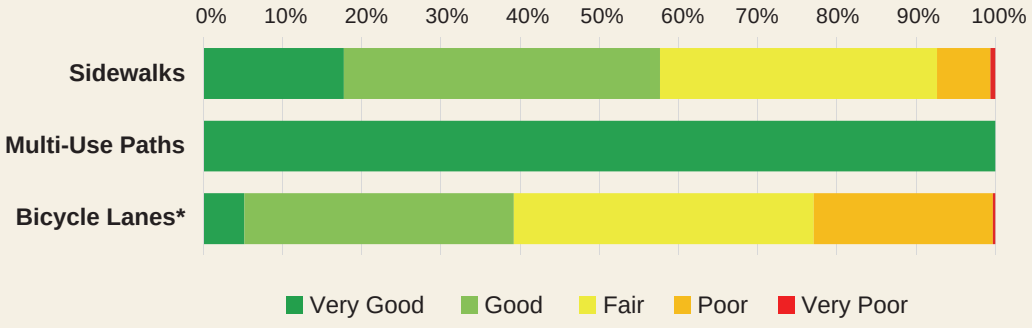
Table 30 summarizes the condition rating system for Active Transportation Assets. Asset age is currently used as a proxy for condition for sidewalks, multi-use paths, and bicycle lanes. Sidewalks are currently inspected annually to ensure the provincial minimum maintenance standard (MMS) is being met. Deficiencies are digitally captured by staff using handheld devices and stored in a database. This inspection data will be leveraged in the future to provide a more accurate representation of sidewalk condition, which will in turn improve the accuracy of reporting and forecasting.

Table 30: Asset Condition Rating System for Active Transportation

Performance Category	Letter Grade	Sidewalks Multi-Use Paths Bicycle Lanes Service Life Remaining
Very Good	A	>80% of life remaining
Good	B	60-80% of life remaining
Fair	C	40-60% of life remaining
Poor	D	20-40% of life remaining
Very Poor	F	<20% of life remaining

More than 55% of sidewalk assets are estimated to be in Good or Very Good condition. Multi-use paths are newer assets (with an average age of 3 years), and as a result, are all estimated to be in Very Good condition. Less than 40% of bicycle lanes are in Good or Very Good condition based on the age of its associated road.

Figure 47: Condition Profile for Active Transportation

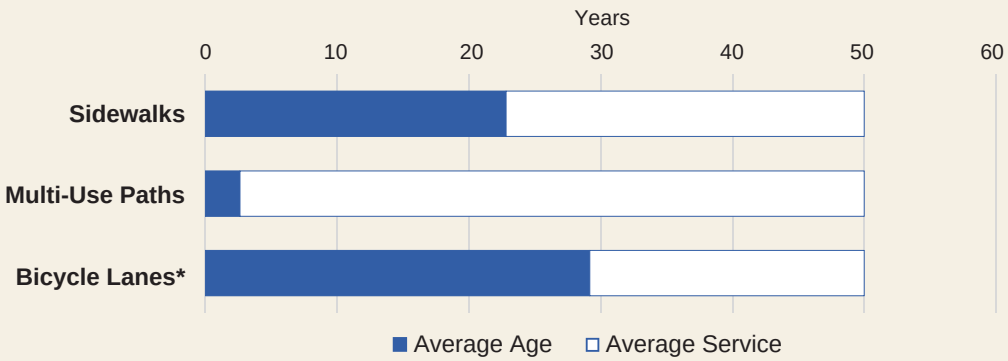


*Condition of bicycle lanes is distributed based on length, not replacement cost.

B1.4 Asset Age

Figure 48 shows the average age and estimated service life of Active Transportation assets. Similar to the Roadway System, most Active Transportation assets have been constructed within the last 30 years. As indicated in Section B1.3, bicycle lanes are assumed to be the same age as the associated road. Multi-use paths are newer assets and will continue to be constructed as the City focuses on providing a sustainable multi-modal network.

Figure 48: Average Asset Age vs. Average Service Life for Active Transportation



*Average age of bicycle lanes is determined based on length, not replacement cost.

B2 Levels of Service

With a growing population in Richmond Hill and the surrounding Greater Toronto Area, traffic congestion, air pollution, and greenhouse gas emissions are expected to increase. To counter these trends, the City promotes infrastructure and programs that support more sustainable options, such as walking, cycling, and public transit. The Active Transportation Sub-Service is a vital counterpart to the Roadway System Sub-Service and has similar objectives and Strategic LOS to provide connected and sustainable modes of travel. Alignment of Strategic LOS with the City's strategic priorities is outlined in Table 31.

Table 31: Strategic LOS Alignment for Active Transportation

Strategic LOS	Strategic Priorities Themes (2020-2022)	Climate Change Framework Goals
Provide connected, comfortable, and reliable options for active transportation that support the use of sustainable modes of travel	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Land-use Planning • Asset Management • Community Risk Mitigation • Natural and Engineered Green Infrastructure

As discussed in Section 3, the LOS provide a Line of Sight by aligning higher level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measures of managing that infrastructure (the Technical LOS).

B2.1 Customer Levels of Service

The City's Customer LOS are summarized in Table 32. Measures pertaining to the availability and usage of Active Transportation assets as well as the completeness of the construction of these assets provide insight into network's accessibility. In 2020, the City achieved 97% compliance to Access Richmond Hill Service levels for requests related to sidewalk and curb maintenance. The active transportation modal split percentage based on the 2016 Federal Census Data identified 2.7% of employed residents walking or bicycling as the main mode of commuting in Richmond Hill. Census data is updated every five years, and therefore more current data will be available in the next AMP update.

Table 32: Customer LOS for Active Transportation

Service Attribute	Performance Measure	Measure Type	2020 Performance
Accessible	Number of kms of trails, sidewalks, and cycling routes	Fnd.	840.5 km
	Active Transportation Modal Split Percentage	Fnd.	2.7%*
Quality	Percentage of complaints or issues resolved in compliance with Access Richmond Hill Service Levels	Fnd.	97%

*2016 performance reported

B2.2 Technical Levels of Service

The Technical LOS demonstrates that Active Transportation assets within the ROW are maintained in a state of good repair based on age. As discussed in Section B1.3, the condition assessment will be better informed in the next AMP with the consideration of sidewalk inspection data.

Table 33: Technical LOS for Active Transportation

Service Attribute	Performance Measure	Measure Type	2020 Performance
Reliable	Percentage of assets in Fair or better condition	Fnd.	92.7%

B2.3 Advanced Levels of Service

The City intends to report on additional measures in the future, including the priority spine network and winter maintenance service levels. The next Transportation Master Plan update will define the final approved priority spine network and enable reporting on associated measures. These additional measures will assist the City in understanding areas of potential improvement and making effective asset investment decisions.

B2.4 External Trends and Issues

As indicated in Appendix A, the Active Transportation assets are highly integrated with the Roadway System. To address the growing population and needs for a multi-modal network of roads, walking, cycling, and trails, the City is currently updating its Transportation Master Plan to meet the future needs of the community.

B3 Asset Management Strategy

Asset management strategies are the planned lifecycle actions that Richmond Hill uses to manage its infrastructure to meet the service levels described in the previous section. Table 34 summarizes the lifecycle strategies for Active Transportation assets.

Table 34: Lifecycle Strategies for Active Transportation

Lifecycle Activity	Description of Activities Practiced by the City
Non-Infrastructure	• The City makes continuous improvements in operations as well as initiatives related to employee capabilities, communications, and training.
Maintenance	• The City performs routine maintenance such as grinding, patching, single and multi-bay replacement, utility cut repairs, and sidewalk/trail levelling. • Winter maintenance is practiced for all sidewalks and multi-use paths within the road right-of-way.
Rehabilitation	• Active transportation assets generally do not undergo rehabilitation activities, and are replaced at end of life. • Refer to discussion below this table for additional details.
Replacement	• Replacement activities includes replacement of sidewalks and resurfacing of pathways. These activities are based on condition and forecasted based on age and expected service lives. • Refer to discussion below this table for additional details.
Disposal	• Pathway disposals are infrequent and generally related to rerouting.
Growth/Service Improvement	• Improvement activities may include technologies such as pavement material alternatives and new and improved materials and design processes. • The City's next Transportation Master Plan update will provide recommendations to upgrade its routes and trails, based upon existing and previously proposed routes that have been identified in approved City planning documents. The City will balance its prioritized path needs (based on condition) with recommendations from the Master Plan to ensure that growth and reliability needs can be serviced at the lowest possible cost while meeting service levels. • Expansions to the primary spine pathway network and connections to neighbourhood destinations are considered as part of the City's Transportation Master Plan to improve the active transportation network.

Focus on Rehabilitation and Replacement Activities

Many Active Transportation assets within the ROW are combined with roadways, and as a result, their lifecycle strategy is detailed in the Roadway System Sub-Service. Sidewalks are replaced at the end of their service life. The City is evaluating the performance of interlock stone sidewalks which in some areas appear to be experiencing higher deterioration rates than expected. A more effective approach to lower lifecycle costs may be to convert these stone sidewalks to a standard concrete material. Planned replacements for paths, which consists of resurfacing the pathways, are also based on age and their expected service life.

Generally, Active Transportation assets are exposed to less wear than their roads counterparts, and as such, the varied interventions typical of roads assets are not generally practiced for sidewalks and multi-use paths. Lifecycles are minimized by using an end of life replacement approach estimated at 50 years.

The City's current approach to managing the lifecycle of sidewalks and multi-use paths within the City's right-of-ways is to replace whole segments only when the adjacent road is being reconstructed. All other interventions to maintain the assets are currently delivered as operational activities. A continuous improvement initiative will be to improve capital planning by incorporating the digital condition information captured annually by operations staff. This information can be used to create an overall condition score that reflects the need to replace all or some of the sidewalk and path segments. This improved understanding of capital needs will support coordination between the reactive operational upkeep of minimum maintenance standards and a proactive capital replacement program that is coordinated with other adjacent assets such as roads.

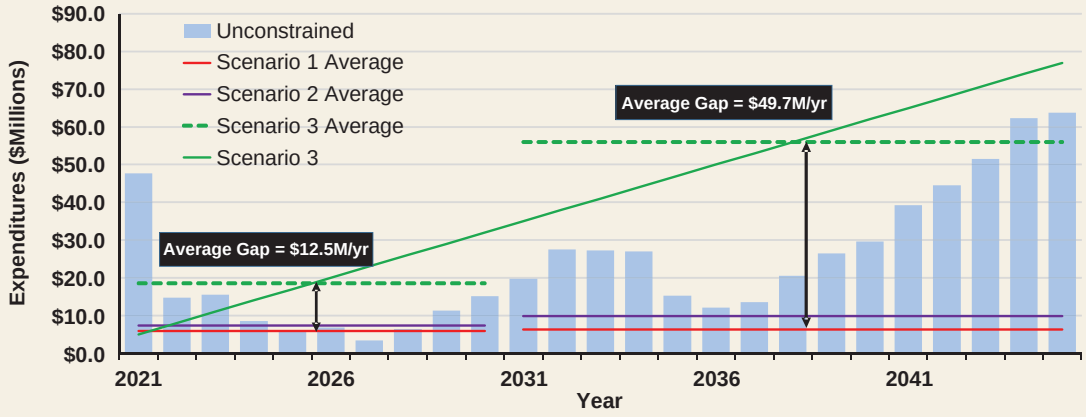
B4 Investment Needs and Financial Assessment

B4.1 Renewal Investment Forecast

Rehabilitation and replacement of Active Transportation assets are primarily funded through the tax levy, federal gas tax grant and occasionally local improvement charges and other grant reserves. As discussed in Section 5.2.1.1, the assets within the Roadway System share the same funding sources as Active Transportation assets within the ROW, and therefore, the scenario analysis considers a consolidated overall funding envelope for the two Sub-Services. The City does not have sufficient funding to meet the Unconstrained Scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS. This Appendix restates the funding gap provided in Section 5.2.1.1 for the overall funding envelope and also discusses in more detail how the overall funding is distributed between Roadway System and Active Transportation Sub-Services and across asset types based on risk.

The analysis in Section 5.2.1.1 showed that the Maintain LOS Forecast (Scenario 3) is able to maintain LOS compared to the Status Quo (Scenario 1). Scenario 3 identifies expenditures that increase steadily over the next 10 years ($18.5 million annual average, starting at $5 million in 2020 and increasing by $3 million each year to $32 million in 2030). As shown in Figure 49, the funding gap was identified as $12.5 million per year on average over the next 10 years, assuming no drawdown of reserve fund balances and no utilization of debt to reduce the gap. The funding gap is expected to increase considerably in years 11 to 25.

Figure 49: Scenario Summary and Funding Gap for Transportation Services*



*Does not include non-Core+: streetlights, traffic signs, active transportation outside ROW

*Does not include construction of sidewalks that are not true R&R (new sidewalks connecting existing segments)

The difference in Status Quo (Scenario 1) and Maintaining LOS (Scenario 3) is demonstrated in more detail by Asset Type in this Appendix. The Status Quo (Scenario 1) funding averages $6.0 million per year of available capital funding over the next 10 years, and $6.3 million annually thereafter. Therefore, in the Status Quo scenario, limited funding is available to address the initial backlog as well as the increasing needs of sidewalks, as shown by the deteriorating condition in Figure 50.

In the Financial Sustainability Strategy (Scenario 2), the average annual amount of funding for Roadway System and Active Transportation assets is $7.3 million over the first ten years and $9.9 million annually in years 11 to 25. This funding is based on the tax-supported contributions associated with a higher annual 1.5% CAS levy increase to 2030. Utilization of debt or drawdown of reserve fund balances are not considered in this AMP. Although the tax-supported contributions are higher in the Financial Sustainability Strategy scenario than the Status Quo scenario and more critical assets are renewed, funding is still insufficient and the condition deteriorates over the forecast period.

Scenario 1 and 2 Common Principles:

- Debt and reserve fund balances are not considered
- Assumes 30% of the tax-supported reserve contributions are allocated to roadway system and active transportation assets
- Assumes federal gas tax funding of $470,000 per year

Scenario 1 and 2 Difference:

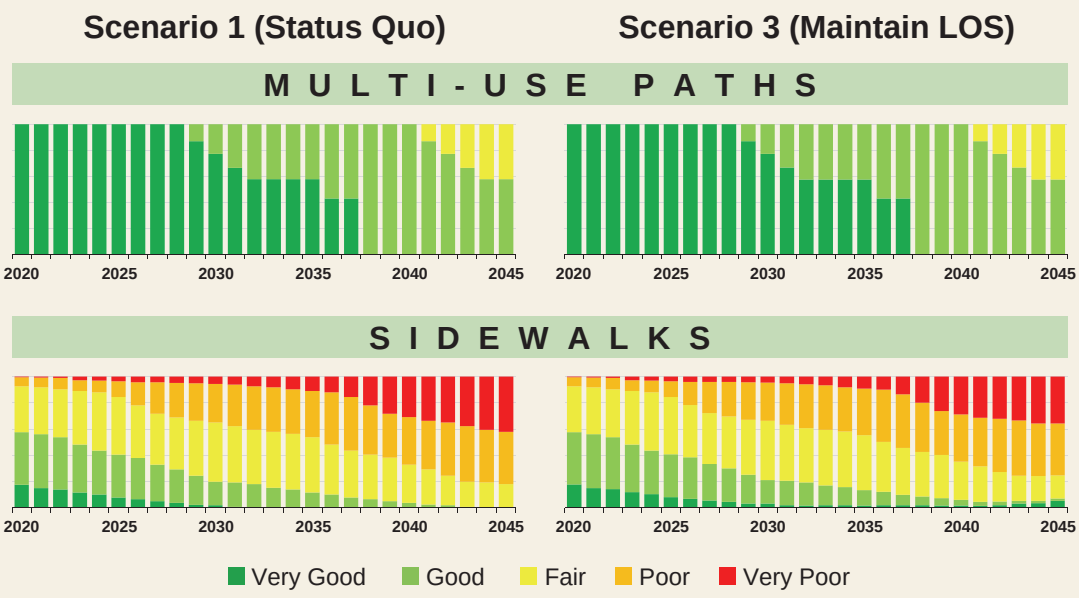
- Scenario 1: contributions based on annual CAS levy increase of 1% to 2025
- Scenario 2: contributions based on annual CAS levy increase of 1.5% to 2030

To maintain condition LOS, Scenario 3 identifies an increased average funding level of $18.5 million annually for Roadway System and Active Transportation asset needs over the first ten years. The funding is still constrained in that the backlog cannot be cleared immediately while still addressing upcoming needs.

Figure 50 compares projected condition for the Status Quo (Scenario 1) and Maintain LOS (Scenario 3) by Asset Type. Though the condition for Roadway System and Active Transportation assets is maintained at the overall level in Scenario 3, Active Transportation assets when viewed separately do not receive adequate funding to maintain service levels. As discussed in Section 5.2.1, at any given constrained funding level, the EAM prioritizes investment decisions to ensure that assets with the highest criticality are addressed on a timely basis. Therefore, much of the annual average expenditure is directed toward Roadway Assets at the expense of Active Transportation assets, which is allocated approximately 1% of the budget. Though Scenario 3 is slightly improved compared to Scenario 1 for Active Transportation assets, a portion of sidewalk assets are still left to deteriorate so that R&R needs for critical roads can be met (refer to Appendix Section A4 for discussion on roads).

The City has on-going initiatives that are expected to improve its understanding of sidewalk capital needs, and it is anticipated that the projected sidewalk condition may improve once these initiatives are implemented. As indicated in Section B3, a continuous improvement initiative will be to improve capital planning by incorporating the digital condition information captured annually by operations staff. This information will improve the City's understanding of the asset lifecycle and support informed decisions in the various timing and application of treatments. With this additional data, the condition outlook for sidewalks may improve in the next AMP.

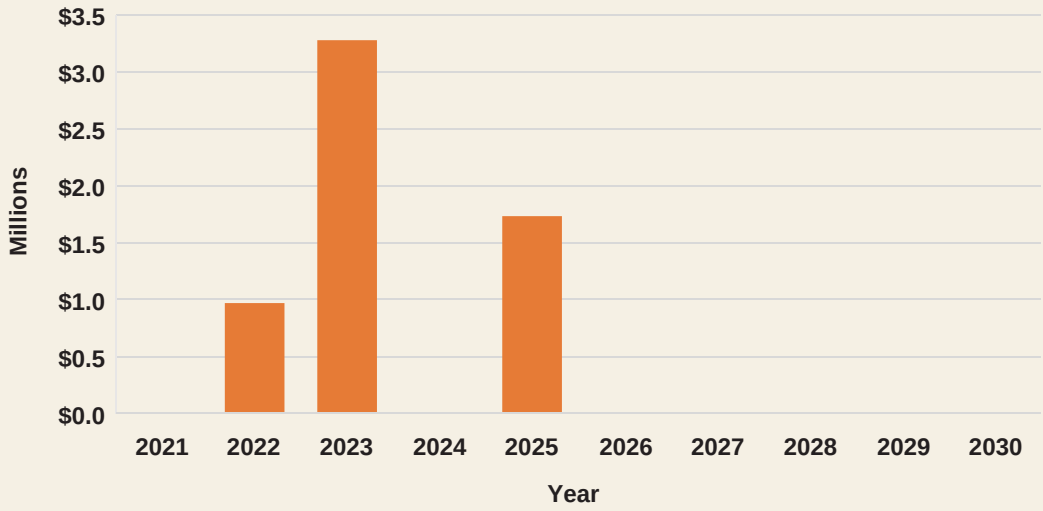
Figure 50: Projected LOS Comparison for Active Transportation



B4.2 Preliminary Growth Investment Forecast

Figure 51 shows the investments in the City's Active Transportation infrastructure that are planned for the next 10 years to meet growth needs. Forecasted growth projects are outlined in the Ten Year Capital Forecast associated with the Financial Sustainability Strategy. The proposed Active Transportation routes are intended to support local neighborhood connectivity as well as key spines through the City to link pedestrians, cyclists, and other multi-modal users to key destinations. Project timing is informed by the Capital Forecast. Regarding assets to be assumed in the future, the forecast only includes assets that are proposed to be funded under the Development Charges By-law.

Figure 51: Growth Investment Forecast for Active Transportation*



*Does not include active transportation projects outside the ROW

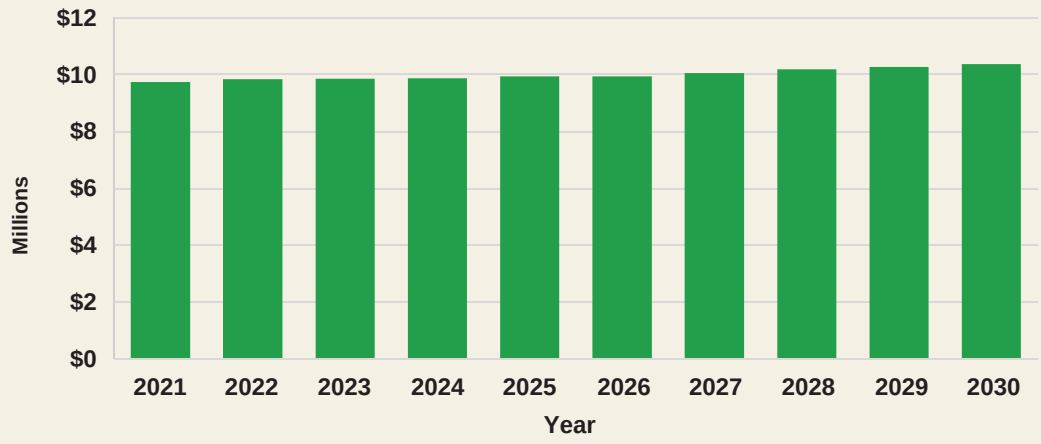
*Does not include construction of sidewalks that are not classified as growth (sidewalk links connecting existing segments)

B4.3 Preliminary Operating Budget Forecast

As the City's Operating Budget considers Roadway System and Active Transportation Sub-Services together, the estimated operating budget forecast for expenditures related to asset operations and maintenance activities for both Sub-Services is provided in Figure 52. Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments can place cumulative, additional pressures on the annual operating budget.

The estimated operating budget forecast for expenditures related to asset operations and maintenance activities for Roadway System and Active Transportation assets in Figure 52 assumes growth based only on the value of new capital projects outlined in Section A4.2 and B4.2. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process.

Figure 52: Operating Budget Forecast for Roadway System and Active Transportation



The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. In particular for sidewalks, the integration of sidewalk inspection information will enable better alignment and planning of operational and capital activities and a lower lifecycle cost approach. Legislation changes may also impact future operating and maintenance costs.

Appendix C: Water Distribution

The City provides distribution of a safe and consistent supply of drinking water through its network of watermains. Drinking water in Richmond Hill is purchased from York Region and is then distributed through the City-owned and managed Water Distribution system. The City is legislated to meet stringent Provincial requirements for management practices and water quality. Almost 5,000 water samples are tested annually and regular audits are performed to ensure compliance.

C1 State of the Infrastructure

C1.1 Overview

The total estimated value of the City's Water Distribution assets is **$1.4 billion**. The average condition of Water Distribution assets is **Very Good (Letter Grade A)**.

The inventory for the City's Water Distribution system, as summarized in Table 35, consists of 638 kilometres of local and large watermains that supply the City's residents and businesses with clean drinking water.

Figure 53: Asset Condition Distribution and Valuation for Water Distribution

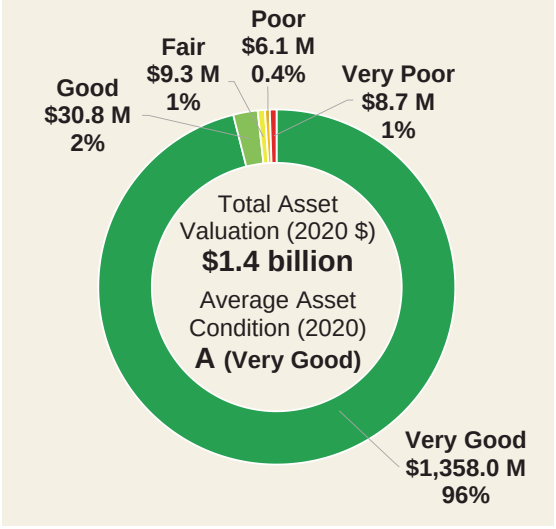


Table 35: Inventory Overview for Water Distribution

Asset Type	Asset Sub-Type	Quantity	Replacement Cost ($ millions)	Average Age	Average Condition
Watermains	Local Watermains*	632.7 km of pipe	$1,383.2	26	Very Good (A Grade)
	Large Watermains*	5.5 km of pipe	$29.8	23	Very Good (A Grade)
		TOTAL	$1,413.0	26	Very Good (A Grade)

*Local watermains are less than 500mm in diameter; large watermains are 500mm and greater.

C1.2 Asset Valuation

The $1.4 billion valuation of the Water Distribution system is based on a unit cost estimate. Replacement costs for watermains are estimated by multiplying the length of a watermain segment by a specific unit cost associated with watermain replacement for a particular diameter of pipe and material. The costs of other ancillary assets in the Water Supply Network, such as fire hydrants and valves, are captured in the watermain's unit construction costs. Estimated soft costs such as design and engineering are also considered in each unit cost.

C1.3 Asset Condition

The City maintains a detailed database of watermain breaks. Breaks are logged with work order data every time new breaks occur and a repair is performed. The City records important data related to each break event, such as the duration and number of customers affected, pipe material, and repair performed to understand issues within the network and develop appropriate lifecycle strategies to minimize service interruptions in the future. Once a given pipe segment has experienced an established number of breaks, it is considered for capital intervention (refer to Section C3 for additional details on lifecycle strategies).

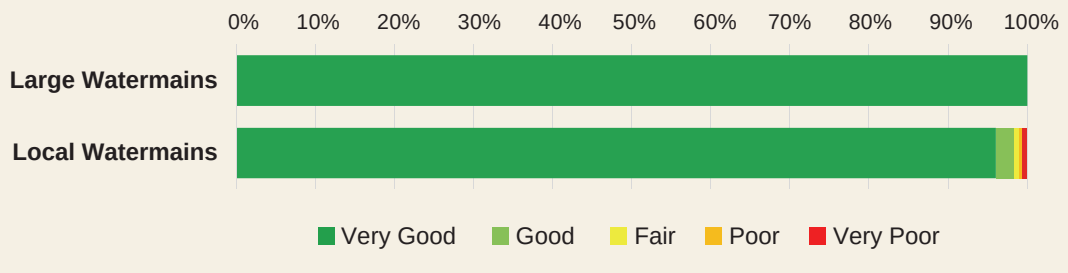
The City's LOS for watermains is to maintain these assets in Fair or better condition, which is defined as four or less breaks over the service life. The condition rating system in Table 36 illustrates the relationship between number of breaks and the various performance categories.

Table 36: Asset Condition Rating System for Water Distribution

Performance Category	Letter Grade	Watermains Number of Breaks
Very Good	A	0 to 1 Breaks
Good	B	2 to 3 Breaks
Fair	C	4 Breaks
Poor	D	5 to 6 Breaks
Very Poor	F	7+ Breaks

The long estimated life and relatively new installation of Water Distribution assets is reflected in the asset condition distribution below (Figure 54). The majority of watermains currently have no breaks, and therefore more than 95% of the City's Water Distribution system assets are in Very Good condition. A significant portion of the Very Poor watermains are ductile iron and cast iron material, reflective of the higher number of breaks experienced for these pipe materials.

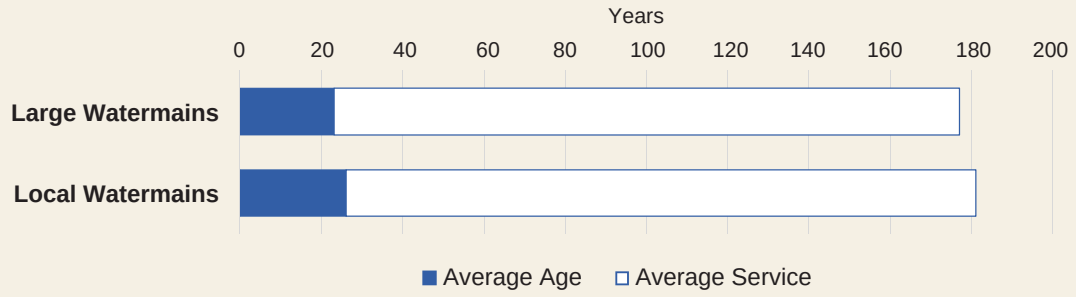
Figure 54: Condition Profile for Water Distribution



C1.4 Asset Age

Figure 55 shows the average age and estimated service life of Water Distribution Assets. Large and Local Watermains have an average age of 23 and 26 years, respectively. The majority of watermains are made from PVC material and results in a relatively high average estimated service life (around 180 years). Continued improvement in the City's break history data will enable the City to refine service life expectations based on observed trends in asset deterioration.

Figure 55: Average Asset Age vs. Average Service Life for Water Distribution



C2 Levels of Service

The principles that drive decision making and service delivery for the Water Distribution system are generally associated with reliability and safety to provide a consistent and safe supply of drinking water. The Strategic LOS reflects these objectives, by focusing on the continuity and quality of water supply, and aligns with the City's strategic priorities as outlined in Table 37.

Table 37: Strategic LOS Alignment for Water Distribution

Strategic LOS	Strategic Priorities Themes (2020-2022)	Climate Change Framework Goals
Provide a safe and consistent supply of drinking water through proactive planning and preventative measures	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Asset Management • Community Risk Mitigation

To support the Strategic LOS, the City focuses on measures that demonstrate the network's safety and reliability. As discussed in Section 3, the LOS provide a Line of Sight by aligning higher level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measures of managing that infrastructure (the Technical LOS).

C2.1 Customer Levels of Service

The City's Customer LOS are summarized in Table 38. The O. Reg. 588/17 qualitative LOS are described in further detail below.

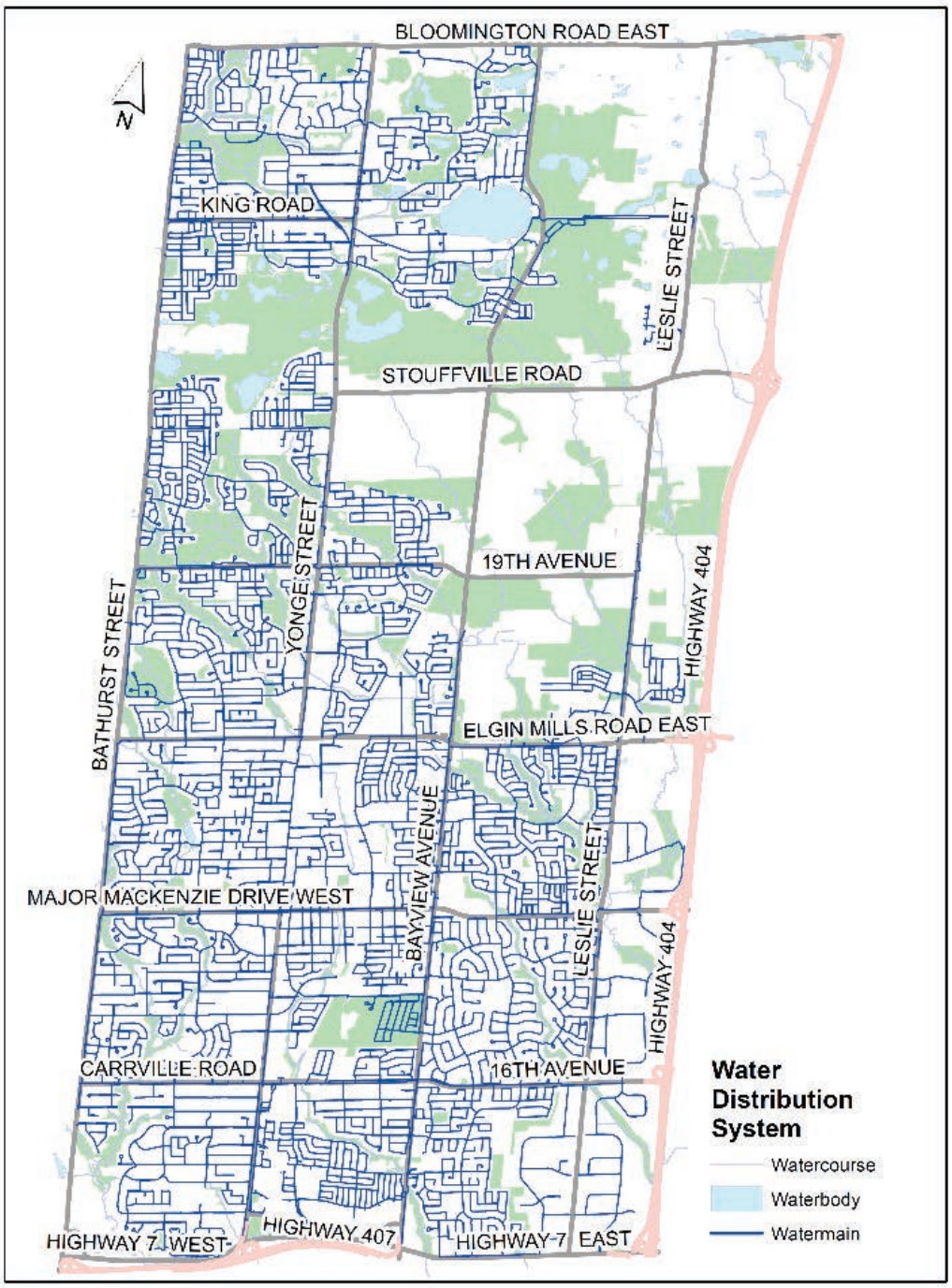
Table 38: Customer LOS for Water Distribution

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system.	O. Reg.	See "Municipal Water Distribution System" below
	Description, which may include maps, of the user groups or areas of the municipality that have fire flow.	O. Reg.	See "Fire Flow" Below
Quality / Reliable / Safe	Description of boil water advisories and service interruptions.	O. Reg.	See "Boil Water Advisories and Service Disruptions" below
Operational	Timely delivery of infrastructure (Percentage of planned linear meter of watermains completed).	Fnd.	100%
Safe	Percentage of samples that are adverse.	Fnd.	1.3%

Municipal Water Distribution System

York Region treats, stores and distributes water to Richmond Hill and the other local municipalities. The City is responsible for delivering the water to its residential, commercial, industrial and institutional users through a 638 kilometre-long network of watermains, as shown in Figure 56 (additional details on user groups are provided in Section C2.2).

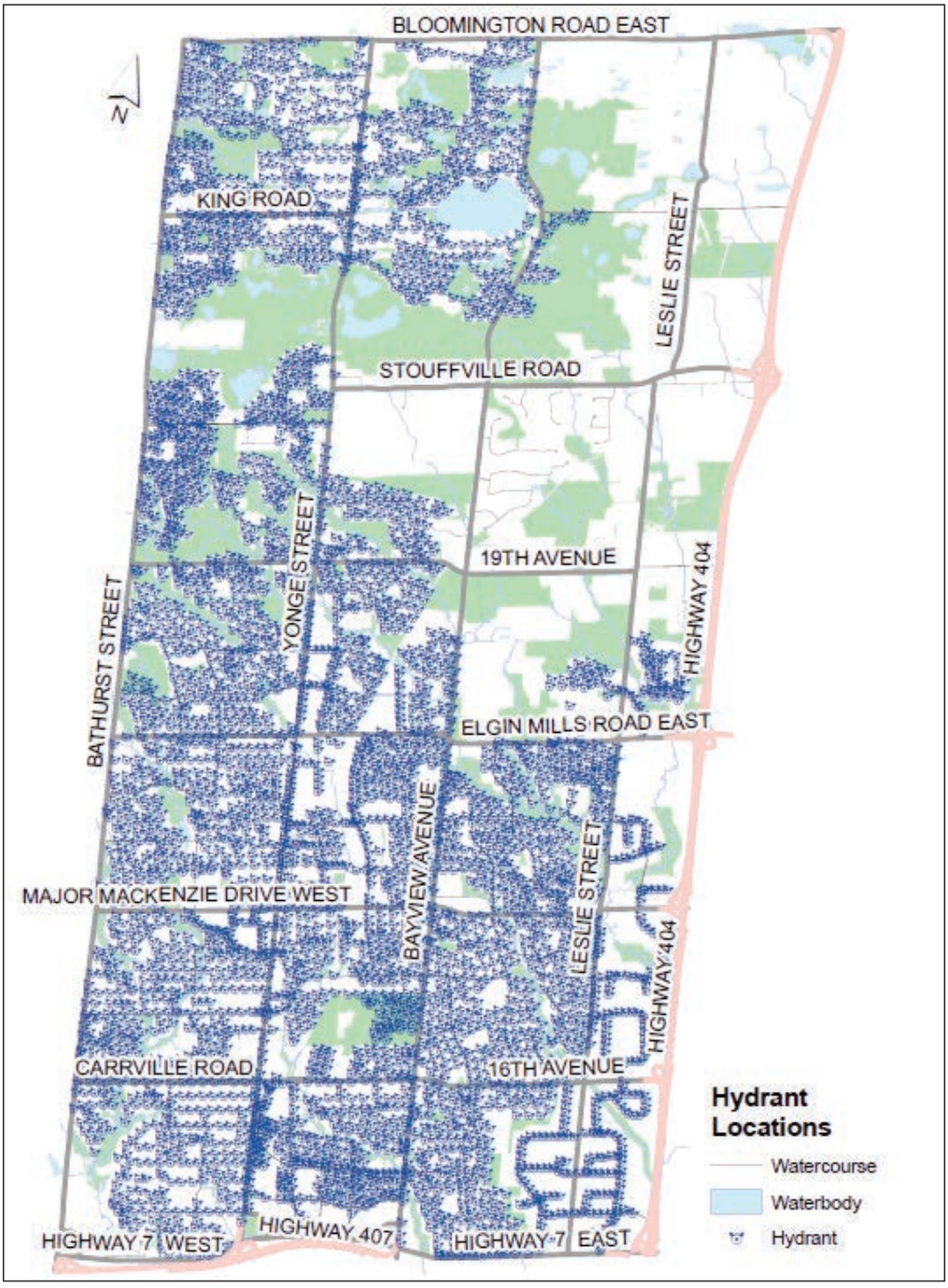
Figure 56: City of Richmond Hill Water Distribution System



Fire Flow

Fire hydrants are key components of the Water Distribution system for providing fire protection services. At the City, there are 4550 hydrants that are generally spaced at 75 metres in non-residential areas (e.g. industrial) and 150 metres in residential areas.

Figure 57: City of Richmond Hill Hydrant Locations



Boil Water Advisories and Service Disruptions

A Drinking Water Quality Management System is in place in Richmond Hill to make sure the City provides the community with safe drinking water, and Richmond Hill's Drinking Water Quality Management System Policy ensures that quality and safety standards are regularly met. York Region also implements a rigorous water quality sampling program to ensure water is safe to drink and works to identify and correct any situation that poses a threat to the community's drinking water. A Boil Water Advisory or Drinking Water Advisory is issued if contamination is found. As discussed in Section C1, service interruptions are typically caused by watermain breaks, and are tracked by the City in terms of duration and number of customers affected.

C2.2 Technical Levels of Service

93.0% of the City's properties are connected to the Water Distribution system and have fire flow. The majority of the properties not connected are vacant lands, farms, conservation lands, parks, and residential properties on wells. For fire flow, non-residential properties within 75 metres of a hydrant and residential properties within 150 metres of a hydrant were assumed to have available fire flow.

The condition of the Water Supply Network is the primary driver for determining reliability. This condition is expressed in different ways, which include the percentage of assets in Fair or better condition and the total number of network-wide pipe breaks. The City's list of Technical LOS is summarized in Table 39.

Table 39: Technical LOS for Water Distribution

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Percentage of properties connected to the municipal water system.	O. Reg.	93.0%
	Percentage of properties where fire flow is available.	O. Reg.	93.0%
Quality / Reliable / Safe	Number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.	O. Reg.	0
Reliable	Number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system.	O. Reg.	0.00038*
	Percentage of assets in Fair or better condition.	Fnd.	99%
	Annual number of watermain breaks per 100 km.	Fnd.	3.4* breaks/100km
	Annual number of watermain breaks.	Fnd.	22*

*2019 performance reported

C2.3 Advanced Levels of Service

With the City's on-going development of the water and wastewater hydraulic models, the City will be able to identify areas in the Water Distribution system where there are pressure and/or flow issues in different demand situations. The model will also help determine areas that have sufficient fire flow, to supplement the current measure which only assesses the availability of fire flow based on proximity to hydrants.

C2.4 External Trends and Issues

The significant risk for the heavily regulated Water Distribution system is the multi-jurisdictional model by which water is treated and supplied. Richmond Hill relies on other jurisdictions for its supply of water, and there is potential for population growth to outpace the capacity of the Water Distribution system. The City is currently working on a water and wastewater model to determine operational deficiencies as well as updating its Servicing Plans to consider the impacts of population growth. Growth needs are balanced with water conservation initiatives and water usage trends.

C3 Asset Management Strategy

Asset management strategies are the planned lifecycle actions that Richmond Hill uses to manage its infrastructure to meet the service levels described in the previous section. Table 40 summarizes the lifecycle strategies for the City's Water Distribution assets.

Table 40: Lifecycle Strategies for Water Distribution

Lifecycle Activity	Description of Activities Practiced by the City
Non-Infrastructure	• The City encourages the conservation of water and energy through policies, procedures, and public outreach. For Water Distribution, these initiatives support the City's ability to meet system demands. (RichmondHill.ca/WaterConservation)
Maintenance	• The City completes ongoing maintenance activities as necessary, such as emergency repairs and exercising valves. These activities support lowest lifecycle costs by extending the timing of capital replacement works.
Rehabilitation	• The City currently plans for replacement, rather than relining of watermains. Refer to discussion below this table for additional details.
Replacement	• Water Distribution assets are replaced based on the condition of assets and break history data. Refer to discussion below this table for additional details.
Disposal	• Watermains are either removed during renewal construction or are disconnected and abandoned in place depending on the construction circumstances. Abandoned mains are capped and/or grouted to protect other infrastructure.
Growth/Service Improvement	• New or larger assets are identified through technical analysis as part of servicing plans completed to service new development and growth. • New assets to accommodate an increase in capacity are based on studies pertaining to available and sufficient fire flow, demand, and pressure. • The City is undertaking the development of a two-dimensional water infrastructure network model. The model will be used to support growth planning as well as capital project delivery, operations, and maintenance of the Water Distribution system.

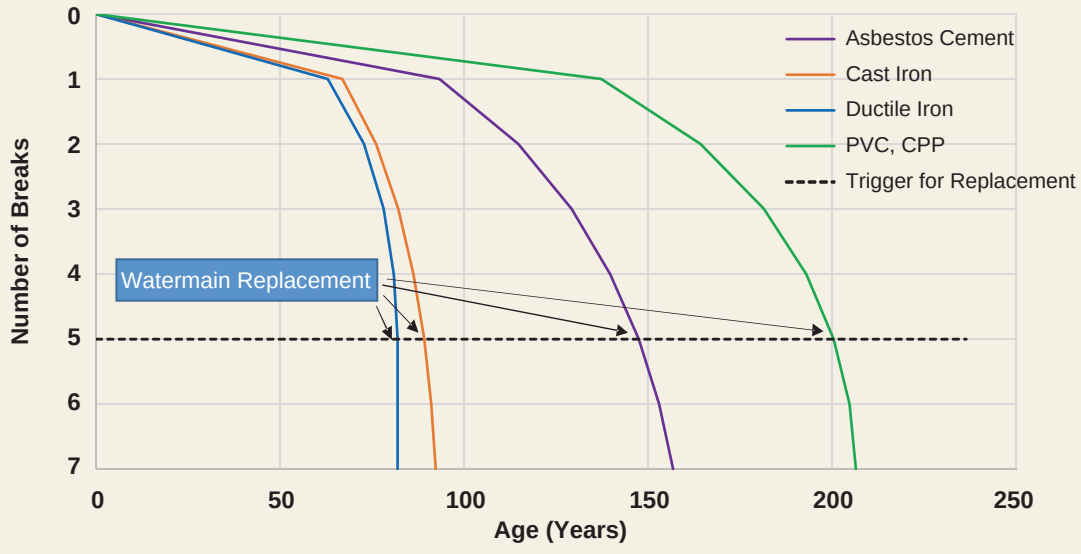
Focus on Rehabilitation and Replacement Activities

The City maintains watermains in a state of good repair and tracks the number of watermain breaks and percentage of watermains in Fair or better condition. The City's local watermains are predominantly made of PVC material. Breaks typically occur on cast iron and ductile iron pipes smaller than 450 mm. Larger watermains typically have less breaks and have a longer estimated life. Appurtenances, such as valves, chambers, and other infrastructure such as sampling stations, are typically replaced at the same time as the watermain and align to the same lifecycle strategies as the watermain itself. Therefore, replacement costs for a water main include costs for these appurtenances. Bundling similar works reflects the City's approach to managing related assets and reduces overall lifecycle costs. New watermains are typically replaced with PVC pipe, which reflects industry best practices in lifecycle modelling and construction and represents the lowest total lifecycle cost. To reduce service disruption and minimize costs, watermains are generally replaced at the same time as the road, and replacements have historically been driven by road needs. Future planning will incorporate an improved approach to corridor planning and bundling such that both road and watermain needs are considered based on risk, with a dedicated watermain replacement program in place if required.

Repairs and minor replacements for these assets are considered maintenance items outside of the scope of the City's capital program. The City may investigate the benefits of relining rehabilitations in the future to further extend asset lifecycles and lower lifecycle costs.

The estimated rate of deterioration and timing for replacement at the trigger of five breaks is summarized in Figure 58. PVC and concrete (CPP) pipes have the longest estimated service life. Cast iron and ductile irons pipes have a much shorter estimated service life, and will be replaced by PVC or concrete pipes based on pipe diameter. As evidenced from the curves, once a pipe experiences one break, there is a significant increase in the rate of deterioration towards the watermain's expected replacement. As the City improves tracking of breaks and accumulates more break history data, it will be able to align these deterioration curves with actual experience and improve the forecasting discussed in the next section.

Figure 58: Estimated Deterioration Curves by Pipe Material (Watermains)

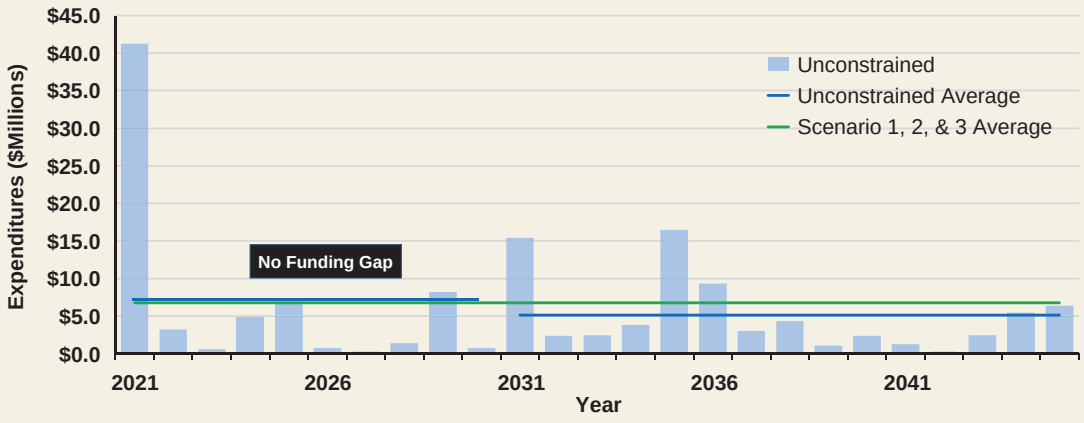


C4 Investment Needs and Financial Assessment

C4.1 Renewal Investment Forecast

Rehabilitation and replacement of Water Distribution and Wastewater Collection assets are both funded through the Water/Wastewater Reserve Funds, and therefore the financial forecasting scenarios for these two Sub-Services are combined into one analysis. As discussed in 5.2.1.2, the City analyzed the unconstrained and constrained budget scenarios for the rehabilitation and replacement of Water Distribution and Wastewater Collection assets. The expenditures for the Status Quo and Maintain LOS constrained scenarios were the same at an average annual expenditure of $6.8 million per year, and no funding gap was identified over the next ten years.

Figure 59: Scenario Summary for Water Distribution and Wastewater Collection*

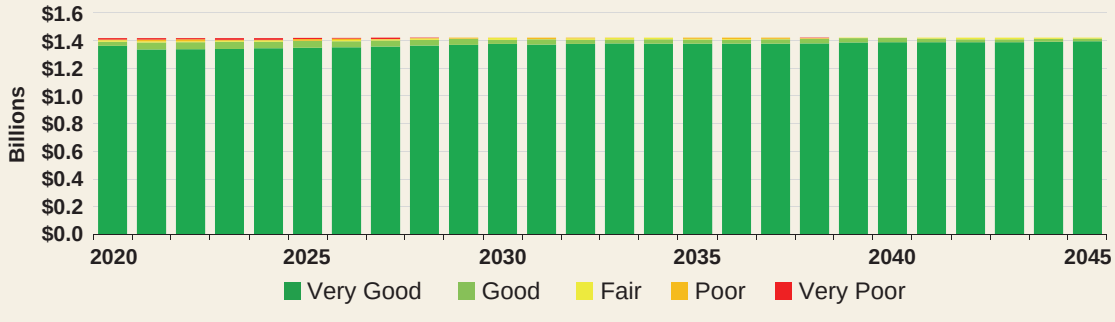


*Does not include water meters, process equipment within pumping stations

With an average expenditure of $6.8 million per year, the City's EAM system allocates $4.9 million per year over the next 10 years to the Water Distribution system, reflecting the higher expenditure needs compared to the Wastewater Collection system.

The initial constraint means that the backlog of Poor and Very Poor assets cannot be addressed in the first year. However, as shown in Figure 60, at the funding of $4.9 million per year, most of the Poor and Very Poor assets are addressed by the end of the 10-year outlook, and condition is also maintained over the 25-year forecast.

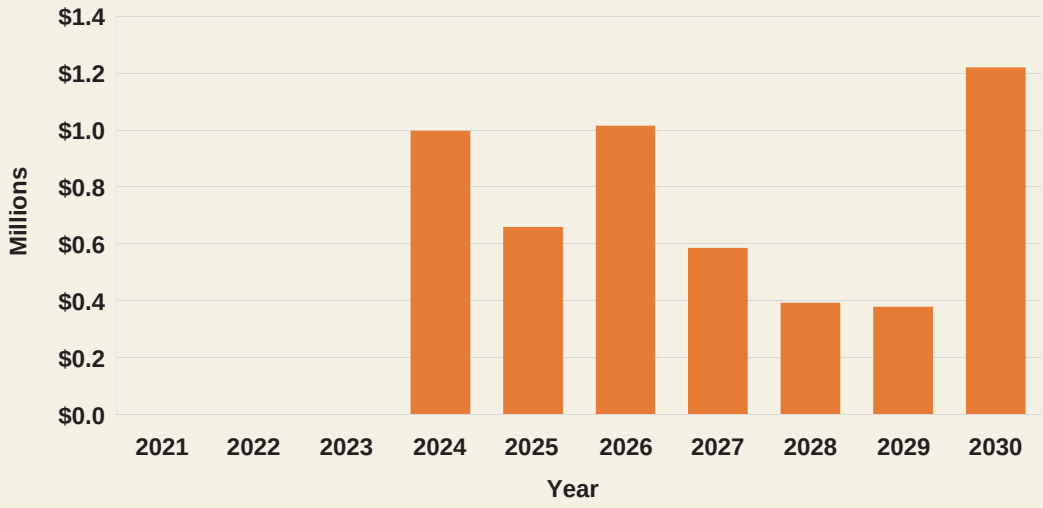
Figure 60: Projected LOS for Water Distribution



C4.2 Preliminary Growth Investment Forecast

Figure 61 shows the investments in the City's Water Distribution system that are planned for the next 10 years to meet growth needs. Forecasted growth projects are informed by technical analyses, which recommend required infrastructure upgrades to serve the City's intensification areas and maintain an adequate LOS for current and future customers. The proposed upgrades include constructing new and upsizing existing watermains to provide sufficient pressure and flow. The improvements are required prior to 2031, but more detailed project timing is still to be determined; for the purposes of this AMP, the projects have been distributed over the 10-year planning horizon. Regarding assets to be assumed in the future, the forecast only includes assets that are proposed to be funded under the Development Charges By-law.

Figure 61: Growth Investment Forecast for Water Distribution

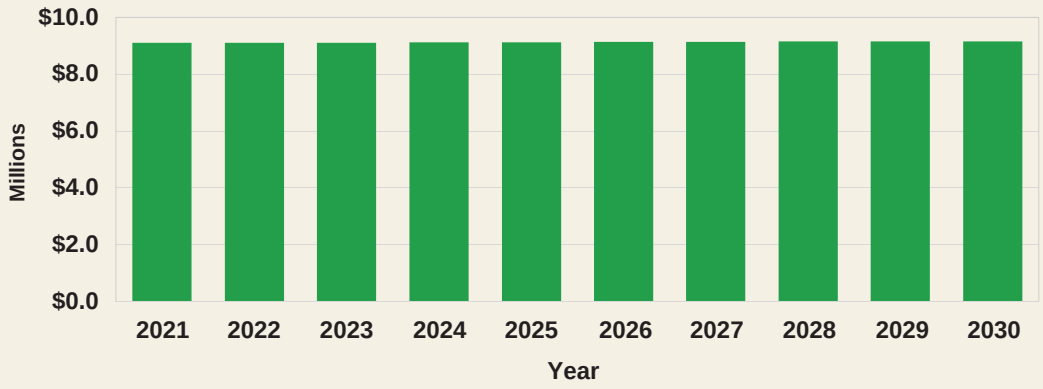


C4.3 Preliminary Operating Budget Forecast

Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments can place cumulative, additional pressures on the annual operating budget.

As the City's Operating Budget considers Water Distribution and Wastewater Collection together, the estimated operating budget forecast for expenditures related to asset operations and maintenance activities for both Sub-Services is provided in Figure 62. The forecast assumes growth based only on the value of new capital projects outlined in Section C4.2 and D4.2. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process. The expected growth in the City's asset portfolio and its associated impact on the Operating Budget will continue to be updated as on-going initiatives such as the hydraulic water model are completed.

Figure 62: Operating Budget Forecast for Water Distribution and Wastewater Collection



The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. Legislation changes may also impact future operating and maintenance costs.

Appendix D: Wastewater Collection

The City is responsible for providing reliable and efficient collection of wastewater from properties through a network of sewermains and six sewage pump stations. This sewage flows from the City's network into large wastewater pipes, owned and operated by York Region, and ultimately to a wastewater treatment plant jointly owned and operated by York Region and Durham Region.

D1 State of the Infrastructure

D1.1 Overview

The total estimated value of the City's Wastewater Collection infrastructure is **$2.1 billion**. The average condition of Wastewater Collection assets is **Very Good (Letter Grade A)**.

The inventory for the City's Wastewater Collection system, as summarized in Table 41, consists of 586 kilometres of sewermains and 6 pump stations.

Figure 63: Asset Condition Distribution and Valuation for Wastewater Collection

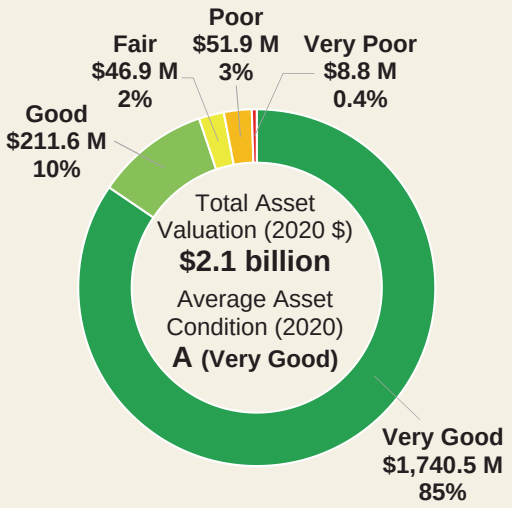


Table 41: Inventory Overview for Wastewater Collection

Asset Type	Quantity	Replacement Cost ($ millions)	Average Age	Average Condition
Sanitary Sewermains	586 km of pipe	$2,045.5	29	Very Good (A Grade)
Pump Stations	6 pump stations	$14.2	25	Good (B Grade)
	TOTAL	$2,059.7	29	Very Good (A Grade)

D1.2 Asset Valuation

Replacement costs for sanitary sewer mains are determined by multiplying the length of a sewer segment by a unit cost associated with sewer main replacement for a particular diameter of pipe and material. The costs of other ancillary assets in the Wastewater Collection system, like maintenance holes and service connections, are captured in the unit construction costs. Estimated soft costs such as design and engineering are also considered in each unit cost.

The replacement costs for pump station assets are derived from the City's ReCAPP (Renewal Capital Asset Planning Process) system.

D1.3 Asset Condition

Table 42 summarizes the condition rating system for Wastewater Collection assets. The measure used to report on the general overall condition of sanitary sewermains is the Pipeline Assessment Certification Program (PACP) peak score. This score is obtained from Closed Circuit Television (CCTV) inspection data and calculated based on structural defects observed in the sewermains. PACP is the North American Standard for pipeline defect identification and assessment, providing standardization and consistency to the methods in which pipeline conditions are identified, evaluated and managed. The goal of PACP is to create a comprehensive database to properly identify, plan, prioritize, manage and renew pipes based on the condition evaluation.

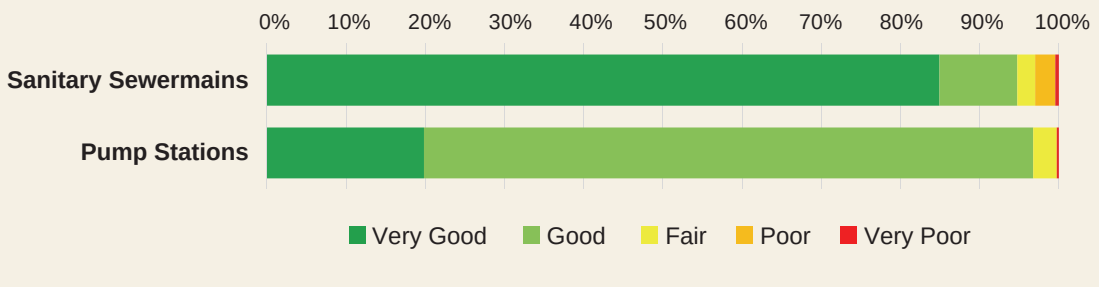
The PACP peak score ranges from 0 to 5 (with 0 or 1 indicating Very Good condition and 5 indicating Very Poor condition). The City's LOS for sanitary sewermains is to maintain these assets in Fair or better condition, which is defined as a PACP peak score of 3 or less. For pump station assets, observed condition from inspections is used where available, and supplemented with service life information where necessary.

Table 42: Asset Condition Rating System for Wastewater Collection

Performance Category	Letter Grade	Sanitary Sewers PACP Score	Pump Stations Condition Rating (from Inspection)
Very Good	A	0 or 1	Excellent
Good	B	2	Good
Fair	C	3	Fair
Poor	D	4	Poor AND not exceeded service life
Very Poor	F	5	Poor AND exceeded service life

Similar to Water Distribution infrastructure, the long Estimated Service Life of Wastewater Collection infrastructure and relatively new installation of the assets is reflected in the asset condition distribution (Figure 64). PACP scores are available for approximately 60% of the system, and most have a PACP score of 3 or lower. Based on a mix of age-based and PACP ratings, more than 90% of the assets are currently in Good or Very Good condition.

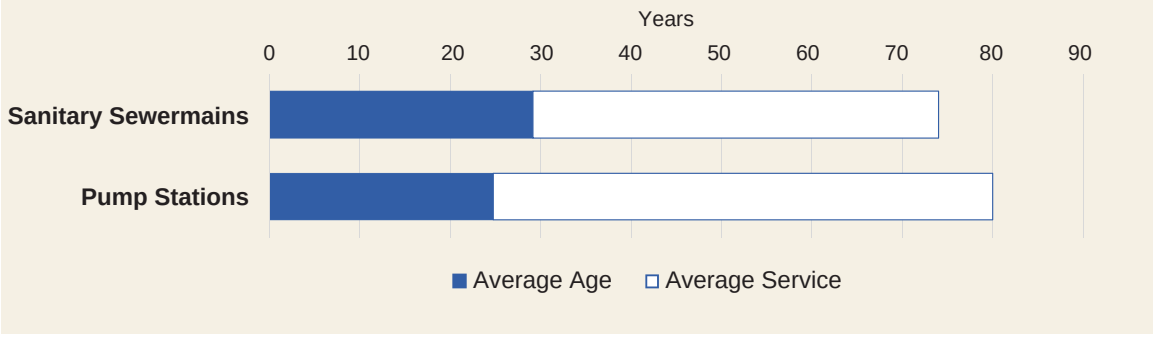
Figure 64: Condition Profile for Wastewater Collection



D1.4 Asset Age

Figure 65 shows the average age and estimated service life of Wastewater Collection assets. Sanitary sewermains are on average 29 years old, while Pump Station assets are on average 25 years old.

Figure 65: Average Asset Age vs. Average Service Life for Wastewater Collection



D2 Levels of Service

The Strategic LOS for the Wastewater Collection system is to provide a reliable and efficient collection system that reduces environmental and health risks, and aligns with the City's strategic priorities as outlined in Table 43.

Table 43: Strategic LOS Alignment for Wastewater Collection

Strategic LOS	Strategic Priorities Themes (2020-2022)	Climate Change Framework Goals
Provide a reliable and efficient Wastewater Collection system that reduces environmental and health risks	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Asset Management • Community Risk Mitigation

As discussed in Section 3, the LOS provide a Line of Sight by aligning higher level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measure of managing that infrastructure (the Technical LOS).

D2.1 Customer Levels of Service

The City's Customer LOS are summarized in Table 44. The O. Reg. 588/17 qualitative LOS are described in further detail below. O. Reg. measures related to combined sewers and sewage treatment plants are not applicable to the City.

Table 44: Customer LOS for Wastewater Collection

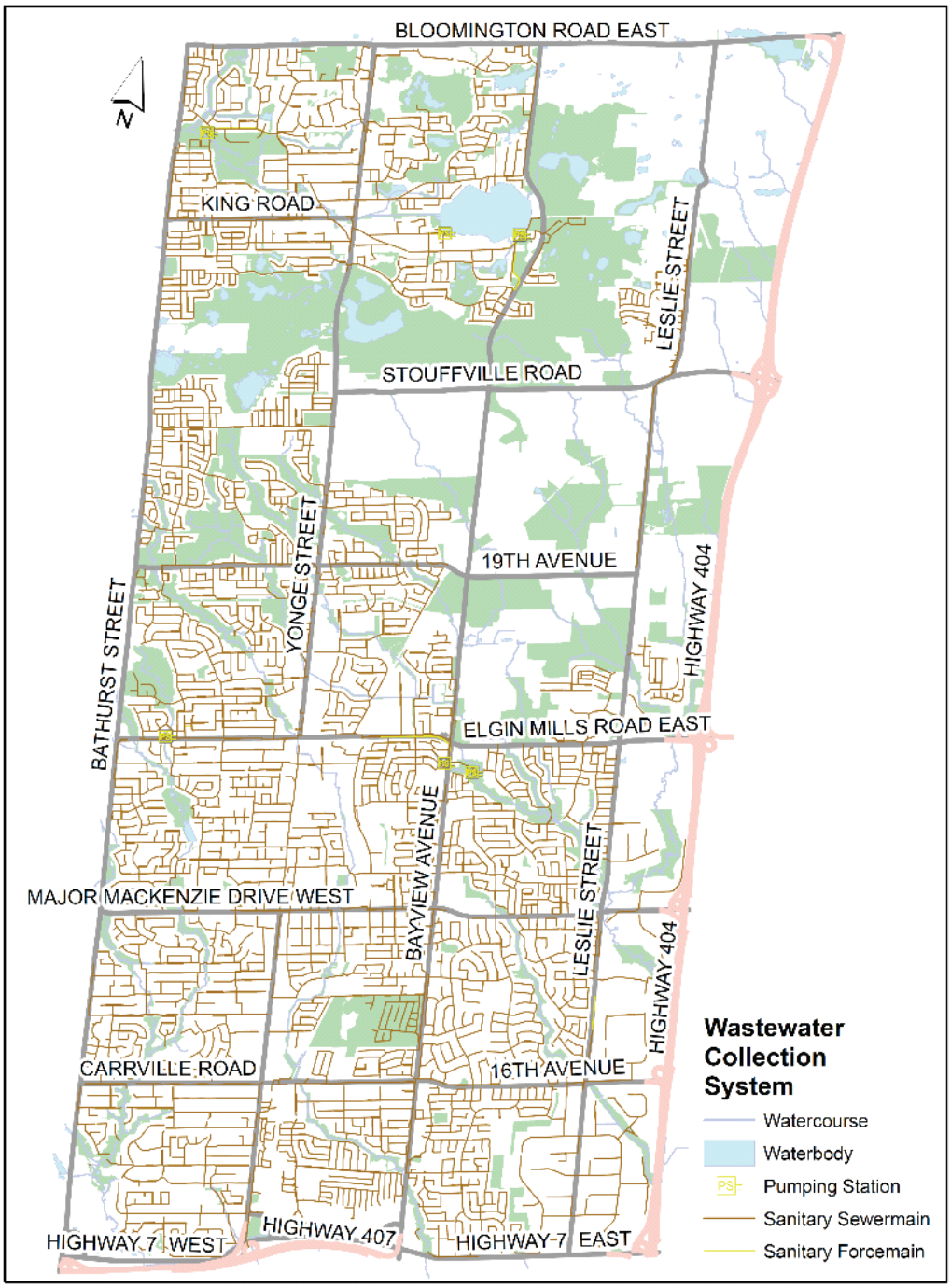
Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal Wastewater Collection system.	O. Reg.	Refer to "Municipal Wastewater Collection System" below
Reliable	Description of how stormwater can get into sanitary sewers in the municipal Wastewater Collection system, causing sewage to overflow into streets or backup into homes.	O. Reg.	Refer to "Inflow and Infiltration" below
	Description of how sanitary sewers in the municipal Wastewater Collection system are designed to be resilient to avoid sewage overflow into streets or backup into homes.	O. Reg.	Refer to "Wastewater Design Resilience to Sewage Overflow" Below
	Number of mainline blockages resulting in backup per km.	Fnd.	0.00508
Operational	Timely delivery of infrastructure (Percentage of planned linear meter of sewers completed).	Fnd.	None planned in 2020

Municipal Wastewater Collection System

Durham Region and York Region sewage systems treat the sanitary sewage collected from Richmond Hill. The City is responsible for collecting wastewater from properties through a network of sewermains and six sewage pump stations, as shown in Figure 66 (additional details on user groups are provided in Section D2.2). The Wastewater Collection system discharges to three Regional trunk sewers:

- The North Don Collector;
- The Richmond Hill Collector (also referred as the Yonge Street Collector); and
- The 19th Avenue Collector.

Figure 66: City of Richmond Hill Wastewater Collection System



Inflow and Infiltration

Inflow and infiltration are surface water and groundwater that enter the sewage collection system. Excessive stormwater inflow in sanitary sewers can impact the system's hydraulics which would cause surcharging, basement flooding, sewer bypasses, and reduced treatment efficiency.

Rainfall-derived inflow consists of leakage through major defects in the Wastewater Collection system where storm or surface water directly enters the system. Typical sources of inflow into the system include roof drains, area drains, foundation drains, cooling-water discharges, drains from springs, manhole covers, defective pipes, or manholes. Rainfall-induced infiltration enters the system when the level of shallow groundwater rises above the elevation of the collection system piping. The groundwater can then enter the collection system in places such as damaged service connections, or defective pipes, joints, and manhole connections. Rainfall landing on a sub catchment area can flow quickly into storm sewers and other drainage facilities, evaporate, be absorbed by vegetation, or percolate into the ground to become shallow groundwater. The amount of rainfall that becomes groundwater is dependent on the surface moisture conditions, soil type, ground slope, and the intensity and duration of the rainfall event.

Wastewater Design Resilience to Sewage Overflow

The 2011 Inflow and Infiltration Reduction Strategy was developed by York Region and local municipalities including the City of Richmond Hill, and it was updated in 2016.

As one of the local municipalities in York Region, the City contributes to the Region's strategy by:

- Continuing to support the Region's flow monitoring programs.
- Undertaking infrastructure rehabilitation and repair work to address sources of inflow and infiltration in priority areas identified through flow monitoring and through local municipal condition assessment programs.
- Reviewing and utilizing sanitary sewer flow and rainfall data to assist in prioritizing remediation in local systems.
- Exploring, developing, and launching local municipality private property programs, in conjunction with the Region and the other local municipalities.
- Maintaining local municipal infrastructure in a state of good repair.

The Region's Inflow and Infiltration Strategy consists of eight program areas:

- Establishing goals and targets
- Flow monitoring and analysis
- Investigation and mitigation
- New developments and capital projects
- Financial management
- Communication, education, and advocacy
- Reporting reductions
- Continuous improvement

D2.2 Technical Levels of Service

93.0% of the City's properties are connected to the Wastewater Collection system. The majority of the properties not connected are vacant lands, farms, conservation lands, parks, and residential properties on septic systems. Backups and effluent violations are tracked to understand deficient areas of the system and to minimize future service disruptions.

The City's Technical LOS for Wastewater Collection are summarized in Table 45. As with most Asset Classes, reliability measures are typically related to the physical condition of assets. As indicated in Section D1.3, the City has a robust CCTV program to measure physical condition of the linear portion of its system.

Table 45: Technical LOS for Wastewater Collection

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Percentage of properties connected to the municipal Wastewater Collection system.	O. Reg.	93.0%
Reliable	The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal Wastewater Collection system.	O. Reg.	0.0011
	The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal Wastewater Collection system.	O. Reg.	0.00122
	Percentage in sewers in Fair or better condition.	Fnd.	97.0%

D2.3 Advanced Levels of Service

With the City's on-going development of the water and wastewater hydraulic models, the City expects to be able to determine the Wastewater Collection system's resilience to basement flooding and identify sewers that do not meet capacity requirements. The City also expects to improve data collection in spill occurrences and overflows, which will supplement the outcomes from the hydraulic model.

D2.4 External Trends and Issues

Extreme storm events and inflow and infiltration are key risks that can affect the Wastewater Collection system's capacity to carry its design sewage flows. Similar to the Water Distribution system, the Wastewater Collection system relies on the multi-jurisdictional model by which sewage is collected and treated. The City's development of the wastewater model and Servicing Plans will identify the impacts of population growth on Richmond Hill's sewer network.

D3 Asset Management Strategy

Asset management strategies are the planned lifecycle actions that Richmond Hill uses to manage its infrastructure to meet the service levels described in the previous section. Table 46 summarizes the lifecycle strategies for Wastewater Collection assets.

Table 46: Lifecycle Strategies for Wastewater Collection

Lifecycle Activity	Description of Activities Practiced by the City
Non-Infrastructure	• The City performs studies such as Inflow & Infiltration Reduction to improve operational efficiency. • The City is currently implementing new SCADA systems to monitor and improve the efficiency and capacity of pump stations and their related assets. • Education and outreach programs for residents on the sewer use by-law and discouraging the disposal of fats, oils, and grease (FOGs) down the drain can prevent backups and extend the life of the City's sewer infrastructure.
Maintenance	• The City completes ongoing maintenance activities as necessary. • Emergency repairs for linear and vertical infrastructure are performed as necessary. • Flushing and CCTV inspections of sewers are completed proactively across the entire system on a 5-year cycle with some targeted areas being inspected more frequently as required.
Rehabilitation	• Sanitary sewermain candidates in Poor or Very Poor condition (identified via CCTV) are relined where possible. • Pumping station assets are rehabilitated based on condition and facility inspection reports. • Refer to discussion below this table for additional details.
Replacement	• Sanitary sewermain candidates in Poor or Very Poor condition (identified via CCTV) are replaced when rehabilitation has previously been completed or is not possible. • Pumping station assets are replaced based on condition and facility inspection reports. • Refer to discussion below this table for additional details.
Disposal	• Sewers are either removed during renewal or are disconnected and abandoned in place depending on the construction circumstances. Abandoned sewers are capped and/or grouted to protect other infrastructure.
Growth/Service Improvement	• New or larger assets are identified through technical analysis as part of servicing plans completed to service new development. • Pipes that do not meet capacity requirements are upsized to increase capacity; these projects are generally aligned with road construction. • The City is undertaking the development of a two-dimensional sanitary infrastructure network model. The model will be used to support growth planning as well as capital project delivery, operations and maintenance of the Wastewater Collection system. • Pipes may need to be replaced/rehabilitated due to inflow and infiltration, which is identified through Regional flow monitoring analysis and CCTV. In the future, the City's hydraulic model may also be used for identifying issues. • Other service improvements to assets are identified based on basement flooding incidents, climate change resilience and effluent violations.

Focus on Rehabilitation and Replacement Activities

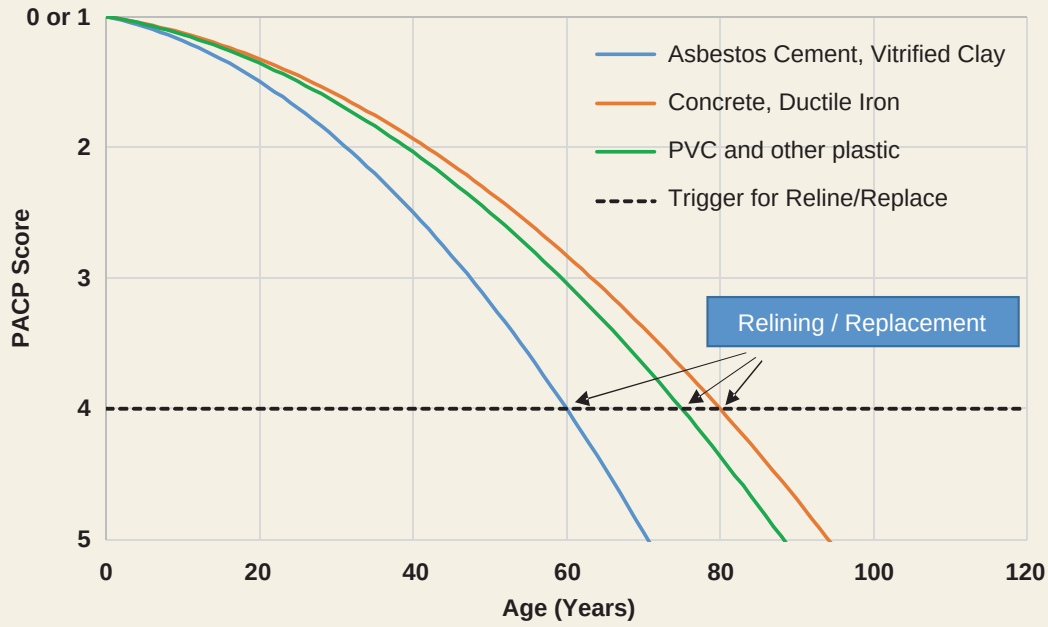
Typically, repair and full or partial relining activities are conducted on an as-needed, reactive basis. Sewer replacement is typically completed when it can be bundled with other projects to reduce construction costs and minimize impacts to residents.

The City has recognized the need to create a capital sanitary sewermain replacement program. The City leverages PACP condition scores, obtained from CCTV inspections, to identify candidates for rehabilitation and replacement. Assets identified for rehabilitation or replacement are those with PACP scores of 4 or 5 (i.e. Poor or Very Poor condition). Assets with PACP scores of 3 are reviewed on a case-by-case basis, especially where inflow and infiltration is a concern, and when project bundling can be optimized with other asset needs. Planned rehabilitations are typically Cured-In-Place Pipe (CIPP) relining, where possible on pipes up to 600mm in diameter. In cases where rehabilitation is not possible due to the extent of damage or other factors such as slope issues, the sewers will be replaced. Incorporating a relining approach is based on industry best practices and extends the asset's service life and reduces overall lifecycle costs.

Service connections and maintenance holes are typically replaced at the same time as the sewer main. Therefore, replacement costs for a sewer main include costs for the connections and maintenance holes. Bundling similar works reflects the City's approach to managing related assets and reduces overall lifecycle costs. The CIPP relining material has similar properties to PVC pipe and behaves with a similar estimated service life and deterioration profile. New sewermains are typically replaced with either concrete or PVC pipe, which reflects industry best practices in lifecycle modelling and construction and reduces total lifecycle costs. Repairs and minor replacements to service connections and maintenance holes outside of the scope of capital works are completed as maintenance items.

The estimated rate of deterioration and timing for replacement at the trigger PACP score of 4 is summarized in Figure 67. Sewers are expected to be relined or replaced between 60 and 80 years based on material. As evidenced from the curves in Figure 67, the rate of deterioration increases as the pipe ages. As the City grows its historical PACP assessment database, it will be able to align these deterioration curves with actual experience and improve the forecasting discussed in the next section.

Figure 67: Estimated Deterioration Curves by Pipe Material (Sanitary Sewermains)



For pumping station assets associated with the building envelope, planning is completed by analyzing age, condition, and expected remaining service life. Service life values vary between individual assets and reflect the varied lifecycles of facility assets.

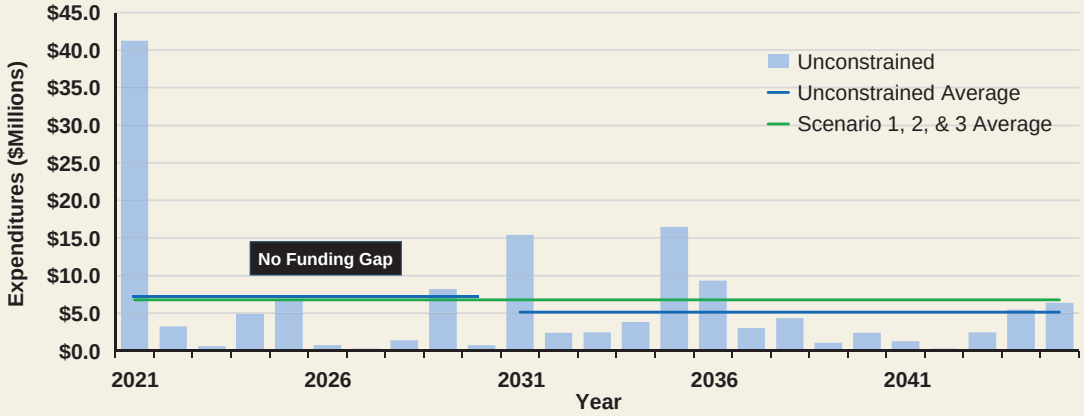
The City's forcemains currently have not experienced any historical failures. The City's lifecycle model plans for replacements of these assets based on an estimated service life approach, which provides an overall indicator of condition based on age. The deterioration rates are defined by the forcemain's material, and a different estimated service life value is assigned to each forcemain material type.

D4 Investment Needs and Financial Assessment

D4.1 Renewal Investment Forecast

Rehabilitation and replacement of Water Distribution and Wastewater Collection assets are both funded through the Water/Wastewater Reserve Funds, and therefore the financial forecasting scenarios for these two Sub-Services are combined into one analysis. As discussed in Section 5.2.1.2, the City analyzed the unconstrained and constrained budget scenarios for the rehabilitation and replacement of Water Distribution and Wastewater Collection assets. The expenditures for the Status Quo and Maintain LOS constrained scenarios were the same at an annual expenditure of up to $6.8 million per year, and no funding gap was identified.

Figure 68: Scenario Summary for Water Distribution and Wastewater Collection*

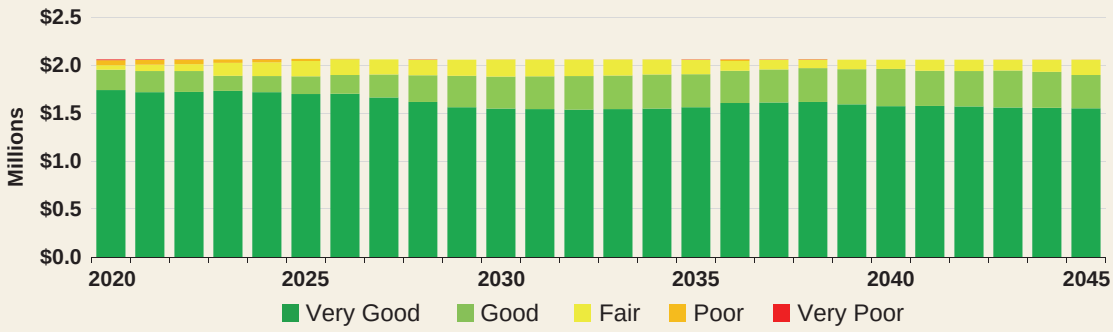


*Does not include water meters, process equipment within pumping stations

With an average annual expenditure of $6.8 million per year, the City's EAM system allocates $1.9 million per year over the next 10 years on the Wastewater Collection system, reflecting the lower expenditure needs compared to the Water Distribution system.

The initial constraint means that the backlog of Poor and Very Poor assets cannot be addressed in the first year. However, as shown in Figure 69, at the funding of $1.9 million per year, most of the Poor and Very Poor assets are addressed by the end of the 10-year outlook, and condition is also maintained over the 25-year forecast.

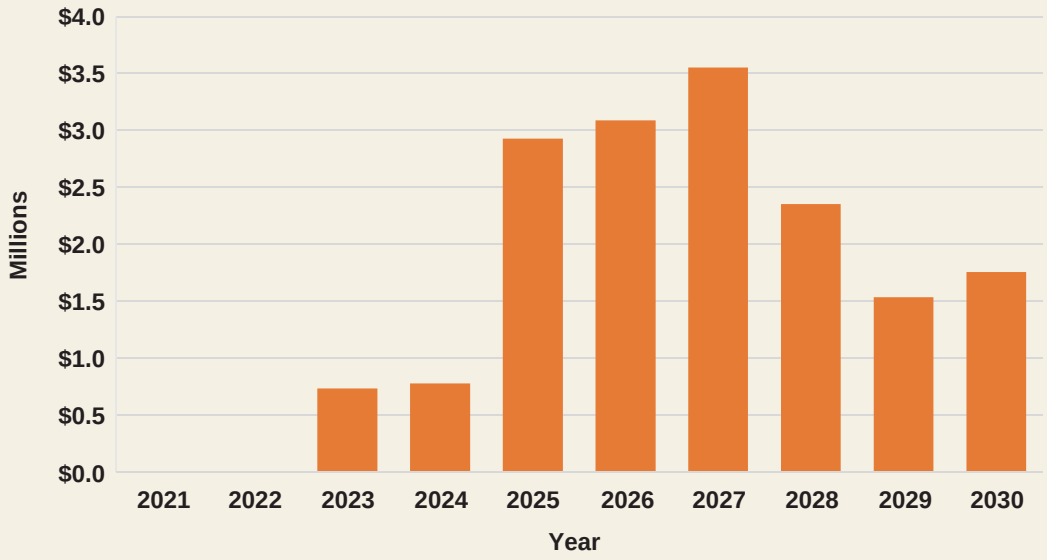
Figure 69: Projected LOS for Wastewater Collection



D4.2 Preliminary Growth Investment Forecast

Figure 70 shows the investments in the City's Wastewater Collection system that are planned for the next 10 years to meet growth needs. Forecasted growth projects are informed by technical analyses, which recommend required infrastructure upgrades to serve the City's intensification areas and maintain an adequate LOS for current and future customers. The proposed upgrades include upsizing existing sewermains to improve system capacity. The improvements are required prior to 2031, but more detailed project timing is still to be determined; for the purposes of this AMP, the projects have been distributed over the 10-year planning horizon. Regarding assets to be assumed in the future, the forecast only includes assets that are proposed to be funded under the Development Charges By-law.

Figure 70: Growth Investment Forecast for Wastewater Collection

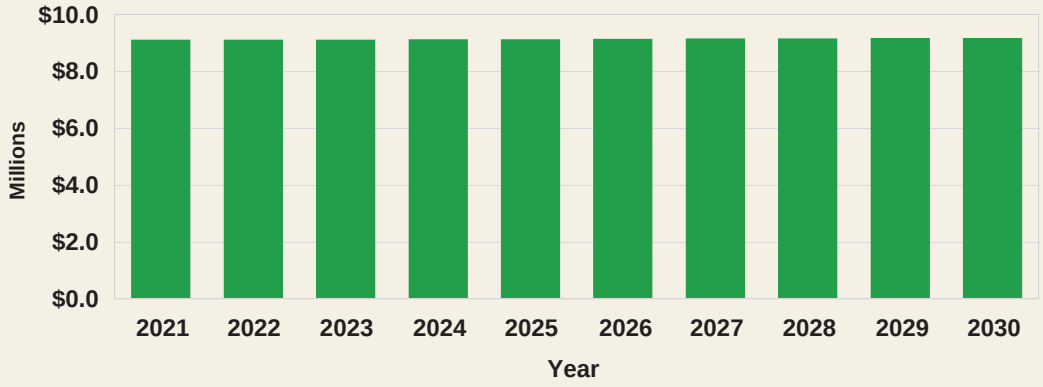


D4.3 Preliminary Operating Budget Forecast

Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments can place cumulative, additional pressures on the annual operating budget.

As the Operating Budget considers Water Distribution and Wastewater Collection expenditures together, the estimated operating budget forecast for expenditures related to asset operations and maintenance activities for both Sub-Services is provided in Figure 71. The forecast assumes growth based only on the value of new capital projects outlined in Section C4.2 and D4.2. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process. The expected growth in the City's asset portfolio and its associated impact on the Operating Budget will continue to be updated as on-going initiatives such as the hydraulic wastewater model are completed.

Figure 71: Operating Budget Forecast for Water Distribution and Wastewater Collection



The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. Legislation changes may also impact future operating and maintenance costs.

Appendix E: Stormwater Management

Richmond Hill owns and operates Stormwater Management infrastructure including stormwater management ponds, Low Impact Development (LID), storm culverts, and hundreds of kilometres of storm sewers. This infrastructure plays an important role in protecting the environment from flooding and erosion and by treating the quality of water before it is released back into natural rivers and streams.

E1 State of the Infrastructure

E1.1 Overview

The total estimated value of the City's Stormwater Management system is **$2.0 billion**. The average condition of the City's Stormwater Management assets is **Very Good (Letter Grade A)**.

The various assets of the Stormwater Management system that work together to improve water quality and provide erosion and flood protection for the City are summarized in Table 47.

Figure 72: Asset Condition Distribution and Valuation for Stormwater Management

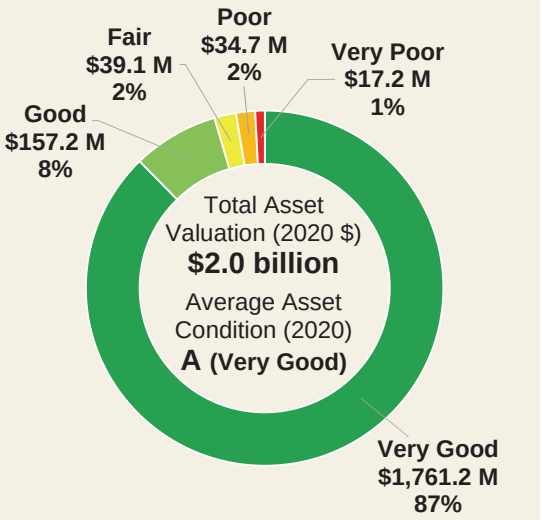


Table 47: Inventory Overview for Stormwater Management

Asset Type	Quantity	Replacement Cost ($ millions)	Average Age	Average Condition
Storm Sewermains	586 km of pipe	$1,866.7	24	Very Good (A Grade)
Above Ground Conveyance	97 storm culverts	$28.3	25	Fair (C Grade)
Stormwater Management Facilities (SWMF)	90 SWMF	$110.3	20	Fair (C Grade)
Low Impact Development	63 LID	$4.1	18	Fair (C Grade)
	TOTAL	$2,009.3	24	Very Good (A Grade)

The City has recently improved the inventory for storm culverts, including a clearer classification defined between road culverts and storm culverts. The inventory will be updated in future AMPs to reflect these improvements.

E1.2 Asset Valuation

Replacement costs for storm sewermains and above ground conveyance assets (culverts) are estimated by multiplying the length of the asset by a unit cost associated with asset main replacement for a particular diameter and material. The costs of other ancillary assets in the storm sewermains inventory, such as maintenance holes and service connections, are captured in the sewermain unit construction costs. Estimated soft costs such as design and engineering are also considered in each unit cost.

For Stormwater Management Facilities (SWMF), the initial construction cost recorded in the City's Tangible Capital Asset (TCA) data is inflated to current year dollars to determine an estimated replacement cost. For LID, standard unit costs are applied based on the type of LID (e.g. exfiltration facilities, bioretention facilities, rainwater cisterns, and green roofs).

E1.3 Asset Condition

Table 48 summarizes the condition rating system for Stormwater Management system assets. Similar to the sanitary sewermains, the Pipeline Assessment Certification Program (PACP) peak score is used to report on the overall condition of storm sewermains. This score is obtained from Closed Circuit Television (CCTV) inspection data and calculated based on observed structural defects. The PACP peak score ranges from 0 to 5 (with 0 and 1 indicating Very Good condition and 5 indicating Very Poor condition). The City's LOS for storm sewermains is to maintain these assets in Fair or better condition, which is defined as a PACP peak score of 3 or less. Storm sewermains are assessed on a ten-year cycle, and the City currently has approximately 15% of the storm sewermains rated with PACP scores.

To ensure that SWMF continue to deliver their water quality and quantity objectives, the City performs bathymetric studies that measure the level of accumulated sediment in its wet ponds. SWMF condition is estimated based on the percentage of TSS removal, which is determined using the sediment levels recorded. A pond is considered to be in Poor condition when the percentage of TSS removal reaches 5% below its design TSS removal.

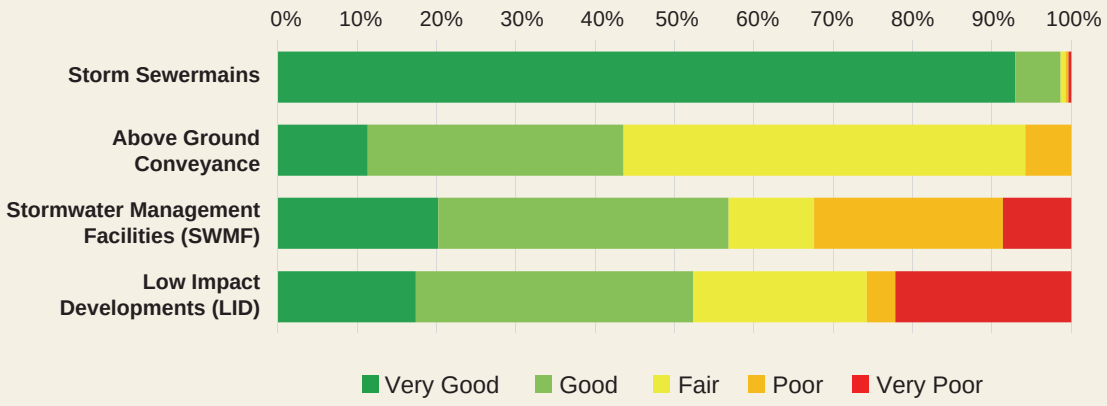
Table 48: Asset Condition Rating System for Stormwater Management

Performance Category	Letter Grade	Storm Sewermains PACP Score	Storm Culverts Age-based BCI	LID, SWMF (Oil/Grit Separators) % Service Life Remaining	SWMF (Ponds) % Below Design TSS Removal
Very Good	A	0 or 1	>80	>80%	<0.5%
Good	B	2	>70 to 80	60-80%	0.5-4%
Fair	C	3	>50 to 70	40-60%	4-5%
Poor	D	4	>35 to 50	20-40%	5-7.5%
Very Poor	F	5	0 to 35	<20%	>7.5%

For storm culverts, an estimated BCI similar to road culverts is determined based on age. Age versus the estimated service life is used as a proxy for condition for LIDs, and oil/grit separators, as well as storm sewermains that do not have a PACP score. For dry ponds, as formal sediment level measurements are not made, the pond's age compared to the estimated frequency for sediment removal is used to estimate condition. The City needs to continue to invest in improving data collection for its Stormwater Management system in order to improve its understanding of the condition of its assets, which will better inform decision making and the investment costs discussed in Section E4.

The longer estimated life of storm sewermains is reflected in the asset condition distribution (Figure 73) which shows that more than 95% of storm sewermains inventory are in Good or Very Good condition. This profile will be updated as the City builds its PACP database. Above ground conveyance, SWMF, and LID assets are in overall Fair condition, with 40 to 60% of asset value in Good or Very Good condition.

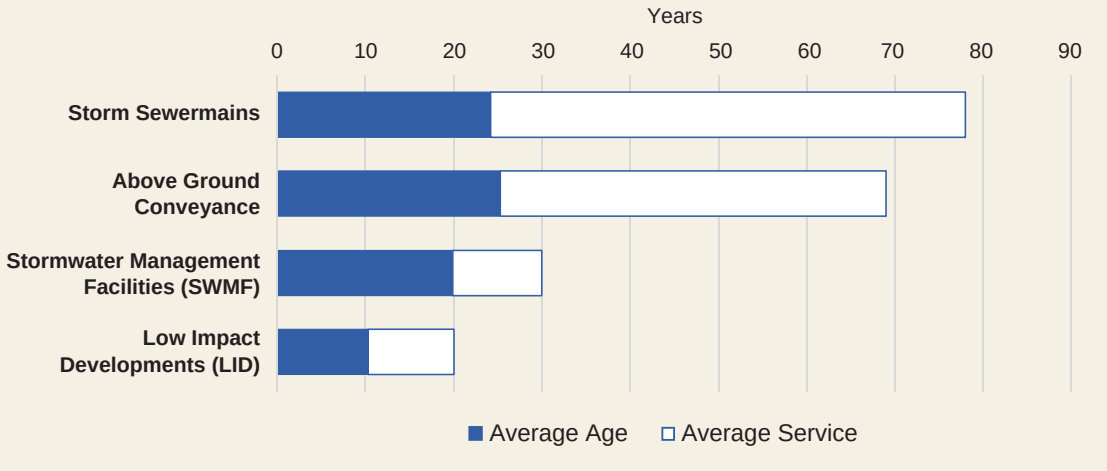
Figure 73: Condition Profile for Stormwater Management



E1.4 Asset Age

Figure 74 shows the average age and estimated service life of Stormwater Management assets. Storm sewermains, above ground conveyance, and SWMF assets are on average 20 to 25 years old. LID are newer assets, with an average age of 10 years.

Figure 74: Average Asset Age vs. Average Service Life for Stormwater Management



E2 Levels of Service

The Strategic LOS for Stormwater Management is to plan for and build sustainable stormwater infrastructure that improves water quality and provides erosion and flood protection; reduces environmental, property and human risks; and complements the community. The Strategic LOS are aligned with the City's strategic priorities as outlined in Table 49.

Table 49: Strategic LOS Alignment for Stormwater Management

Strategic LOS	Strategic Priorities Themes (2020-2022)	Climate Change Framework Goals
Plan for and build sustainable stormwater infrastructure that improves water quality and provides erosion and flood protection; reduces environmental, property and human risks; and complements the community	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Land-use Planning • Asset Management • Community Risk Mitigation • Natural and Engineered Green Infrastructure

As discussed in Section 3, the LOS provide a Line of Sight by aligning higher level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measure of managing that infrastructure (the Technical LOS).

E2.1 Customer Levels of Service

The City's Customer LOS are summarized in Table 50. The O. Reg. 588/17 qualitative LOS is described in further detail below.

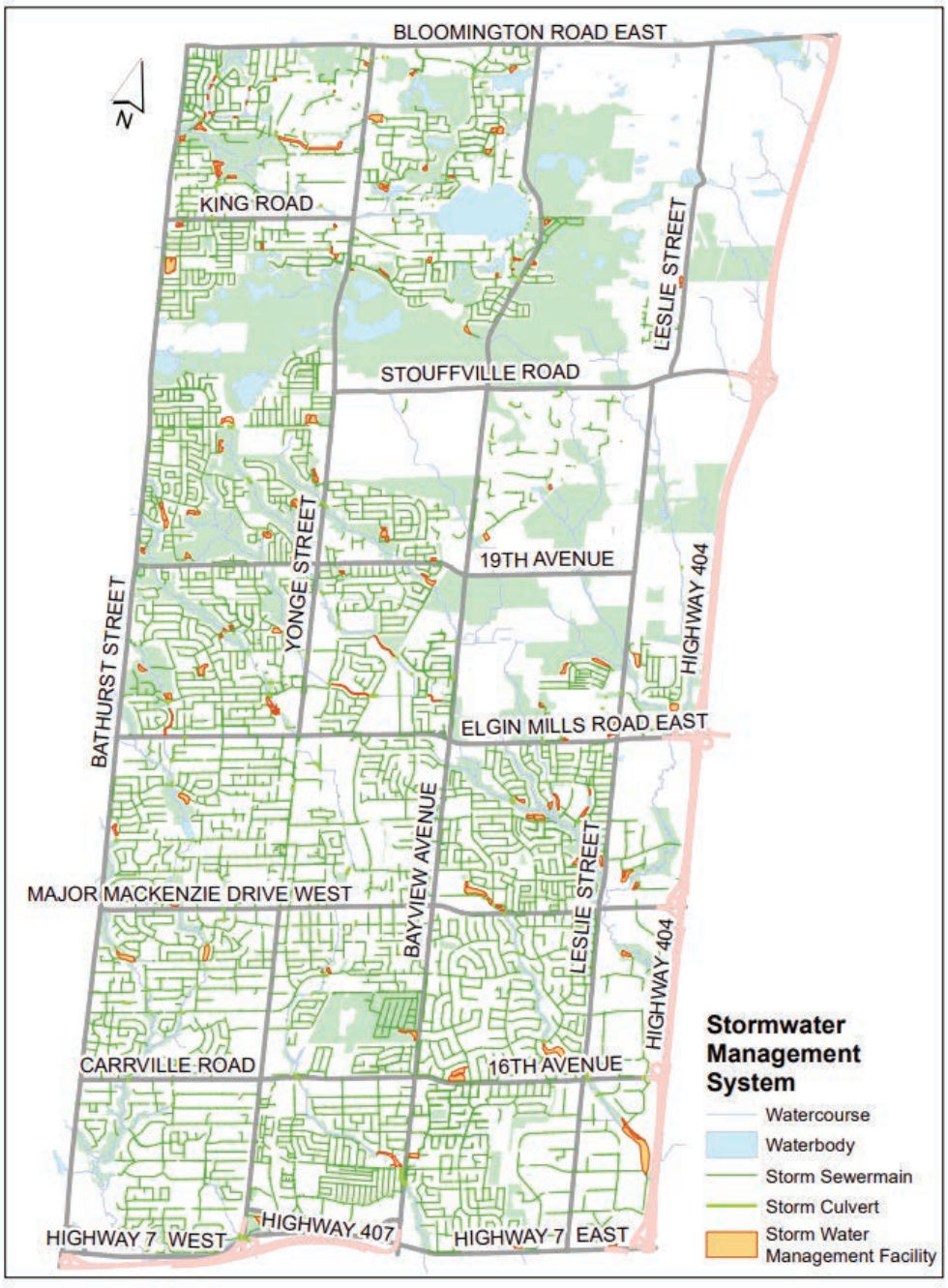
Table 50: Customer LOS for Stormwater Management

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal Stormwater Management System.	O. Reg.	See "Protection provided by stormwater management system" Below
Reliable	Timely delivery of infrastructure (% of planned ponds completed)	Fnd.	100%
	Timely delivery of infrastructure (% of planned linear meter of sewers completed)	Fnd.	100%
Quality	Percentage of SWMF optimized	Fnd.	78%

Protection provided by Stormwater Management system

Ensuring safe and reliable stormwater service is a core municipal responsibility. The City operates stormwater ponds, storm sewermains and catchbasins to store, direct, and control stormwater runoff. These efforts protect the community's more than 150 kilometres of streams and rivers, prevents flooding and erosion, and improves water quality. Almost 100% of the City's street-facing properties are resilient to a 100-year storm event (for further details, refer to the Technical LOS section). Refer to Figure 75 for a map of the City's storm sewermains, storm culverts, and SWMF.

Figure 75: City of Richmond Hill Stormwater Management System



E2.2 Technical Levels of Service

To deliver services that meet customer and strategic LOS, technical measures are tracked to demonstrate the resiliency of the network and that assets are maintained in a state of good repair. In terms of resiliency, the current stormwater network model determined that 99.6% of properties within the City are resilient to a 100-year storm event, considering riverine flooding and overland flow of the major (road) system. The network itself is 79% resilient to a 5-year storm, though this is a conservative analysis. 11.5% of the network is currently assessed as not resilient but this evaluation is only due to these sewers being shallow and inherently not meeting the 1.8m below ground surface elevation threshold. The City is working on on-going model updates to refine this analysis. In terms of condition measures, from an overall perspective the majority of Stormwater Management assets, as indicated in Section E1, are in Very Good condition, though 22% of LID are potentially past their Estimated Service Life. LID are newer assets for the City and the understanding of its service life will improve as data is collected over time. There are opportunities to improve the performance of stormwater ponds, as 10% are currently not functioning as intended, and some ponds have passed the threshold for sediment removal.

Table 51: Technical LOS for Stormwater Management

Service Attribute	Performance Measure	Measure Type	2020 Performance
Scope	Percentage of properties in municipality resilient to a 100-year storm.	O. Reg.	99.6%
	Percentage of the municipal Stormwater Management system resilient to a 5-year storm.	O. Reg.	79.0%
Reliable	Percentage of assets in Fair or better condition (PACP Score 0 to 3)	Fnd.	99.2% (sewers)
	Percentage of assets in Fair or better condition (Culverts)	Fnd.	94.2% (culverts)
	Percentage of LID, OGS, and stormwater filters that have not exceeded their ESL.	Fnd.	78% (LID) 100% (OGS)
	Percentage of OGS and stormwater filters that are inspected annually.	Fnd.	92%
	Percentage of SWMF that function analyses with a “pass” - % of stormwater ponds functioning as intended.	Fnd.	90%
	Percentage of SWMF that meet TSS removal targets.	Fnd.	93%

E2.3 Advanced Levels of Service

The City is moving towards comprehensive modelling of the complete Stormwater Management system. The goal is to gain an understanding of the overall system capacity and constraints, and direction with respect to optimizing the existing system and in consideration of climate change, as well as the capacity to model various scenarios when new development is added to the system. This model will allow the City to track additional measures in the future, such as identification of areas of insufficient capacity in consideration of climate change. These additional measures will assist the City in understanding potential improvement activities and providing additional data to support asset investment decisions.

E2.4 External Trends and Issues

There is considerable coordination and integration required between Stormwater Management and Roadway System activities, as much of the Stormwater Management system provides drainage from the road surface and is located under the road bed. A major risk to maintaining LOS for Stormwater Management assets is the changing weather conditions associated with climate change. These changing conditions have the potential to overload the network leading to flooding events. Stormwater management needs will continue to evolve and LOS will need to take into consideration new stormwater treatment technologies as well as new source and conveyance controls. The City of Richmond Hill and the Toronto Region Conservation Authority (TRCA) work together to address watershed management issues, and this continued collaboration with various agencies may also impact required service levels.

E3 Asset Management Strategy

Asset management strategies are the planned lifecycle actions that Richmond Hill uses to manage its infrastructure to meet the service levels described in the previous section. Table 52 summarizes the lifecycle strategies and the associated LOS for Stormwater Management assets.

Table 52: Lifecycle Strategies for Stormwater Management

Lifecycle Activity	Description of Activities Practiced by the City
Non-Infrastructure	• The City performs street sweeping and implements erosion controls for new construction to reduce sediment loads to stormwater management ponds.
Maintenance	• The City completes ongoing maintenance activities as necessary, including maintenance on ditches and flushing of outlet structures. • Emergency repairs for linear and vertical infrastructure are performed as necessary. • Flushing and CCTV inspections of sewers are completed proactively across the system. • The City prepares scheduled CCTV inspections and clean out programs for catchbasins, stormwater facilities, inlet/outlets, oil and grit separators, and other assets as required. • Bathymetric surveys for wet ponds are completed to determine sediment levels.

continued...

Table 52: Lifecycle Strategies for Stormwater Management	
Lifecycle Activity	**Description of Activities Practiced by the City**
Rehabilitation	• Storm sewermain candidates in Poor or Very Poor condition (identified via CCTV) are relined where possible. • SWMF dredging is completed to reduce sediment levels. • Refer to discussion below this table for additional details.
Replacement	• Storm sewermain candidates in Poor or Very Poor condition (identified via CCTV) will be replaced when rehabilitation has previously been completed or is not possible. • Stormwater vertical assets are replaced based on age and expected service life. • Refer to discussion below this table for additional details.
Disposal	• Sewers are either removed during renewal construction or are disconnected and abandoned in place depending on the construction circumstances. Abandoned mains are capped and/or grouted to protect other infrastructure.
Growth/Service Improvement	• New or larger assets are identified through technical analysis as part of servicing plans completed to service new development. • Assets are identified for upgrading due to capacity restrictions evaluated under different storm events, which take into account the impacts of climate change. • The City plans for stormwater pond rehabilitations or upgrades to meet water quality and/or water quantity objectives. • The City is undertaking the development of a stormwater network model which will be used to support growth planning, capital project delivery, and operations and maintenance of the Stormwater Management system.

Focus on Rehabilitation and Replacement Activities

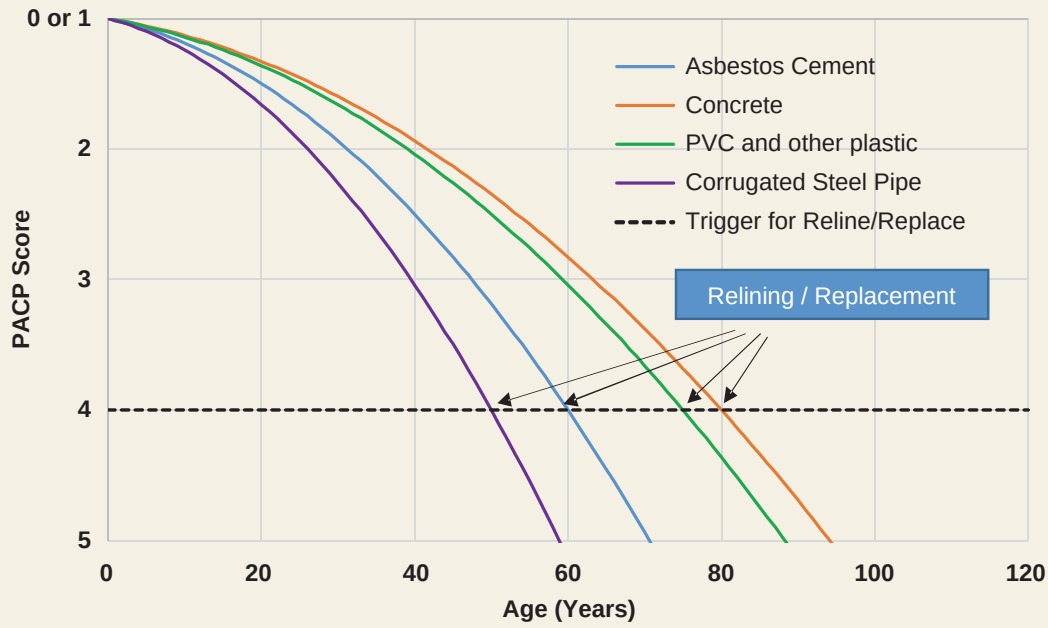
Typically, repair and full or partial relining activities are conducted on an as needed, reactive basis. Stormwater Management linear replacements are typically completed when they can be bundled with other projects which allows the City to reduce construction costs and minimize impacts to residents.

The City has recognized the need to create a capital storm sewermain linear replacement program. Similar to sanitary sewers, the City will leverage PACP condition scores, obtained from CCTV inspections, to identify candidates for rehabilitation and replacement. Assets identified for rehabilitation or replacement are those with PACP scores of 4 or 5 (i.e. Poor or Very Poor condition). Some assets with PACP scores of 3 are also considered on a case-by-case basis. The City plans to reline sewers up to 600 mm in diameter and replace sewers above 600 mm.

The City replaces catchbasins, maintenance holes, and laterals typically at the same time as the associated storm sewermain. Therefore, replacement costs for a storm sewermain include costs for the catchbasins, maintenance holes, and laterals. Bundling similar works reflects the City's approach to managing related assets and reduces overall lifecycle costs. Repairs and minor replacements to catchbasins, maintenance holes, and laterals that are outside the scope of capital works are addressed by the City as maintenance items.

The estimated rate of deterioration and timing for replacement of sewers at the trigger PACP score of 4 is summarized in the following figure. Storm sewermains are expected to be relined or replaced between 50 and 80 years based on its material. As shown in the curves in Figure 76, the rate of deterioration increases as the pipe ages. As the City grows its historical PACP assessment database, it will be able to align these deterioration curves with actual experience and improve the forecasting discussed in the next section.

Figure 76: Estimated Deterioration Curves by Pipe Material (Storm Sewermains)



Capital interventions for concrete storm culverts are similar to municipal structures discussed in Section A3, and are expected to consist of a minor rehabilitation, a major rehabilitation, and then be reconstructed between 70 and 80 years. Steel culverts are expected to be replaced at the end of life after approximately 55 years. In addition to storm sewermains and culverts, open channels are part of the Stormwater Conveyance network. The lifecycle for open channels is assumed to be mainly maintenance type activities, and this strategy will be reviewed and developed as the inventory for open channels is improved and included in the next AMP.

Stormwater Controls assets including oil/grit separators, stormwater filters, and LID are replaced based on age and reviews of condition where available. LID are relatively newer assets that increase infiltration and reduce urban runoff volumes, and the City expects to better understand the lifecycle needs of these assets over the upcoming years.

The City manages Stormwater Management Facilities (SWMF) in a state of good repair by completing regular dredging to remove sediment. Major storm pond rehabilitation upgrades are also completed to ensure that water quality and quantity objectives are met. The City implements a monitoring program to complete sediment surveys for wet ponds on a 5-year cycle to plan for upcoming dredging needs. The City defines deterioration curves for each type of pond, with differing curves for dry ponds and wet pond categories to support the capital forecasting discussed in Section E4. It is expected that the strategies implemented for the Stormwater Management system will only increase in importance as the Ministry of the Environment, Conservation and Parks (MECP) moves towards implementing a new consolidated system-wide Environmental Compliance Approval (ECA) for stormwater infrastructure works in 2021.

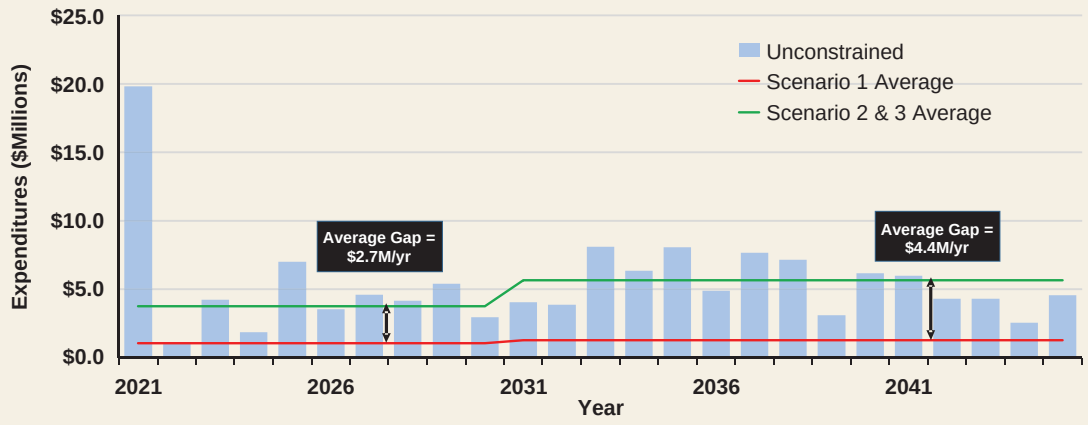
E4 Investment Needs and Financial Assessment

E4.1 Renewal Investment Forecast

Rehabilitation and replacement of Stormwater Management assets are funded through the Water Quality Protection Reserve Fund. As discussed in Section 5.2.1.3, the City does not have sufficient funding to meet the Unconstrained Scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS.

The analysis in Section 5.2.1.3 showed that the Ten Year Capital Forecast (Scenario 2) funding is able to maintain condition LOS (same as Scenario 3) compared to the Status Quo (Scenario 1). The Ten Year Capital Forecast incorporates higher stormwater rate increases such that there is an annual average of $3.8 million of funding to maintain LOS. As shown in Figure 77, the funding gap was identified as $2.7 million per year on average over the next 10 years, with a higher gap expected in years 11 to 25.

Figure 77: Scenario Summary and Funding Gap for Stormwater Management*

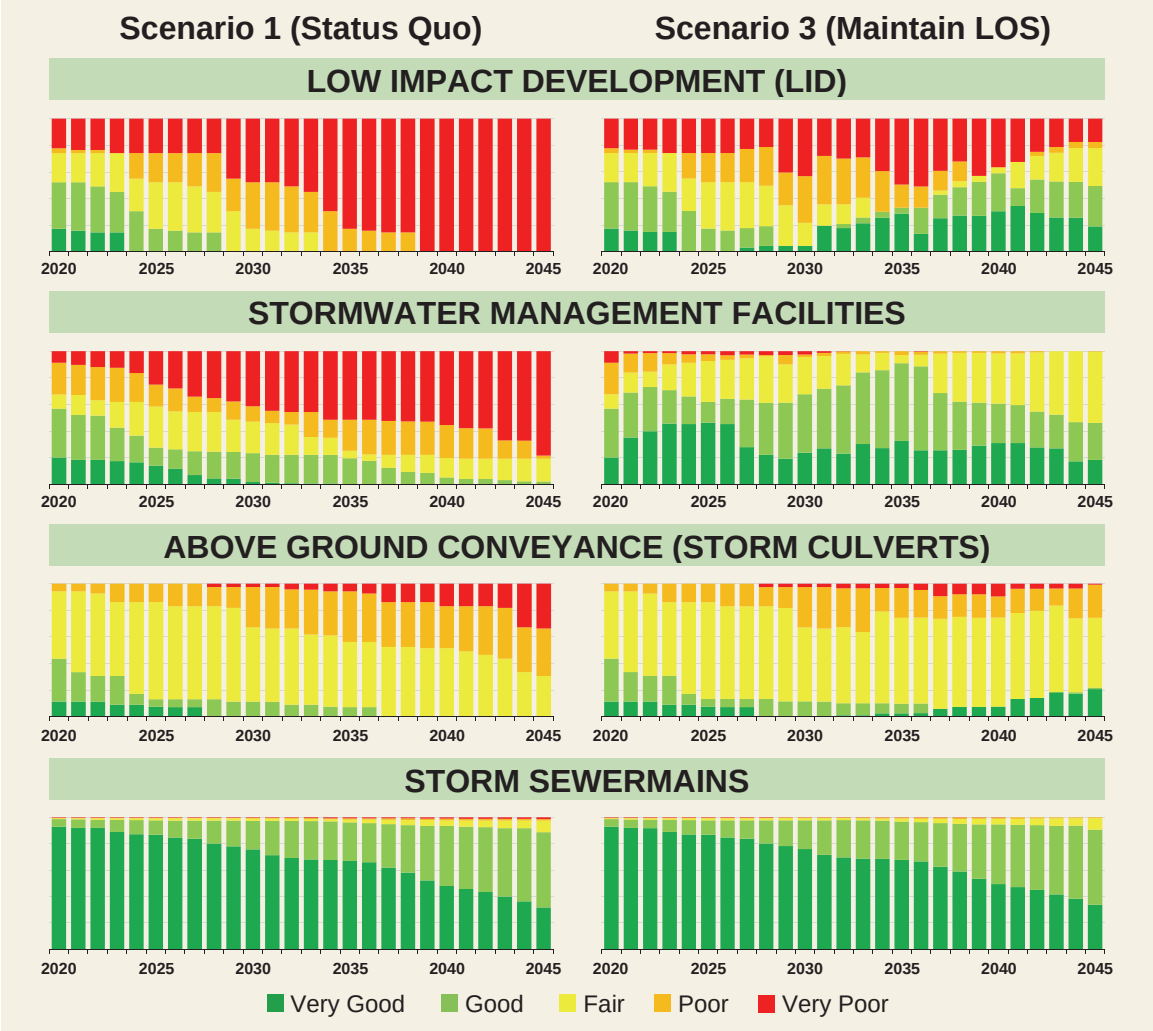


*Does not include open channels, plunge pools

The difference in Status Quo (Scenario 1) and Maintaining LOS (Scenario 2 and 3) is demonstrated in more detail by Asset Type in this Appendix. The Status Quo (Scenario 1) funding averages $1.1 million per year of available capital funding over the next 10 years, and $1.3 million annually thereafter. The City requires an average of $2.3 million annually to fund stormwater pond rehabilitations. Therefore, in the Status Quo scenario, no funding is left available for sediment removal or renewal of sewers, culverts, or LID assets, and the condition deteriorates as shown in Figure 78.

At the increased level of funding in Scenarios 2 and 3, overall condition is maintained. The funding is still constrained in that the backlog is not cleared and the needs of sewers, LID, and storm culverts are not fully addressed at the expense of more critical SWMF infrastructure. At any given constrained funding level, the EAM prioritizes investment decisions to ensure that assets with the highest criticality are addressed on a timely basis. Therefore, even though there is no dedicated funding for storm culverts or LID in the Ten Year Capital Forecast, Scenario 3 shows a reallocation of funding that prioritizes work on the more critical assets throughout each year of the forecast and minimizes the overall risk to the City. Prioritization should be balanced with maintaining current LOS across asset areas, as allowing one asset to deteriorate can have negative impacts on the condition of other associated assets in an interconnected network.

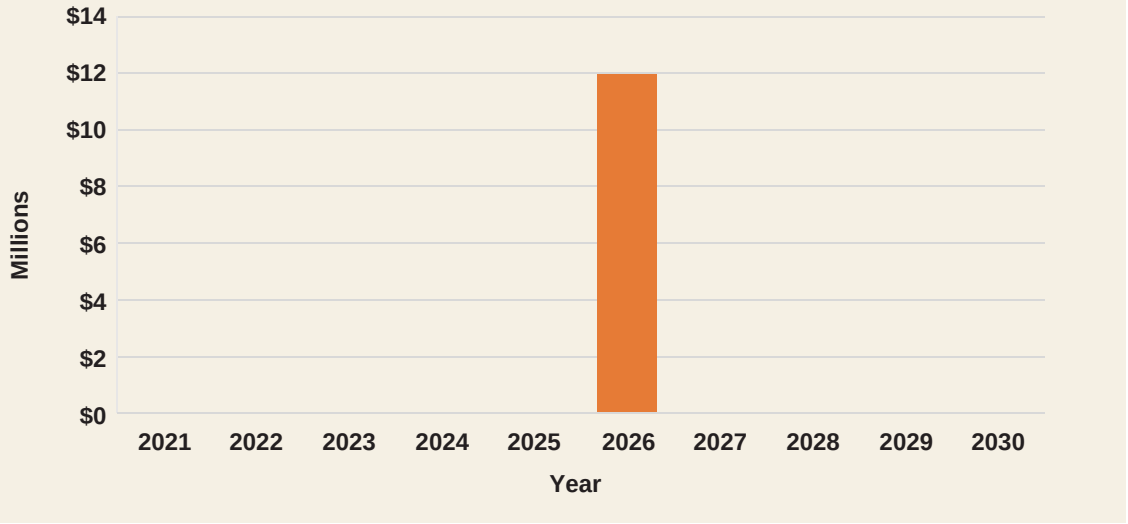
Figure 78: Projected LOS Comparison for Stormwater Management



E4.2 Preliminary Growth Investment Forecast

Figure 79 below shows the investments in the City's Stormwater Management system that are planned for the next 10 years to meet growth needs. Regarding assets to be assumed in the future, the forecast only includes assets that are proposed to be funded under the Development Charges By-law. Based on the City's Ten Year Capital Forecast associated with the Financial Sustainability Strategy, a flood remediation project at a major City intersection is planned for 2026.

Figure 79: Growth Investment Forecast for Stormwater Management

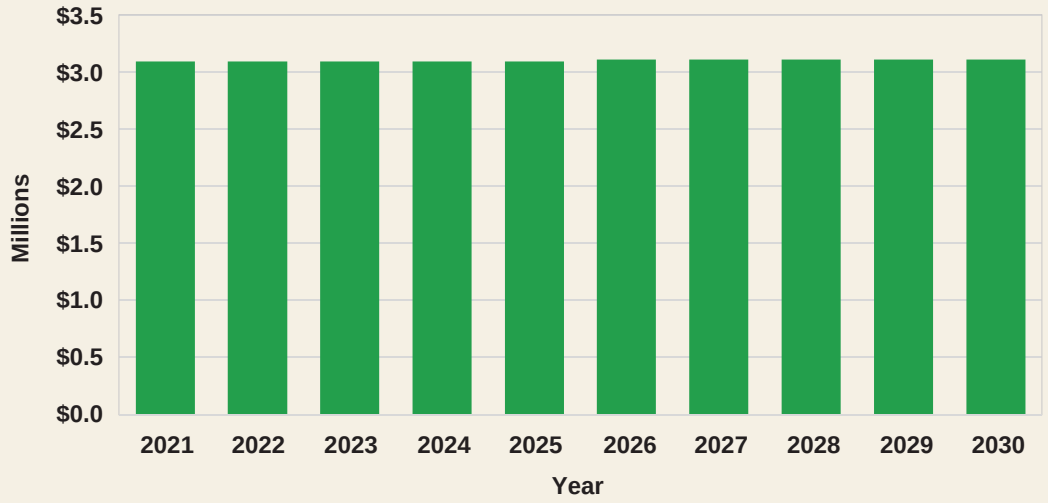


E4.3 Preliminary Operating Budget Forecast

Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments can place cumulative, additional pressures on the annual operating budget.

The estimated operating budget forecast for expenditures related to asset operations and maintenance activities for Stormwater Management assets in Figure 80 assumes growth based only on the value of new capital projects outlined in Section E4.2. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process. The expected growth in the City's asset portfolio and its associated impact on the Operating Budget will continue to be updated as on-going initiatives such as the stormwater model are completed.

Figure 80: Operating Budget Forecast for Stormwater Management



The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. Legislation changes may also impact future operating and maintenance costs.

Appendix F: Recreation Facilities

The City's Recreation Facilities are the buildings where people come together to connect, be active, and get involved. There are two types of facilities in the Recreation Facilities Sub-Service: Community Centres (which can contain indoor aquatic facilities, fitness facilities, and/or gymnasiums) and Arenas (which contain ice pads). Both types of facilities also offer a variety of community program spaces, such as meeting rooms, activity and crafts rooms, and general-purpose program rooms. This AMP focuses on the building envelope of Recreation Facilities, and does not include recreation assets such as equipment or site-related assets such as parking lots and landscaping.

F1 State of the Infrastructure

F1.1 Overview

The total estimated value of the City's Recreation Facilities is **$159.4 million**. The average asset condition is **Good (Letter Grade B)**.

The City's Recreation Facilities inventory is summarized in Table 53.

Figure 81: Asset Condition Distribution and Valuation for Recreation Facilities

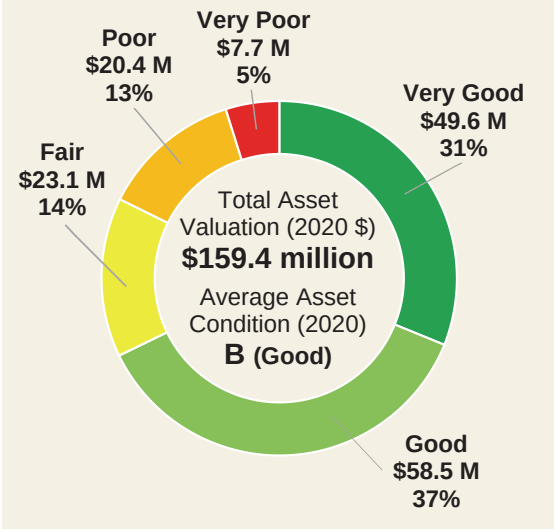


Table 53: Inventory Overview for Recreation Facilities

Asset Class	Quantity	Replacement Cost ($ millions)	Average Age	Average Condition
Building Type				
Community Centres	11	$100.7	20	**Good (B Grade)**
Arenas	5	$58.7	28	**Good (B Grade)**
	TOTAL	$159.4	23	**Good (B Grade)**

F1.2 Asset Valuation

Replacement costs for facilities are derived from the City's ReCAPP (Renewal Capital Asset Planning Process) system, and estimated soft costs are added to account for items such as design and engineering. This asset-focused valuation differs from the property appraisals completed for determining facility insurance valuations.

F1.3 Asset Condition

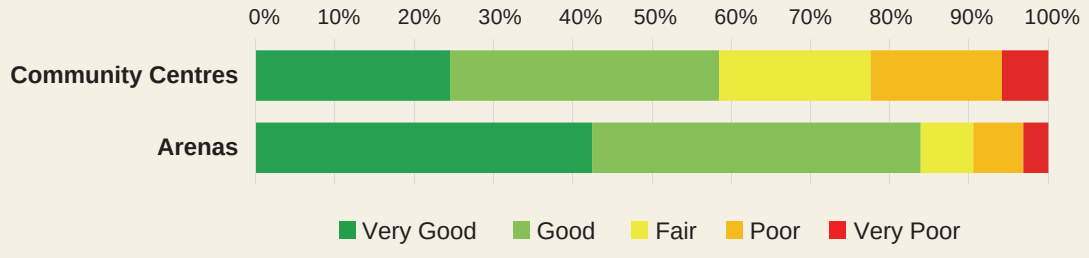
Regular condition assessments and inspections are performed on Recreation Facilities assets to determine their condition, and the information is used to estimate each asset's remaining life. Current assessments use a four-point scale, which is converted to the five-point scale used in this AMP as outlined in Table 54. The inspection condition ratings for three categories (Excellent, Good, Fair) correspond directly to the performance categories Very Good, Good, and Fair. Poor assets identified in the condition assessment are classified in the AMP as Poor or Very Poor based on the added consideration of age and estimated service life.

Table 54: Asset Condition Rating System for Recreation Facilities

Performance Category	Letter Grade	Recreation Facilities Condition Rating (from Inspection)
Very Good	A	Excellent
Good	B	Good
Fair	C	Fair
Poor	D	Poor AND not exceeded service life
Very Poor	F	Poor AND exceeded service life

As shown in Figure 82 below, almost 60% of community centre assets are in Good or Very Good condition. Arenas are generally faring better due to a significant investment in these facilities in recent years, with more than 80% of assets in Good or Very Good condition.

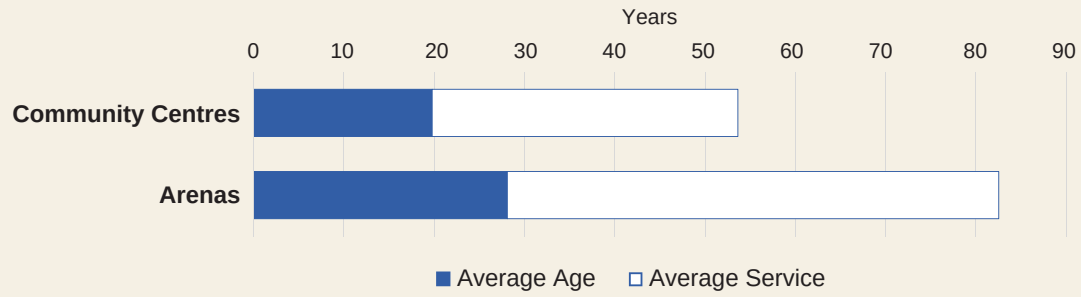
Figure 82: Condition Profile for Recreation Facilities



F1.4 Asset Age

Figure 83 below shows the average age and estimated service life for Facilities assets. Average age and average service life values were calculated based on a weighted average of individual building components, which vary considerably between each asset, and therefore do not represent the overall life of the facility as a whole.

Figure 83: Average Asset Age vs. Average Service Life for Recreation Facilities



F2 Levels of Service

Recreation Facilities assets are managed by Facility Management (FM). FM works together with Recreation & Culture Services to ensure that the facilities are in a state of condition that enables delivery of the required services and corporate objectives. The Strategic LOS is to facilitate healthy lifestyles and enhance community vibrancy and promote well-being, in alignment with the City's strategic priorities in Table 55.

Table 55: Strategic LOS Alignment for Recreation Facilities

Strategic LOS	Strategic Priorities Themes (2020-2022)	Climate Change Framework Goals
Provide equitable access to affordable, high-quality recreation and culture programs in order to facilitate healthy lifestyles for individuals, enhance community vibrancy and promote well-being	• Balancing Growth and Green • Fiscal Responsibility • Getting Around the City	• Asset Management • Community Risk Mitigation

As discussed in Section 3, the LOS provide a Line of Sight by aligning higher level corporate objectives with the general public's understanding of the services provided by the City's infrastructure systems (the Customer LOS) and the technical details and performance measure of managing that infrastructure (the Technical LOS).

F2.1 Customer Levels of Service

The Recreation Facilities Sub-Service focuses on providing high quality, affordable, and accessible recreation programs. These qualities are typically measured by facility usage data, which provides information on adequacy of amenities as well as if the facilities have adequate capacity to meet community needs. For Community Centres, usage may not differ significantly between prime-time and non-prime time due to the availability of smaller programs that are regularly used during the day to meet the needs of a wide range of demographic groups.

The City's Customer LOS are summarized in Table 56.

Table 56: Customer LOS for Recreation Facilities			
Service Attribute	**Performance Measure**	**Measure Type**	**2019 Performance**
Cost Efficient	Percentage cost recovery	Fnd.	78%
Accessible	Fill rate for programs (Number of attendees vs. total available spots)	Fnd.	63%
	Percentage of customers who are satisfied/ highly satisfied with programs	Fnd.	92%**
	Number of recreation facilities per number of residents***	Fnd.	1 indoor icepad for every 24,400 residents 1 Integrated Community Program Room for every 4,150 residents 1 indoor gym for every 27,900 residents 1 fitness facility for every 65,000 residents 1 indoor Aquatic Facility for every 32,500 residents
Quality	Recreation Facilities primetime usage	Fnd.	Community Center 37.72%* Gymnasium 65.46%* Sports Dome 63.68%* RG Sports Centre 79.53%* Arenas 88%
	Recreation Facilities non-primetime usage	Fnd.	Community Centre 37.92%* Gymnasium 58.83%* Sports Dome 62.32%* RG Sports Dome 56.59%* Arenas 40%

*2018 performance reported
**Source: 2019 Community Survey
***Based on population in 2016 Census data

F2.2 Technical Levels of Service

The primary focus of the facilities Technical LOS is reliability, which is measured by Facility Condition Index (FCI) and the percentage of assets in Fair or better condition. Recreation facilities currently have an average FCI of 7%.

The City's Technical LOS for Recreation Facilities is summarized in Table 51. Environmental sustainability measures pertaining to water and energy consumption are included to support the City's environmental goals and objectives. The City's 2019-2023 Corporate Energy Plan Summary outlines the measures the City will undertake over the next five years to reduce energy consumption, costs, and greenhouse gas emissions.

Table 57: Technical LOS for Recreation Facilities			
Service Attribute	**Performance Measure**	**Measure Type**	**2020 Performance**
Reliable	Average Facility Condition Index (FCI)	Fnd.	7%
	Percentage of assets in Fair or better condition	Fnd.	82%
Environmentally Sustainable	Annual water consumption per square foot**	Fnd.	232.6 L/ft²*
	Annual energy consumption per square foot	Fnd.	56.4 ekWh/ft²*

*2019 performance reported
**water consumption does not include Langstaff Community Centre

F2.3 Advanced Levels of Service

For the next AMP, the City will consider development of other measures that may assist in asset decision making for both Recreation facilities and the other non-Core+ facilities.

F2.4 External Trends and Issues

The City's facilities have a long history of best practice in asset management and the risks are relatively well understood. Richmond Hill has recently implemented a LOS framework for much of its facilities portfolio and invested in the Maximo work and asset management system to track preventative maintenance, repairs and end of life replacement forecasts. Risks to LOS in facilities in Richmond Hill include the potential for additional regulation related to energy usage and emissions.

F3 Asset Management Strategy

Asset management strategies are the planned lifecycle actions that Richmond Hill uses to manage its infrastructure to meet the service levels described in the previous section. Table 58 summarizes the lifecycle strategies for Recreation Facilities assets.

Table 58: Lifecycle Strategies for Recreation Facilities	
Lifecycle Activity	**Description of Activities Practiced by the City**
Non-Infrastructure	• The City encourages care and conservation of associated infrastructure assets through policy, procedures, and public outreach. • The City manages infrastructure in conformance with Provincial, Federal and Municipal policies, standards, and regulations. • Initiatives such as arc flash studies and air quality and noise assessments are completed to maintain service levels and provide a safe facility environment.
Maintenance	• Scheduled preventative maintenance programs are planned and executed to manage assets proactively. • Reactive maintenance is performed as required. • Building condition assessments are completed to determine repair and renewal needs.

continued...

Table 58: Lifecycle Strategies for Recreation Facilities	
Lifecycle Activity	**Description of Activities Practiced by the City**
Rehabilitation	• Rehabilitation of various assets is determined through regular comprehensive condition assessments and completed as required. • Refer to discussion below this table for additional details.
Replacement	• Similar to rehabilitation, the replacement of various assets is determined through regular comprehensive condition assessments and completed as required. • Refer to discussion below this table for additional details.
Disposal	• Appropriate and proper disposal occurs when assets are replaced or renewed.
Growth/Service Improvement	• New assets are identified through master plans to address capacity issues and provide appropriate amenities to service the community. • AODA compliance is addressed through asset renewals and considered during rehabilitation work planning. • Assets are considered for replacement to address energy efficiency, water consumption, technical obsolescence, and regulatory obsolescence. • Assets are also considered for replacement for service improvements to ensure adequate space and amenities meet evolving community needs.

Focus on Rehabilitation and Replacement Activities

Facilities assets are replaced based on considerations of age, condition and estimated remaining service life. Condition assessments are performed to ensure that knowledge on the asset portfolio and its condition is integrated into decision making. The maintenance, rehabilitation, and replacement recommendations from the assessments ensures that planned capital works are appropriate and that asset lifecycles are managed at the lowest possible cost.

Facility assets are highly varied in type, ranging from structural building components to architectural building components and building services. Mid-life rehabilitations are planned for assets where the benefit from the extension of service life outweighs the cost of intervention, resulting in a lower lifecycle approach. Assets are forecasted to be replaced when they reach the end of their service life, which is individual to each asset and is based on data such as the type of asset, manufacturer, model, and material of construction.

F4 Investment Needs and Financial Assessment

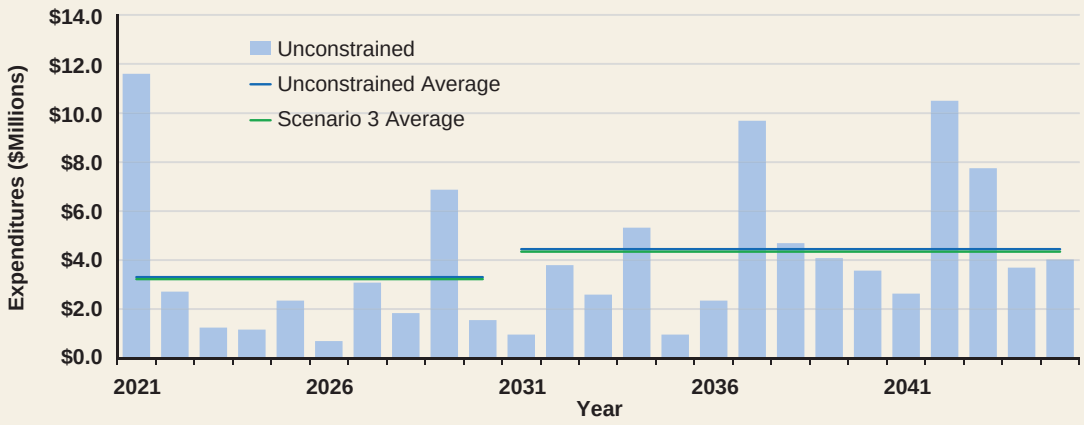
F4.1 Renewal Investment Forecast

Rehabilitation and replacement of recreation facility assets associated with the building envelope are funded through the tax levy, federal gas tax grant, and other grant reserves.

As indicated in Section 5.2.1.4, the Status Quo (Scenario 1) and Financial Sustainability Strategy (Scenario 2) budgets are not easily determined specific to Recreation Facility building envelope assets. The available budget will be more accurately defined with the addition of non-Core+ assets (e.g. libraries, cultural facilities, municipal offices, etc.) in the next AMP. Therefore, a formal assessment of a funding shortfall for recreation facilities is not provided in this AMP.

To maintain LOS (Scenario 3) over the next 25 years, an average expenditure of $3.3 million per year over the next 10 years, and $4.4 million over years 11 to 25 is identified, in line with the Unconstrained Scenario. This results in an average annual expenditure of $4.0 million over the 25-year forecast.

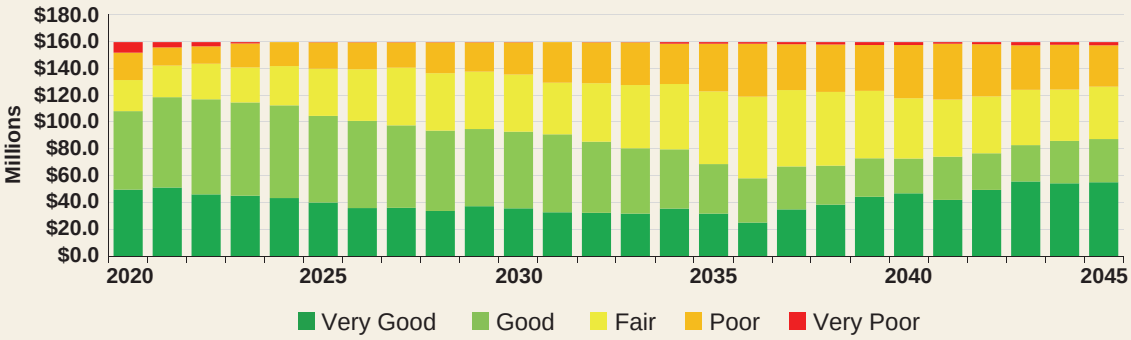
Figure 84: Scenario 3 for Recreation Facilities*



*Does not include site assets (e.g. parking lots, landscaping) or non-Core+ facilities

Scenario 3 accounts for a $7.6 million expenditure in 2021 per the approved 2021 Capital Budget. Due to the current backlog, this increased 2021 expenditure is required to address the current needs for recreation facilities and supports the City in maintaining an average FCI of 7%. The funding still represents an initial constraint in that not all Very Poor assets are replaced immediately, but as shown in Figure 85, a significant portion of the Very Poor assets are addressed by the end of the ten-year outlook. In 2031 to 2045, an increased annual average expenditure of $4.4 million is required as another cycle of assets are expected to reach end of life. At this level of funding, the percentage of assets in Very Poor condition is minimized at the end of the forecast similar to the current 2020 condition profile. Note that the projected condition profile does not consider the needs of planned growth projects, which will put additional pressures on the budget. As facilities are constructed and added to the portfolio, funding will need to be increased to account for the rehabilitation and replacement of assets in these new facilities. As previously discussed, the next AMP will provide a shortfall analysis that will include a comprehensive assessment including non-Core+ facilities.

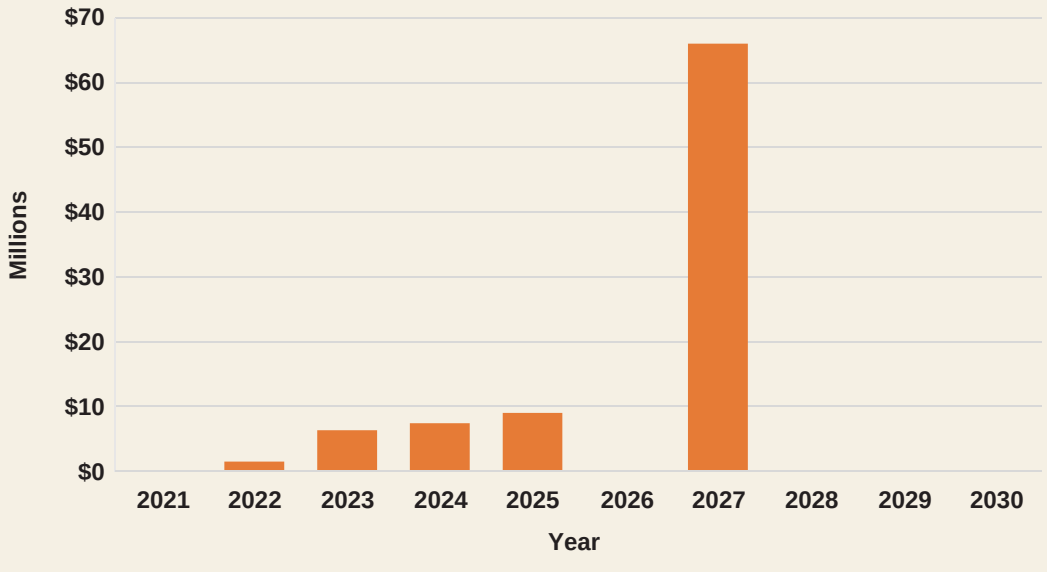
Figure 85: Projected LOS (Condition) for Scenario 3 for Recreation Facilities



F4.2 Preliminary Growth Investment Forecast

Figure 86 below shows the investments in the City's Recreation Facilities that are planned for the next 10 years to meet growth needs. The forecasted growth projects originate from the City's Ten Year Capital Forecast associated with the Financial Sustainability Strategy, and include the construction of two sports facilities and a multi-purpose recreational facility.

Figure 86: Growth Investment Forecast for Recreation Facilities

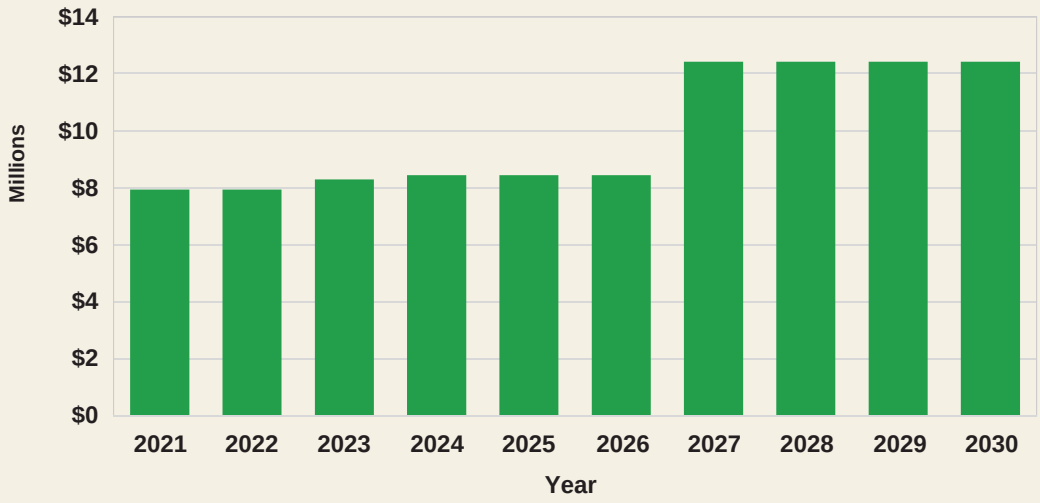


F4.3 Preliminary Operating Budget Forecast

Ongoing operational and service costs associated with capital renewal expenditures as well as growth investments can place cumulative, additional pressures on the annual operating budget.

The estimated operating budget forecast for expenditures related to asset operations and maintenance activities for recreation facility assets in Figure 87 assumes growth based only on the value of new capital projects outlined in Section F4.2. The forecast does not include costs associated with future assets that are to be assumed as a part of the development process. The expected growth in the City's asset portfolio and its associated impact on the Operating Budget will continue to be updated as on-going initiatives such as the Recreation Master Plan update are completed. The significant increase in operations costs is expected due to the construction of a new recreation facility.

Figure 87: Operating Budget Forecast for Recreation Facilities



The City will continue to improve its data collection, analysis and forecasting related to the costs incurred through operating and maintenance activities such that shortfalls within the Operating Budget can be better assessed in future AMP updates. Future improvements to the forecast will include consideration of budget pressures due to increasing operating costs for existing assets, such as contracts with external resources. Legislation changes may also impact future operating and maintenance costs.

Appendix G: Definitions and Acronyms

Definitions

Asset:

"An item, thing, or entity that has potential or actual value to an organization" (ISO 55000, 2014). The value can be tangible (or intangible); financial (or non-financial) and includes consideration of risks and liabilities.

Asset Management (AM):

Coordinated activities that help an organization to realize value from its assets. It encompasses all asset types – tangible and intangible, individual components or complex systems, and all activities involved in the asset's lifecycle. Asset management translates organization objectives into asset-related decisions, plans, and activities while managing risk. (ISO 55000, 2014).

Asset Management Plan (AMP):

Documented information that specifies the activities, resources, and timescales required for asset-based services to achieve the organization's AM objectives (ISO 55000, 2014).

Asset Management Policy:

A high-level statement of an organization's principles and approach to asset management (IIMM, 2015).

Asset Management Program:

The term used to describe the activities, people, and processes that make up AM at the City.

Asset Management Strategy:

Documented information that specifies how organizational objectives are to be converted into Asset Management objectives, the approach for developing Asset Management Plans and the role of the Asset Management System in supporting achievement of the Asset Management objectives (ISO 55000, 2014).

Asset Management System:

A broad collection of interconnected processes and documentation that is designed to direct and deliver the discipline of asset management. An Asset Management System is a "management system" for asset management that establishes an organization's AM Policy and AM objectives.

Asset Register:

An asset register is a table which stores assets owned by the City and the required attributes that support asset management decision making. It contains pertinent details about each fixed asset and is used to track information such as replacement value, age, location, condition, criticality rating, etc. An asset register supports Enterprise Asset Management, by consolidating data needs within one location.

Backlog:

A backlog is the result of the analysis of current state of the infrastructure and what treatments or interventions are applied to each asset according to the lifecycle strategies. The backlog consists of current year needs as well as any overdue rehabilitations or replacements.

Customer Levels of Service (Customer LOS):

Customer Levels of Service measures are expressed in non-technical terms that describe the general public's understanding of services being provided by infrastructure systems. Customer LOS measures are typically related to the service that is provided by the overall system supporting the service delivery, rather than the specific assets.

Condition to Performance Map:

A table, which illustrates the relationship between condition, performance scores, and performance categories. Measurements of conditions vary between different assets. The tables are used to convert the various condition measurements to a consistent set of performance scores (from 0 to 1) and categories (Very Poor, Poor, Fair, Good, and Very Good).

Consequence of Failure (CoF):

The outcome or impact of an asset failing its condition or capacity targeted LOS.

Deterioration Models:

Deterioration models or curves are a mathematical representation of the change in condition of an asset over time.

Decision Support System (DSS):

A system that has the ability to support the integration and management of information across all physical asset types within the scope of the corporate asset management plan, and have the ability to store, analyze, and optimize infrastructure data to justify and prioritize infrastructure investment decisions.

Enterprise Resource Planning (ERP):

Usually referred to as a category of business management software. Typically a suite of integrated applications, that an organization can use to collect, store, manage, and interpret data from many business activities. Currently Richmond Hill employs SAP as its ERP software.

Estimated Service Life (ESL):

The estimated amount of time that an asset is expected to maintain its performance or function.

Intervention Threshold:

A point in a lifecycle model when a particular action is applied. The term threshold is commonly used interchangeably with the term 'trigger'.

Lean:

An industry-recognized continuous improvement methodology designed to eliminate waste and inefficiencies, and optimize process flow.

Levels of Service (LOS):

Levels of service is a qualitative or quantitative description of a service that is being provided. Two types of Levels of Service (LOS) generally exist: Customer (or Community) Levels of Service; and Technical Levels of Service.

Lifecycle Strategy:

Asset Lifecycle Management Strategies refer to the processes to make decisions related to investment on an asset over its lifecycle. It includes processes to understand:

- How the condition of an asset impacts the overall performance of the infrastructure system and the asset's ability to meet its LOS requirements.
- How an asset's condition and performance deteriorate and the impact of this deterioration on the ability to rehabilitate or replace the asset.
- The optimal points in an asset's lifecycle to complete maintenance, rehabilitation, or replacement treatments

Lifecycle Models:

Lifecycle models are mathematical, statistical, and logic models of planned actions as well as the behaviour or deterioration of assets over time. They are used to forecast required asset lifecycle activities and their impacts on LOS, risk, and funding levels.

Likelihood of Failure:

The likelihood or probability an asset will fail to meet its targeted LOS.

Line of Sight:

The connection between the City's high-level strategic objectives, and detailed-level day-to-day activities, carried out by the City's staff, programs, and assets. The Line of Sight clearly illustrates how organizational objectives link to day-to-day activities.

Maintenance Management Software (MMS):

A software package that maintains a computer database of information about an organization's maintenance operations. Currently Richmond Hill employs Maximo as its MMS software.

Risk:

The effect of uncertainty on objectives. Risk is often expressed as the consequences of an event in combination with the associated likelihood of that event occurring (ISO 55000, 2014).

Strategic Levels of Service (Strategic LOS):

Strategic Levels of Service (SLOS) are statements or qualitative descriptions of services levels that describe the main vision or objective of service provision and align to the Strategic Goals and Vision of the City.

Technical Levels of Service (TLOS):

Technical Levels of Service (TLOS) are technical measures applied against assets and overall systems that define the performance requirements to support Customer Levels of Service. Technical Levels of Service are used to determine which criteria will be used to drive business decisions.

Acronyms

AM	Asset Management
AMP	Asset Management Plan
AMO	Association of Municipalities of Ontario
AODA	Accessibility for Ontarians with Disabilities Act
ASTM	American Society for Testing and Materials
BCI	Bridge Condition Index
CAM	Corporate Asset Management
CAS	Capital Asset Sustainability
CCTV	Closed Circuit Television
CIPP	Cured in Place Pipe (pipe lining rehabilitation technique)
CIRC	Canadian Infrastructure Report Card
CLOS	Customer Level(s) of Service
CoF	Consequence of Failure
CSP	Corrugated Steel Pipe
CSSC	Capital Sustainability Steering Committee
DC	Development Charges
DSS	Decision Support System
EAM	Enterprise Asset Management
ECA	Environmental Compliance Approval
ELT	Executive Leadership Team
ESL	Estimated Service Life
FCI	Facility Condition Index
FM	Facility Management
FOG	Fats, oils, and grease
LoF	Likelihood of Failure
LID	Low Impact Development
LOS	Level(s) of Service
MECP	Ministry of the Environment, Conservation and Parks
MESP	Master Environmental Servicing Plan
MMS	Minimum Maintenance Standards
MMS	Maintenance Management Software
MTO	Ministry of Transportation
OGS	Oil Grit Separator
PACP	Pipeline Assessment Certification Program
PQI	Pavement Quality Index
PSAB	Public Sector Accounting Board
R&R	Rehabilitation and Replacement
ReCAPP	Renewal Capital Asset Planning Process
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisition
SLOS	Strategic Level(s) of Service
SME	Subject Matter Expert
SOI	State of Infrastructure
SWMF	Stormwater Management Facilities
TCA	Tangible Capital Assets
TLOS	Technical Level(s) of Service
TRCA	Toronto Region Conservation Authority

Richmond Hill

Richmond Hill, where people come together to build our community.

City of Richmond Hill
225 East Beaver Creek Road
Richmond Hill, ON L4B 3P4

Tel: 905-771-8800
Website: RichmondHill.ca