Municipal Asset Management Plan

5/02/2022

Whitby

Executive Summary

The Town of Whitby maintains an **infrastructure** portfolio with an estimated replacement value of $2.59 Billion comprising seven distinct **Service Areas**: Road Right-of-Way, Facilities, Fire Equipment, Technology and Innovation Services (TIS) Equipment, Parks, Library Resources, and Fleet. Town Staff are committed to employing asset management practices in order to deliver services that make a difference in the community.

Strategic asset management is a critical practice that empowers modern municipalities to demonstrate a deep understanding of the infrastructure and services that they provide. The Municipal Asset Management Plan (MAMP) gives a high-level overview of the **condition** of Town infrastructure, the **levels of service** the Town is providing through its infrastructure, **risk** assessments as a means of prioritizing capital spending, and projected financial needs over the short-, medium-, and long-terms. This document concludes with recommendations for improvements to future plans.

Condition of Town Infrastructure

Based on replacement cost and a blend of age-based data and observed data, the vast majority, 97.6% of Whitby's assets are in Fair to Very Good condition. However, 2.4% of assets fall into the Poor or Very Poor condition classes and are worth $62.1 million. As such, an Overall Asset Health Rating of Good ("B") has been assigned to the municipality.

Asset Health Rating 2022

Good

"B"

There are several factors that contribute to the overall good health of the Town's infrastructure:

- The development and approval of the Town of Whitby's Strategic Asset Management Policy.
- The Town's investments in maintaining and replacing Town infrastructure as it ages.
- Regular condition assessment programs across the Corporation.

Levels of Service

Future iterations of this report will include descriptions of Council-approved levels of service for all asset classes. These will include technical descriptions of the service the Town provides as well as qualitative or community levels of service that will describe how the service is perceived by our customers (residents, local business, and visitors). Reporting on community levels of service will link the Town's Asset Management Plans with its existing Corporate Strategic Plan and Business Plan[1] and the three priorities of People, Organization, and Customer.

Risk and Prioritization

Currently, the Town of Whitby assesses the risks associated with all Town assets. These assessments are primarily based on the asset's condition (probability of failure) and asset type (consequence of failure). The required complexity of these assessments is expected to increase in response to O. Reg. 588/17, which requires municipalities to report on the risks pertaining to lifecycle activities for critical assets by 2021 and for all assets by 2023. This will empower Council and Staff to make informed decisions about desired service levels in the future.

Prioritization of operational and capital spending can only occur with a complete understanding of the all the lifecycle activity options and related risks involved in providing a service through Town assets. As such, it is the Town's stated goal to better capture asset lifecycles and provide a more realistic model of asset needs over time. Condition assessments and Consequence of Failure ratings will be reviewed on an ongoing basis to ensure these remain current and meaningful.

[1] Whitby Corporate Strategic Plan and Business Plan
https://www.whitby.ca/en/townhall/corporate-strategic-plan.asp

Financial Needs

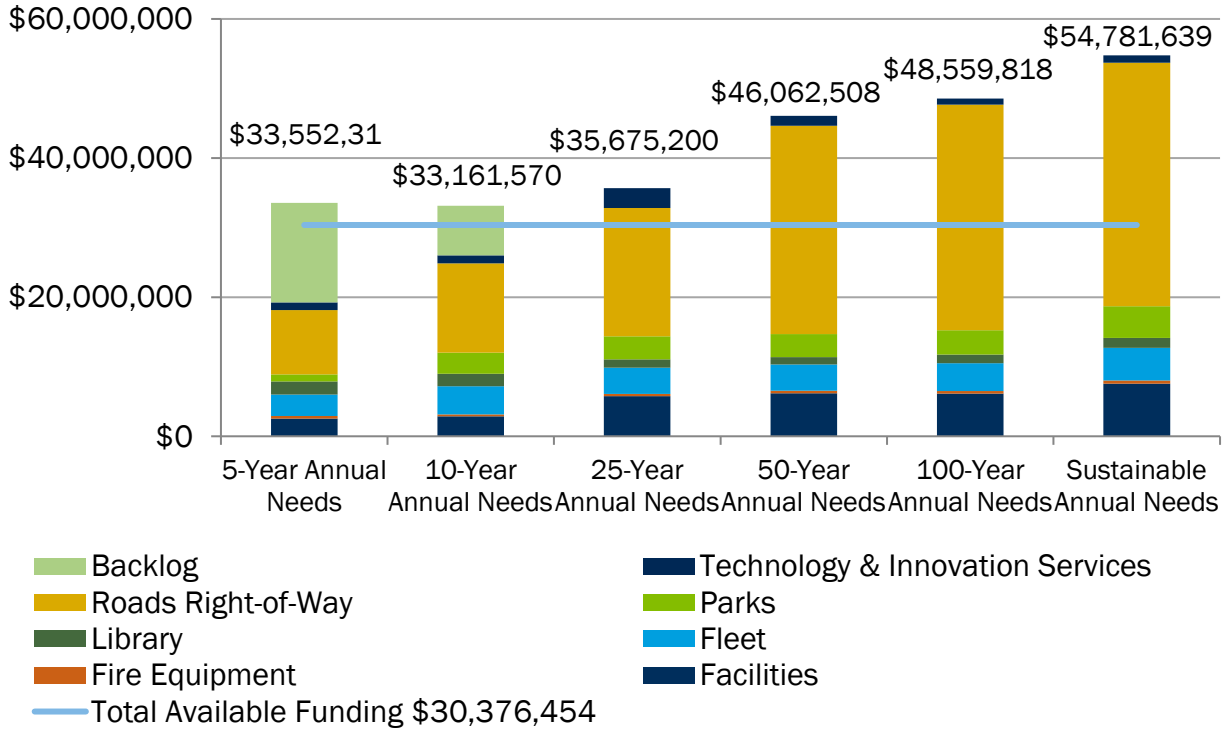

Figure 1 Upcoming financial needs for all Town Assets

Figure 1 depicts the **average annual funding requirements** for 5-, 10-, 25-, 50- and 100-year time periods compared to the capital maintenance envelope funding. The capital budget for these assets for the 10-year time frame is $30,376,454 leaving funding deficit of $2,785,116 for the 10-year average annual funding requirements and $15,686,054 over the 50-year average annual funding requirements. Of the identified average annual funding requirements, the Town is currently funding the 5-year time period at 90%, the 10-year time period at 92%, and the 50-year time period at 66%.

The Municipal Asset Management Plan (MAMP) is a guide to help inform the Town's Long Range Financial Plan of future capital funding requirements. The difference between the available funding and the requirement is known as the **infrastructure deficit**. If available Capital funding remains consistent over time, this gap will grow in the long-term. There are a number of ways to manage this gap and Staff will bring recommendations to Council in the process of presenting levels of service for approval. Some options for closing the infrastructure gap include: extending the lifecycles of assets, adding maintenance activities, reducing levels of service, tax levies, tax increases, and user fees such as a stormwater utility fee. Appropriately, these options will be explored for different service areas and asset types.

Recommendations

- Capture and refine existing levels of service for all other assets and propose sustainable levels of service for all service areas to be approved by Council by July 1, 2025
- Assess and evaluate existing maintenance and repair activities and capture these in the AM database in order to get a complete picture of future financial requirements
- Review consequence of failure ratings regularly
- Assess the costs of Climate Change adaptation and the associated risks to assets
- Propose Climate Change adaptation and mitigation measures for all Service Areas

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Glossary

1. Introduction

The asset portfolios managed by Ontario's municipalities are also highly diverse. The Town of Whitby owns approximately $2.59 Billion of these public assets in seven distinct Service Areas:

Whitby relies on these assets to provide residents, businesses, employees and visitors with safe access to important services, such as transportation, recreation, culture, and economic development. It is critical that the Town manage these assets by making the right decisions, at the right time, for the right reasons, and at the right costs.

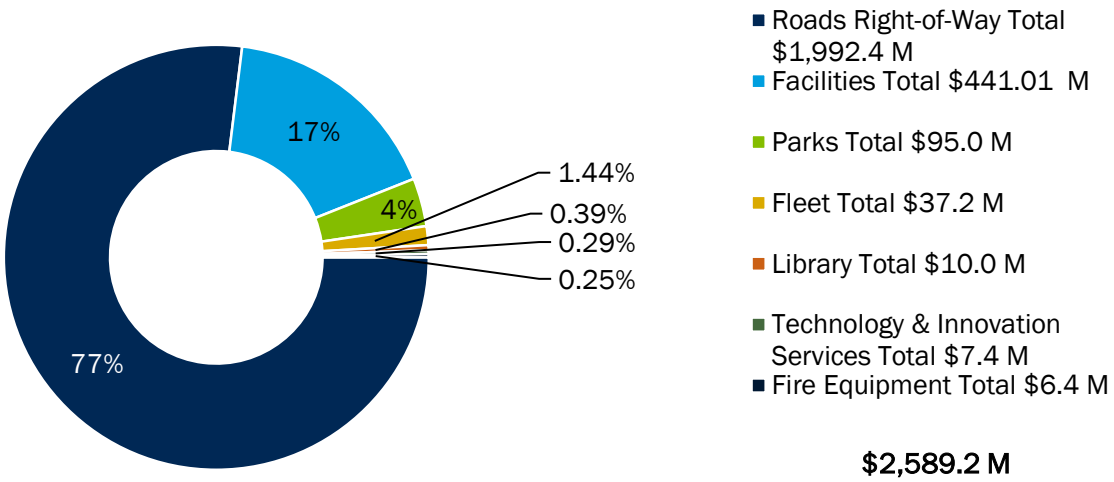


Figure 2 Replacement Value of all Town Assets

1.1. What is Asset Management?

Asset Management (AM) can be best defined as an integrated business approach within an organization that sustainably manages the lifecycle costs of owning, operating, and maintaining assets, at an acceptable level of risk, while continuously delivering expected levels of service for present and future customers.

AM includes the planning, design, construction, operation and maintenance of infrastructure used to provide services. Infrastructure needs can be prioritized over time by utilizing AM processes, while also ensuring timely investments to minimize repair and rehabilitation costs and maintain municipal assets. Asset Management establishes an evidence-based framework for sustainable financial management of municipal assets and empowers municipalities to plan for future needs with respect to growth.

Key questions municipalities must ask themselves today as they develop their AMPs and programs are the following:

- What is the asset worth?
- What is the asset's condition and expected remaining service life?
- What is the level of service expectation, and what needs to be done?
- When do you need to do the preventative maintenance, rehabilitation, or replacement?
- How much will the remedial works cost and what is the acceptable level of risk(s)?
- What are the overall life cycle needs and costs?

1.2. Asset Management at the Town of Whitby

Asset Management (AM) is an integrated business approach that minimizes the lifecycle costs of owning, operating, and maintaining assets, at an acceptable level of risk, while continuously delivering expected levels of service for present and future customers. The Town has been developing its AM practice since 2009, but many asset management practices have long been an important component of regular operations at the Town.

1.3. Alignment to the Corporate Strategic Plan

The 2019-2022 Corporate Strategic Plan was completed in 2019 and describes the mission, vision, priorities, and values that will guide our corporate processes (The Town of Whitby, 2020).

1.3.1. Mission

"Together we deliver services that make a difference in our community."

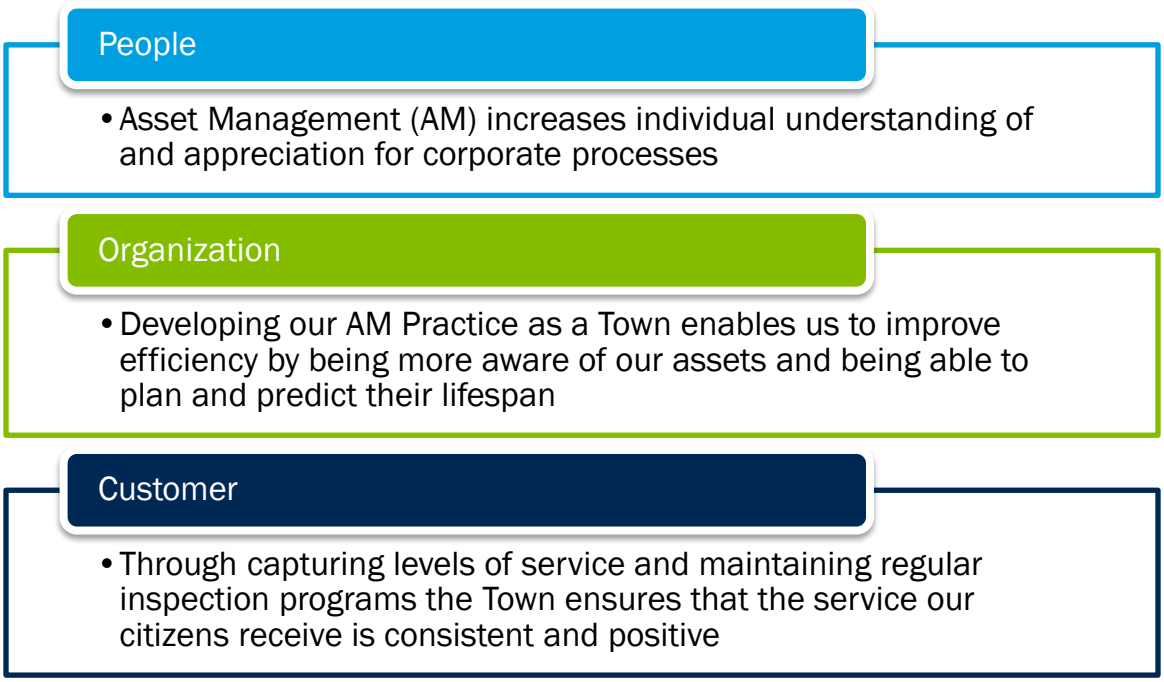
1.3.2. Vision

"Inspiring excellence through a culture where everyone is valued and respected."

1.3.3. Strategic Priorities

1. People
   This refers to Town Staff and the achievement of an inclusive workplace with job satisfaction and rewarding careers.
2. Organization
   Describes the goal to be a "high-performing, innovative, effective and efficient organization".

3. **Customer**
   This is the goal to provide a positive customer service experience.



1.3.4. Core Values

The Town's core values as a corporation are summarized in the acronym WE CARE (Whitby Employees CARE: Collaborative Accountable Respectful Engaged). Strategic Asset Management

- encourages collaboration between departments at the Town and with our colleagues in other municipalities,
- improves accountability and transparency between departments and with the public,
- fosters respect by encouraging more communication and interaction between AM staff and staff in other departments
- promotes employee engagement at all levels by emphasizing the importance of asset management in all roles "We are all asset managers"

1.4. Alignment to Council Goals

With every election, Whitby's Council publishes a list of goals to guide the Town during their term. The following 2018-2022 Council Goals pertain directly to this Plan and our Asset Management activities (The Town of Whitby, 2020):

- To enhance the transparency and accessibility of Town Hall and ensure effective public consultation and engagement, including greater opportunities for voter engagement through the municipal election process.
- To continue the Whitby tradition of responsible financial management and respect for taxpayers; and to understand the importance of affordability and sustainability to a healthy, balanced community.
- To ensure Whitby is clearly seen by all stakeholders to be business and investment friendly and supportive; and to continuously improve the customer experience and the effectiveness and efficiency of communications, service delivery and approvals.
- To remain the community of choice for families and become the community of choice for seniors and job creators; and to focus new growth around the principles of strong, walkable and complete neighbourhoods that offer mobility choices.

To remain the community of choice for families and become the community of choice for seniors and job creators; and to focus new growth around the principles of strong, walkable and complete neighbourhoods that offer mobility choices. AM enhances transparency because it is inherently an evidence-based practice and requires the elimination of information silos in Town departments. Although these data are shown in this document in a summarized format, more detailed data can be requested by Council, Staff, and the public.

Asset management has a positive impact on workplace morale by providing a Line of Sight between decision-makers (Council, SLT, management) and Staff in the field. Through the MAMP and Service Area Summaries, Staff endeavour to provide a link between decisions and policies made at a high level and the impact on the way assets are maintained, rehabilitated, and replaced.

A key to responsible financial management is the ability to predict the financial needs throughout the life of the assets. Asset management attempts to do this by capturing asset lifecycle activities and projecting the future needs, risks and conditions of assets.

1.5. Asset Management Vision

The Town of Whitby's Asset Management vision is: *Providing the framework for responsibly managing all Town owned infrastructure.*

1.5.1. Asset Management Objectives

The Town works as a collaborative team to comprehensively and consistently undertake the following objectives for all Town owned

assets. These asset management objectives help to inform how the Town puts into practice its asset management vision:

- **Inventory**: Capture all asset records, classifications and historical data.
- **Current Valuation**: Calculate current condition ratings and replacement values.
- **Life Cycle Analysis**: Identify Maintenance and Renewal Strategies & Life Cycle Costs.
- **Service Level Targets**: Define technical and customer Levels of Service Targets
- **Risk & Prioritization**: Integrate all asset categories through risk and prioritization strategies.
- **Sustainable Financing**: Identify sustainable Financing Strategies for all asset categories.
- **Continuous Processes**: Provide continuous processes to ensure asset information is kept current and accurate.
- **Decision Making & Transparency**: Employ asset management information in all corporate spending.
- **Monitoring & Reporting**: At defined intervals, assess the assets and report on progress and performance.

1.6. Asset Management Policy

The Town of Whitby's Strategic Asset Management Policy was presented to and approved by Council on April 15, 2019 and emphasized key goals and responsibilities for all Staff and Council in addition to outlining regulatory requirements the Town will need to adhere to in coming years in order to comply with Bill 6, Infrastructure for Jobs and Prosperity Act and the Ontario Regulation 588/17, Asset Management Planning for Municipal Infrastructure.

1.7. Asset Management Line of Sight

Asset Management Line of Sight refers to the viewpoints of Town Staff at either end of the Asset Management process. Staff who directly work with and maintain Town assets need a clear view of how their work furthers the strategic goals of the Town, while Staff who formulate strategy and policy have a clear view of how their work impacts the maintenance and management of assets.

2. State of Existing Infrastructure

Replacement value represents the current cost of replacing an asset in 2022 Canadian Dollars. In this section, we summarize key elements in each of the Town's seven Service Areas. This includes a detailed outline of the asset inventory and the condition of assets. When observed data was not available, the age of the assets was used to approximate their conditions.

2.1. Asset Hierarchy & Inventory

The asset hierarchy illustrates the relationship of individual Service Areas and their associated assets and components to a wider, more expansive network and system, with the 'Town of Whitby' as the first level in the hierarchy. Each level provides greater detail.

Table 1 Hierarchy of Town Assets

Town	Service Area	Asset Class
Town of Whitby	Facilities	Community Centres
		Fire Halls
		Municipal Building
		Operations Facilities
		Other Town Property
		Sports Facilities
	Fire Halls	Equipment
		Personal Protective Equipment (PPE)
	Fleet	Arena Equipment
		Construction Equipment
		Fire Trucks
		Garage & Shop Equipment
		Lawn Care & Forestry
		Passenger Vehicles
		Refuse Trucks
		Snow Equipment
		Trailers
	Library	Collections
		Equipment
	Parks	Amenities and Furniture
		Arboriculture & Horticulture
		Lighting
		Paved Surfaces
		Recreation Facilities

Town	Service Area	Asset Class
Town of Whitby	Road Right-of-Way	Bridges & Culverts
		Parking
		Roads
		Roadside Appurtenances
		Sidewalks & Multi-Use Paths
		Stormwater Management
		Streetlights
		Street Trees
	Technology & Innovation Services	Infrastructure
		Network Hardware
		Peripherals
		Servers
		Telecommunications
		Workstations

To view full asset inventories please see the Service Area Report Cards.

2.2. Replacement Value

Replacement values determined using unit costs for individual asset components will yield more reliable estimates of current market prices. However, in the absence of this detail, the historical costs were inflated to 2022 values. In some cases, the Town provided user-defined replacement costs. The estimated replacement value totalled approximately $2.59 Billion for all of Whitby's assets. The total cost per household is approximately $52,348 using 49,470 households (Durham Region, 2021). In this section, we detail the replacement value of all Town assets by Service Area.

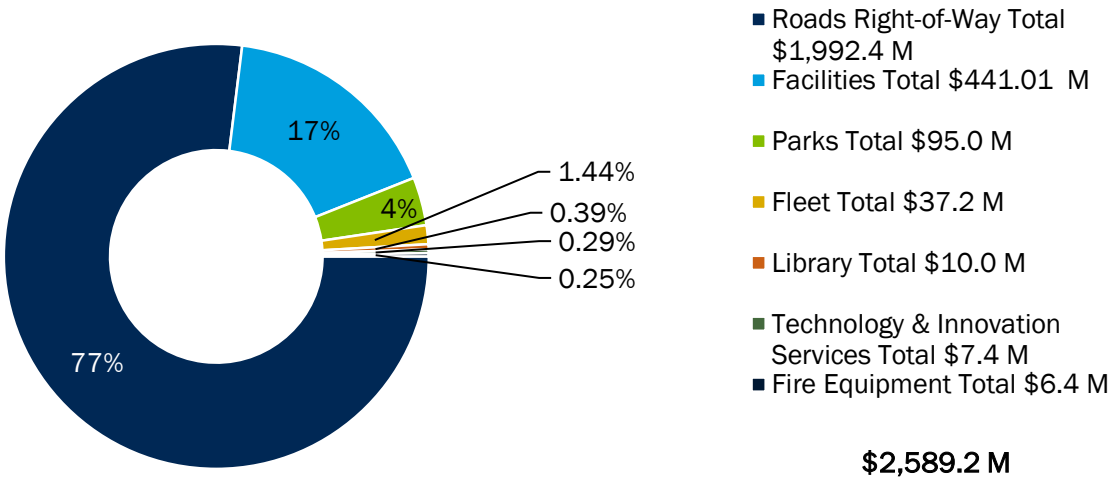


Figure 3 Replacement Value of all Town Assets

Replacement Costs differ from Historical Costs in that Replacement Costs represent expected spending whereas Historical Costs capture actual past spending.

2.3. Asset Conditions

Town assets are inspected regularly by staff and deficiencies are repaired or replaced on an as-needed basis. Where condition ratings are unavailable, an age-based condition was used. Condition distributions for individual service areas can be found in the Service Area Report Cards.

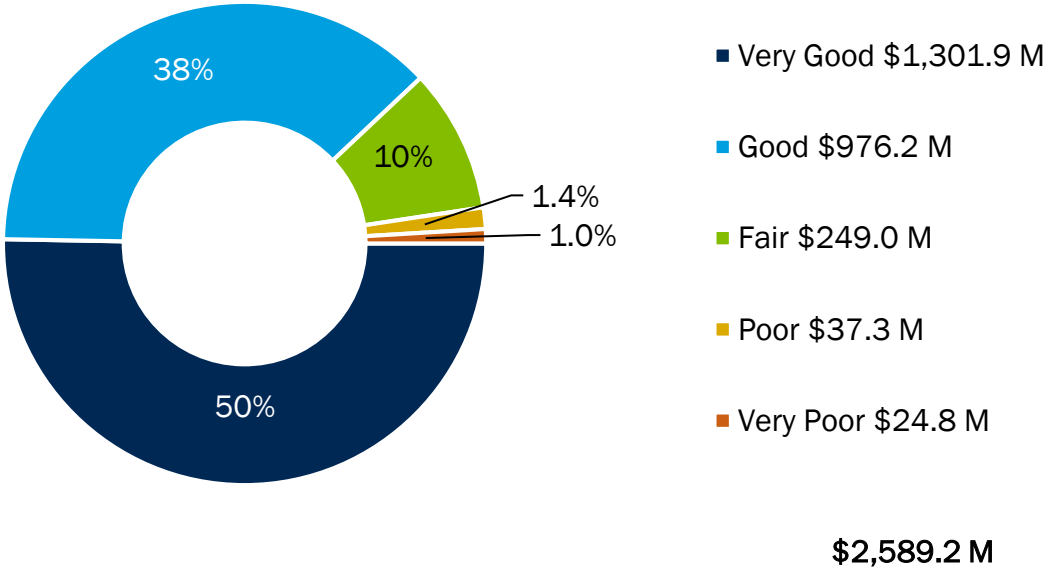


Figure 4 Summary of condition ratings for all Town assets

2.4. Infrastructure Report Card

The Infrastructure Report Card is a summary of our findings in accessible language that municipalities can use for internal and external distribution.

Asset Health: As shown in Table 2, using either field inspection data as available or age-based data, the asset health score provides a grade for each infrastructure class based on the portion of assets in Very Poor to Very Good condition (0-100 percent). These conditions are standardized across Service Areas using replacement value.

Table 2 Infrastructure Report Card – Asset Health Rating Scale

Rating	Numerical Scale	Letter Grade	Description
Very Good	4.50-5.0	A	Assets are mostly new or recently rehabilitated
Good	3.50-4.49	B	Assets are no longer new, but are fulfilling their function. Preventative maintenance is beneficial at this stage.
Fair	2.50-3.49	C	Deterioration is evident but assets continue to fulfill their functions. Preventative maintenance is beneficial at this stage.

Rating	Numerical Scale	Letter Grade	Description
Poor	1.50-2.49	D	Significant deterioration is evident and service is at risk.
Very Poor	1.0-1.49	F	Assets are beyond expected life and have deteriorated to the point that they may no longer be fit to fulfil their functions.

It will be important in the near future to assess how these ratings are reflected in Community and Technical levels of service. For example, an older piece of equipment could be considered to be in fair condition with no outward signs of disrepair and would therefore have little impact on Community levels of service.

Table 3 Asset Health Rating

Service Area	Replacement Cost	%Total Replacement Cost	Numerical Rating	Condition	Weighted Numerical Rating
Road Right-of-Way	$1,992.4 M	76.95%	4.45	Good	3.43
Facilities	$441.0 M	17.03%	4.23	Good	0.72
Parks	$95.0 M	3.67%	3.29	Fair	0.12
Fleet	$37.2 M	1.43%	3.31	Fair	0.05
Library Resources	$10.0 M	0.39%	4.15	Good	0.02
TIS Equipment	$7.4 M	0.29%	3.66	Fair	0.01
Fire Equipment	$6.4 M	0.25%	4.02	Good	0.01
Total Replacement Cost	**$2,589.2 M**	**100.00%**	**Overall Weighted Numerical Rating**		**4.34**
			Overall Weighted Grade		Good (‘B’)

2.5. Asset Age Profile

Municipalities invest large sums in new assets in times of growth, leading to assets having a similar age profile. Dependent on asset type and condition, the assets may need to be replaced at similar times. The following chart (Figure 5) shows the remaining expected useful life in five-year increments of Town assets. Assets that have exceeded their useful life may still be in good condition. Most Town assets have more than 10 years of useful life remaining. The expected useful lives of individual asset classes can be seen in the Service Area Report Cards.

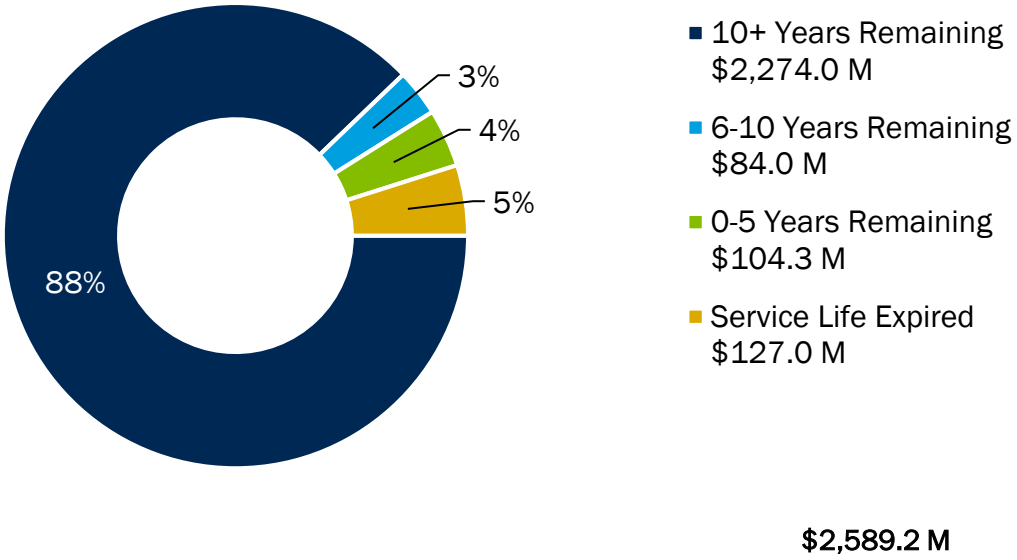


Figure 5 Useful Life Remaining for all Town assets

The Service Area Report Cards show the same chart as above for each Service Area.

3. Levels of Service

As required by O. Reg. 588/17, municipalities must begin to account for community and technical levels of service provided by asset classes in different service areas. Community levels of service refer to the qualitative experience of the customer. Technical levels of service refer to adherence to regulations such as maintenance standards or by-laws, response time, technically assessed condition of the assets and other more quantitative measures of service.

For this version of the MAMP, the Town is required to report on the Community and Technical Levels of Service for core infrastructure assets only. Core infrastructure assets for the Town of Whitby include stormwater assets, bridges and culverts, and roads.

Table 4 Community and Technical Levels of Service for Core Town assets

Asset Class	Community Level of Service	Technical Level of Service
Roads Right-of Way	Figure 15 in the Appendices shows the connectivity of the road network within the Town, the surrounding municipalities, and the rest of Ontario.	The Town of has jurisdiction of • 230.07 lane kilometres of arterial roads, • 176.06 lane kilometres of collector roads, and • 677.66 lane kilometres of local roads. The Town of Whitby also hosts provincial highways — three (3) 400-series highways, Highway 7, and Highway 12 — and is connected to a regional road network that increases the connectivity of Town roads with neighbouring municipalities.
	1. Figure 16 in the Appendices shows the current condition of municipal roads in the Town of Whitby 2. Figure 18 in the Appendices shows the types of roads available in the Town	1. The average condition rating of paved roads is 58.5 2. Gravel roads have an average surface condition of good.

Asset Class	Community Level of Service	Technical Level of Service
Stormwater Management System	The Town's 46 stormwater management ponds are safe and maintained regularly The Town's stormwater management system is shown in Figure 18	1. 98% of Properties in the Town of Whitby are resilient to a 100-year storm 2. Figures for the 5-year resiliency of the Town's Stormwater Management system are in progress
Bridges and Culverts	The Town's 24 road bridges, 32 culverts, and 22 Pedestrian bridges support the transportation of all types of traffic from heavy vehicles to pedestrians	8% of the Town's Road bridges have load restrictions
	1. Bridges are typically in good condition and are suitable for use by most forms of traffic 2. Culverts are in good condition	1. Road Bridges have an average condition of 70% 2. Large Culverts (> 3 m) have an average condition of 73%

3.1. Asset Lifecycles

In addition to examining current levels of service and proposing new ones, it is important that the municipality capture complete asset lifecycles in order to get an accurate picture of the true costs of assets. Currently the Town of Whitby has captured the acquisition and replacement costs of all of its assets and has recorded comprehensive lifecycle events and their costs for core assets (Roads, Bridges, Stormwater Ponds) and some other assets such as Parking Lots.

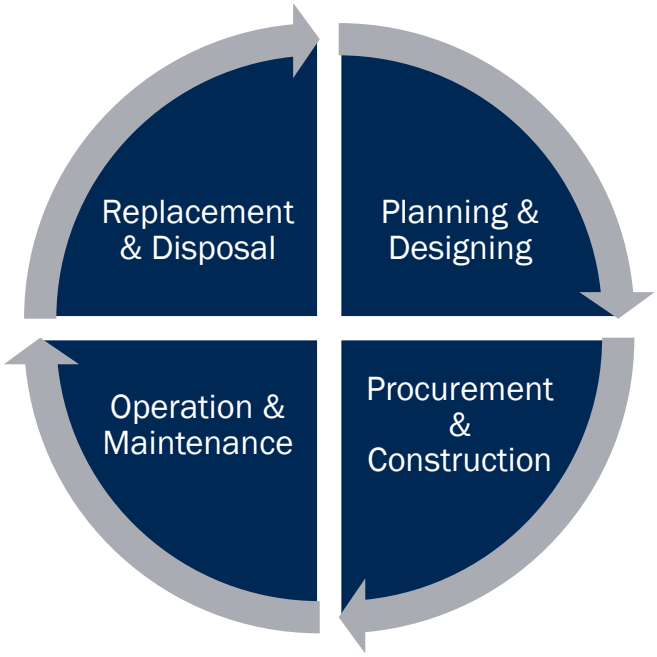


Figure 6 A Basic Asset Lifecycle encompasses the costs of all activities from Planning & Design to Procurement to Operation and Maintenance to Replacement & Disposal

Operation and maintenance activities ensure that assets meet or exceed their expected useful lifespans, and capturing the anticipated costs of these activities can help with future budgeting and with making business cases for the value of these activities.

Disposal requirements for certain assets can increase the cost of replacement and these costs will be captured in future versions of this document. Some assets will need to be disposed of in line with PS3280, Public Sector Accounting Board Asset Retirement Obligations).[2]

3.2. Risk

Municipalities accept a certain degree of financial risk in owning physical assets. This risk can exist in the form of premature deterioration, unexpected maintenance needs, and unforeseen environmental impacts. In order to mitigate this risk, municipalities need to capture asset lifecycle costs, complete regular condition assessments, and stay informed of environmental impacts both on and by assets. These activities give municipalities a complete picture from which to establish existing levels of service and their costs and

[2] https://www.frascanada.ca/-/media/frascanada/psab/committees/2021-05-10-psadg-meeting-report-apr-8_en.pdf

to determine whether these levels of service will be sustainable in the future.

Risk is the product of an asset's probability of failure and its consequence of failure. Probability of failure is largely dependent on condition while consequence of failure can be dependent on a number of factors.

Consequence of failure is calculated in Roads Right-of-Way primarily using the operational category and replacement value as a proxy for economic risk. Currently we do not factor in Environmental factors as risks, this could be forthcoming for an asset's energy usage, carbon emissions, or impacts to the environment.

Risk assessments will be an essential tool in budgeting in future years. It is important for any financially responsible municipality to be able to justify its spending in the bulk of the budget on items that have a higher risk due to poor condition, greater community importance, and/or economic impact. It is imperative that preventative maintenance and rehabilitation words are performed on the assets in the low and medium risk to ensure these assets do not fall into the high risk when their full replacement would be required.

Table 5 Risk Matrix for all Town Assets

Consequence of Failure	1	2	3	4	5
5	846 Assets $168,741,454 6.5%	1,883 Assets $121,013,240 4.7%	265 Assets $44,413,596 1.7%	4 Assets $4,345,434 0.17%	0 Assets $0 0.00%
4	8,626 Assets $63,147,690 2.4%	589 Assets $126,157,293 4.9%	455 Assets $68,950,830 2.7%	43 Assets $5,818,893 0.22%	81 Assets $2,141,350 0.08%
3	23,273 Assets $225,604,694 8.7%	33,398 Assets $340,782,682 13.2%	5,296 Assets $59,306,108 2.3%	1,354 Assets $10,064,986 0.39%	390 Assets $5,677,587 0.22%
2	3,113 Assets $221,355,119 8.5%	6,348 Assets $149,518,975 5.8%	1,763 Assets $36,304,248 1.4%	364 Assets $6,741,851 0.26%	167 Assets $2,266,107 0.09%
1	16,755 Assets $623,158,643 24.1%	10,872 Assets $238,907,178 9.2%	2,545 Assets $41,397,806 1.6%	1,093 Assets $11,614,446 0.45%	887 Assets $11,774,935 0.45%

Probability of Failure

3.3. Climate Change

Climate Change is currently impacting the Town of Whitby and its assets. The Town has a mandate to anticipate the impacts on its assets and services and plan for **adaptation** and **mitigation.** The most recent modelling for predicted impacts indicates that Whitby can expect more frequent and longer extreme heat events, increased flooding, and more icing events in the next 80 years. Staff should look through a Climate Change lens when the Town plans to rehabilitate or reconstruct existing assets or build new assets. This will help to ensure that these assets are built to withstand the current climate as well as the forecasted climate. In future renditions of the MAMP, as the costs to upsize, upgrade and build new infrastructure are more accurately known to deal with climate change, these will incorporated into the future expenditures.

Adaptation to the projected impacts of climate change could include the following:

- Changing standards for paved assets to accommodate higher temperatures
- Requiring greater capacity for stormwater management in flood-prone areas
- Prioritizing Town assets which are used in the event of extreme heat (splash pads, cooling centres) and adding shade in public spaces

Mitigation of climate change involves concrete actions the Town of Whitby can take to reduce its contribution to global Greenhouse Gas (GHG) emissions such as:

- Replacing gas and diesel Town vehicles with electric vehicles where practical
- Reducing natural gas consumption by improving the energy efficiency municipal buildings
- Implementing a standard of warm-mix asphalt paving techniques in place of hot-mix paving to reduce the emissions from the paving process

As a lakeside community, Whitby's climate is strongly impacted by Lake Ontario. The lake has warming effects in the early winter months and cooling effects in the summer. It is predicted that the most impactful change in the next 80 years will be in the reduction of ice cover on Lake Ontario (Zuzek Inc., 2020). Less ice cover in the winter months will have two impacts on Town assets:

1. Less ice cover will result in more wave action during winter months which will increase the rate of shoreline erosion. Shoreline assets and private property may be at increased risk.
2. Ice cover reduces lake-effect precipitation. As ice cover is reduced, the Town of Whitby will see more precipitation in winter months which could lead to an increased number of snow and icing events.

3.3.1. Strategies for Climate Change Adaptation and Mitigation

Road Surfaces

Challenges

There is a significant carbon footprint at all points of road construction from material production, extraction, and transportation, to paving, maintenance, and end of life.

Higher summer temperatures and increased winter precipitation may reduce the lifespan of road surfaces.

Opportunities

Warm mix asphalt paving and the increased use of recycled asphalt concrete can reduce the costs of construction and resurfacing of paved assets and together can reduce the emissions at the production and paving stages (Oner J, 2015).

Adjusting paving standards to asphalt with a higher temperature tolerance may improve the longevity of road surfaces over time. Current mixes are 64-28 and 58-28. The Town of Whitby should continue to monitor and investigate the pavement mixes that are utilized on municipal roads. This will ensure that mixes align with the temperature minimums and maximums and the number of freeze/thaw cycles that are being experienced and forecasted.

Stormwater System

Challenges

Increased precipitation could exceed the current capacity of the Town's stormwater management system

Opportunities

Increase pipe size, storm pond volume to adapt to increased flooding potential this could be in the form or larger pipes, larger stormwater ponds, and upsizing bridges and culverts. Identifying and prioritizing flooding areas is the first step, followed by developing an adaptation plan for each area, and lastly monitoring improvements to ensure they were correctly sized, the right treatment, and/or the right priority.

Bridges and Culverts

Challenges

Flooding, extreme weather and changes to winter maintenance could have impacts on bridge and culvert conditions

Opportunities

Some of Whitby's bridges and culverts are ageing and will need to be replaced. Correctly sizing these assets as they are reconstructed to handle the impacts of climate change is an investment in the Town's future.

Sidewalks and Multi-Use Paths

Steps Completed

Strategically replacing sidewalks with MUPs to improve active transportation network connectivity.

Challenges

As with road surfaces, higher temperatures may reduce the lifespan of paved assets.

Opportunities

Expanding and increasing connectivity of an active transportation network can reduce community contribution to carbon emissions.

Street Trees

Challenges

Changing climate may reduce the viability of some tree species due to temperature ranges, invasive pests or diseases.

Opportunities

Shade from street trees can reduce the urban heat island effect created by roads and parking lots. (Armson, 2012)

4. Financial Needs

In order for an Asset Management Plan to be effectively put into action, it must be integrated with long-term financial planning and budgeting. According to O. Reg. 588/17 municipalities must be able to fully fund their existing levels of service for the 10-year average annual capital expenditures by 2024. To bridge the gap between funds and expenditures the Town will have to consider changes to asset lifecycles and levels of service to reduce costs. The municipality must document any lifecycle works that are identified to occur but are not completed and how the risks associated with not performing these works will be managed.

4.1. Financial Profile

Table 6 Average Annual Requirements for all Service Areas

Service Area	5-Year Total Needs	10-Year Total Needs	25-Year Total Needs	50-Year Total Needs	100-Year Total Needs
Facilities	$12,645,901	$28,781,611	$143,886,612	$309,514,888	$614,522,515
Fire Equipment	$2,019,978	$2,658,155	$8,620,669	$18,374,069	$36,375,952
Fleet	$15,343,312	$40,617,301	$94,273,801	$188,645,501	$401,484,168
Library	$9,306,640	$18,021,648	$29,376,319	$52,082,747	$124,701,014
Parks	$5,271,369	$30,164,524	$82,659,266	$165,352,177	$347,205,035
Roads Right-of-Way	$46,187,367	$128,365,554	$461,440,972	$1,497,533,658	$3,241,998,880
Technology & Innovation Services	$5,364,643	$11,384,553	$21,144,700	$40,700,774	$89,694,264
All Service Areas	**$96,139,209**	**$259,993,345**	**$841,402,340**	**$2,272,203,813**	**$4,855,981,827**
Current Backlog (value of outstanding life cycle activities)	$71,622,356	$71,622,356	$71,622,356	$71,622,356	$71,622,356
Average Annual Requirement	**$33,552,313**	**$33,161,570**	**$35,675,200**	**$46,062,508**	**$48,559,818**

Table 6 shows the total needs and the resultant average annual requirement over the short-, medium-, and long-term as well as the current backlog of necessary spending for replacements and lifecycle events. The municipality can choose to fully fund the short-term rather than committing to achieving fully sustainable funding in the long-term, but this choice runs the risk of passing infrastructure failings down to future Councils and Staff.

The annual requirements shown are a result of current asset lifecycles, condition evaluations, and estimates of replacement costs. The Town of Whitby may be performing maintenance and repair activities that are not currently captured but that could impact annual average requirements in a positive manner. Fully capturing lifecycle activities including regular maintenance and repair will improve these cost projections over time.

Table 7 Financial Sustainability

Funding:	5-Year Annual Funding	10-Year Annual Funding	25-Year Annual Funding	50-Year Annual Funding	100-Year Annual Funding
Council-Approved Tax-based AM Funding	$19,366,704	$19,366,704	$19,366,704	$19,366,704	$19,366,704
Canada Community Building Fund (formerly Federal Gas Tax)	$4,071,496	$4,071,496	$4,071,496	$4,071,496	$4,071,496
Growth Reserve Funding (tax-based) for AM Purposes*	$6,413,126	$6,413,126	$6,413,126	$6,413,126	$6,413,126
Program Reserves	$525,128	$525,128	$525,128	$525,128	$525,128
Total Funding Available*	**$30,376,454**	**$30,376,454**	**$30,376,454**	**$30,376,454**	**$30,376,454**
Total Average Annual Requirement	$33,552,313	$33,161,570	$35,675,200	$46,062,508	$48,559,818
Deficit/Surplus	-$3,175,859	-$2,785,116	-$5,298,746	-$15,686,054	-$18,183,364

* Note – this assumes the average level of growth funding for Asset Management (AM) purposes remains consistent at the 10-year average annual rate for 25-year, 50-year and 100-year forecasts.

The MAMP has identified the funding needs for the short-, medium- and long term planning horizons – ranging from 5 to 100 years. The average annual investment requirement in total for all seven Service Areas over the 5-year planning horizon is $33.6 Million, over the 10-year planning horizon is $33.2 Million and over the 50-year planning horizon is $46.1 Million. The average annual funding currently allocated to these assets for capital purposes is $30.4 Million. The Town is fully funding its asset management requirements in the short-term and this may offset some of the projected long-term deficits.

Figure 7 illustrates the 10 year average annual capital requirement by household (based on 49,470 households).

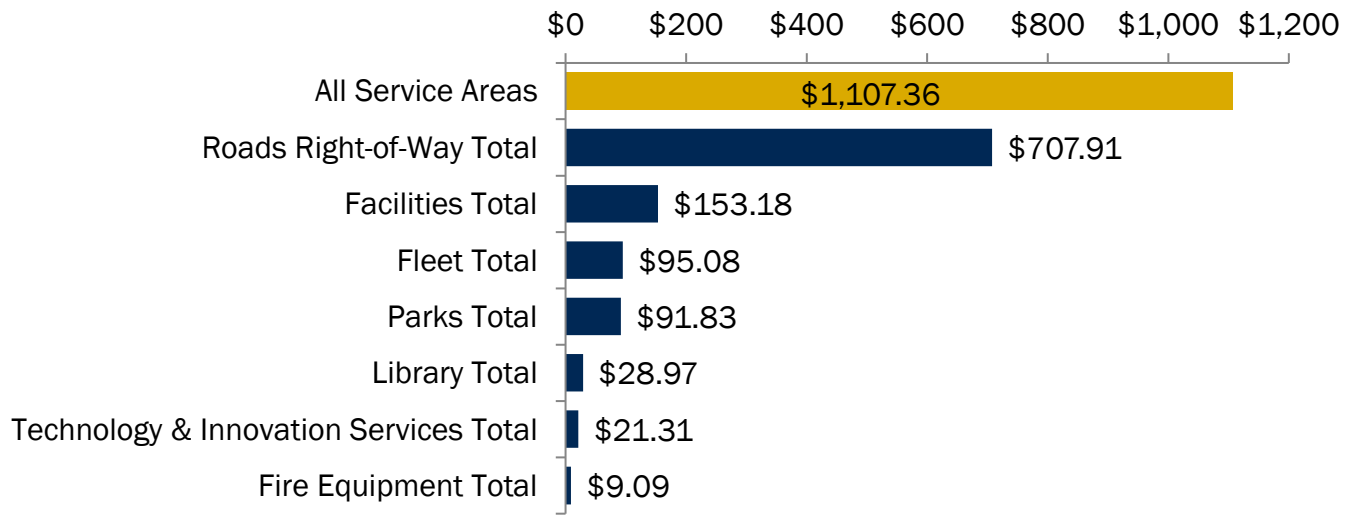


Figure 7 Per-Household 10-Year Average Annual Financial Needs

At this level of funding, the municipality is prepared to meet its short-term infrastructure needs, but is deficient in meeting its medium-term and long-term infrastructure requirements. As a result, replacement for assets in the medium-term will likely be deferred to future years. The municipality may also need to divest some of its assets, where appropriate, and review levels of service currently provided.

4.2. Forecast Replacement Needs

Figure 8 shows the 100-year capital investment needs for all Town assets relative to the average annual requirements in the short-, medium-, and long-term. Replacement profiles like the following can be found for individual Service Areas in the Service Area Report Cards.

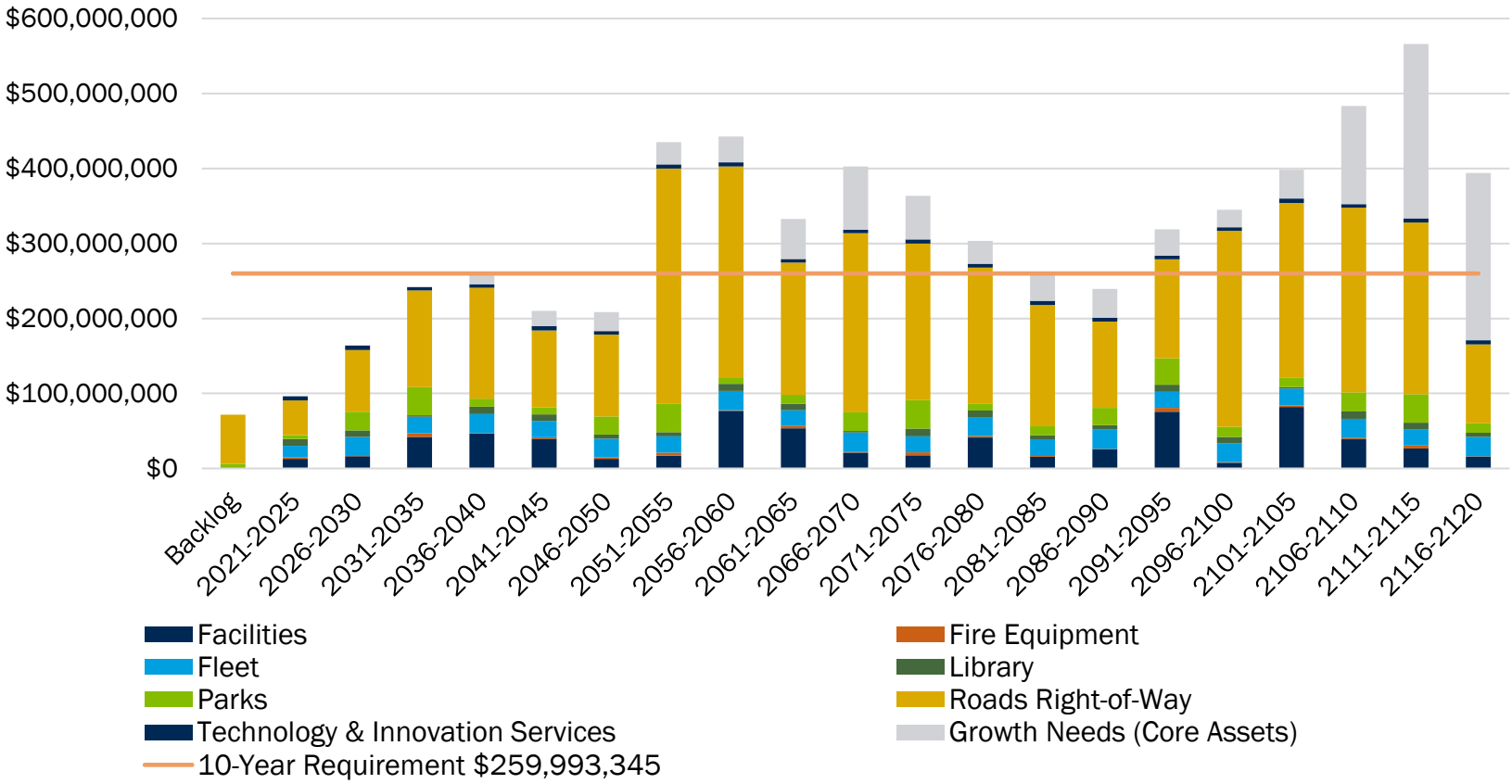


Figure 8 100-Year Capital Needs Forecast

The Municipal Asset Management Plan (MAMP) is a guide to help inform the Town's Long Range Financial Plan of future capital funding requirements. The capital funding requirements can be seen through the average annual capital funding requirements and the peaks and valleys shown above in Figure 8.

5. Growth and Demand

Growth drives critical infrastructure demand for most infrastructure services. As such, the municipality must not only account for the lifecycle cost for its existing asset portfolio, but those of any anticipated and forecasted capital projects associated specifically with growth. Expansion of the Operations Centre was completed in 2019 in anticipation of the developments of West Whitby and the future expansion of Brooklin. The West Whitby development project that will add 5,000 households and the future expansion of Brooklin will add approximately 14,000 households to the Town's current 49,470.

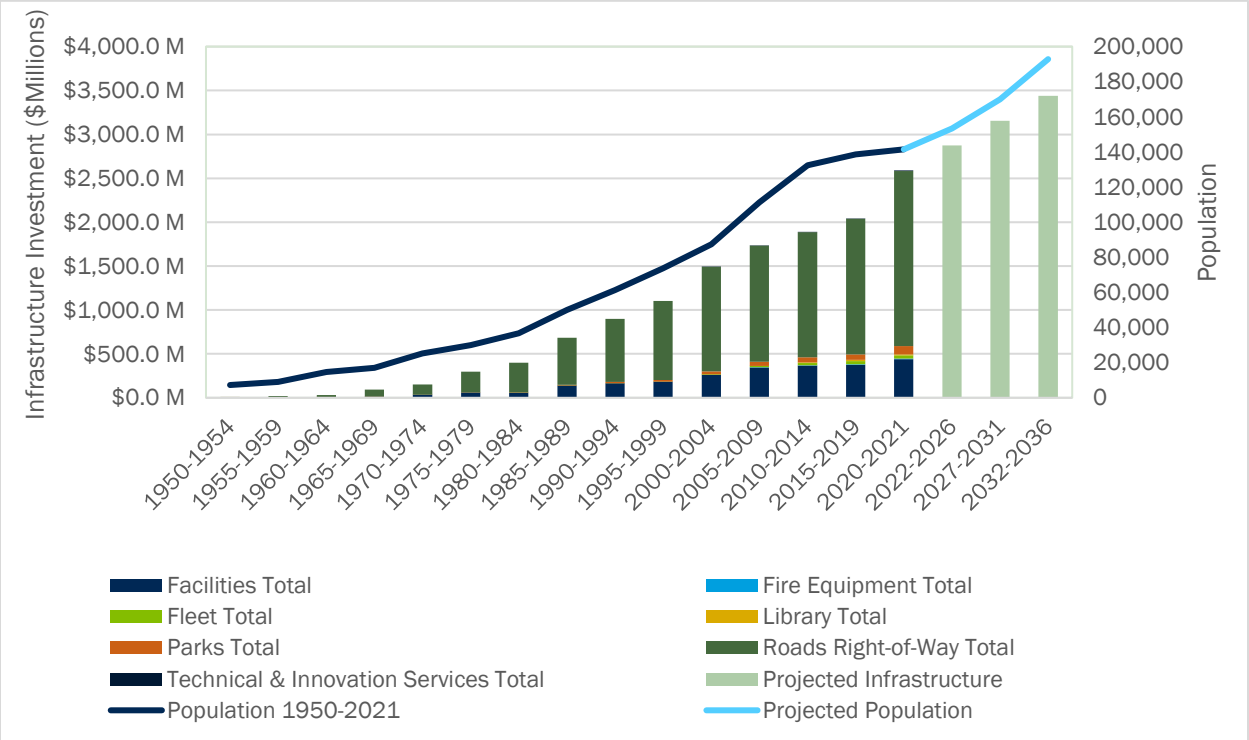


Figure 9 Cumulative infrastructure investment from 1950-2021 alongside Whitby's corresponding population increase over the same period including projected population data to 2031 and projected infrastructure investments to the same time period (Statistics Canada, 2022) (Durham Region, 2021).

6. Recommendations

As the Town of Whitby's Asset Management Program progresses it is important that we stay on track to meet the requirements of Provincial legislation and that we continue to meet the needs of our citizens.

- Capture and refine existing levels of service for all other assets and propose sustainable levels of service for all service areas to be approved by Council by July 1, 2025
- Assess and evaluate existing maintenance and repair activities and capture these in the AM database in order to get a complete picture of future financial requirements
- Review consequence of failure ratings regularly
- Assess the costs of Climate Change adaptation and the associated risks to assets
- Propose Climate Change adaptation and mitigation measures for all Service Areas

Service Area Summaries

A. Facilities 2022 Overview

Facilities Inventory by Construction Year

Community Centres

Ashburn Community Centre	1861
Brock Street Activity Centre	1982
Brooklin Community Centre	1876
Brooklin Community Centre and Library	2010
Centennial Building	1853
Cullen Cottage	1877
Cullen Log Cabin	1830
Heydenshore Pavilion	1972
Lawn Bowling Club	2003
Lynde House Museum	1812
Main Library Branch	2005
James Rowe House	1856
Whitby Seniors Activity Centre	1996
Spencer Community Centre	1877
Station Gallery	2004
Whitby Marina	2004

Fire Halls

Fire Hall #1	2006
Fire Hall #2	1989
Fire Hall #3	2004
Fire Hall #4	2002
Fire Hall #5 (HQ)	1995

Operations Facilities

Cold Storage Building	2012
Operations Centre	1992
Parks Lunch Building	1992
Parks Maintenance Building	1992
Salt and Sand Storage Dome One	1992
Salt and Sand Storage Dome Two	1992
Soils Storage Building	2009

Municipal Building

Whitby Municipal Building	1976

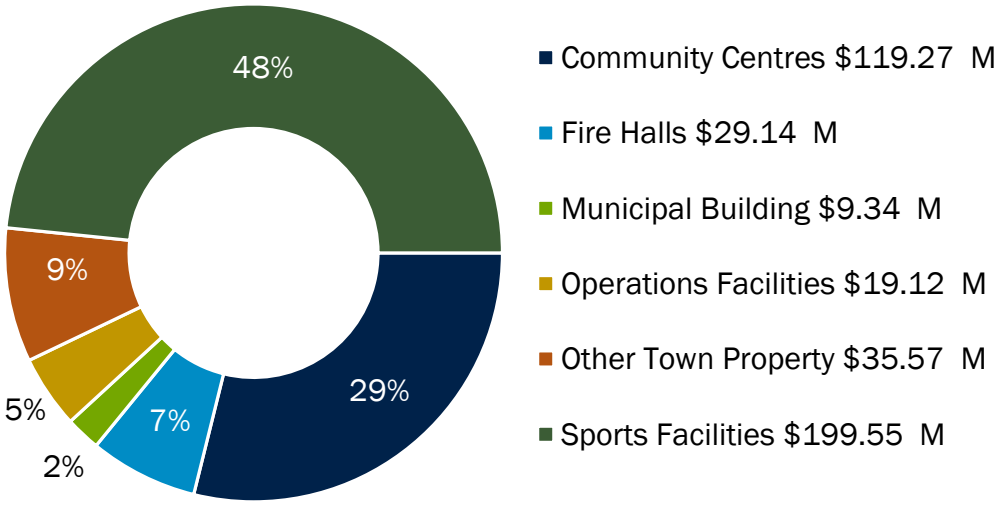
Sports Facilities

Civic Recreation Centre	1991
Iroquois Park Sports Complex	1979
Luther Vipond Memorial Arena	1953
McKinney Arena	2010
Whitby Iroquois Soccer Complex	2016

Other Town Properties

117 King Street	1877
316 Colborne Street West	1877
508 Colborne Street West	1953
Boat Storage Facility (1710 Charles Street)	1974
Boat Storage Facility (1712 Charles Street)	1972
Brock Street Pumping Station	1995
Brooklin Day Care Centre	1968
Brooklin Garage	1952
Camp X	1941
Chamber of Commerce	1948
Garden Street Pumping Station	1996
Groveside Cemetery	1951
Methane Monitoring Station	1989
Myrtle Fire Hall	1955
Myrtle Fire Hall Storage Building	1974
Historic Pumphouse	1904
1855 (Former Land Registry Office)	1873
Sea Cadet Building	1999
Whitby Animal Control	1983
Cullen Park Washroom	1980
Heydenshore Park Washroom	2000
Peel Park Washroom	2010
Pringle Park Washroom	1990
Rotary Park Washroom	1981
Willow Park Washroom	2011

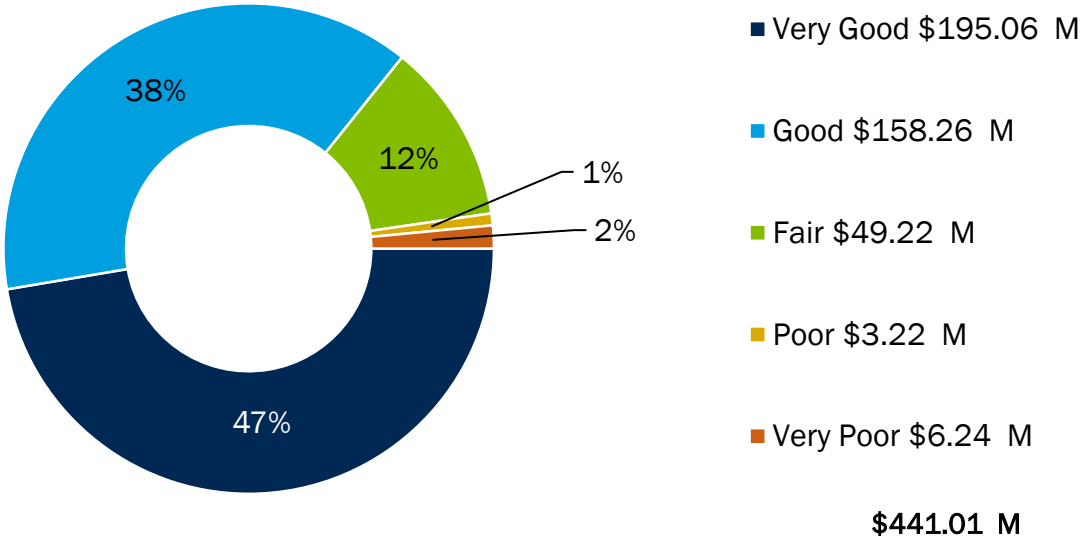
Replacement Value of Facilities



$441.01 M

The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Facilities replacement costs are regularly re-evaluated by a consultant and individual components have had their market value estimated by Facilities staff.

Condition Distribution by Replacement Value



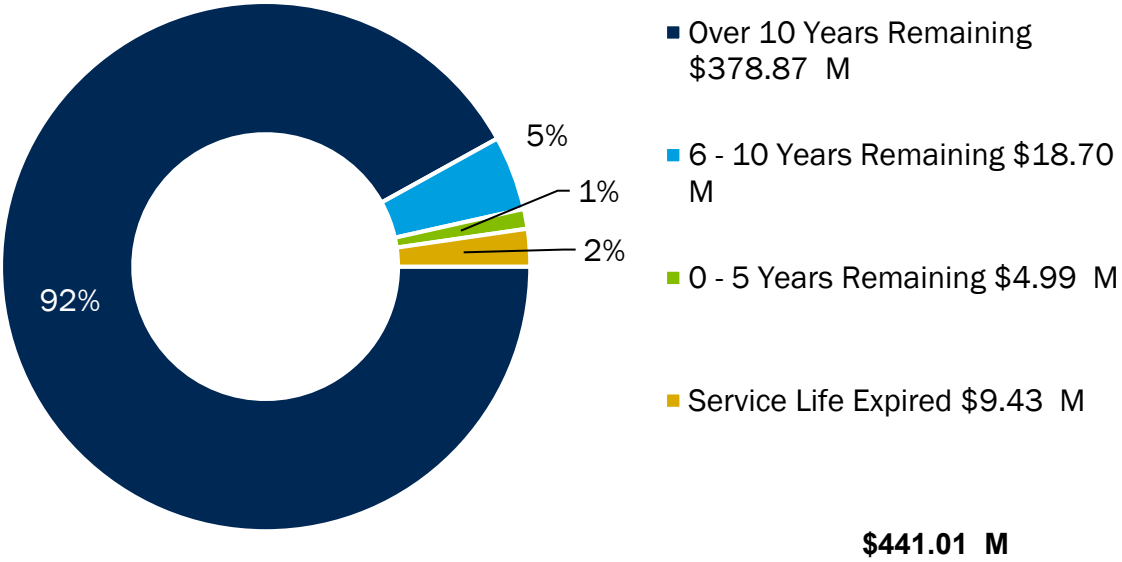
$441.01 M

Condition of Facilities assets was evaluated during the inventory project which took place between 2018 and 2019. Individual assets were visually assessed by students.

Condition Distribution for Facilities

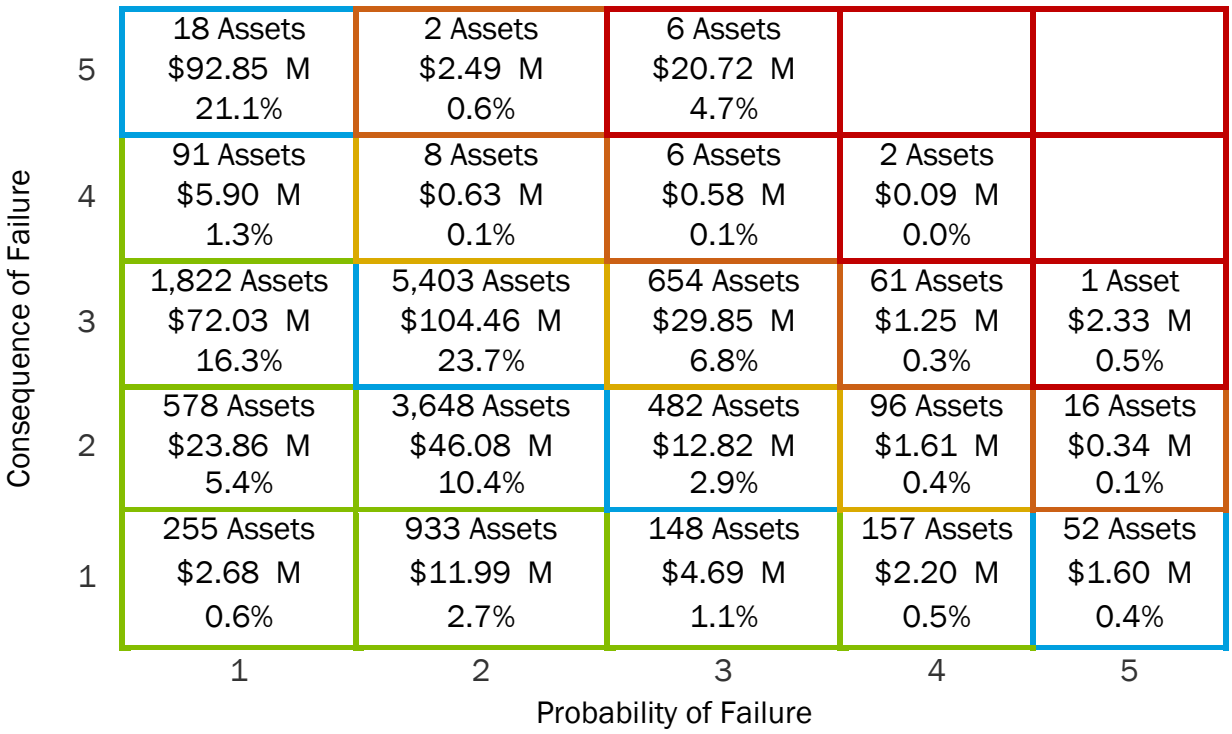
5	**Very Good**	Building components have no defects and are in as-new condition.
4	**Good**	Minor defects are becoming apparent in superficial finishes.
3	**Fair**	Elements likely to become poor within a few years if not addressed.
2	**Poor**	Components are failing and require constant repairs and parts.
1	**Very Poor**	Elements have failed and are at the end of their useful life.

Useful Life Remaining for Facilities Assets



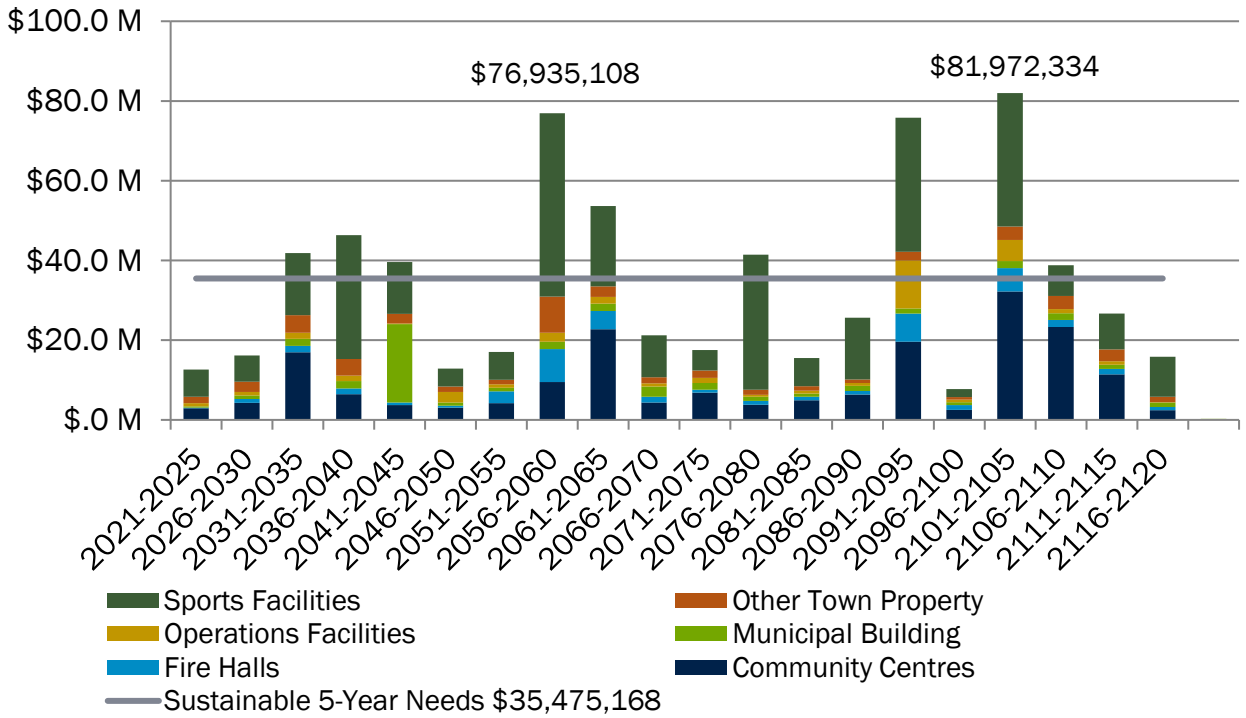
The above chart shows the remaining useful life in five-year increments of Town assets. Assets that have exceeded their useful life may still be in good condition. Most Facility assets have more than 10 years of useful life remaining.

Risk Levels for Facilities Assets



Risk levels for Facilities assets depend on the operational purpose of the asset (consequence of failure) and the condition of the asset (probability of failure). An asset such as a Fire Hall with a high consequence of failure would appear in the top right portion of the above graph if it also had a poor condition rating (high probability of failure).

Replacement Profile for Facilities Assets



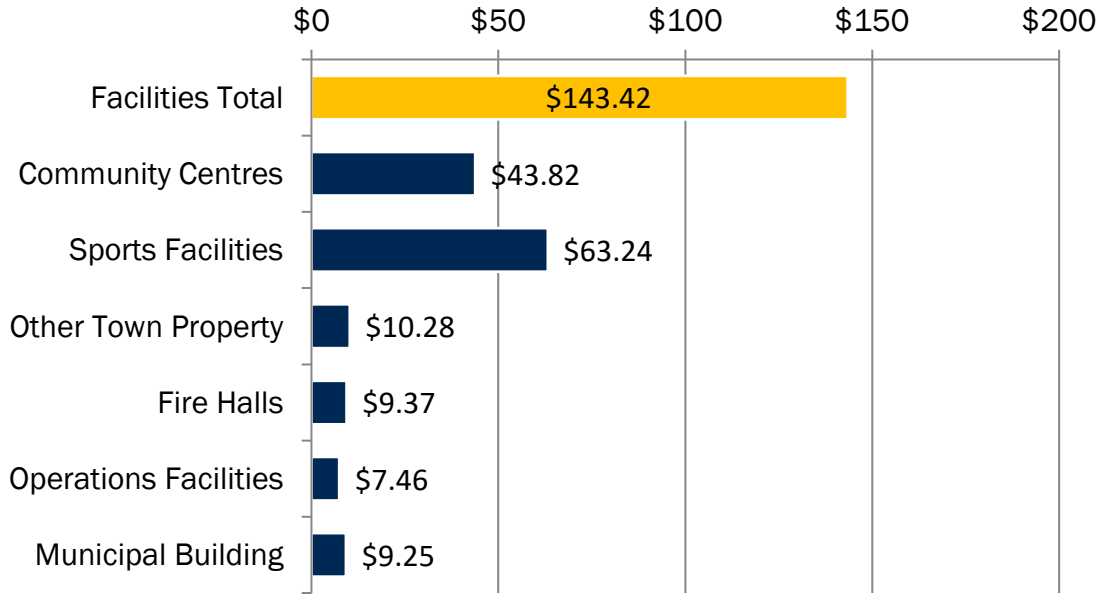
Replacement needs are based on existing lifecycle projections for Facilities assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement with Backlog	10-Year Capital Budget
Total Reinvestment (202 $ *)	$30,150,944	$44,082,285

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

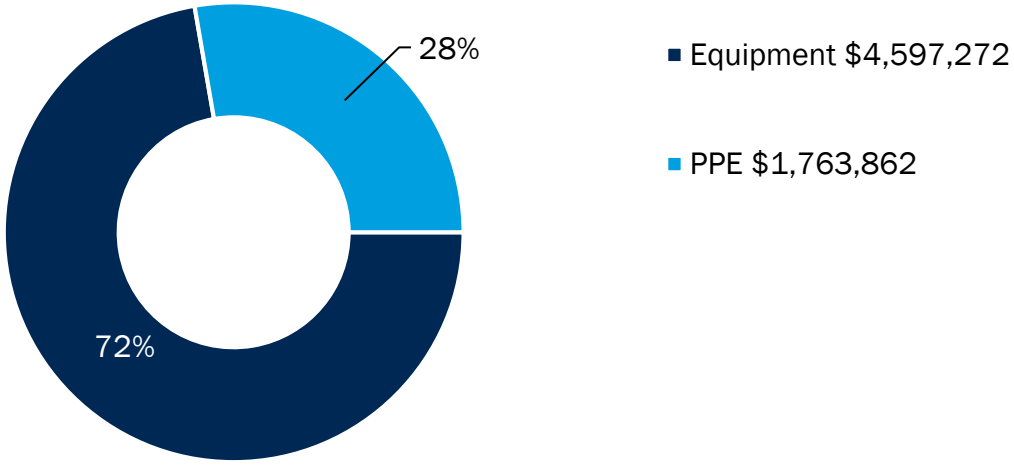
B. Fire Equipment 2022 Overview

Fire Equipment Inventory

PPE	
Breathing Air	456
Bunker Gear	199

Equipment	
Pumper Equipment	9
Aerial Equipment	2
Communications	176

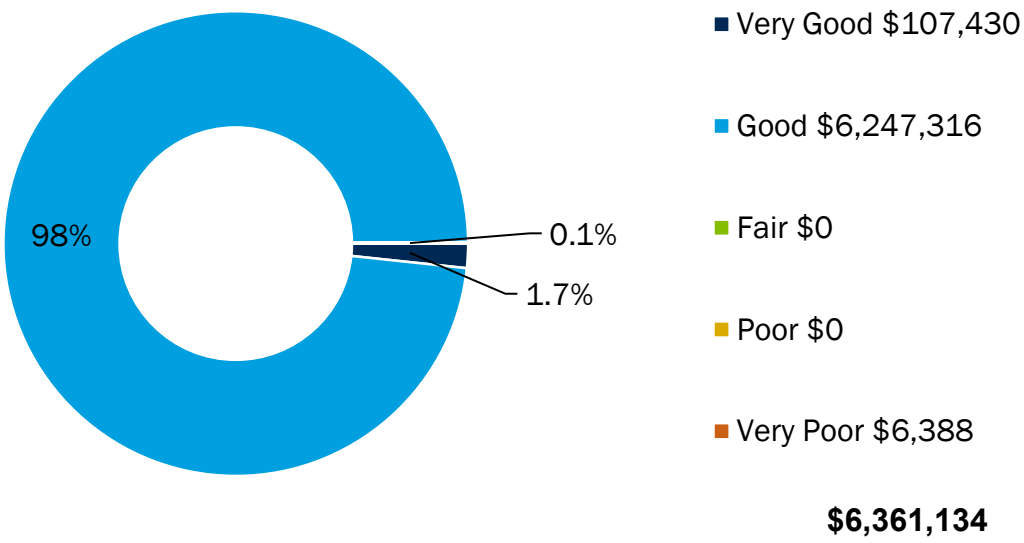
Replacement Value of Fire Equipment



$6,361,134

The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Fire Equipment replacement costs are regularly re-evaluated by Fire staff.

Condition Distribution by Replacement Value

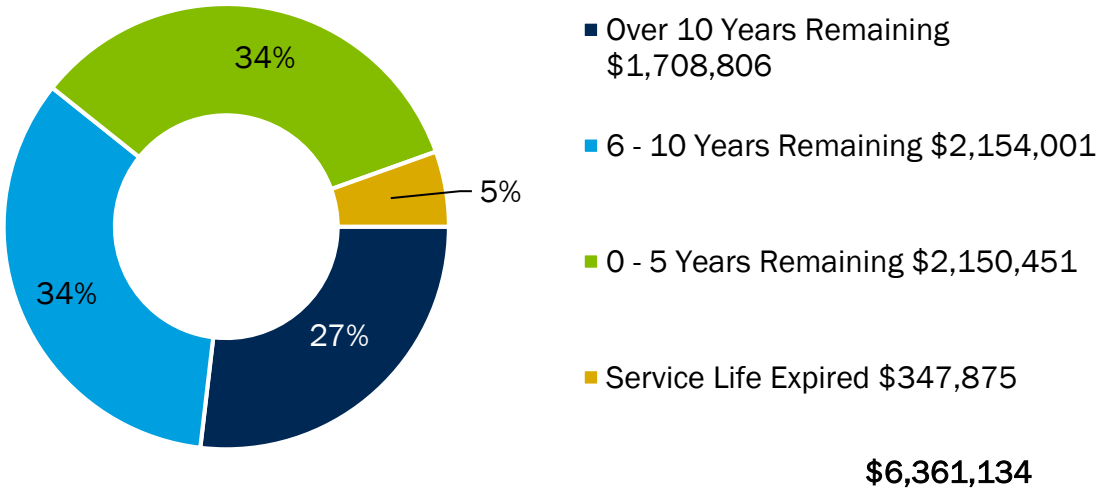


Condition of Fire Equipment assets was evaluated during the inventory project which took place between 2018 and 2019. Individual assets were visually assessed by students.

Condition Distribution for Fire Equipment

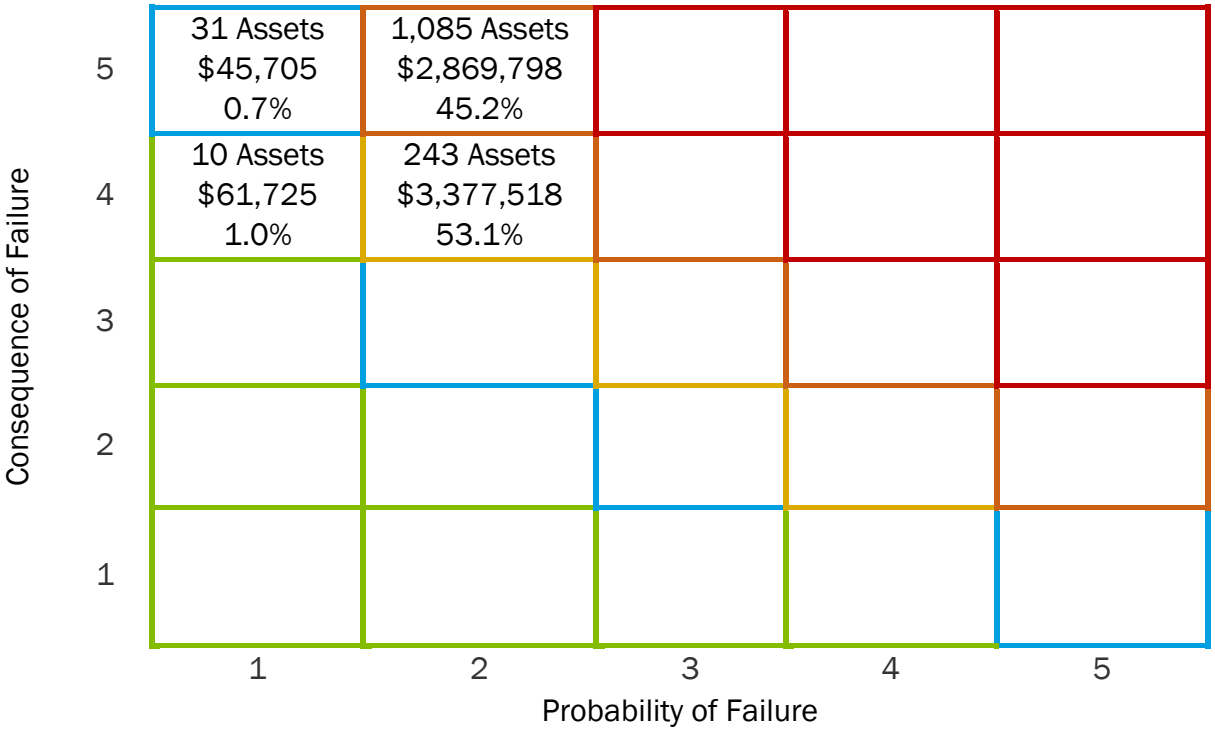
5	**Very Good**	Building components have no defects and are in as-new condition.
4	**Good**	Minor defects are becoming apparent in superficial finishes.
3	**Fair**	Elements likely to become poor within a few years if not addressed.
2	**Poor**	Components are failing and require constant repairs and parts.
1	**Very Poor**	Elements have failed and are at the end of their useful life.

Useful Life Remaining for Fire Equipment Assets



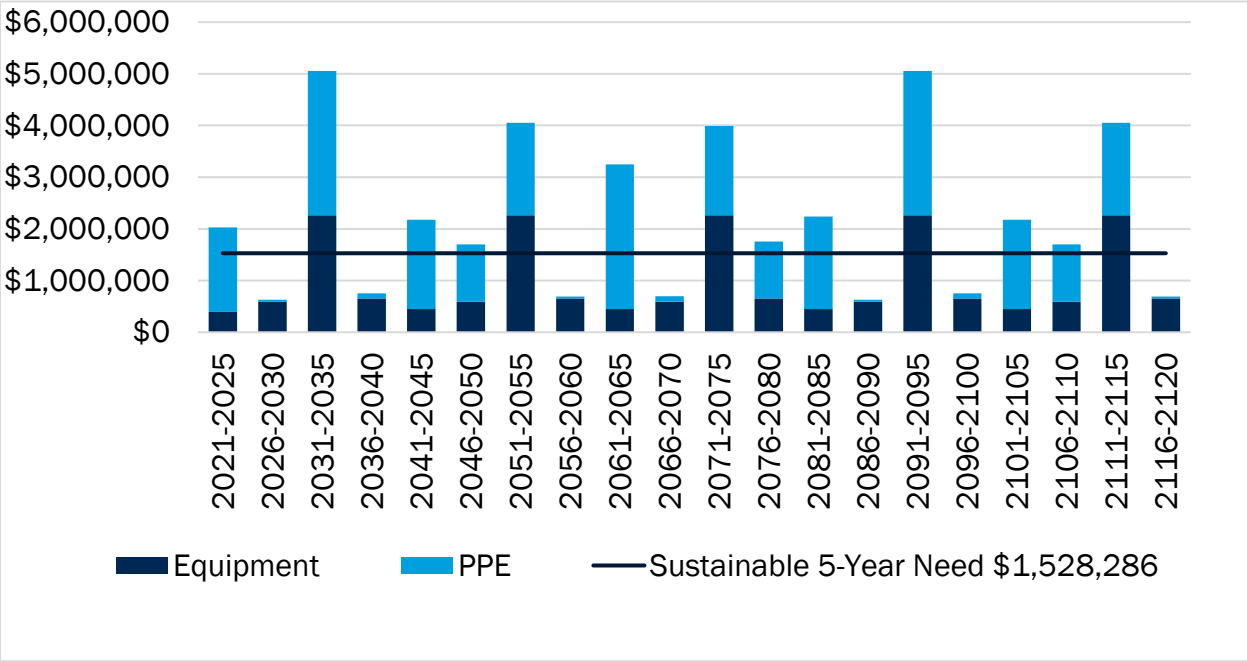
The above chart shows the remaining useful life in five-year increments of Fire Equipment assets. Assets that have exceeded their useful life may still be in good condition. Most Fire Equipment assets have more than 10 years of useful life remaining.

Risk Levels for Fire Equipment Assets



Risk levels for Fire Equipment assets depend on the operational purpose of the asset (consequence of failure) and the condition of the asset (probability of failure). An asset such as Bunker Gear with a high consequence of failure would appear in the top right portion of the above graph if it also had a poor condition rating (high probability of failure). Fire Equipment assets are typically governed by NFPA guidelines and as such are replaced if they reach Fair condition.

Replacement Profile for Fire Equipment Assets



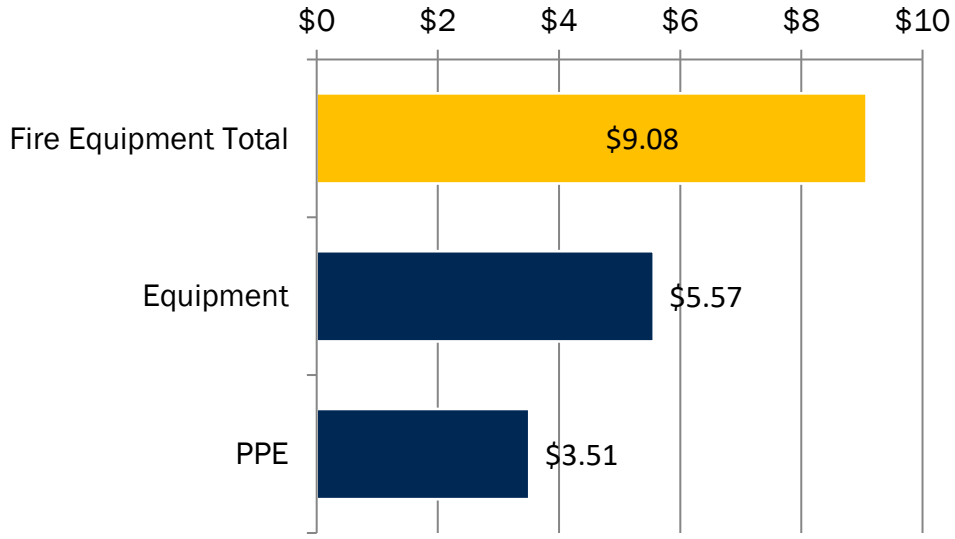
Replacement needs are based on existing lifecycle projections for Fire Equipment assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement	10-Year Capital Budget
Total Reinvestment (202 $ *)	$2,658,155	$3,359,900

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

C. Fleet

Fleet Inventory

Arena Equipment

Ice Edger	6
Ice Resurfacer	10

Construction Equipment

Dump Trucks	32
Gradall	1
Grader	1
Loader	7
Mobile Compressor	8
Pavement Grinder	1
Street Sweeper	2
Street Flusher	1
Utility	12
Vacuum Truck	4

Fire Trucks

Aerial	2
Pumper	7
Rescue	2
Tanker Trucks	1

Garage and Shop Equipment

Cleaning Equipment	26
Fuel Pump	2
Hoist	4
Overhead Crane	2
Saws	3
Sweeper Scrubber	2
Tools	19
Welders	3

Lawn Care & Forestry

Bucket Truck	2
Chipper Truck	1
Crane Truck	1
Front Mount Mowers	3
Litter Loader	2
Rotary Mowers	19
Saws	23
Small Equipment	45
Tractors	6
Turf Care Machines	77
Turf Topper	4

Passenger Vehicles

Cars	3
Equipment	27
Pick-up Trucks	58
SUVs	19
Vans	12

Refuse Trucks

Rear Loader	3
Side Loader	20

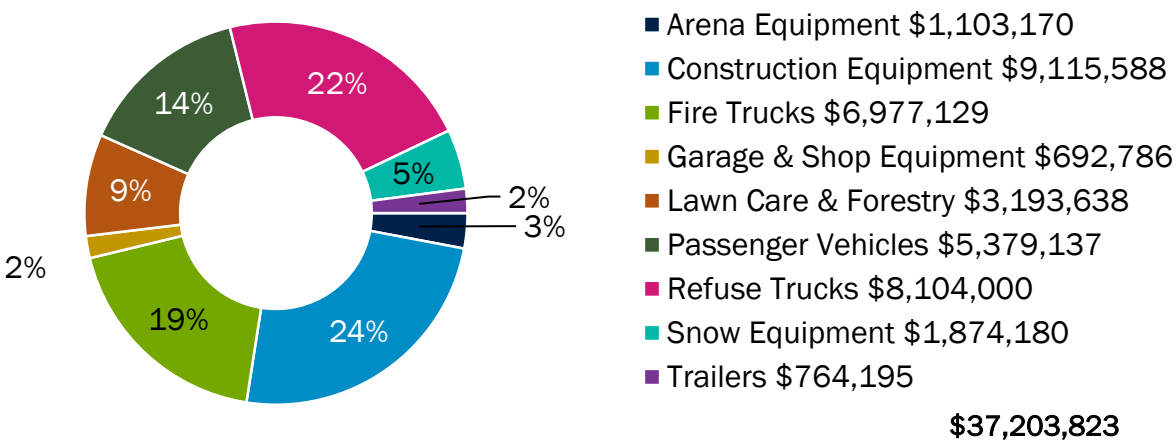
Snow Equipment

Plows	9
Sanders	1
Sidewalk Machines	15
Snow Blowers	3

Trailers

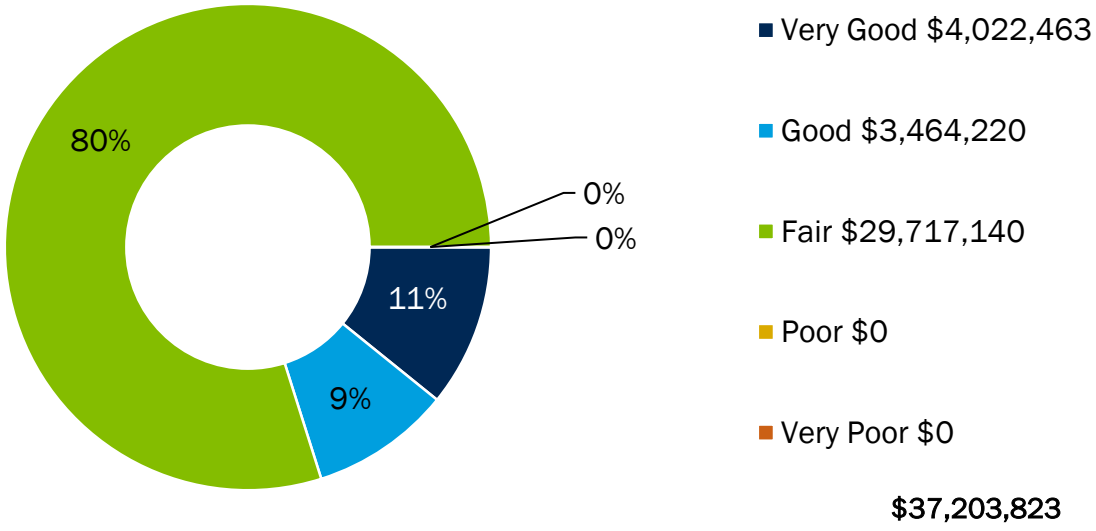
Boat Trailers	4
Ice Painting Trailer	1
Utility Trailers	14
Water Tanker Trailers	3

Replacement Value of Fleet



The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Fleet replacement costs are regularly re-evaluated by Town Staff and correspond where possible to budgeted amounts for new assets.

Condition Distribution by Replacement Value

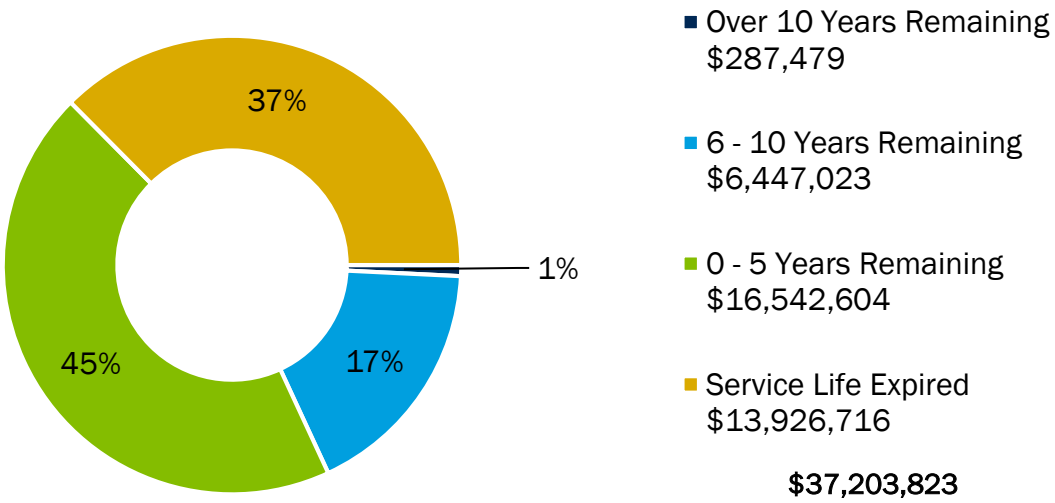


Condition of Fleet assets is evaluated regularly by staff. No assets on the road are less than Fair.

Condition Distribution for Fleet

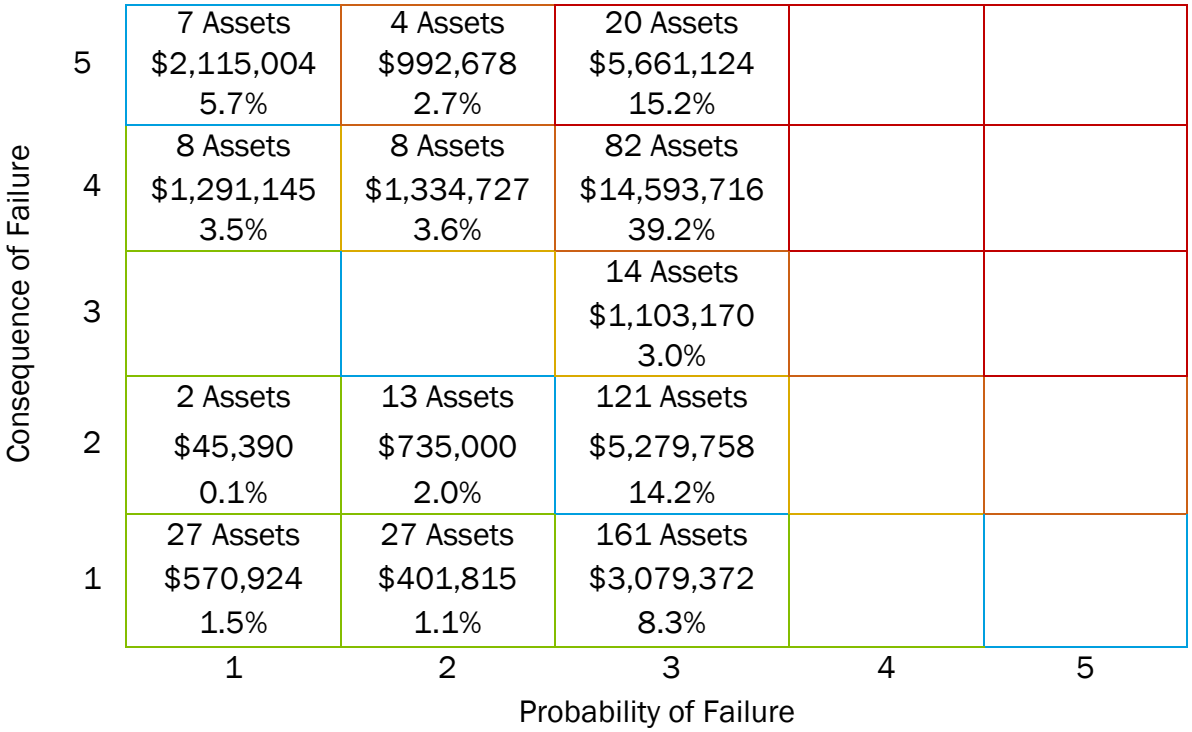
5	**Very Good**	The asset is typically new with good public appearance.
4	**Good**	The asset is still in good condition with good public appearance.
3	**Fair**	The asset is showing signs of corrosion, increased maintenance costs and down-time in order to meet governing standards. Poor visual appearance.
2	**Poor**	Assets are repaired or replaced if they reach this level.
1	**Very Poor**	Assets do not reach this level.

Useful Life Remaining for Fleet Assets



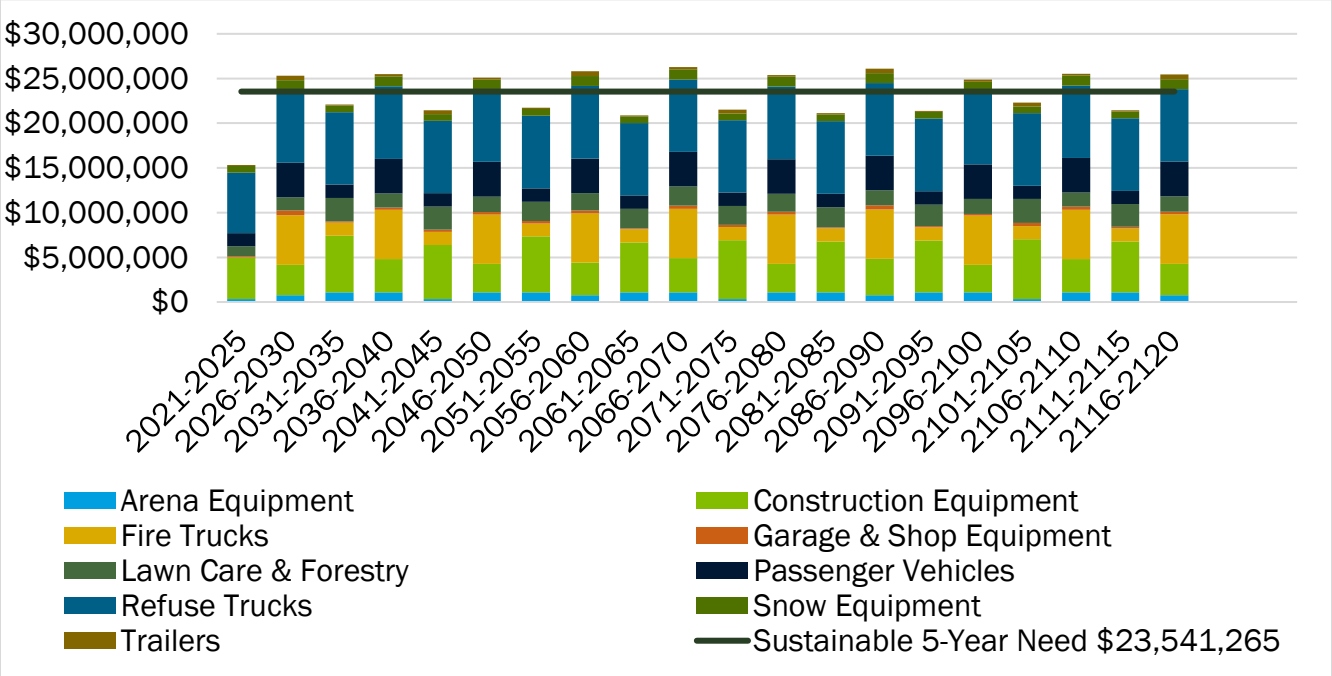
Most Fleet assets have an estimated life span of 10 or fewer years. Any assets that have exceeded their useful life are still in Fair or better condition.

Risk Levels for Fleet Assets



The Risk Levels chart shows the operational consequence of failure relative to the condition-dependent probability of failure. Essential assets such as Fire Trucks rank higher in consequence of failure and appear higher on the chart.

Replacement Profile for Fleet Assets



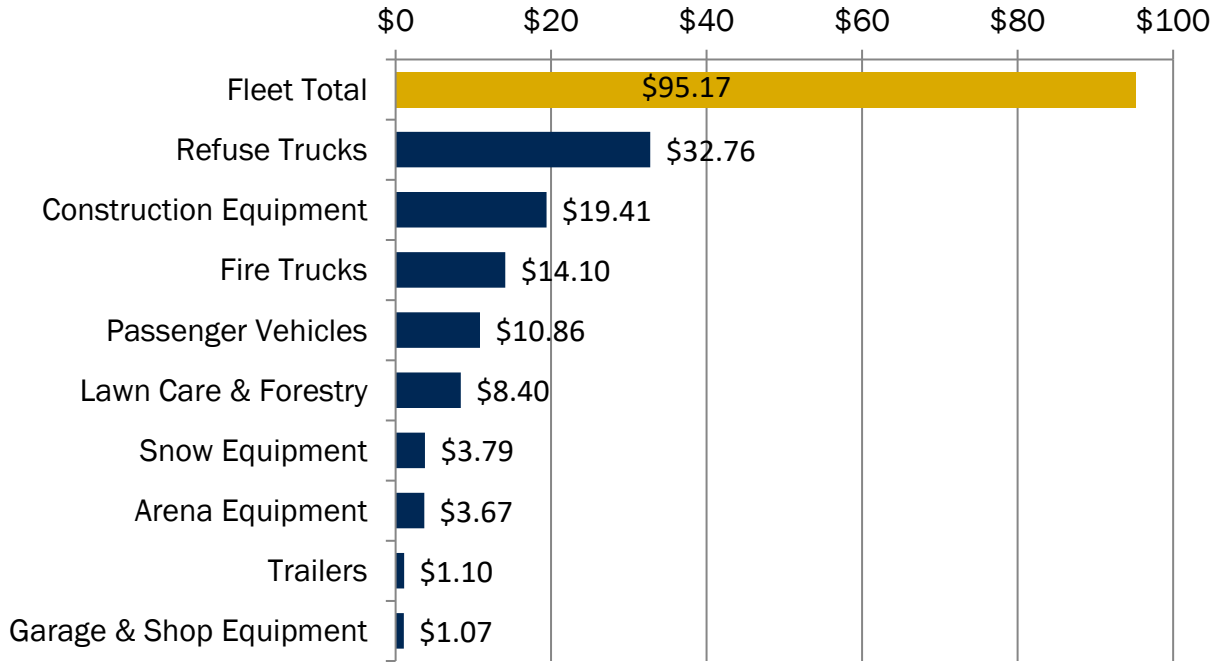
Replacement needs are based on existing lifecycle projections for Facilities assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement	10-Year Capital Budget
Total Reinvestment (202 $ *)	$40,662,301	$44,247,310

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



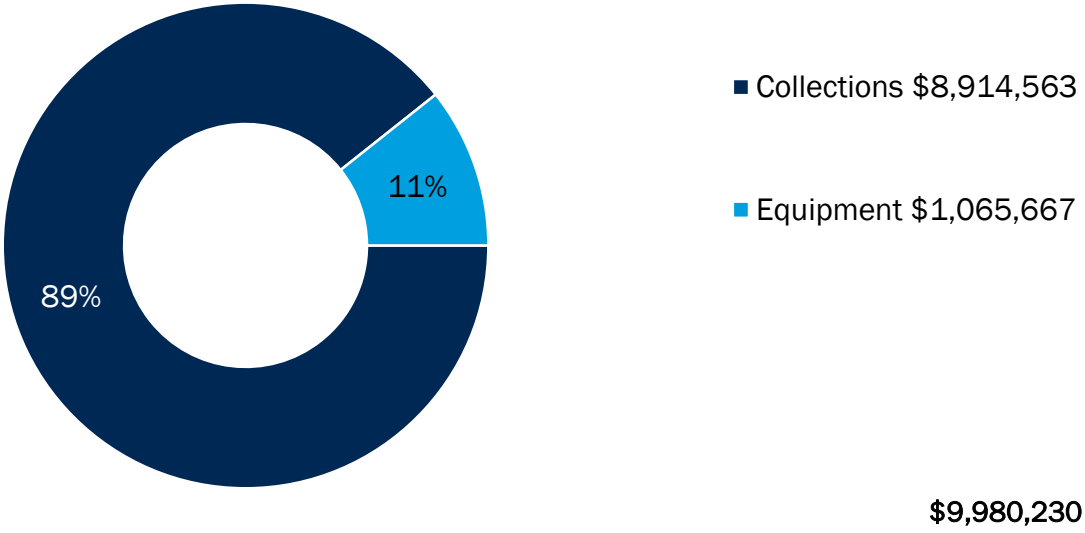
The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

D. Library 2022 Overview

Library Inventory by Construction Year

Collections	
Various	184,377
Equipment	
Desktop Laptop	312
Monitors	85
Network Hardware	224
Peripherals	101
Maker Gear	14
Servers	44
Power and Charging	17

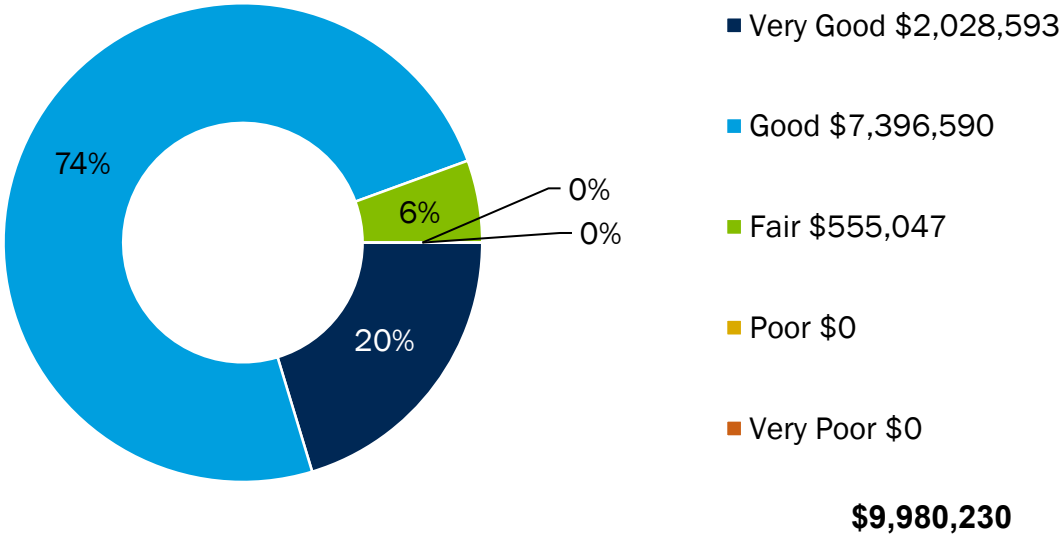
Replacement Value of Library Assets



$9,980,230

The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Library replacement costs are regularly re-evaluated by a consultant and individual components have had their market value estimated by Library staff.

Condition Distribution by Replacement Value



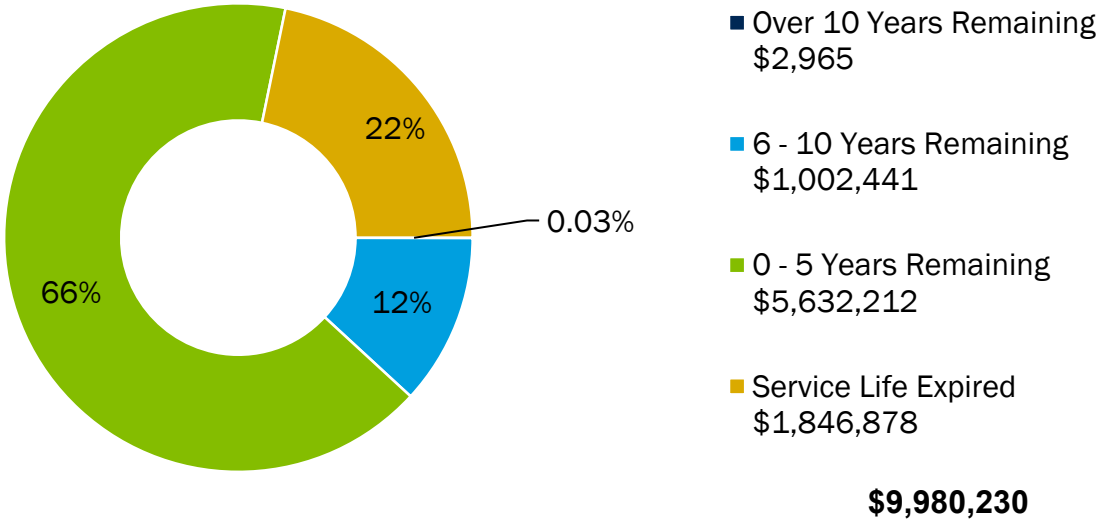
$9,980,230

Condition of Library assets was evaluated during the inventory project which took place between 2018 and 2019. Individual assets were visually assessed by students.

Condition Distribution for Library

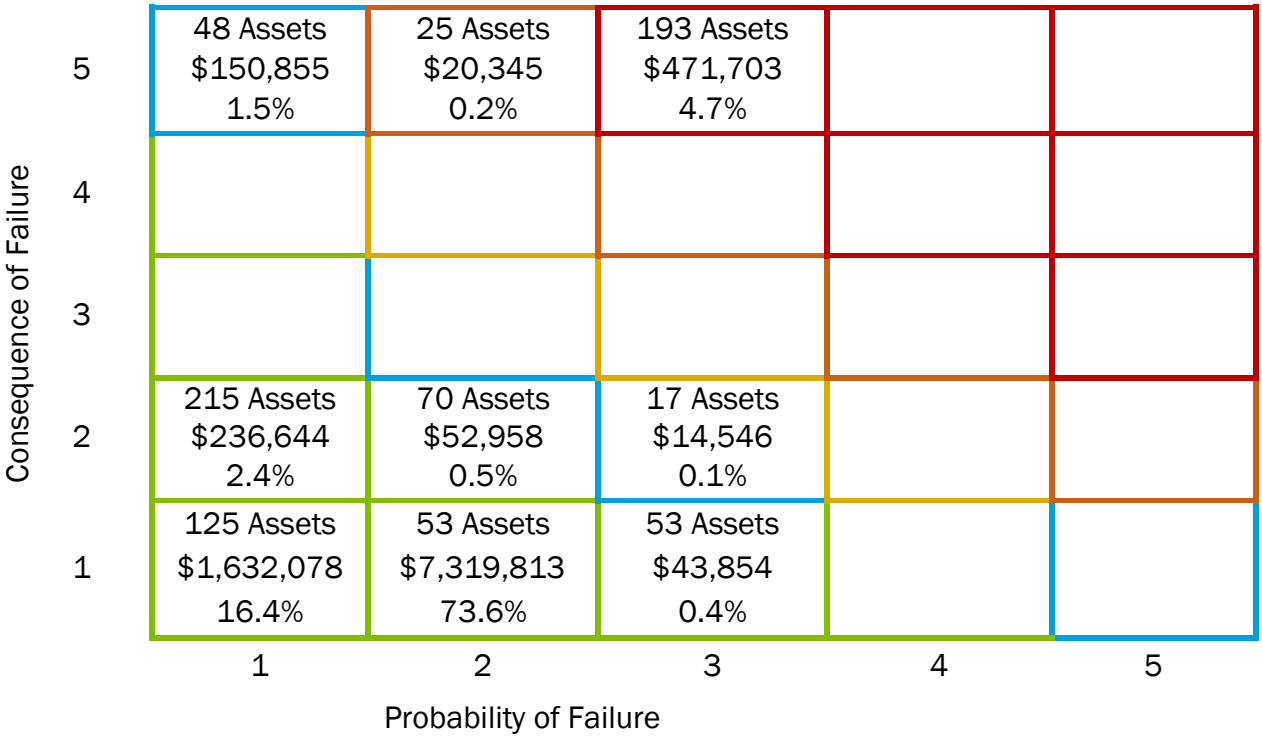
5	**Very Good**	The equipment is in new condition and meets or exceeds needs.
4	**Good**	Minor deficiencies are fixed so that the asset remains in service.
3	**Fair**	Equipment is scheduled to be replaced when in fair condition.
2	**Poor**	Assets are disposed of when they are in less than fair condition.
1	**Very Poor**	Assets are disposed of when they are in less than fair condition.

Useful Life Remaining for Library Assets



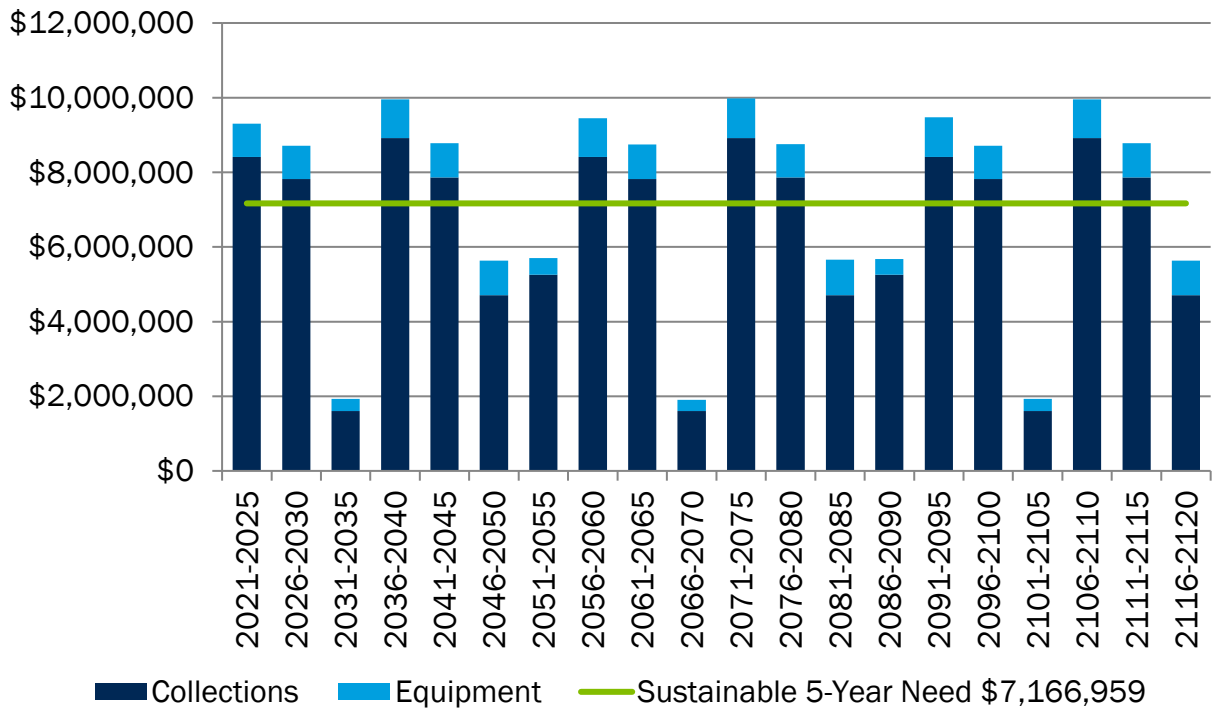
The above chart shows the remaining useful life in five-year increments of Town assets. Assets that have exceeded their useful life may still be in good condition. Most Library assets have 0-5 years of useful life remaining.

Risk Levels for Library Assets



Risk levels for Library assets depend on the operational purpose of the asset (consequence of failure) and the condition of the asset (probability of failure). An asset such as a Fire Hall with a high consequence of failure would appear in the top right portion of the above graph if it also had a poor condition rating (high probability of failure).

Replacement Profile for Library Assets



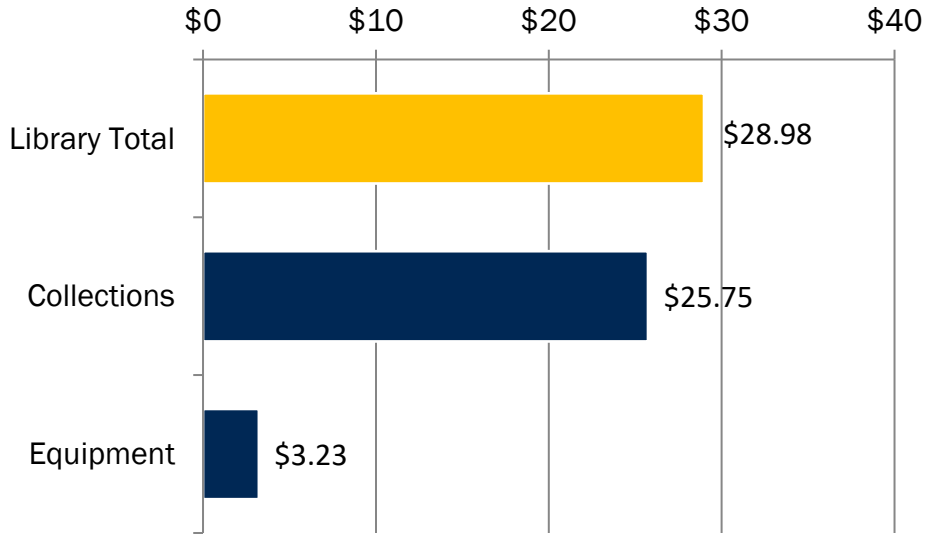
Replacement needs are based on existing lifecycle projections for Library assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement	10-Year Capital Budget
Total Reinvestment (2022 $*)	$18,021,648	$9,112,163

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

E. Parks 2022 Overview

Parks Inventory

Amenities and Furniture	
Amphitheatre	1
Picnic Shelter	32
Fencing	56 km
Retaining Wall	797 m
Misc. Park Amenities	859
Signage	743
Lighting	250
Seating	957
Sports Equipment Bunker	15
Fountains	3

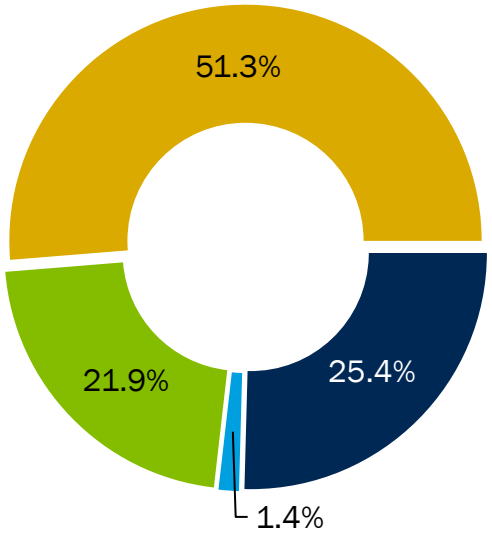
Arboriculture & Horticulture	
Garden Beds	4,462 m^2
Parks Trees	75[3]

Paved Surfaces	
Access Drives	1562 m^2
Trails and Walkways	91,859 m^2
Parking Lots	90,594 m^2

Recreation Facilities	
Splash Pad	16
Lacrosse Box	2
Bocce Court	4
Skateboard Park	3
Soccer Pitch	57
Play Space	93
Baseball Diamond	37
Basketball Court	34
Multi-Use Court	2
Tennis Court	31
Pickleball Court	3

[3] Parks Trees have not been fully inventoried

Replacement Value of Parks

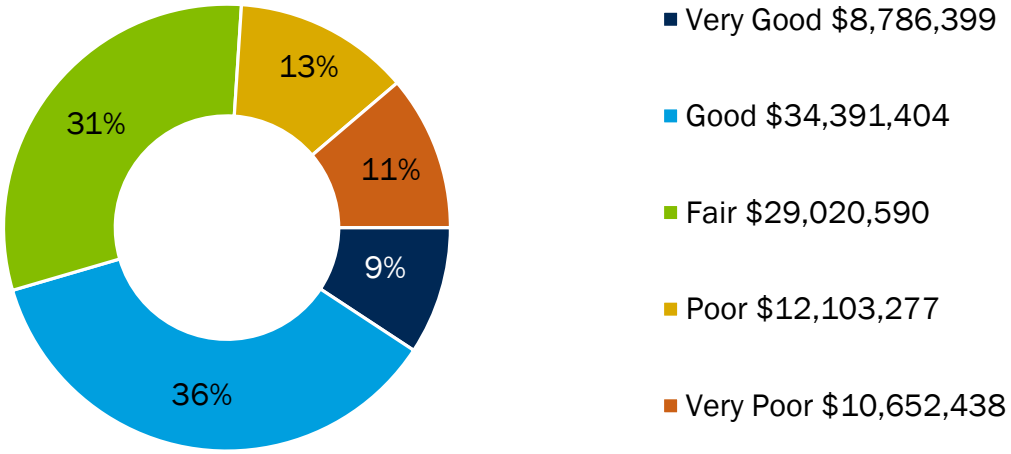


- Amenities and Furniture $24.14 M
- Arboriculture and Horticulture $1.32 M
- Paved Surfaces $20.80 M
- Recreation Facilities $48.69 M

$94.95 M

The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Parks replacement costs are regularly re-evaluated by a consultant and individual components have had their market value estimated by Parks staff.

Condition Distribution by Replacement Value



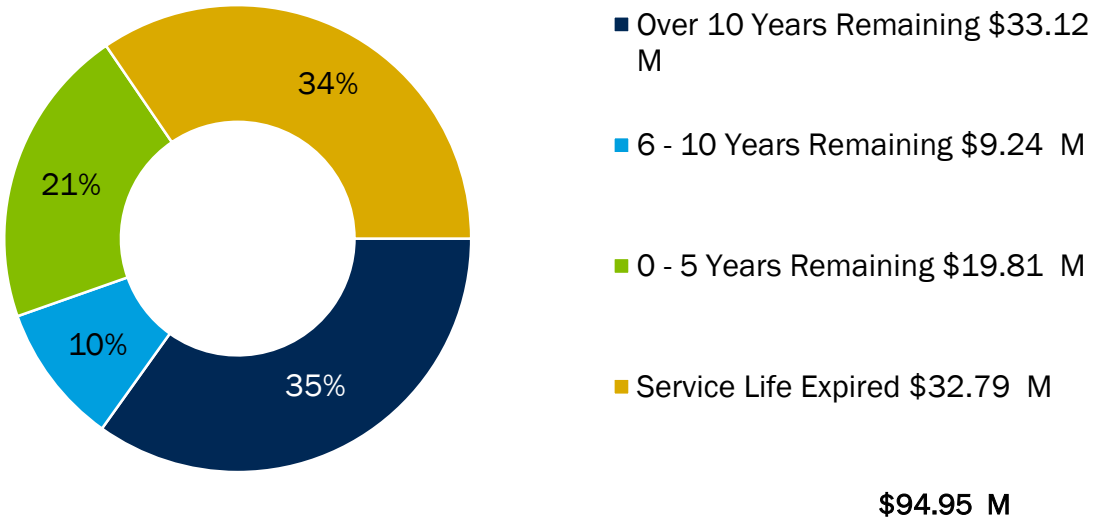
$94,954,108

Condition of Parks assets are evaluated regularly. Individual assets were visually assessed by students.

Condition Distribution for Parks

5	**Very Good**	The asset is typically new or well-maintained without wear or damage.
4	**Good**	The asset is still has good public appearance with normal wear.
3	**Fair**	The asset is showing minor defects.
2	**Poor**	Asset has defects and needs more maintenance and repair.
1	**Very Poor**	Assets have failed and are at the end of their useful life.

Useful Life Remaining for Parks Assets



$94.95 M

The above chart shows the remaining useful life in five-year increments of Town assets. Assets that have exceeded their useful life may still be in good condition. Most Parks assets are within their expected service life.

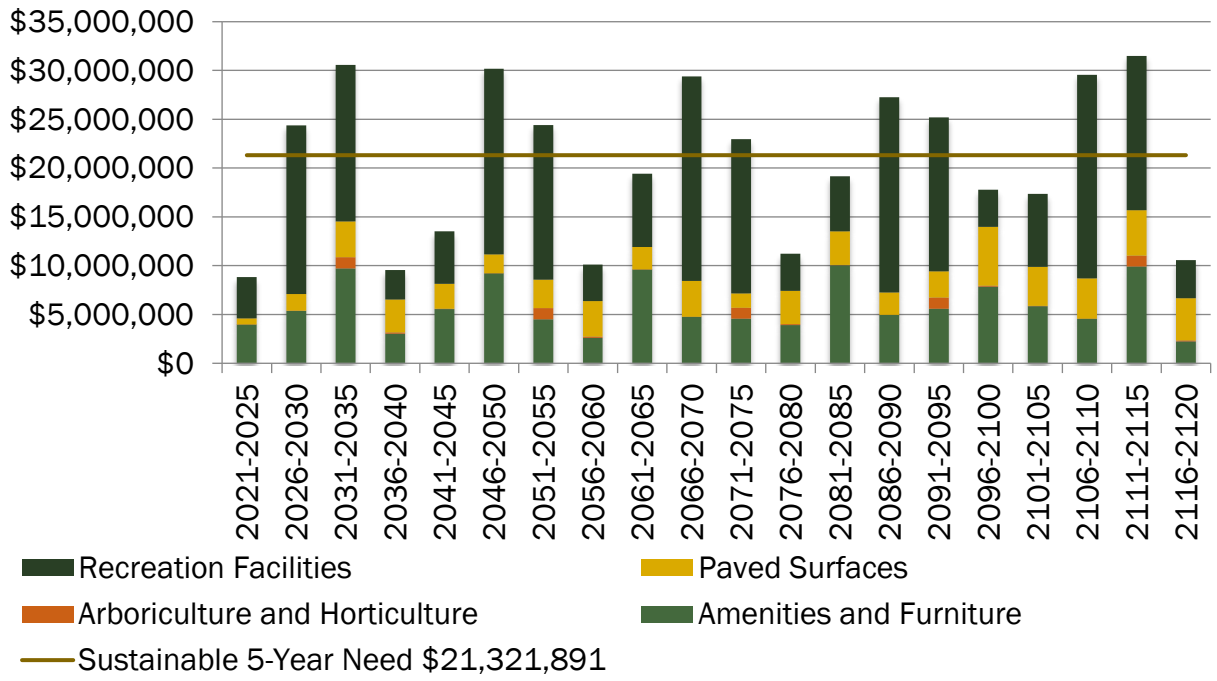
Risk Levels for Parks Assets

Consequence of Failure	1	2	3	4	5
5					
4	17 Assets $1,445,264 1.5%	116 Assets $18,269,178 19.2%	134 Assets $20,864,486 22.0%	31 Assets $4,723,434 5.0%	14 Assets $1,727,131 1.8%
3	96 Assets $961,140 1.0%	54 Assets $1,853,476 2.0%	168 Assets $1,779,621 1.9%	516 Assets $4,351,371 4.6%	227 Assets $3,128,094 3.3%
2	238 Assets $6,540,817 6.9%	1,439 Assets $16,205,347 17.1%	658 Assets $4,062,830 4.3%	148 Assets $1,632,766 1.7%	128 Assets $1,207,721 1.3%
1	16 Assets $236,323 0.2%	27 Assets $186,531 0.2%	228 Assets $1,399,933 1.5%	360 Assets $1,285,314 1.4%	246 Assets $3,093,331 3.3%

Probability of Failure

Risk levels for Parks assets depend on the operational purpose of the asset (consequence of failure) and the condition of the asset (probability of failure). An asset such as a Fire Hall with a high consequence of failure would appear in the top right portion of the above graph if it also had a poor condition rating (high probability of failure).

Replacement Profile for Parks Assets



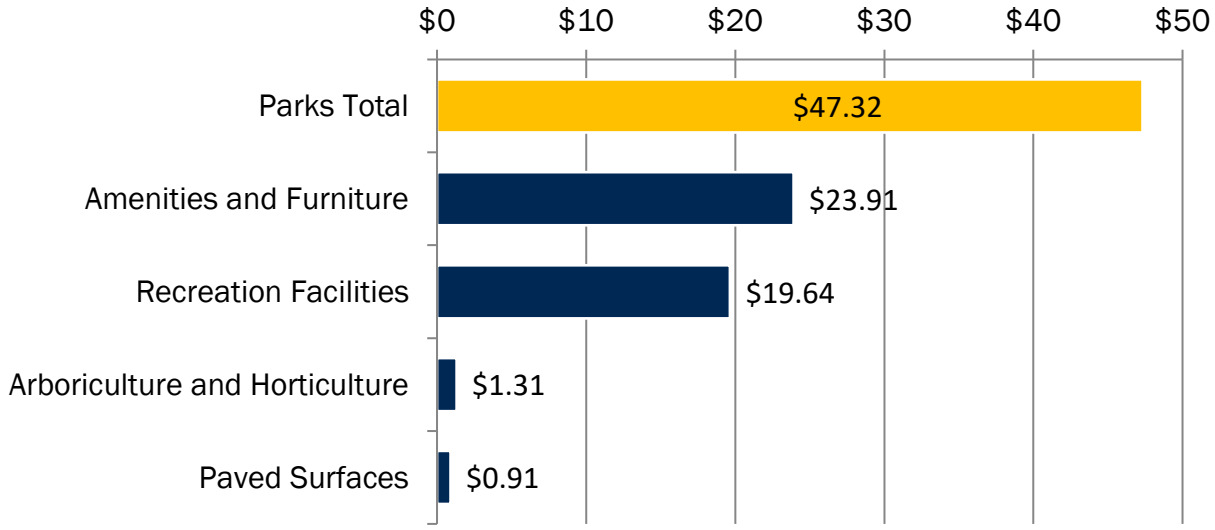
Replacement needs are based on existing lifecycle projections for Parks assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement with Backlog	10-Year Capital Budget
Total Reinvestment (2022 $*)	$30,164,524	$22,481,043

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

F. Roads Right-of-Way 2022 Overview

Roads Right-of-Way Inventory

Roadways

Arterial Roads	199 lane km
Collector Roads	156 lane km
Local Roads	601 lane km
LCB Roads	120 lane km
Gravel Roads	2.9 lane km

Bridges & Culverts

Road Bridges	24
Culverts 3 m+	32
Culverts 0 – 2.9 m	18,079 m
Pedestrian Bridges	22

Parking

Kiosks	11
Parking Meters	282
Paid Parking Lots	9 lots (31,240 m^2)

Sidewalks & Multi-Use Paths

Sidewalks	524 km
Multi-Use Paths	27 km

Roadside Appurtenances

Fences	32 km
Signs	13,088
Retaining Walls	65 (3,558 m^2)
Guiderails	11,872

Stormwater Management

Stormlines	451 km
Stormwater Management Ponds	47
Major Channels	2.4 km

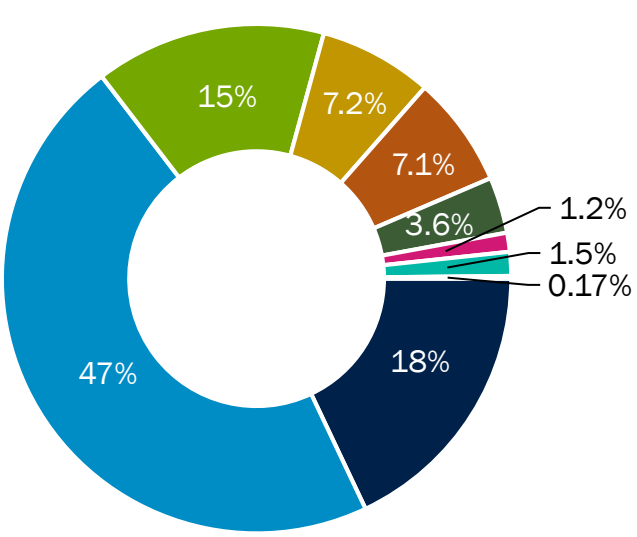
Street Lights

Poles	8,353
Luminaires	11,121

Street Trees

Street Trees	40,743

Replacement Value of Roads Right-of-Way

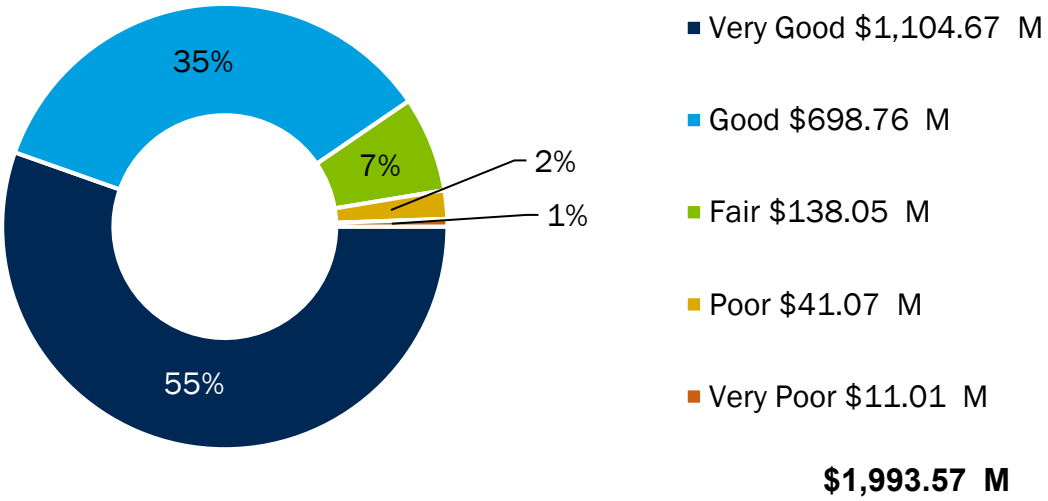


- Road Surfaces $357.93 M
- Road Bases $929.13 M
- Storm Water Management $292.10 M
- Sidewalks & Multi-Use Paths $143.96 M
- Bridges & Culverts $140.62 M
- Street Trees $70.98 M
- Roadside Appurtenances $24.11 M
- Street Lights $30.19 M

$1,992.37 M

The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Roads Right-of-Way replacement costs are regularly re-evaluated by a consultant and individual components have had their market value estimated by Roads Right-of-Way staff.

Condition Distribution by Replacement Value



Conditions of Roads Right-of-Way assets are evaluated regularly as described below.

Table 8 Inspection Programs for Roads Right-of-Way Assets

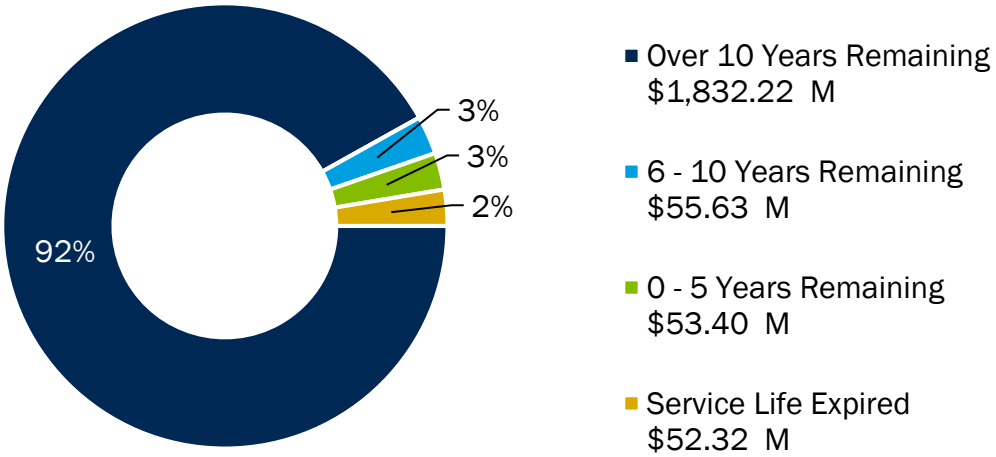
Asset	Inspection Frequency	Inspection Method
Roadways	Half of all roadways inspected annually on a biennial cycle	Contractor visually inspects roads
Bridges & Culverts	Inspected biennially	Contractor inspects all structures visually and submits a report
Stormlines	A portion inspected annually on a 9-year cycle	Contractor inspects using a CCTV robot and cleaning is performed as needed
Sidewalks	Inspected annually	Summer students ride a tricycle capturing video and deficiencies on a web map
Streetlights	Inspected every 7 years	Contractor visually inspects streetlights
Signs	Inspected annually	Summer students inspect regulatory and warning signs with a retroreflectometer
Pedestrian Bridges	Inspected biennially	Contractor inspects pedestrian bridges and submits a report
Retaining Walls	Inspected biennially	Contractor performs a visual inspection of all retaining walls

Asset	Inspection Frequency	Inspection Method
Driveway Culverts	Inspected 2020	Students/Staff inspect culverts
Fences	Every 5 years	Students inspect fences visually
Guiderails	Every 5 years	Contractor inspects all guiderails
Headwalls	Will be inspected in 2022	
SWM Ponds	Biannual and as-needed inspections Every 4-5 years	Staff inspect ponds for blockages and flooding in the Spring, Fall, and after major storms Contractors perform in-depth pond studies to determine sedimentation rates, soil condition, etc.

Condition Distribution for Roads Right-of-Way

5	Very Good	Building components have no defects and are in as-new condition.
4	Good	Minor defects are becoming apparent in superficial finishes.
3	Fair	Elements likely to become poor within a few years if not addressed.
2	Poor	Components are failing and require constant repairs and parts.
1	Very Poor	Elements have failed and are at the end of their useful life.

Useful Life Remaining for Roads Right-of-Way Assets



The above chart shows the remaining useful life in five-year increments of Road Right-of-Way assets. Assets that have exceeded their useful life may still be in good condition. Most Roads assets have more than 10 years of useful life remaining.

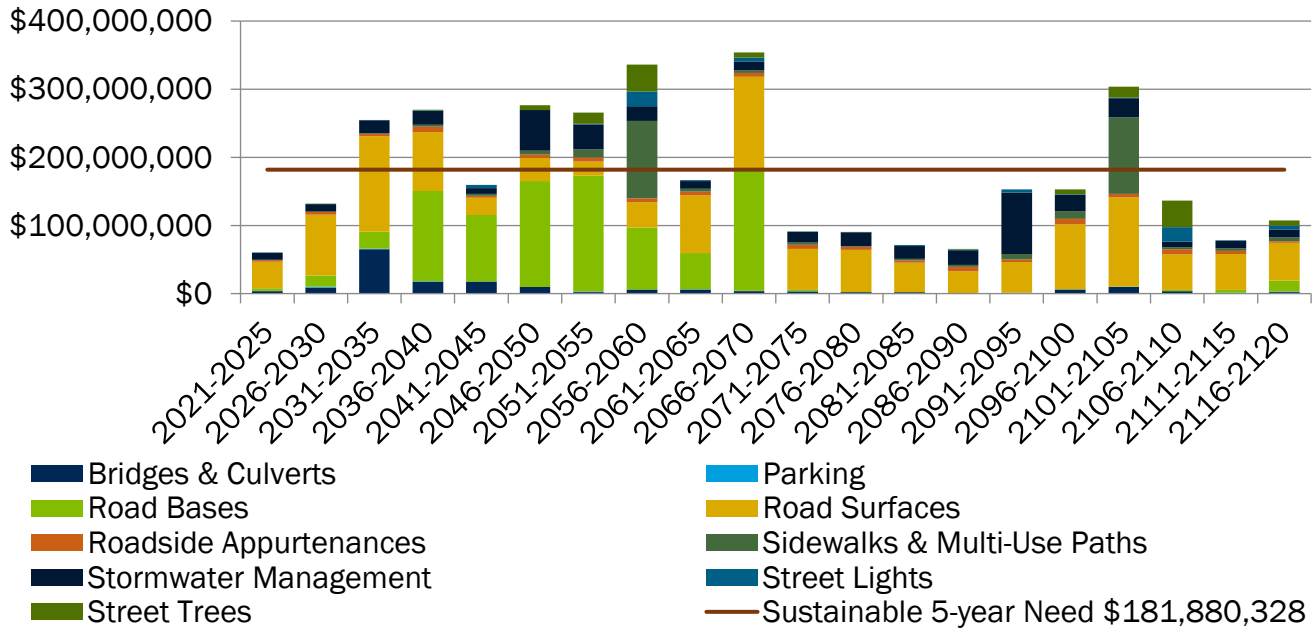
Risk Levels for Roads Right-of-Way Assets

Consequence of Failure	1	2	3	4	5
5	668 Assets $73.5 M 3.7%	584 Assets $114.2 M 5.7%	34 Assets $16.4 M 0.8%	4 Assets $4.3 M 0.22%	
4	8,464 Assets $54.4 M 2.7%	208 Assets $101.9 M 5.1%	219 Assets $32.3 M 1.6%	10 Assets $1.0 M 0.05%	67 Assets $0.4 M 0.02%
3	21,353 Assets $152.6 M 7.7%	27,937 Assets $233.8 M 11.7%	4,448 Assets $26.2 M 1.3%	777 Assets $4.5 M 0.22%	162 Assets $0.22 M 0.01%
2	1,657 Assets $190.0 M 9.5%	1,066 Assets $86.2 M 4.3%	108 Assets $13.6 M 0.7%	120 Assets $3.5 M 0.18%	23 Assets $0.7 M 0.04%
1	15,860 Assets $617.6 M 31.0%	9,769 Assets $218.9 M 11.0%	1,665 Assets $31.1 M 1.6%	575 Assets $8.1 M 0.41%	589 Assets $7.1 M 0.36%

Probability of Failure

Risk levels for Roads Right-of-Way assets depend on the operational purpose of the asset (consequence of failure) and the condition of the asset (probability of failure). An asset such as a Fire Hall with a high consequence of failure would appear in the top right portion of the above graph if it also had a poor condition rating (high probability of failure).

Replacement Profile for Roads Right-of-Way Assets



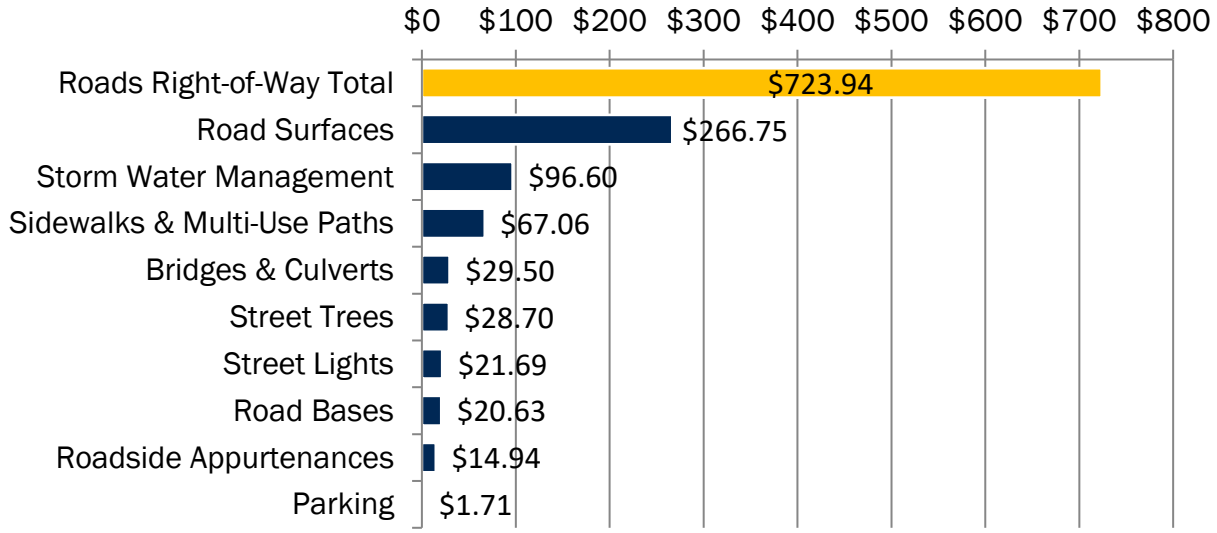
Replacement needs are based on existing lifecycle projections for Roads Right-of-Way assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement with Backlog	10-Year Capital Budget
Total Reinvestment (202 $ *)	$193,860,543	$121,793,226

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



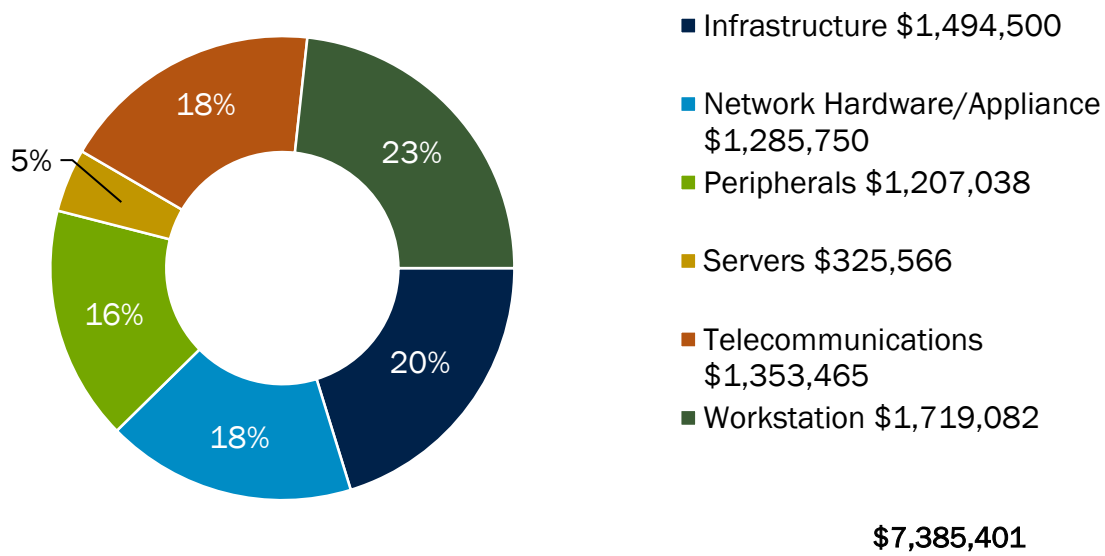
The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

G. Technology & Innovation Services 2022 Overview

Technology & Innovation Services Inventory

Network Appliances	305	Peripherals	1,304
Servers	24	Telecommunication	402
Workstations	914	Infrastructure	30,058 m

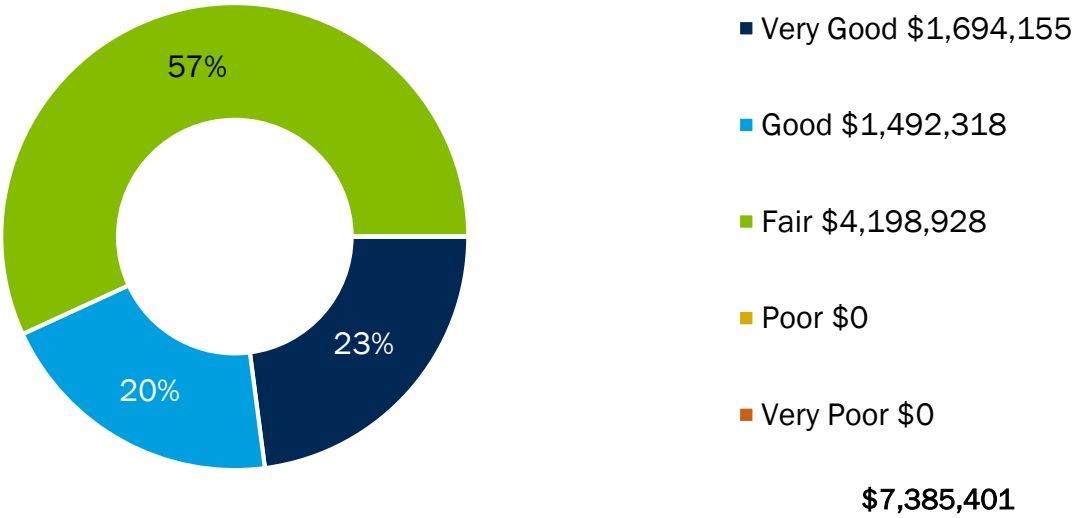
Replacement Value of Technology & Innovation Services



$7,385,401

The replacement value represents the proposed budget amount to replace an item in the year of publication (2022). Technology & Innovation Services replacement costs are regularly re-evaluated by a consultant and individual components have had their market value estimated by Technology & Innovation Services staff.

Condition Distribution by Replacement Value

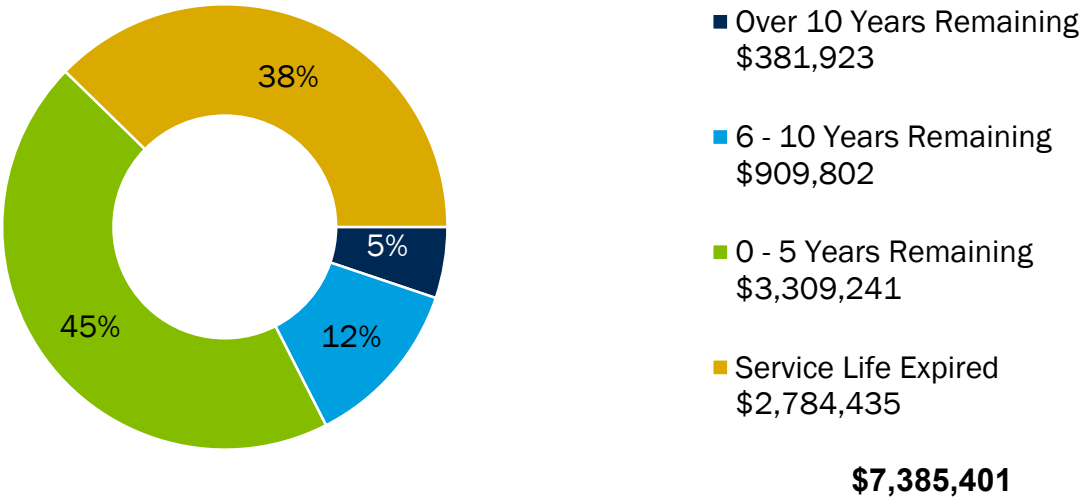


Condition of Technology & Innovation Services assets were visually assessed by TIS Staff.

Condition Distribution for Technology & Innovation Services

5	**Very Good**	Asset is typically new or recently rehabilitated.
4	**Good**	Asset is meeting the operational needs.
3	**Fair**	Asset likely to become poor if not improved.
2	**Poor**	Assets are decommissioned at this level.
1	**Very Poor**	Assets do not reach this level while in service.

Useful Life Remaining for Technology & Innovation Services Assets



The above chart shows the remaining useful life in five-year increments of assets. Assets that have exceeded their useful life may still be in good condition. Most TIS assets are within their expected service life.

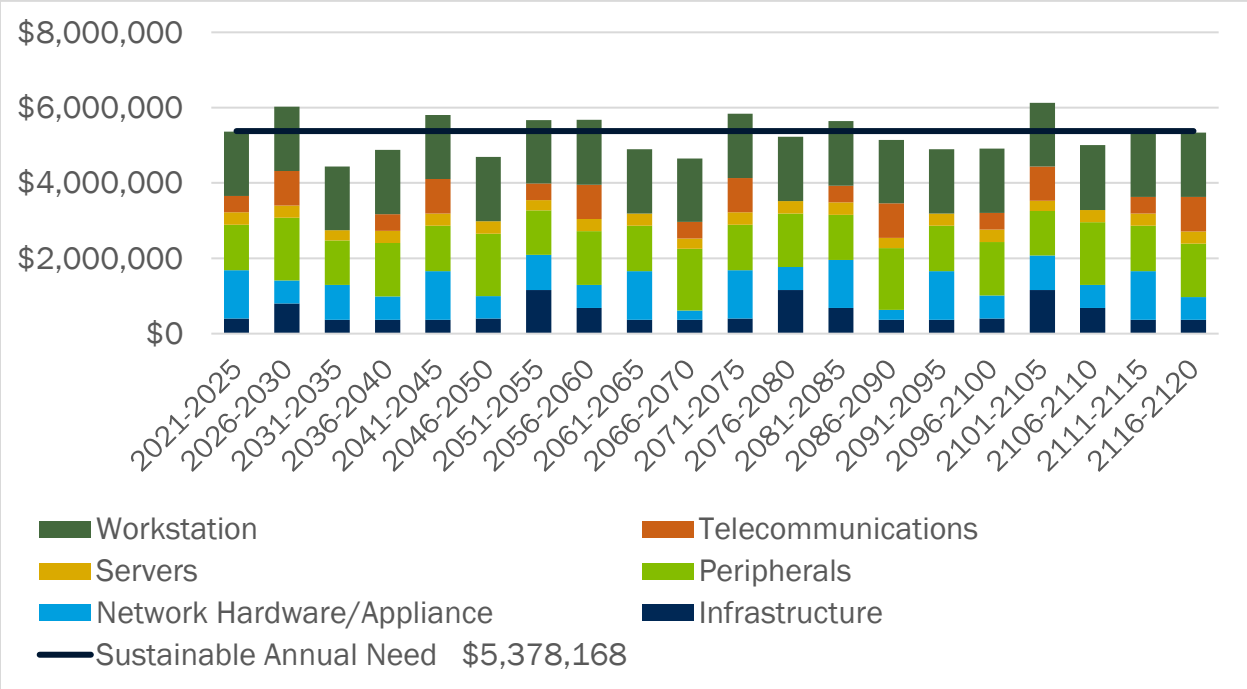
Risk Levels for Technology & Innovation Services Assets

Consequence of Failure	1	2	3	4	5
5	11 Assets $8,954 0.12%		204 Assets $1,605,208 21.7%		
4	36 Assets $81,412 1.1%	7 Assets $906,527 12.3%	13 Assets $365,526 4.95%		
3	4 Assets $666,660 9.03%	2 Assets $72,259 0.98%	12 Assets $383,873 5.2%		
2	432 Assets $640,828 8.68%	196 Assets $444,545 6.02%	397 Assets $633,709 8.58%		
1	400 Assets $296,301 4.01%	11 Assets $68,987 0.93%	343 Assets $1,210,613 15.8%		

Probability of Failure

Risk levels for Technology & Innovation Services assets depend on the operational purpose of the asset (consequence of failure) and the condition of the asset (probability of failure). An asset such as a Fire Hall with a high consequence of failure would appear in the top right portion of the above graph if it also had a poor condition rating (high probability of failure).

Replacement Profile for Technology & Innovation Services Assets



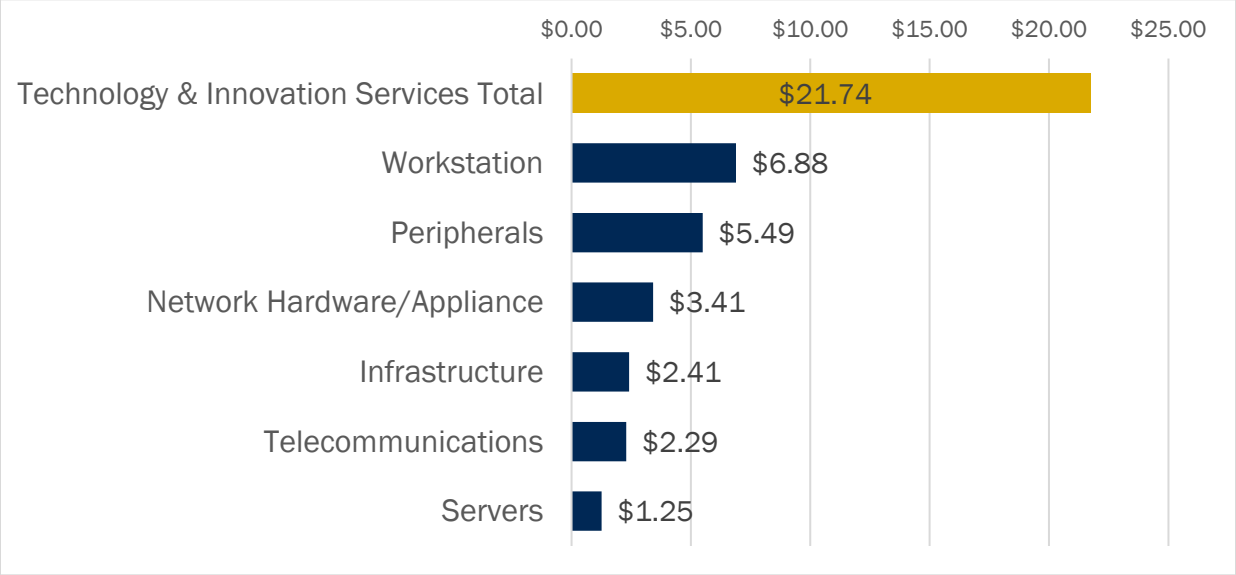
Replacement needs are based on existing lifecycle projections for Technology & Innovation Services assets and the projected costs may be reduced upon re-evaluation of lifecycles, capturing maintenance and repair activities, or new condition assessments.

10-Year Reinvestment	10-Year Total Requirement	10-Year Capital Budget
Total Reinvestment (202 $ *)	$11,389,125	$20,932,325

*Values are in 2022 Dollars

Capital investments in the next 10 years include only spending allocated to Asset Management – growth investment is not included.

Annual Requirement per Household



The annual requirement represents the amount required to fully fund a given service area's replacement and lifecycle needs. The above chart shows this amount distributed over the 49,470 households in the Town.

H. References

Armson, D. (2012). The Effect of Trees and Grass on the Thermal and Hydrological Performance of an Urban Area. *University of Manchester - Faculty of Life Sciences*. Retrieved from https://www.research.manchester.ac.uk/portal/files/54524206/FULL_TEXT.PDF

Delaney, F. N. (2020). *Guide to Conducting a Climate Change Analysis at the Local Scale.* Ontario Climate Consortium.

Durham Region. (2021). *Monitoring of Growth Trends.* The Regional Municipality of Durham, Commissioner of Planning and Economic Development. Whitby, ON: Durham Region. Retrieved from https://www.durham.ca/en/living-here/resources/Documents/2021-INFO-132-Monitoring-of-Growth-Trends.pdf

Mussetti, G. (2019). Urban Climate Modelling with Explicit Representation of Street Trees. *ETH Zurich*. Retrieved from http://hdl.handle.net/20.500.11850/429056

Oner J, S. B. (2015). Utilization of Recycled Asphalt Concrete with Warm Mix Asphalt and Cost-Benefit Analysis. *PLOS ONE*, 10(1): e116180. doi:10.1371/journal.pone.0116180

Statistics Canada. (2022, 02 10). *Focus on Geography Series, Census 2021*. Retrieved from Statistics Canada: https://www12.statcan.gc.ca/census-recensement/2021/as-sa/fogs-spg/page.cfm?r=1&Lang=E&dguid=2021A00053518009&TOPIC=1

The Town of Whitby. (2020). *Corporate Strategic Plan.* Retrieved from The Town of Whitby: https://www.whitby.ca/en/town-hall/corporate-strategic-plan.aspx

The Town of Whitby. (2020). *Mayor and Council.* Retrieved January 28, 2022, from The Town of Whitby: https://www.whitby.ca/en/town-hall/mayor-and-council.aspx#Council-Goals-2018-to-2022

Town of Whitby. (2020). *Durham Ensemble Climate Model: Climate Projections to 2100.* Office of the CAO. Whitby, ON: Staff Report. Retrieved from https://whitby.civicweb.net/FileStorage/1AC7EEA6B67749638B745B6C869F492F-CAO%2016-20%20Staff%20Report.pdf

Zuzek Inc. (2020). *Lake Ontario Shoreline Management Plan.* Oshawa, ON: Central Lake Ontario Conservation Authority. Retrieved from https://03879a07-372c-443e-997e-ae65078d7559.filesusr.com/ugd/3483ab_94e08ea33a7b45ea9eee5bd6c06b3671.pdf

I. Appendices

Appendix A: Condition Scales for roads Right-of-Way

Figure 10 A photo of a road in Very Good condition

Figure 11 A photo of a road in Good condition

Figure 12 A photo of a road in Fair condition

Figure 13 A photo of a road in Poor condition

Figure 14 A photo of a road in Very Poor condition

Appendix B: Expected Useful Life

Table 9 Asset Useful Life in Years: Facilities

Building Element	Element Type	Useful Life in Years
Driveways, Parking Lots, Walkways, Curbs	Asphalt	10
	Concrete	15
	Gravel	10
	Interlocking blocks	20
Fencing, Handrails	Concrete	20
	Masonry	20
	Metal, Wrought Iron	25
	Aluminium	15
	Steel, Chain Link	15
	Wood	10
Landscaping, General	Sodding, Shrubs, Etc.	10
	Trees	20
Parking Lot Guards	Parking Bumpers	5
	Guard rails	10
Retaining Walls	Concrete	25
	Masonry	25
	Wood	15
Stairs, Porches, Decks	Concrete	15
	Wood	10
Storage, Service Buildings	Masonry	20
	Wood	15
Balcony Railings	Steel	15
	Aluminium	15
	Wood	10
	Concrete slabs	25
	Concrete	15
	Toppings/waterproofing	15
Caulking, Weather Stripping	Caulking, weather-stripping	10
Exterior Entrance and Patio Doors	Aluminium	20
	Steel	20
	Wood	20
	Aluminium – storm	15
Exterior Walls, Columns, Siding	Aluminium	25
	Asphalt shingles	15
	Masonite	20
	Masonry	20
	Steel	25

Building Element	Element Type	Useful Life in Years
Exterior Walls, Columns, Siding	Stucco	20
	Vinyl	25
	Damp – proofing	25
Metal Flashing	Aluminium	25
	Galvanized, Painted	15
	Pre-finished Steel	10
Rainwater Gutters and Downspouts	Aluminium	15
	Plastic	15
	Galvanized	20
Roofing	Asphalt shingles	15
	Built-up	15
	Inverted	20
	Metal	25
	Single-ply	20

Table 10 Asset Useful Life in Years: Fire

Asset Class	Asset Type	Useful Life (Years)
PPE	Breathing Air	10/15/20
	Bunker Gear	10
Equipment	Pumper Equipment	15
	Aerial Equipment	20
	Communications	10

Table 11 Asset Useful Life in Years: Fleet

Asset Class	Asset Type	Useful Life
Passenger Vehicles	Cars	10
	Pick-up Trucks	10
	SUVs	10
	Vans	10
Construction Equipment	Dump Trucks	10
	Loader	10
	Gradeall	10
	Backhoe	15
	Mobile Compressor	10
	Cement Mixer	20
	Grader	15
	Street Sweeper	7
	Street Flusher	10
	Vacuum Truck	10
	Pavement Grinder	5
	Hot Patcher	10
	Utility	10

Asset Class	Asset Type	Useful Life
Trailers	Boat Trailers	15
	Paint Trailer	15
	Ice Painting Trailer	15
	Utility Trailers	15
	Water Tanker Trailers	10
Fire Trucks	Aerial Trucks	10
	Pumper Trucks	10
	Rescue Trucks	15
Fire Trucks	Tanker Trucks	15
Lawn Care & Forestry	Litter Truck	7
	Chipper Truck	8
	Tractors	10
	Wide Cut Mowers	8
	Walk Behind and Front Mount Mowers	7
	Turf Care Machines	20
Refuse Trucks	Side-loader	7
	Rear-loader	10
	Hooklift	10
Arena Equipment	Zamboni	6
	Ice Edger	10
Snow Equipment	Sidewalk Machines	10
	Sanders	10
	Snow Blowers	10
Garage & Shop Equipment	Hoist	15
	A/C Machine	10
	Overhead Crane	25
	Blade Sharpener	10
	Fuel Pump	15
	Drill Press	15
	Compressor	20
	Sweeper/Scrubber	15
	Saws	20

Table 12 Asset Useful Life in Years: Library

Asset Class	Asset Type	Expected Useful Life
Collections	Various	7
Equipment	Servers	5
	Printers	5
	Network Hardware	5
	Monitors	5
	Desktop Laptop	5

Table 13 Asset Useful Life in Years: Parks

Asset Class	Asset Type	Expected Useful Life
Arboriculture & Horticulture	Garden Beds	25
Paved Surfaces	Access Drives	5/7/10
	Trails and Walkways	10/20/50
	Parking Lots	35
Recreation Facilities	Splash Pads	15
	Lacrosse Boxes	20
	Bocce Courts	20
	Skateboard Parks	25
	Soccer Pitches	40
	Play Spaces	15
	Baseball Diamonds	30
	Basketball Courts	20
	Multi-Use Courts	20
	Tennis Courts	20
Amenities and Furniture	Picnic Shelters	15/25
	Restrooms	25
	Field Houses	25
	Fencing	10/20/40
	Arbours/Trellis	25
	Retaining Walls	20
	Misc. Park Amenities	10/20/100
	Pavilions	25
	Signage	10/15/100
	Lighting	40
	Seating	10/20
	Sports Equipment Bunkers	20/100
	Fountains	20

Table 14 Asset Useful Life in Years: Road Right of Way

Asset Class	Asset Type	Expected Useful Life
Roads	HCB 1 Surface/HCB 1 Base	90/90
	HCB 2 Surface/HCB 2 Base	90/90
	HCB 3 Surface/HCB 3 Base	35/96
	HCB 4 Surface/HCB 4 Base	35/96
	LCB	20
Bridges & Culverts	Deck and Superstructure	60
	Substructure	120
	Culverts (3m+)	90
	Culverts (0 to 3m)	50
	Pedestrian Bridges	30/35/40/50
Sidewalks & Multi-Use Paths	Sidewalks	45
	Multi-Use Paths	20
Parking	Public Lots - Surface	25
	Public Lots - Base	100
	Meters	20
Roadside Appurtenances	Traffic Control Signs	30
	Information Signs	10/20
	Fences	20/25/30
	Guiderails	25
	Retaining Walls	25/30/35/50/65/80
Stormwater Management	Stormwater Ponds	90
	Storm Sewers	90
	Major Channels	80
Street Lights	Poles	50
	Luminaries	25
Street Trees	Street Trees	50

Table 15 Asset Useful Life in Years: TIS Equipment

Asset Class	Asset Type	Expected Useful Life
Network Appliances	Switches	5
	Storage Arrays	5
	Security Appliances	5
	Wi-Fi Access Points	5
Servers	Tape Backup Devices	5
	VM Servers	5
	Physical Servers	5
Workstations	Desktops	5
	Laptops	4
	Tablets	3
Peripherals	Large Multifunction copiers	5
	Network Printers	5
	Monitors	5
	Scanners	3
	Projectors	3
	Rack Mounted Uninterrupted Power Supplies	5
Tele-Communications	PBX Equipment	15
	Digital Telephone Sets	10
	IP Telephone Sets	10
Infrastructure	External Fibre Cable	35

Appendix C: Levels of Service - Scope of Town Road Network

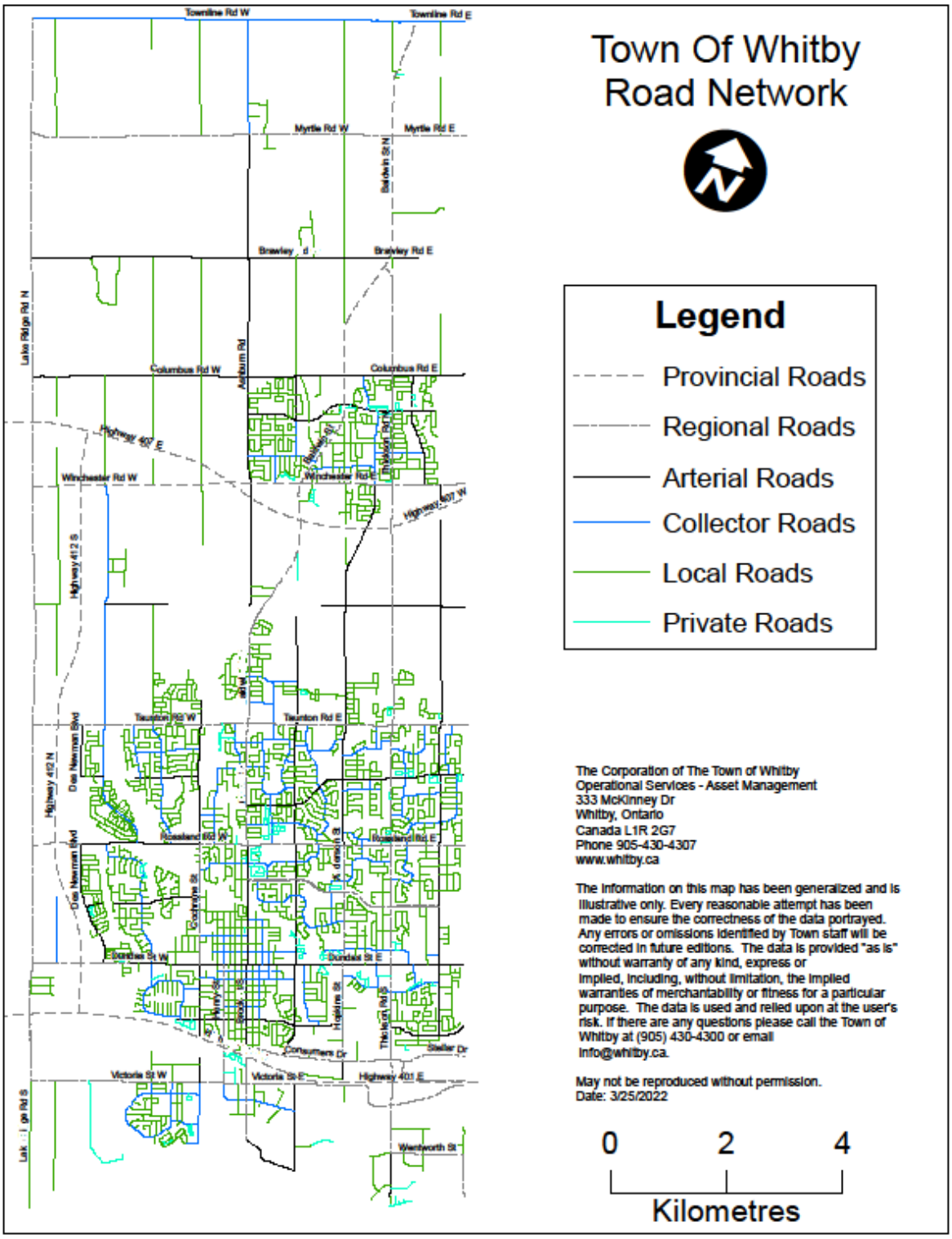


Figure 15 Scope and Connectivity of Town of Whitby Roads

Levels of Service - Road Conditions

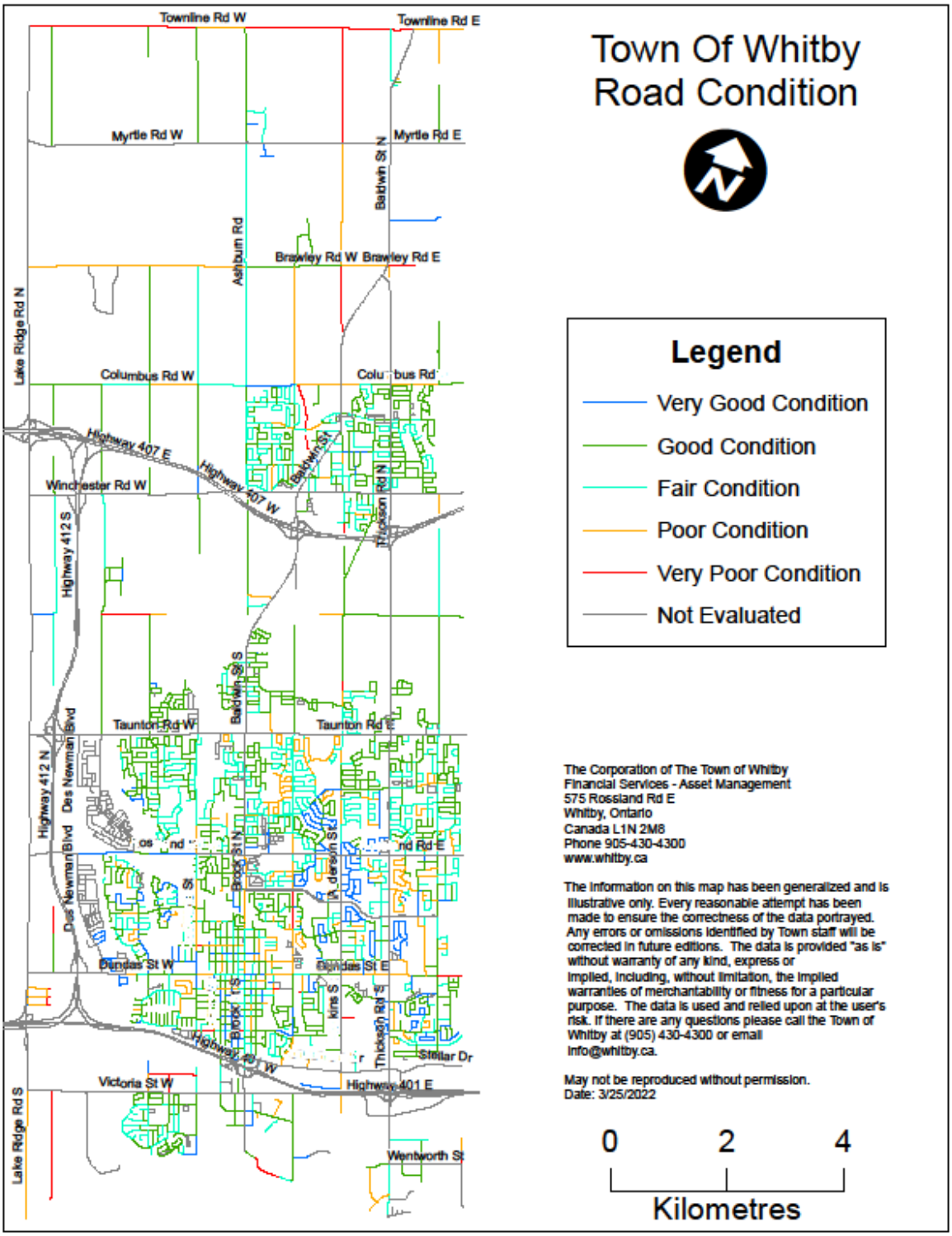


Figure 16 Conditions of Town Roads

Levels of Service - Road Surface Types

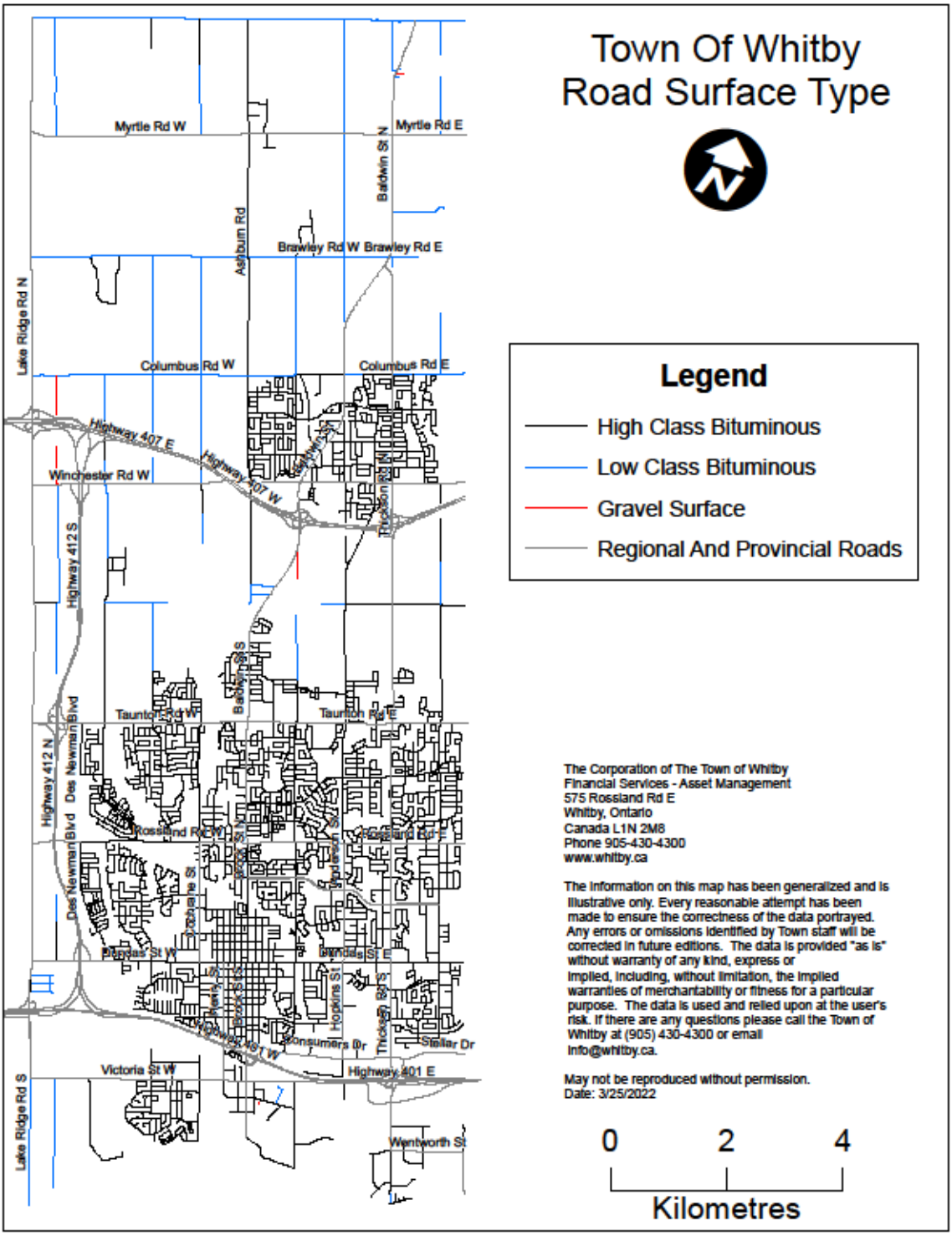


Figure 17 Surface Types of Town Roads

Levels of Service - Stormwater Management

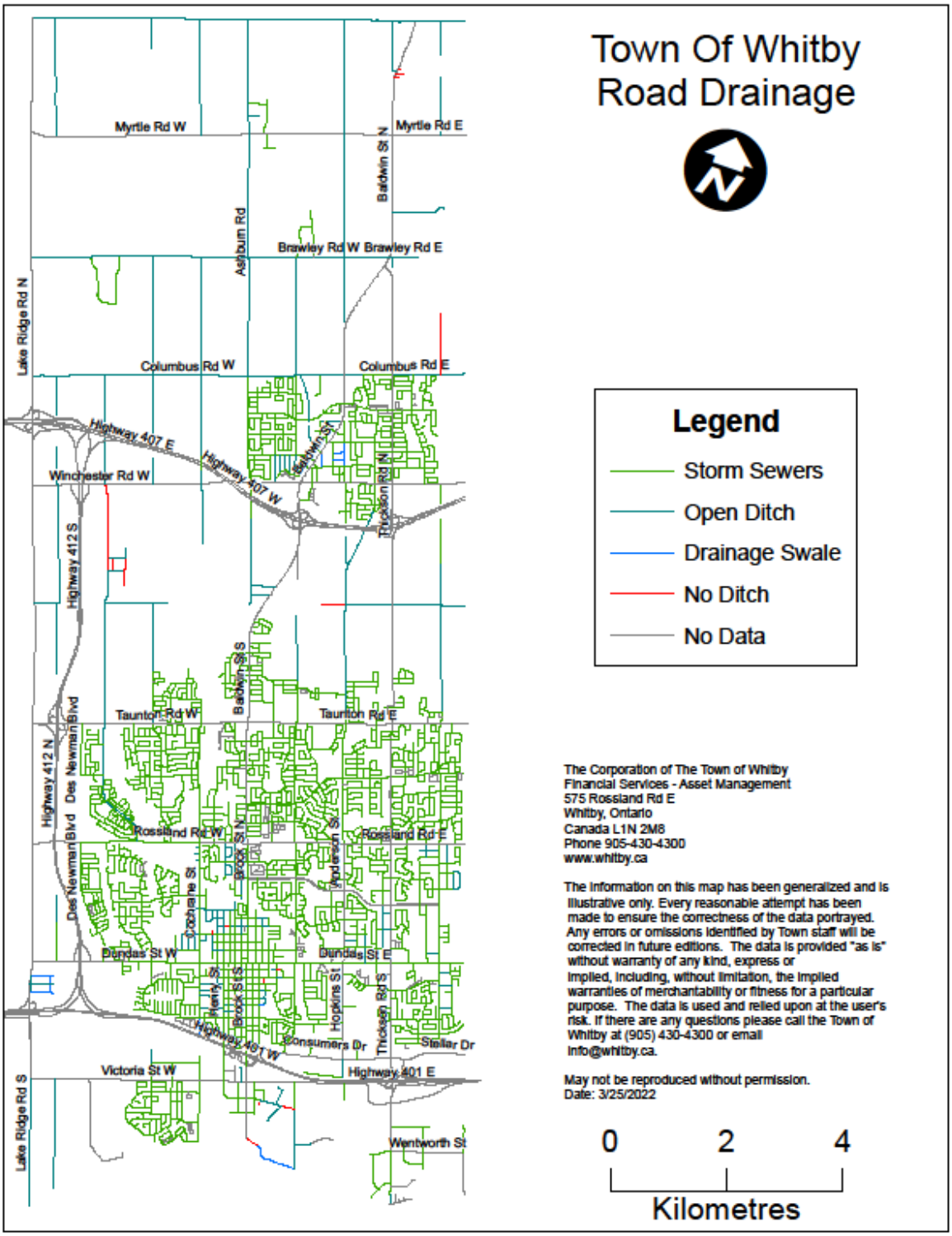


Figure 18 Extent of Stormwater Management on Town Roads