City of Kingston

2024 Asset Management Plan

Executive Summary and Introduction	**Volume 1 Infrastructure, Transportation, Transit, & Emergency Services**	Volume 2 Corporate Services & Parking Operations	Volume 3 Community Services	Volume 4 Parks, Parkland, & Trails	Volume 5 Police, Libraries, City Real Estate & Environment

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Appendices (Provided in Separate Document)

Acronyms

Acronym	Definition
AMP	Asset Management Plan
CPSE	Centre for Public Service Excellence
EUL	Expected Useful Life
FMCS	Facilities Management & Construction Services
IPS	Intersection Pedestrian Signal
IT	Information Technology
KTMP	Kingston Transportation Master Plan
LOS	Levels of Service
NFPA	National Fire Protection Association
SOLI	State of the Local Infrastructure

1.0 Overview

The asset management project includes 21 service areas, covering all assets owned by the City of Kingston (City) that are not already included in other Asset Management Plans (AMP). This is the first iteration of an AMP for these service areas. Given the extensive range of assets included in the project, the plan is presented in the following six documents:

- Executive Summary and Introduction
- Volume 1: Infrastructure, Transportation, Transit, & Emergency Services
- Volume 2: Corporate Services & Parking Operations
- Volume 3: Community Services
- Volume 4: Parks, Parkland, & Trails
- Volume 5: Police, Libraries, City Real Estate & Environment

Overview

The Introduction document presents key asset management principles and an overview of how each service area will be presented in its own chapter with the following sections: State of the Local Infrastructure (SOLI); Levels of Service (LOS); Risk Assessment; and Asset Management Strategy. The Introduction also includes a section on Growth and a Roadmap with Next Steps. The following sections are included in the Introduction document:

- Section 1.1 Asset Management
- Section 1.2 Scope of Assets
- Section 1.3 Alignment with Strategic Plan, Policy, and Regulation
- Section 1.4 Governance and Relationship to Other Planning Documents
- Section 1.5 Growth
- Section 1.6 Overview of the AMP
    - State of the Local Infrastructure
    - Levels of Service
    - Risk Assessment
    - Asset Management Strategy
- Section 1.7 Roadmap with Next Steps

1.1 Scope of Assets in Volume 1

The service areas included in **Volume 1: Infrastructure, Transportation, Transit, & Emergency Services** are: Transit; Traffic Control & Safety; Structures; Urban Forestry; Kingston Fire & Rescue; Solid Waste; and Airport Operations. See **Table 1-1** for the respective asset classes for each service area and the relevant chapter.

Table 1-1: Service Areas included in Infrastructure, Transportation, Transit, & Emergency Services

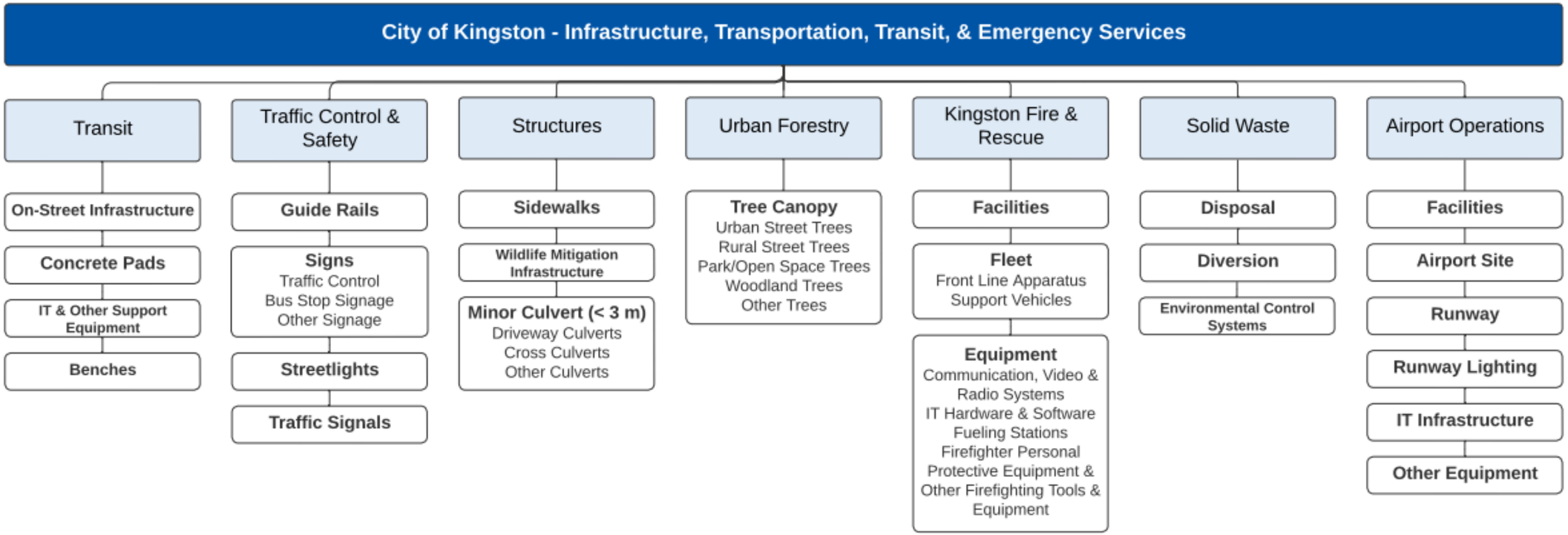
Service Area	Asset Classes	Report Chapter
Transit	• On-Street Infrastructure • Concrete Pads • IT & Other Support Equipment • Benches	Chapter 2.0
Traffic Control & Safety	• Guide Rails • Signs (Traffic Control, Bus Stop Signage, Other) • Streetlights • Traffic Signals	Chapter 3.0
Structures	• Sidewalks • Wildlife Mitigation Infrastructure • Minor Culverts, < 3 metre (m) (Driveway, Cross, Other)	Chapter 4.0
Urban Forestry	• Tree Canopy (Urban Street, Rural, Park/Open, Woodland, Other)	Chapter 5.0

Service Area	Asset Classes	Report Chapter
Kingston Fire & Rescue	• Facilities • Fleet (Front Line Apparatus, Support Vehicles) • Equipment (Communications, Radio, Video, Fuelling Stations, IT, Firefighter Personal Protective Equipment & Other Firefighting Tools & Equipment)	Chapter 6.0
Solid Waste	• Disposal • Diversion • Environmental Control Systems	Chapter 7.0
Airport Operations	• Facilities • Airport Site • Runway • Runway Lighting • IT Software • Other Equipment	Chapter 8.0

1.2 Asset Hierarchy

The asset hierarchy that was generated and used for the City's assets is shown in **Figure 1-1**. The asset group (level 1) is shown in the blue box, the seven service areas (level 2) are shown in the light blue boxes, the asset classes are shown in bold (level 3), and where applicable, the asset sub-classes are shown in regular text (level 4).

Figure 1-1: Asset Hierarchy for Infrastructure, Transportation, Transit, & Emergency Services



1.3 Asset Inventory and Replacement Costs

An asset inventory was generated for all assets included in this AMP using Microsoft Excel. The inventory organizes assets using the various levels of the asset hierarchy and acts as a central repository for the asset data that can be used to inform asset management planning. It is recommended that the City continually updates the asset information stored within the asset inventory to facilitate asset management planning based on reliable data.

Where replacement costs were provided, the values were inflated based on the Bank of Canada Consumer Price Index (CPI) to estimate the replacement cost in 2023 dollars. If replacement costs were not provided, Dillon leveraged a unit cost model to assign replacement costs based on unit cost estimated for 2023. It is recommended that unit prices should be reviewed annually by the City based on costs observed from local suppliers and contractors.

1.4 Establishing Levels of Service

There were four LOS workshops that were held with staff. The service categories for this volume were covered in Workshop 1 and 2.

- Workshop 1 was held on November 7, 2023, and included the stakeholders for Transit, Traffic Control & Safety, Urban Forestry and Solid Waste service areas.
- Workshop 2 was held on November 10, 2023, and included the stakeholders for Police, Information Systems & Technology and Parking Equipment, Lots, and Structures service areas.

There were City staff from each service area that attended the workshop. The list of attendees is summarized in **Table 1-2**.

Table 1-2: Workshop Attendees - Infrastructure, Transportation, Transit, & Emergency Services

Service	Name	Role
Corporate Asset Management and Fleet Services	Brent Fowler	Director, Corporate Asset Management and Fleet
Corporate Asset Management and Fleet Services	Mike Montgomery	Systems and Technology Support Specialist
Transit	Ian Semple	Director, Transportation and Transit
Transit	Andrew Morton	Transit Service Project Manager
Traffic Control and Safety	Mark Dickson	Manager, Transportation Infrastructure
Traffic Control and Safety	Joel Melburn	Project Manager, Transportation
Structures/Urban Forestry/Solid Waste	Karen Santucci	Director, Public Works and Solid Waste
Structures/Urban Forestry/Solid Waste	Troy Stubinski	Manager, Operations, Public Works Services
Structures	Adam McDonald	Operations Manager
Structures	Luke Follwell	Director, Engineering
Structures	John Piraino	Asset Management Coordinator/Cartegraph Administrator

Service	Name	Role
Urban Forestry	Marty Mayberry	Supervisor, Foresty
Kingston Fire & Rescue	Monique Belair	Fire Chief and Director of Kingston Fire & Rescue
Kingston Fire & Rescue	Kevin Donaldson	Deputy Fire Chief, Kingston Fire & Rescue
Kingston Fire & Rescue	Don Carter	Deputy Chief of Operations and Training
Kingston Fire & Rescue	Tara Perry	Administrative Assistant Fire and Rescue
Kingston Fire & Rescue	Brandi Timpson	Manager, Administration and Emergency Preparedness
Kingston Fire & Rescue /IS&T	Wayne Rice	Manager, Distributed Computing Services
Solid Waste	Jason Hollett	Manager, Solid Waste Operations
Solid Waste	Adam Mueller	Supervisor, Solid Waste Operations
Airport Operations	Craig Desjardins	Director, Strategy, Innovation & Partnerships
Airport Operations	Aron Winterstein	Airport Manager
Facilities Management and Construction Services	Dan Korneluk	Manager, Energy & Asset Management

1.5 Growth Related Impacts on Lifecycle of Assets

As the City continues to expand, there are impacts to existing service levels and assets based on these future needs. The growth-related assumptions and potential impact on the lifecycle of the assets is shown in **Table 1-3**.

Table 1-3: Growth Related Impacts on Lifecycle of Assets

Service Category	Growth Impact Assumptions	How Assumptions Relate to Lifecycle of Assets
Transit	• Increase in service demands due to increased operating hours, or capacity covering greater distances • Increases to internal capacity (staffing) required to maintain equipment	• Potential increase in capital expenditures for the purchase of additional assets to meet service needs • Potential increase in operational costs to maintain fleet assets
Traffic Control and Safety	• Increase in service demands to operation or capacity of the services • Higher risk of cyberattacks due to increased number of assets required to provide service	• Potential increase in capital expenditures for facility services and maintenance • Potential increased operational costs due to increase in collection and network size
Structures	• Increase in service demands due to increased operating hours, or capacity covering greater distances • Increased development will occur as a result of continued growth	• Potential increase in capital expenditures for the purchase of additional assets to meet service needs

Service Category	Growth Impact Assumptions	How Assumptions Relate to Lifecycle of Assets
		• Potential increase in operational costs due to an increase in the overall asset portfolio
Urban Forestry	• Increase in service demands in operations and maintenance due to increased assets (canopy cover)	• Potential increase in capital expenditures for services and maintenance
Kingston Fire & Rescue	• Increase in service demands-requiring increased operation or capacity at greater distances • Increases to internal capacity (staffing) required to maintain equipment	• Potential increase in capital expenditures for the purchase of additional assets to meet service and facilities services needs • Potential increase in operational costs to maintain fleet assets
Airport Operations	• Increase in service demands-requiring increased operation or capacity at greater distances	• Potential increase in capital expenditures for the purchase of additional assets to meet service and facilities services needs

2.0 Transit

The City of Kingston provides scheduled transit service throughout the urban area of the City, and under contract into neighbouring Amherstview in Loyalist Township. Operated as Kingston Transit, the transit network connects residents and visitors to destinations across the City, be it for work, school, or recreation. Over 270,000 revenue hours are operated on scheduled service with a fleet of transit buses. The specialized transit operation is managed through Kingston Access Bus, a separate agency, on behalf of the City. The operation and maintenance of a variety of transit assets, in addition to the fleet of buses, is managed by the City. The following section of the AMP includes assets that are under the Transit service, excluding the fleet of transit buses and non-revenue vehicles which have been inventoried under Corporate Fleet Service which is included in Volume 2 of the AMP.

Note on Scope: At the time of preparing this AMP no data was available for concrete pads and benches associated with transit shelters and transit stations, or assets associated with transit locations administered through service agreements between the City and third-party property owners including a park and ride location and bus terminals at the Cataraqui Centre and the Kingston Centre. As a result, those assets are not included in this AMP. It is recommended that the City further develops an inventory of these assets to be considered in subsequent iterations of the AMP.

2.1 State of the Local Infrastructure

2.1.1 Asset Inventory and Valuation

For inventory purposes, Transit assets have been summarized into asset classes and further divided into applicable asset types. **Table 2-1** summarizes the asset inventory for Transit services by asset class, asset type, asset count, total replacement cost (in 2023 dollars). The total replacement cost (2023 dollars) is estimated at **$7.9 million** for the **756 assets** included in the inventory.

Table 2-1: Inventory Summary by Asset Type - Transit

Asset Class	Asset Type	Asset Count	Total Replacement Cost (2023)
On-Street Infrastructure	Transit Shelters	241	$2,830,120
On-Street Infrastructure	Transit Stations	2	$539,500
Information Technology (IT) & Other Support Equipment	Transit Equipment	513	$4,539,900
Overall	**Not Applicable (N/A)**	**756**	**$7,909,520**

2.1.2 Asset Age Summary

Table 2-2 summarizes the average age, average condition, expected useful life (EUL), and the average remaining useful life of assets pertaining to Transit services. The overall average age of Transit assets is five years, and the average remaining useful life is 10 years.

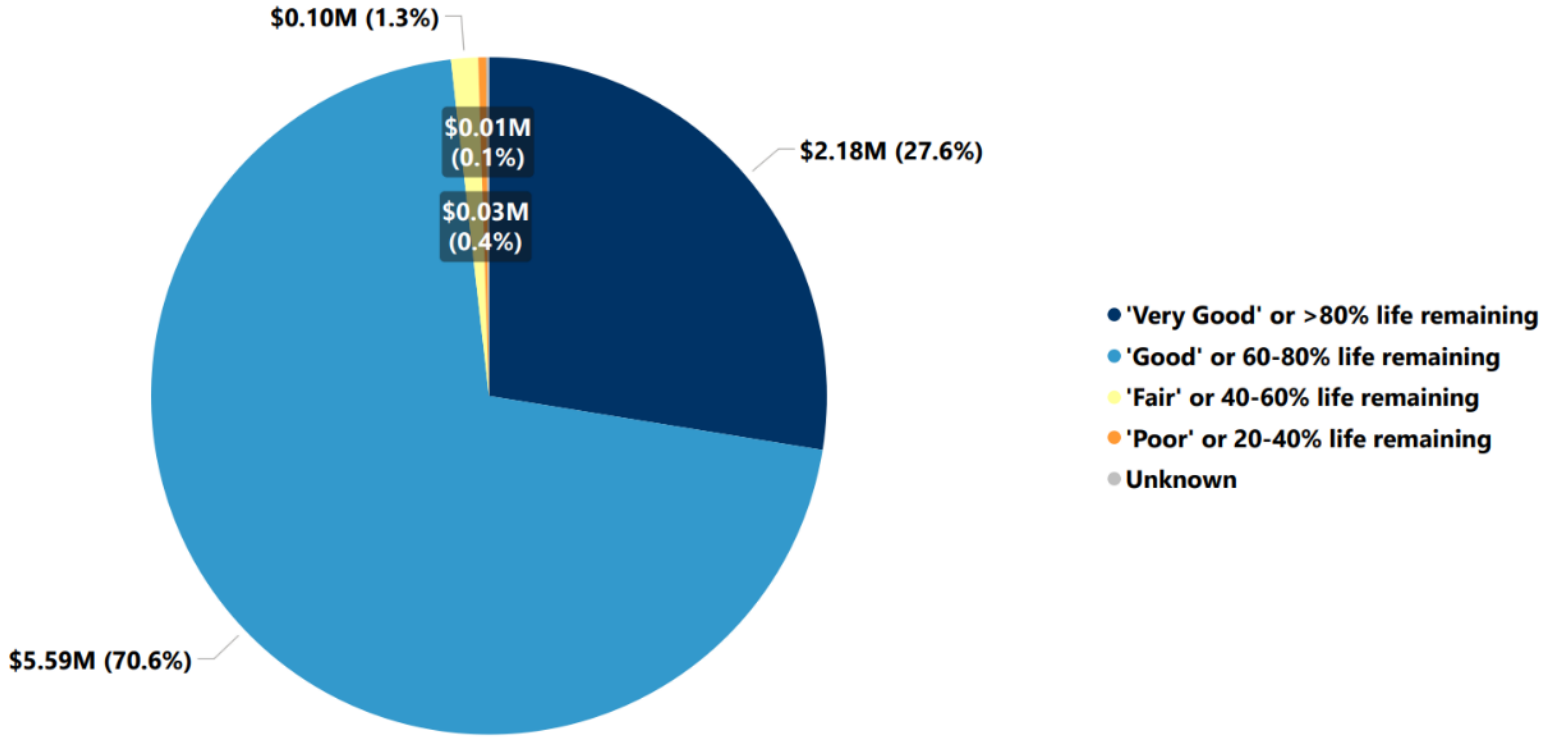
Table 2-2: Average Age, Average Condition, Expected Useful Life, and Average Remaining Useful Life – Transit

Asset Class	Asset Type	Average Age (Years)	Average Condition Grade	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
On-Street Infrastructure	Transit Shelters	10	Good	25	17
On-Street Infrastructure	Transit Stations	1	Very Good	25	22
IT & Other Support Equipment	Transit Equipment	3	Good	10	7
Overall	**N/A**	**5**	**Good**	**10 to 25**	**10**

2.1.3 Asset Condition

An overall condition summary for Transit assets by replacement cost (in 2023 dollars) is shown in **Figure 2-1**. About 99.5% of the assets are in very good to fair condition, with 0.4% of the assets with unknown condition.

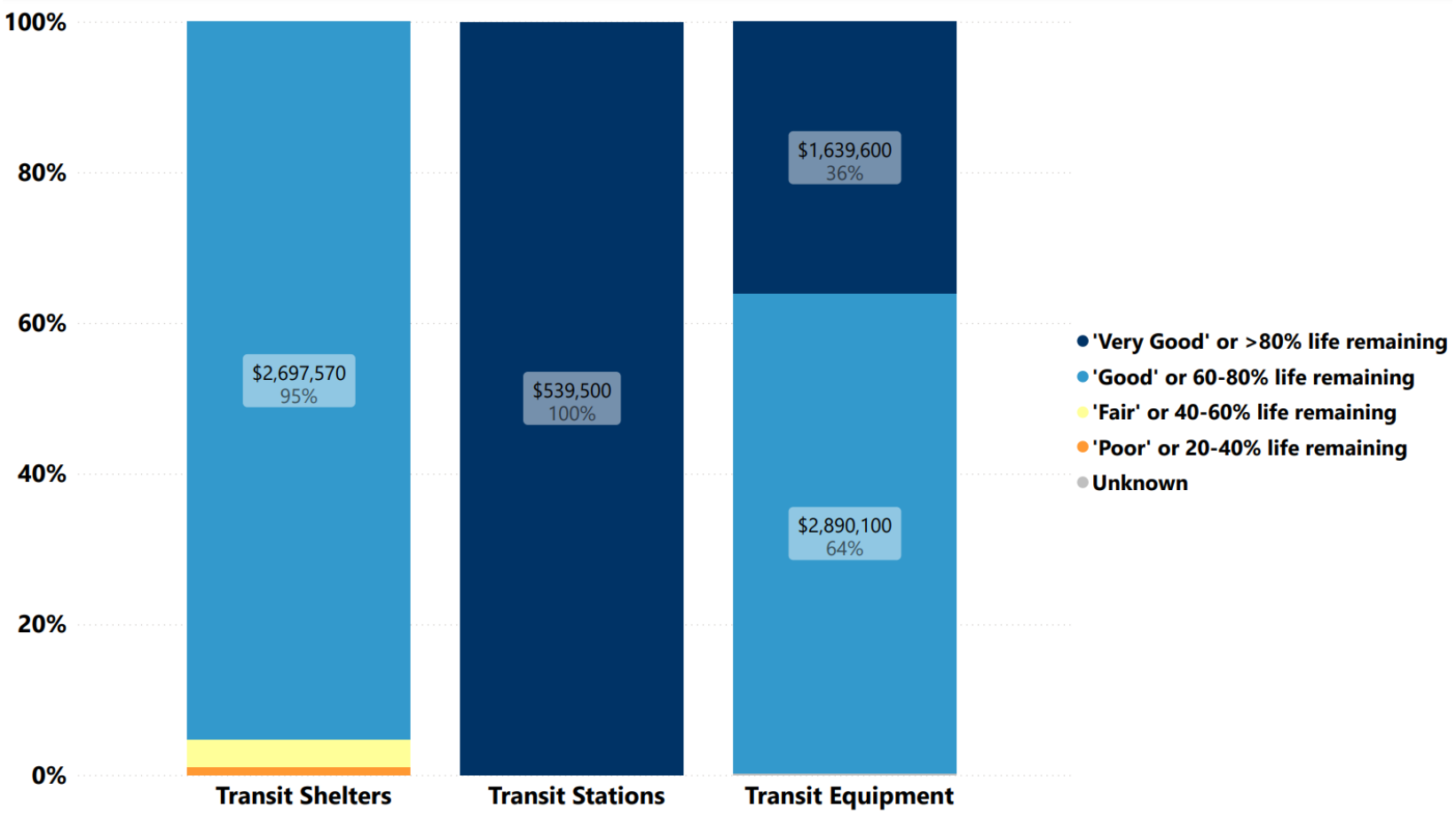
Figure 2-1: Condition Summary by 2023 Replacement Cost - Transit



Transit

A condition summary is provided in **Figure 2-2** by asset class and replacement cost (in 2023 dollars). Condition data for On-Street Infrastructure is maintained by City staff within an Excel-based inventory sheet. In the absence of condition assessment data, the condition of IT & Other Support Equipment has been primarily determined based on age and EUL.

Figure 2-2: Condition Summary by Asset Type and 2023 Replacement Cost - Transit (On-Street Infrastructure and IT & Other Support Equipment)



2.1.4 Data Sources and Confidence

The asset data for Transit assets is maintained by the City between two main data repositories. The transit equipment data is maintained by the City in a Enterprise-wide fleet and equipment asset and work order management application from AssetWorks Inc. called FleetFocus (also known as M5) and the transit shelter data is stored in a Microsoft Excel-based inventory spreadsheet. The City has staff who regularly update the inventory data for Transit assets hosted within FleetFocus and the spreadsheet. This suggests that the data source can be assumed to be reliable.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 2-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

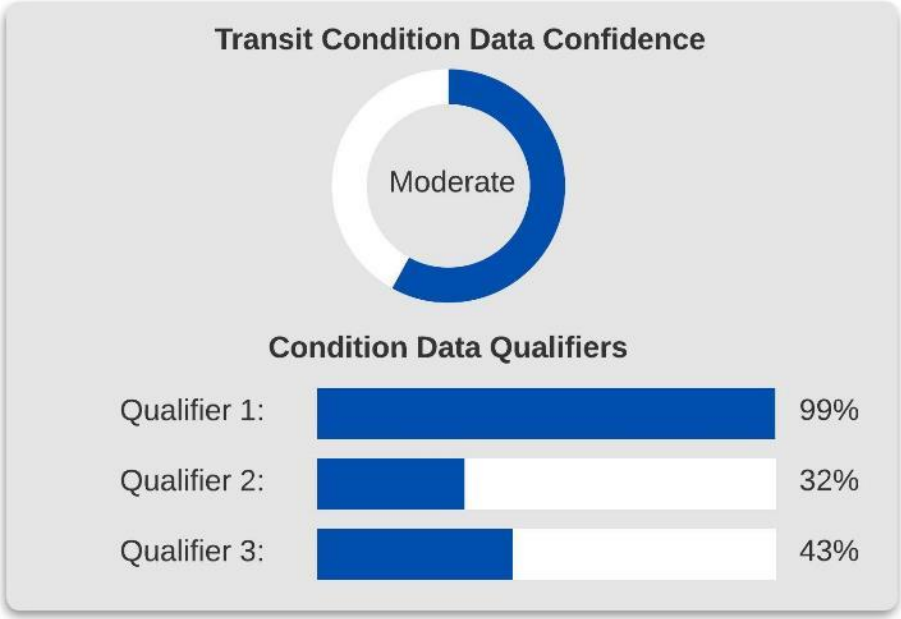
Table 2-3: Data Confidence Scale

Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data source is reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (99%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (32%); and,
- **Qualifier 3**: The percentage of the estimated overall replacement value, in 2023 dollars, attributed to assets in the asset inventory with documented condition assessment data (i.e., condition is not solely age-based) (43%).

Figure 2-3: SOLI Report Data Confidence - Transit



As summarized in **Figure 2-3**, the overall asset condition data confidence for Transit assets is estimated as Moderate. Presently, condition assessment data is available for all On-Street Infrastructure which significantly increases the overall condition data confidence for Transit assets. For IT & Other Support Equipment, no condition assessment data was available. However, all installation years for IT & Other Support Equipment are documented allowing for age-based condition to be evaluated.

2.2 Levels of Service

In 2015, the City developed the Kingston Transportation Master Plan (KTMP) which aimed at providing a long-term direction for the development of the transportation networks and supporting policies, programs, and service. The KTMP included active transportation, public transit, transportation demand management, transportation systems management, and the City's Road network. Additionally, Kingston generated a draft Active Transportation Master Plan (ATMP) in 2018.

For public transit, a key objective was to increase transit mode share and decrease single-occupancy vehicle (SOV) use. The target for the transit mode share is 15% by 2034. To achieve this target, it was recommended that transit service be expanded and investments in infrastructure and technology be accelerated to improve access and comfort.

In June 2024, an updated presentation to Council outlined Options for Transit Improvements which included planned Transit Stop, Terminals and updated Station Guidelines to outline and inform infrastructure requirements, including new and future customer amenity requirements. A new Kingston Transit Service Strategy is currently being developed for implementation in 2027 based on the following service principles; Accessible, Frequent, Available, and Reliable.

As the master plan provides a long-term vision for the system, the City has developed community and technical Levels of Service (LOS), for their existing assets within the network. These LOS were developed based on contributions from the municipal staff and in the review of the 2015 KTMP. **Table 2-4** and **Table 2-5** outline the City's current community and technical LOS for Transit.

Transit

Table 2-4: Community LOS - Transit

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Accessibility	Compliance with Ontario Regulation (O. Reg.) 191/11, s. 78 for accessible transit stops.	Percent of transit stops that are accessible	65%
Accessibility	Compliance with O. Reg. 191/11, s. 78 for accessible shelters.	Percent of transit shelters that are accessible	To be included in the 2025 AMP
Accessibility	Compliance with O. Reg. 191/11, s. 51 and 52 for pre-boarding and on-board announcements.	Percent availability of pre-boarding and on-board announcements.	100%
Availability	All transit stops will be connected to the pedestrian network.	Percent of transit stops connected to the pedestrian network	To be included in the 2025 AMP

Transit

Table 2-5: Technical LOS - Transit

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Quality	Transit Hard Surfacing without heaving or cracking.	Percentage of assets that are in poor or better condition.	100%
Quality	Transit shelters in good structural condition	Percentage of assets that are in poor or better condition.	100%
Quality	Transit stations in good structural condition	Percentage of assets that are in poor or better condition.	100%

2.3 Risk Assessment

The risk ratings for Transit assets included On-Street Infrastructure and IT & Other Support Equipment. The risk scores were calculated using the risk methodology and approach outlined in the Introduction document. **Table 2-6** summarizes the risk factors for the Transit assets.

Transit

Table 2-6: Risk Factors - Transit

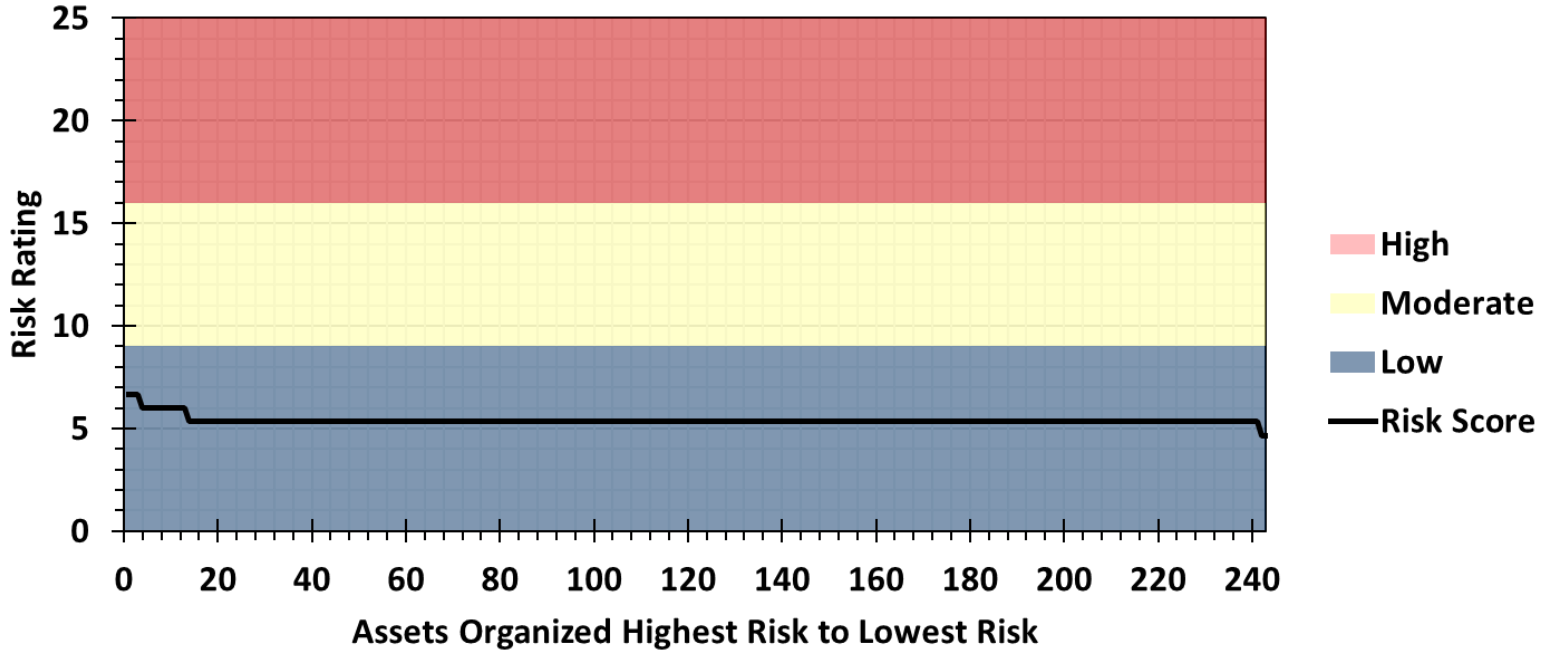
Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.
B - Performance	The performance of the On-Street Infrastructure assets was identified as being “always reliable” and assigned a rating of 1 for calculating risk score. IT & Other Support Equipment assets was assigned a rating of 3 for calculating risk score and deemed as “usually reliable”.
C - Climate Change	The climate change ratings were determined at the asset class level by identifying climate change hazard interactions. The On-Street Infrastructure assets were identified as a “high” risk and assigned a rating of 5 for calculating the risk score. IT & Other Support Equipment assets were identified as a “low” risk and assigned a rating of 1 for calculating the risk score.
D - Impact	The impact of the On-Street Infrastructure and IT & Other Support Equipment assets was identified as "low" impact and assigned a rating of 0 for calculating risk score.
E - Importance	A “moderate” importance rating was applied to On-Street Infrastructure and IT & Other Support Equipment assets and a rating of 2 was assigned for calculating risk score.

The individual risk ratings were used in calculating the risk score for each of the assets.

2.3.1 Risk Profile

The Risk profile of the On-Street Infrastructure assets is displayed in **Figure 2-4**. All of the 243 On-Street Infrastructure tracked within the asset inventory are classified as Low risk.

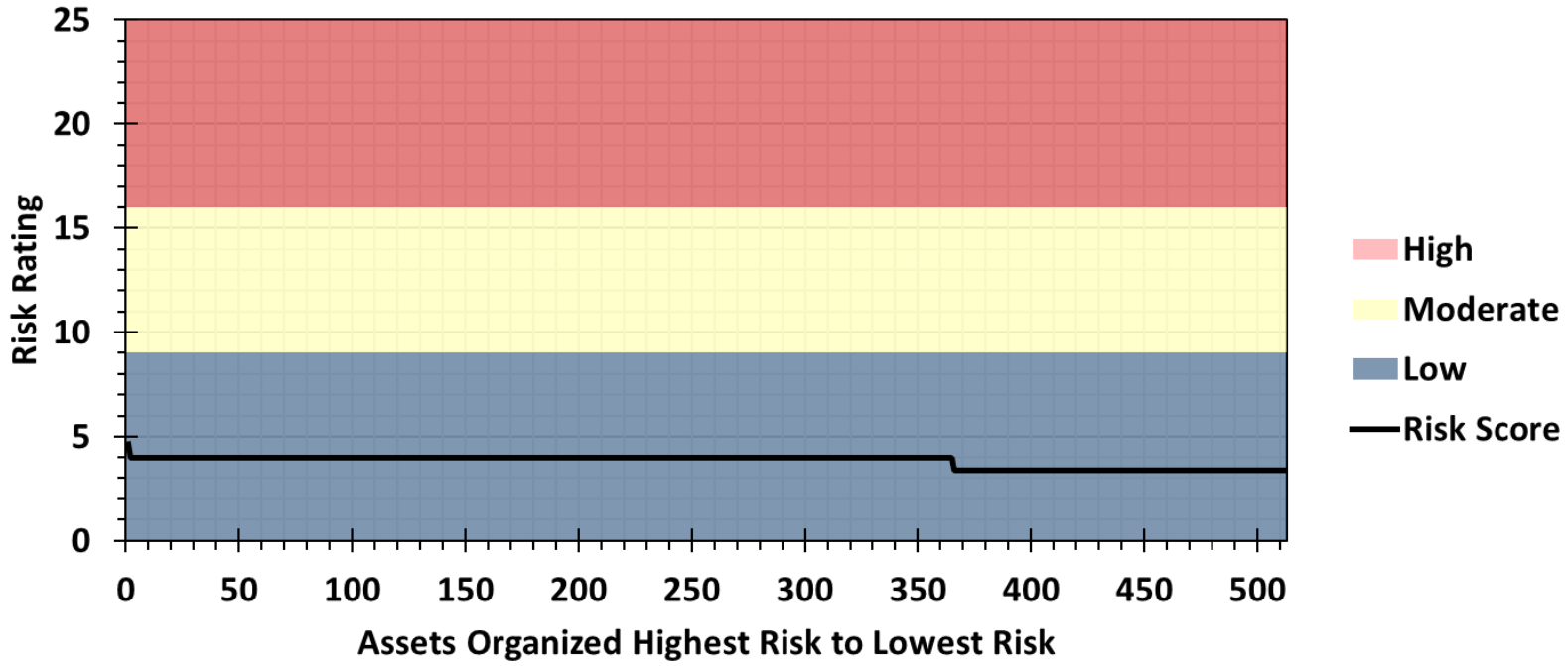
Figure 2-4: Risk Profile - Transit (On-Street Infrastructure)



The Risk profile of the IT & Other Support Equipment assets is displayed in **Figure 2-5**. All 513 assets tracked in the asset inventory are considered as Low risk.

Transit

Figure 2-5: Risk Profile – Transit (IT & Other Support Equipment)



2.4 Asset Management Strategy

2.4.1 Lifecycle Activities - Transit

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.

- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.
- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 2-7 describes the lifecycle activities that can be implemented within the asset management strategy for Transit assets. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in January 2024.

Table 2-7: Lifecycle Activities - Transit

Lifecycle Activity Type	Description of Activity	Frequency / Timing
Non-Infrastructure Solutions	Zero Emission Electric Bus Feasibility Study.	Based on service provider's needs
Non-Infrastructure Solutions	Annual Service Plan, 5-Year Service Strategy and 10-year Outlook	Every 5 years
Non-Infrastructure Solutions	Multi-year plan for asset growth and replacement	As needed
Maintenance Activities	Preventative maintenance of transit shelters and stations	Bi-annually
Maintenance Activities	Replacement of shelters due to significant damage/collisions.	As needed

Transit

Lifecycle Activity Type	Description of Activity	Frequency / Timing
Maintenance Activities	Condition assessment of transit stops, shelters, and stations.	Annually
Renewal / Rehabilitation Activities	Replace equipment and benches.	Equipment: As identified by periodic servicing Shelters/Benches: As needed
Replacement / Construction Activities	Replacement at end of service life, incorporate modernization where feasible, disposal of previous asset.	As needed
Expansion / Growth / Service Improvement Activities	Watson Development Charges Background Study	Currently in development
Expansion / Growth / Service Improvement Activities	Campus Planning, Facility & Space Needs Review	Currently in development
Expansion / Growth / Service Improvement Activities	Annual Service Plan, Transit Stop, Terminals and Station Guidelines, 5-Year Service Strategy, and 10-Year Outlook	Based on service provider's needs

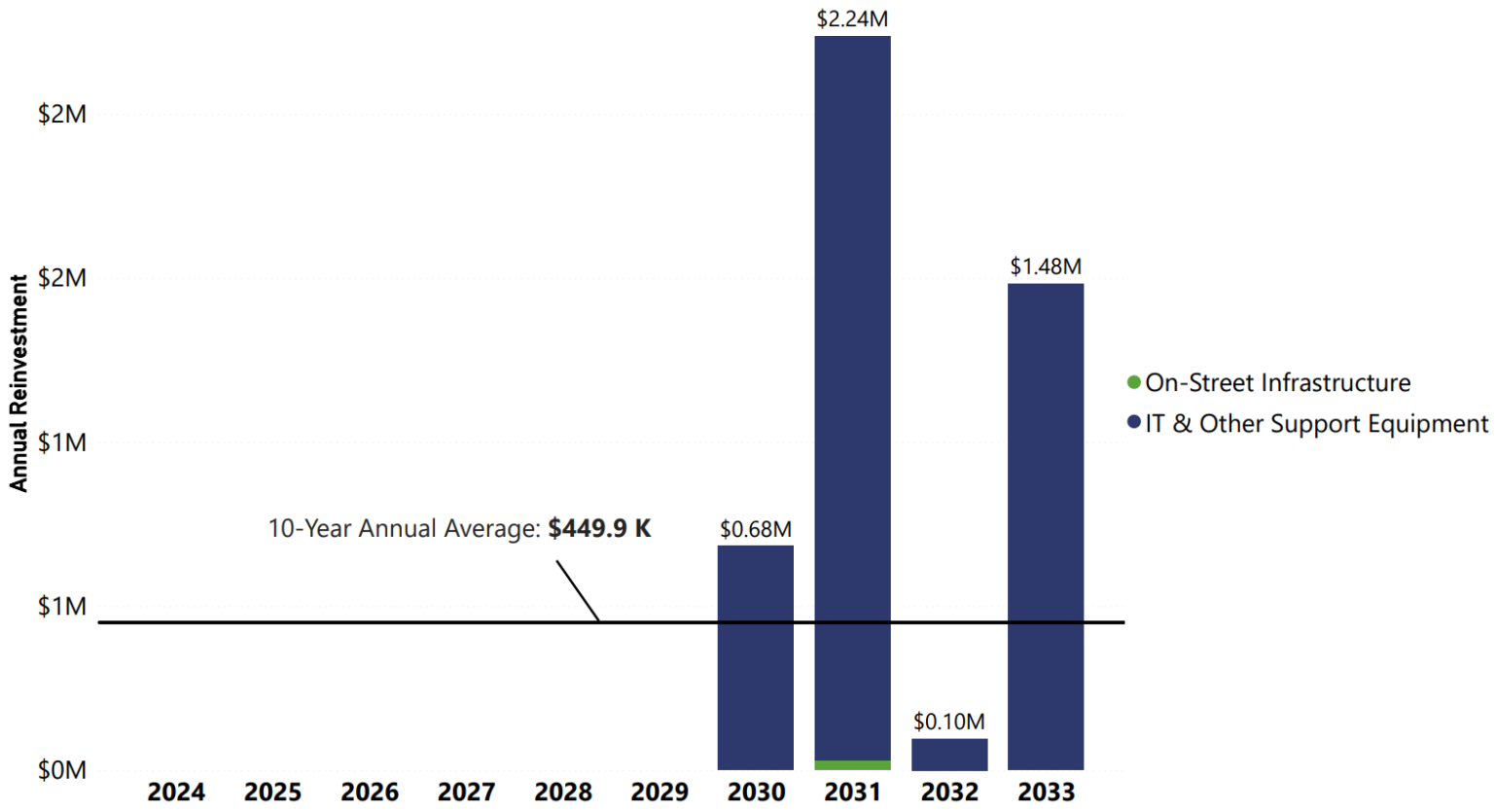
2.4.2 Funding the Lifecycle Activities - Transit

Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, Expected Useful Life (EUL), replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of time. Asset replacement forecasts within this subsection estimate the required reinvestment for Transit assets over the next 10 years based on available asset inventory data.

There is a total of approximately **$4.5 million** to be reinvested into the Transit assets owned by the City in the next 10 years, **excluding** reinvestment associated with transit buses, the transit facility and maintenance garage. This translates to a 10-year annual average of approximately **$449.9 thousand**, as presented in **Figure 2-6**. For details regarding transit buses and facilities, refer to the Corporate Fleet section in Volume 2 of this AMP and the Facilities 2023 Corporate AMP.

Transit

Figure 2-6: 10-Year Capital Reinvestment Needs - Transit



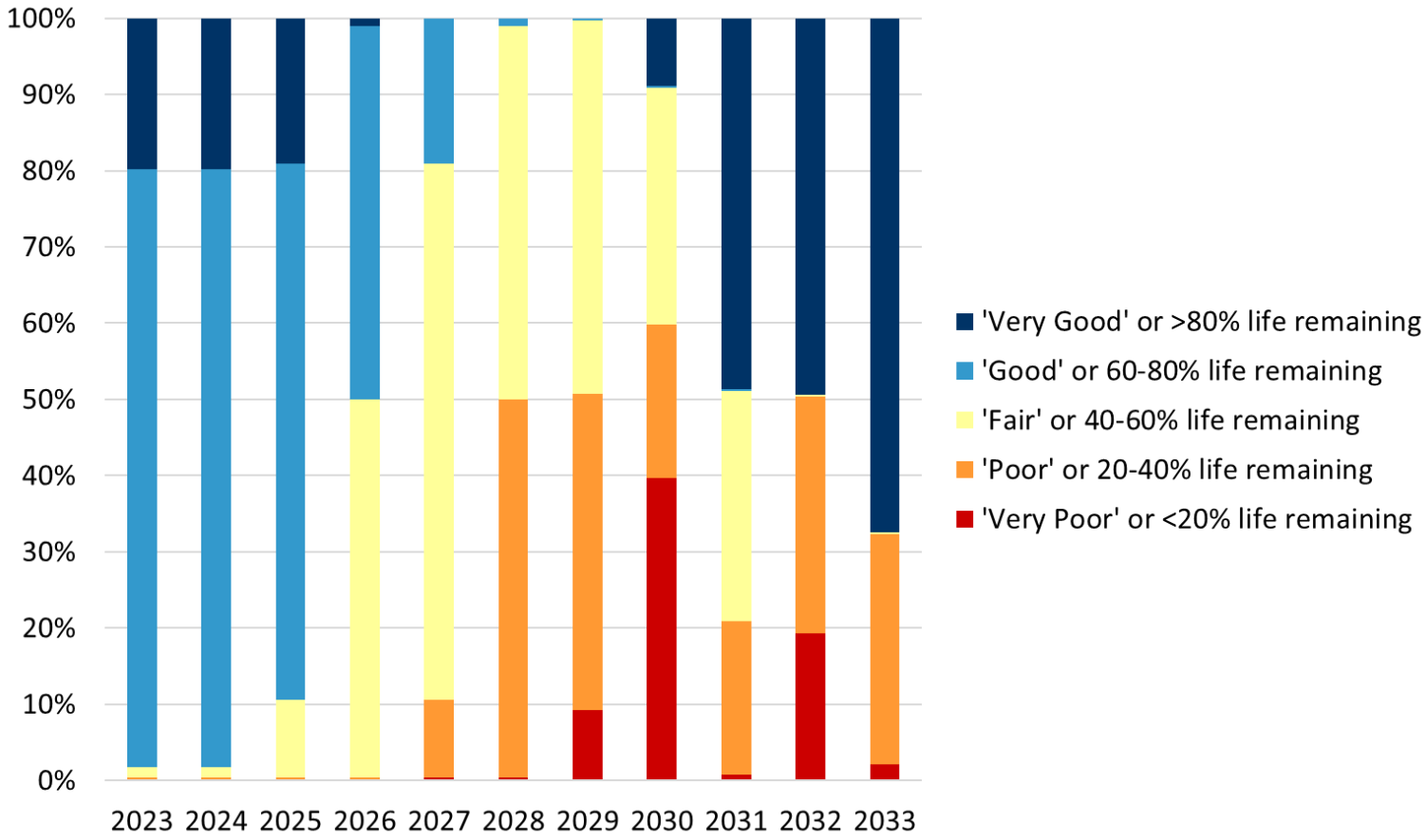
Transit

The distribution of reinvestment needs for IT and Other Equipment is skewed due to the significant 2021 and 2023 investments made in driver protection systems (barriers), upgraded fareboxes and the Quantum wheelchair restraint systems. It is important to note that forecasting in this lifecycle model relies heavily on age and EUL to determine renewal or replacement needs and that tracking of condition data for Transit assets by the City will assist at refining forecasted expenditures in the decades to come. The LOS includes maintaining the current assets in poor or better condition (100%). From the lifecycle model, the percentage of Transit assets in poor or better condition fluctuates throughout the next 10-years due to the EUL of the assets. Based on the EUL and age of the Transit assets, the forecasted portion of Transit assets in poor or better condition remains at 100% until 2027, eventually finishing at 98% in 2033.

Figure 2-7 shows an overview of the condition of Transit over the next 10 years based on the lifecycle model.

Transit

Figure 2-7: Condition Overview by Year Based on Lifecycle Model - Transit



3.0 Traffic Control & Safety

The City places significant emphasis on traffic control and safety, doing its utmost to ensure all roads, pedestrian pathways, and cycle lanes are safe and well-maintained for both residents and visitors. Traffic control initiatives include a robust system of traffic signals, signage, road markings, roundabouts, and traffic calming measures, all aimed to allow for smooth and efficient flow of traffic. The City is committed to enhancing pedestrian and cyclist safety, with features like designated bicycle lanes, pedestrian crossovers, and crosswalk signals. In providing the Traffic Control & Safety service, the City manages a wide range of assets including Guide Rails, Signs, Streetlights, and Traffic Signals. The following section of the AMP includes assets that are under the Traffic Control & Safety service areas.

3.1 State of the Local Infrastructure

3.1.1 Asset Inventory and Valuation

For inventory purposes, Traffic Control & Safety assets have been summarized into asset classes and further divided into applicable asset types. **Table 3-1** summarizes the asset inventory for Traffic Control & Safety by asset class, asset type, asset count, total replacement cost (in 2023 dollars). The 335 Guide Rails recorded in the asset inventory have a total length of 25.3 kilometres (km). The total replacement cost (2023 dollars) is estimated at **$119.4 million** for the **43,946 assets** included in the inventory.

Table 3-1: Inventory Summary by Asset Type - Traffic Control & Safety

Asset Class	Asset Type	Count	Total Replacement Cost (2023)
Guide Rails	Guide Rail	335	$2,301,650
Signs	Traffic Sign	18,256	$11,866,400
Streetlights	Street Lighting – Lights	14,888	$7,444,000
Streetlights	Street Lighting – Pole – Concrete	5,914	$59,140,000
Streetlights	Street Lighting – Pole – Other	2,401	$16,807,000
Streetlights	Traffic Signal – Pole – Concrete	287	$2,870,000
Streetlights	Traffic Signal – Pole – Other	1,337	$9,359,000
Traffic Signals	Traffic Signal – Cabinet	192	$4,876,800
Traffic Signals	Traffic Signal – Controller	195	$819,000
Traffic Signals	Traffic Signal – Intersection Pedestrain Signal (IPS)	12	$3,300,000
Traffic Signals	Traffic Signal – Opticom/Video/Vehicle Detection	129	$645,000

Asset Class	Asset Type	Count	Total Replacement Cost (2023)
Overall	**N/A**	**43,946**	**$119,428,850**

3.1.2 Asset Age Summary

Table 3-2 summarizes the average age, average condition, expected useful life, and the average remaining useful life of assets pertaining to Traffic Control & Safety. The overall average age of Traffic Control & Safety assets is 21 years, and the average remaining useful life is seven years.

Table 3-2: Average Age, Average Condition, Expected Useful Life, and Average Remaining Useful Life - Traffic Control & Safety

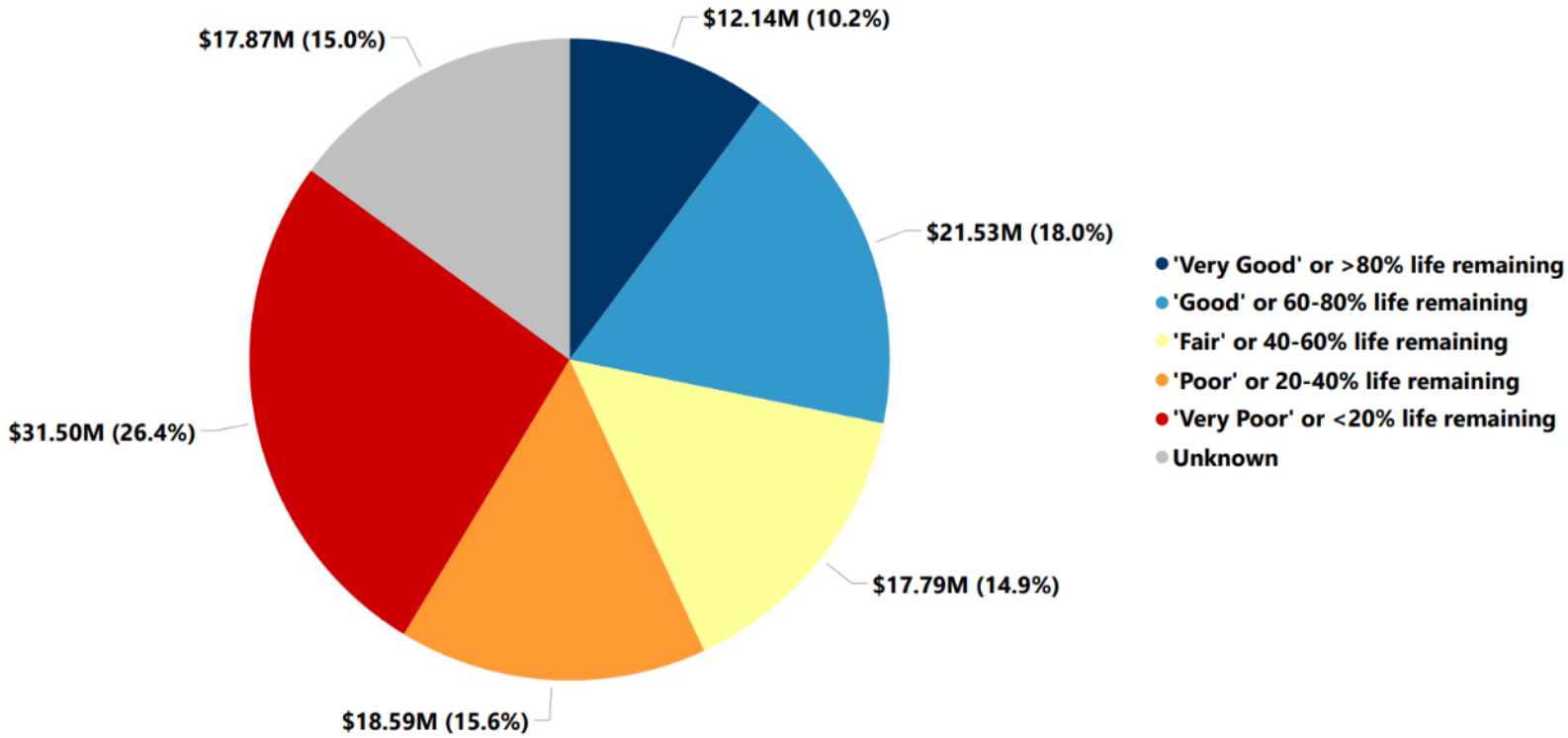
Asset Class	Asset Type	Average Age (Years)	Average Condition Grade	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Guide Rails	Guide Rail	93	Poor	30	8
Signs	Traffic Sign	7	Fair	10	5
Streetlights	Street Lighting – Lights	15	Very Poor	12	1
Streetlights	Street Lighting – Pole – Concrete	32	Fair	50	19
Streetlights	Street Lighting – Pole – Other	19	Fair	35	18
Streetlights	Traffic Signal – Pole – Concrete	45	Poor	50	11
Streetlights	Traffic Signal – Pole – Other	17	Fair	35	21

Asset Class	Asset Type	Average Age (Years)	Average Condition Grade	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Traffic Signals	Traffic Signal – Cabinet	17	Fair	35	18
Traffic Signals	Traffic Signal – Controller	14	Poor	15	4
Traffic Signals	Traffic Signal – IPS	6	Good	15	9
Traffic Signals	Traffic Signal – Opticom/Video/Vehicle Detection	18	Poor	20	4
Overall	**N/A**	**21**	**Poor**	**12 to 50**	**7**

3.1.3 Asset Condition

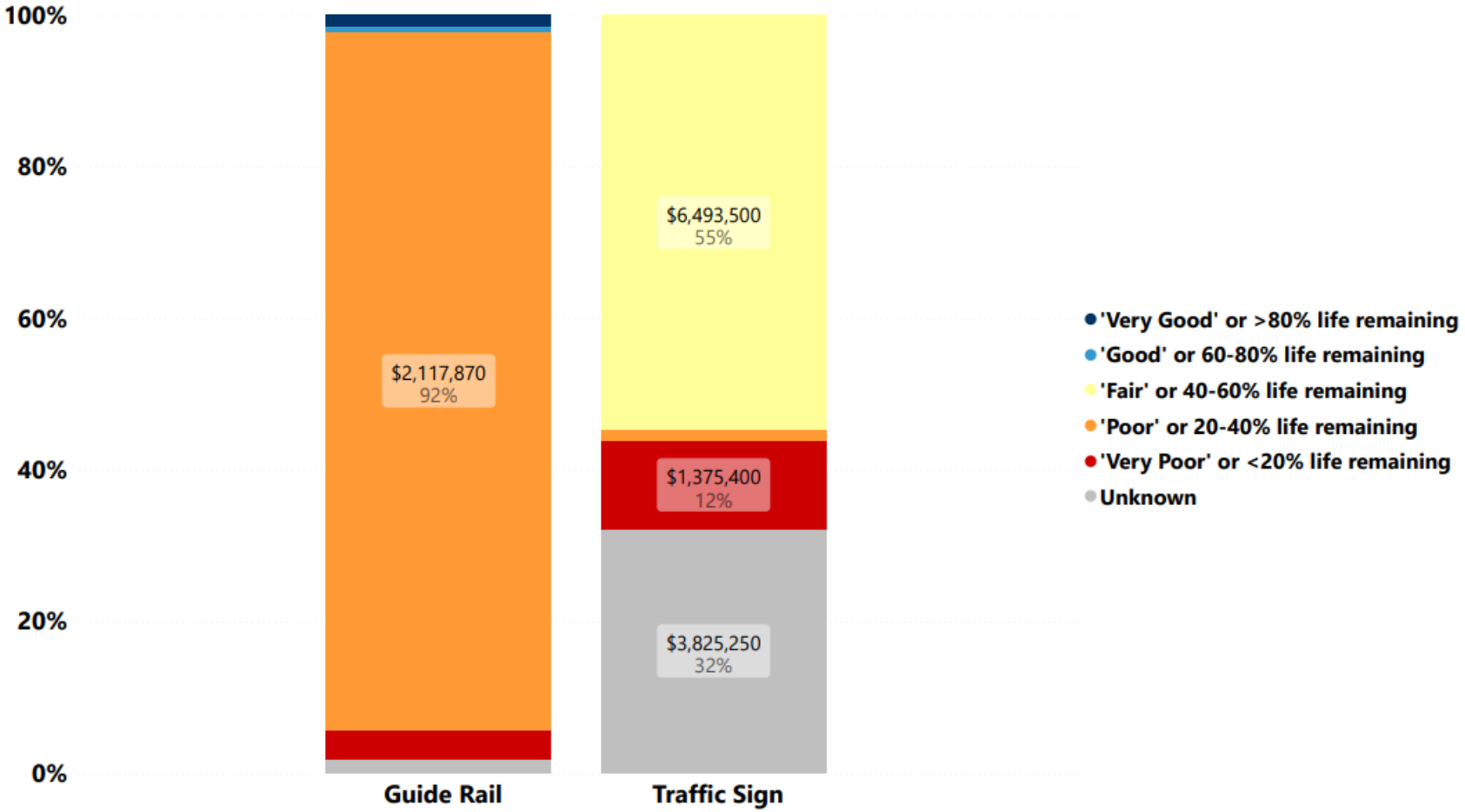
An overall condition summary for Traffic Control & Safety assets by replacement cost (in 2023 dollars) is shown in **Figure 3-1**. About 43.1% of the assets are in very good to fair condition, with 15% of the assets with unknown condition.

Figure 3-1: Condition Summary by 2023 Replacement Cost - Traffic Control & Safety



A condition summary for Guide Rails and Sign assets is provided in **Figure 3-2** by asset type and replacement cost (in 2023 dollars). Condition has been determined utilizing a combination of available asset condition data and age-based condition methods.

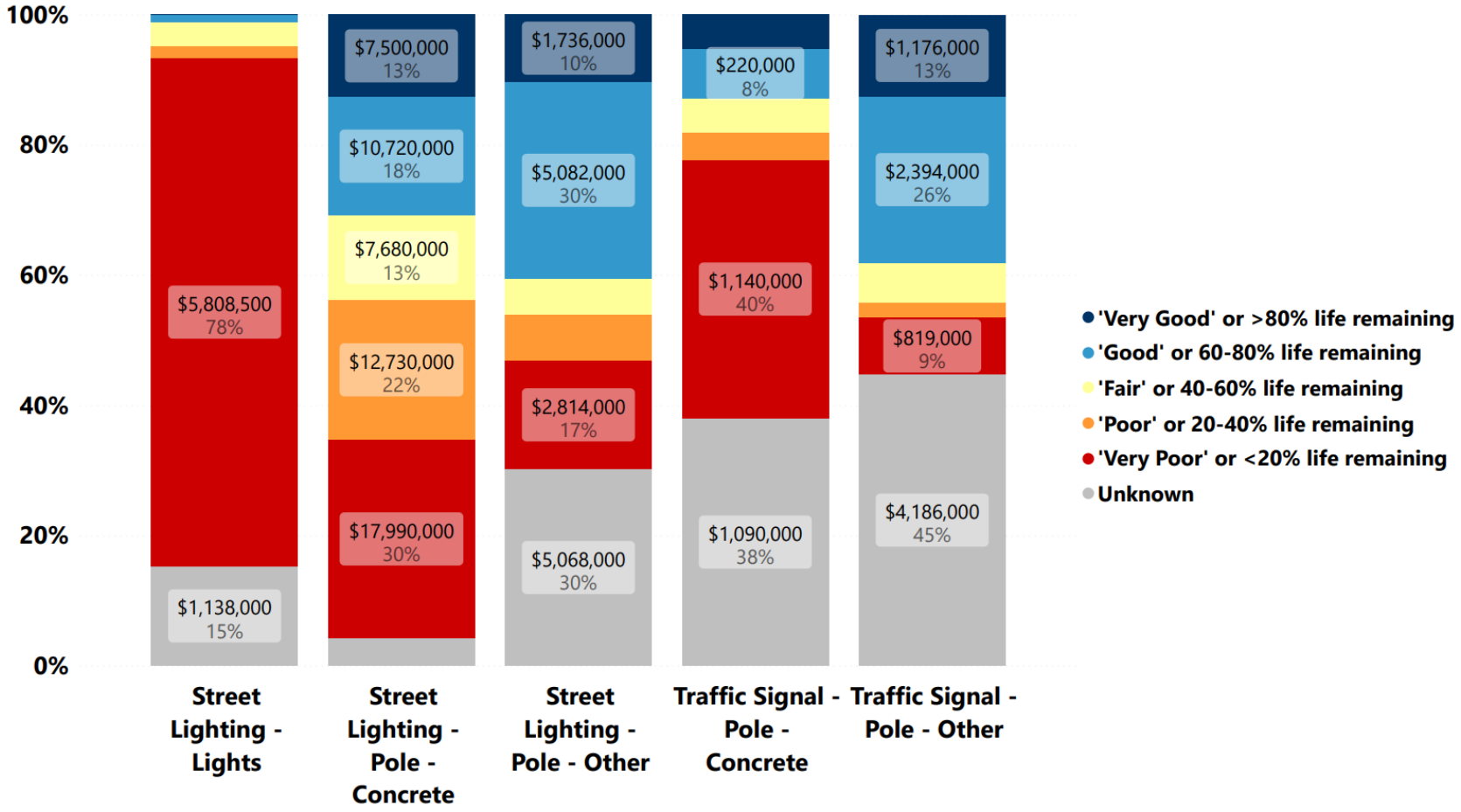
Figure 3-2: Condition Summary by Asset Type and 2023 Replacement Cost - Traffic Control & Safety (Guide Rails and Signs)



Traffic Control & Safety

A condition summary for Streetlights assets is provided in **Figure 3-3** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of Streetlight assets has been primarily determined based on age and expected useful life.

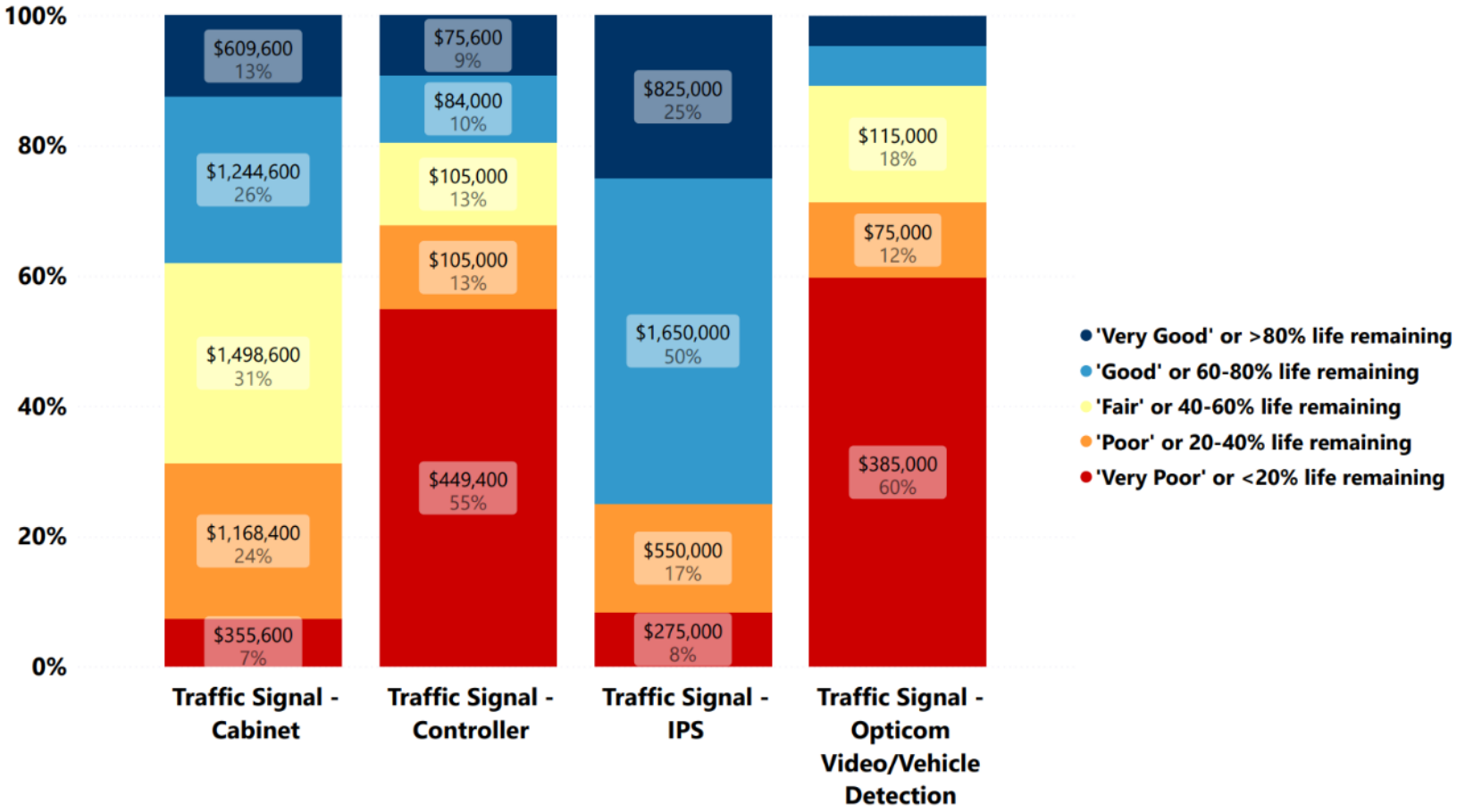
Figure 3-3: Condition Summary by Asset Type and 2023 Replacement Cost - Traffic Control & Safety (Streetlights)



Traffic Control & Safety

A condition summary for Traffic Signal assets is provided in **Figure 3-4** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of Traffic Signal assets has been primarily determined based on age and expected useful life.

Figure 3-4: Condition Summary by Asset Type and 2023 Replacement Cost - Traffic Control & Safety (Traffic Signals)



3.1.4 Data Sources and Confidence

The asset data for Traffic Control & Safety assets is maintained by the City between two main data repositories. Data for Guide Rails, Traffic Signs, and Streetlights is maintained in a Geographic Information System (GIS)-based repository and data for Traffic Signals is currently stored in a Microsoft Excel-based inventory spreadsheet with a plan to transition to GIS and Cartegraph in the next year. The City has staff who regularly update the inventory data for Traffic Control & Safety assets hosted within the GIS-based repository and Excel-based inventory sheet. This suggests that the data source can be assumed to be reliable.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 3-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

Table 3-3: Data Confidence Scale

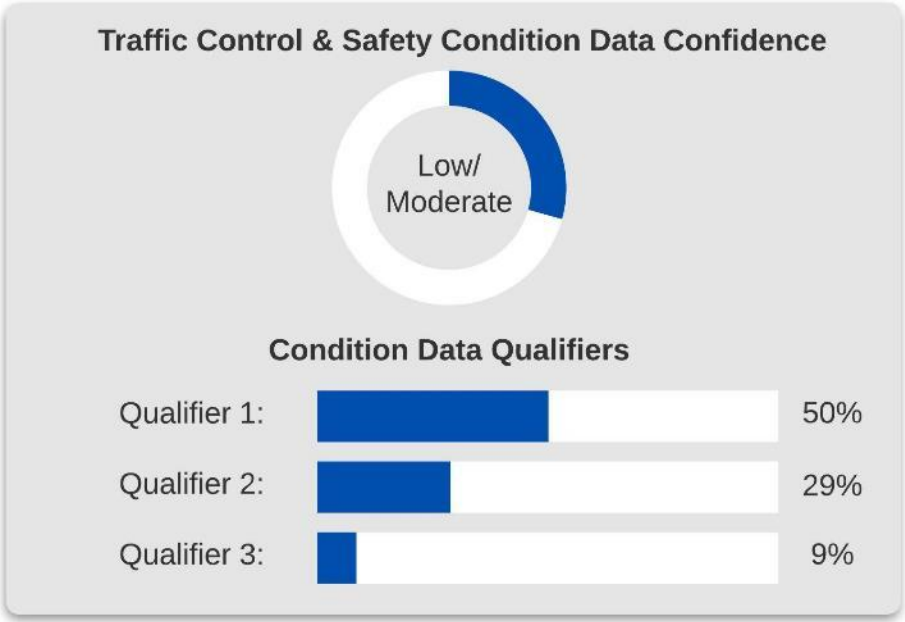
Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data sources are reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (50%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (29%); and,

- **Qualifier 3**: The percentage of the estimated overall replacement value, in 2023 dollars, attributed to assets in the asset inventory with documented condition assessment data (i.e., condition is not solely age-based) (9%).

Figure 3-5: SOLI Report Data Confidence – Traffic Control & Safety



As summarized in **Figure 3-5**, the overall asset condition data confidence for Traffic Control & Safety assets is estimated as Low/Moderate. Presently, condition assessment data is available for most guiderails and traffic signs, but none of the other asset classes. Additionally, the installation years are only known for 50% of the asset inventory which represents a significant data gap. Data confidence can be increased by improving the quality of the data and/or filling data gaps.

3.2 Levels of Service

The City has developed the community and technical Levels of Service (LOS), based on contributions from the municipal staff. It was decided that Safety and Quality were key attributes in gauging the performance of the assets. **Table 3-4** and **Table 3-5** outline the City's current community and technical levels of service for Traffic Control & Safety.

Table 3-4: Community LOS - Traffic Control & Safety

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Safety	Provide a traffic network that is safe for all end-users (drivers, pedestrians, and cyclists).	Number of non-scheduled service issues per year (including weather related)	374

Table 3-5: Technical LOS - Traffic Control & Safety

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Quality	Assets are kept in good working condition.	Percentage of assets that are in poor or better condition.	52%

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Safety	Providing an operational road network that is safe for drivers, pedestrians and cyclists and meets legislative requirements.	Percentage of regulated Signs that meet retro reflectivity targets.	97.58%

3.3 Risk Assessment

The risk ratings for physical Traffic Control & Safety assets included Guide Rails, Signs, Streetlights, and Traffic Signals. The risk scores were calculated using the risk methodology and approach outlined in Section 1.4 of the Introduction. **Table 3-6** summarizes the risk factors for the Traffic Control & Safety assets.

Table 3-6: Risk Factors - Traffic Control & Safety

Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.
B - Performance	The performance of Signs and Streetlights assets are both assigned a rating of 1, representing that the assets are “always reliable”. The performance of the Guide Rail and Traffic Signal assets was identified as "usually reliable" and assigned a rating of 3 for calculating risk score.

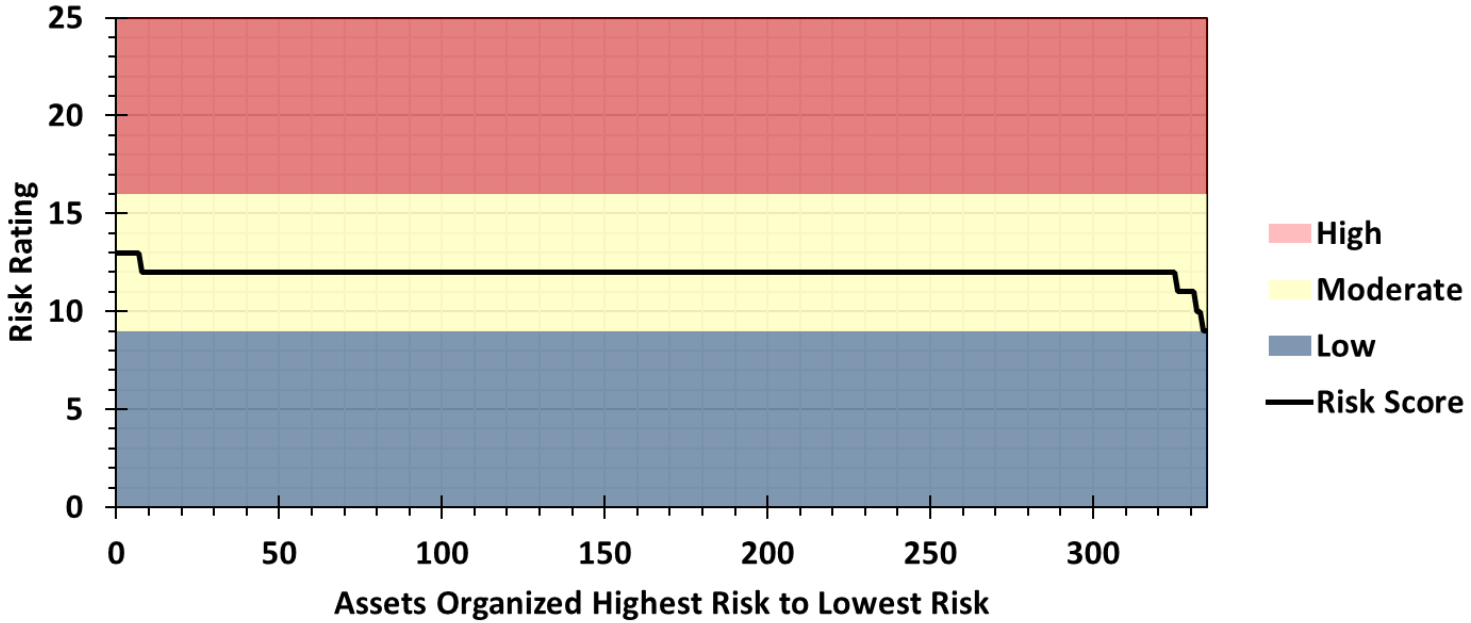
Factors	Risk Ratings
C - Climate Change	The climate change ratings were determined at the asset class level by identifying climate change hazard interactions. The Signs and Streetlights assets were identified as a “low” risk and assigned a rating of 1 for calculating the risk score. The Guide Rails and Traffic Signals were identified as a “high” risk and assigned a rating of 5 for calculating the risk score.
D - Impact	The impact of all asset classes was identified as "moderate" impact and assigned a rating of 1 for calculating risk score.
E - Importance	The Guide Rails, Signs, and Streetlights asset classes was identified as “moderate” importance and assigned a rating of 2 when calculating risk. A “high” importance rating was applied to the Traffic Signal assets and a rating of 3 was assigned for calculating risk score.

The individual risk ratings were used in calculating the risk score for each of the assets.

3.3.1 Risk Profile

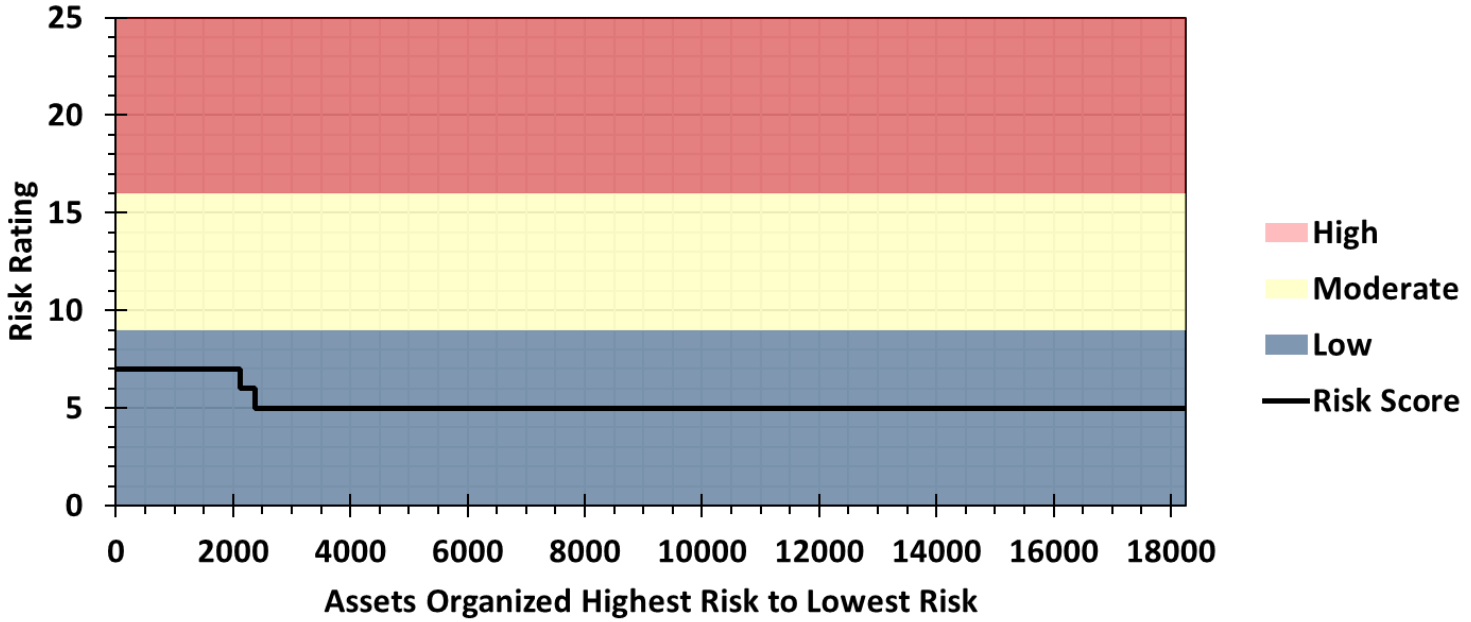
The Risk profile of the Guide Rail assets is displayed in **Figure 3-6**. Of the 335 Guide Rail assets tracked in the asset inventory, approximately 99.5% (333) are considered as Moderate risk and the remaining 0.5% (2) assets are Low risk.

Figure 3-6: Risk Profile - Traffic Control & Safety (Guide Rails)



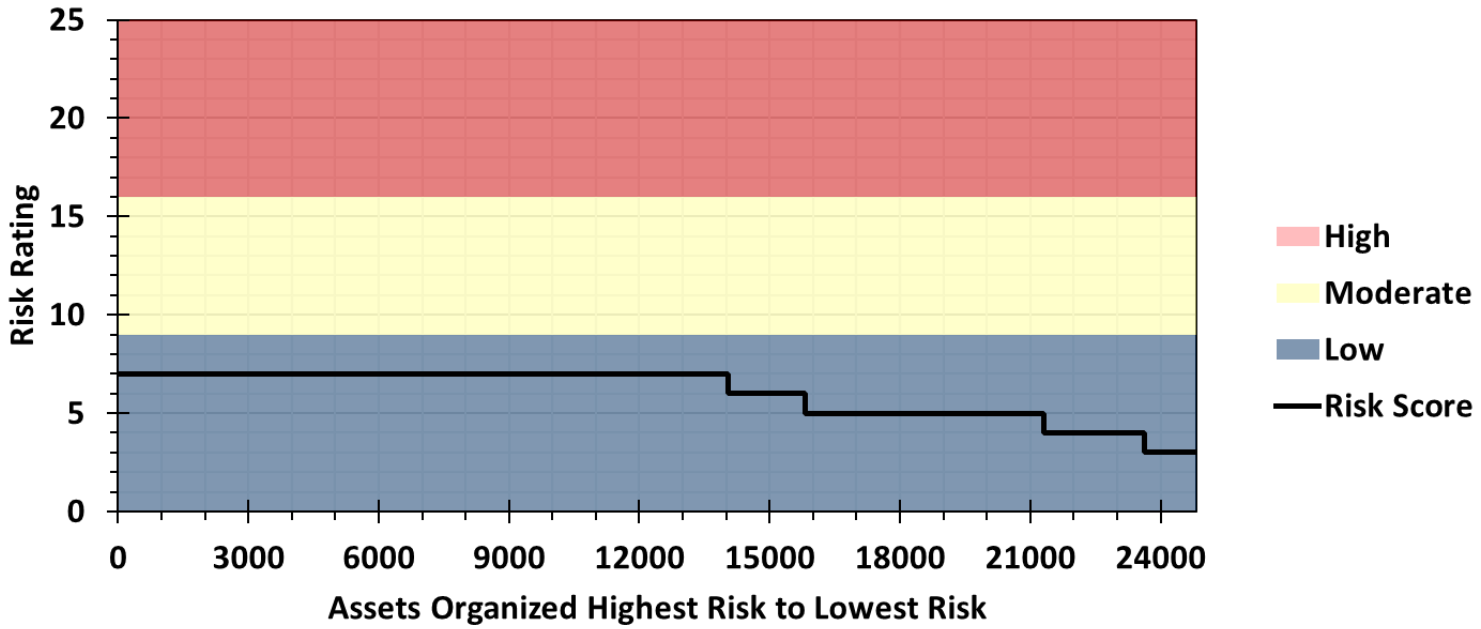
The Risk profile for Traffic Signs assets is displayed in **Figure 3-7**. All 18,256 Sign assets tracked in the asset inventory are considered as Low risk.

Figure 3-7: Risk Profile - Traffic Control & Safety (Signs)



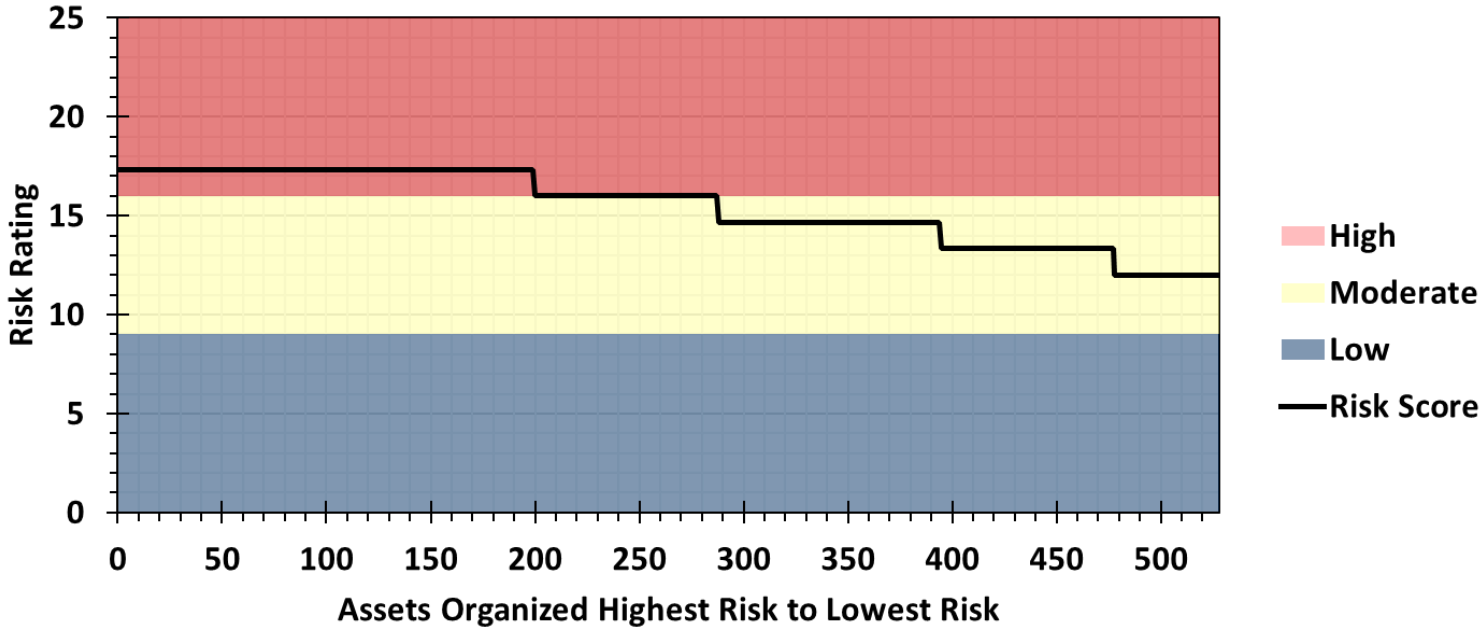
The Risk profile for Streetlight assets is displayed in **Figure 3-8**. All 24,827 Streetlight assets tracked in the asset inventory are considered as Low risk.

Figure 3-8: Risk Profile - Traffic Control & Safety (Streetlights)



The Risk profile for Traffic Signal assets is displayed in **Figure 3-9**. Of the 528 Traffic Signal assets tracked within the asset inventory, about 37.7% (199) are classified as High risk and the remaining 62.3% (329) are Moderate risk.

Figure 3-9: Risk Profile - Traffic Control & Safety (Traffic Signals)



3.4 Asset Management Strategy

3.4.1 Lifecycle Activities – Traffic Control & Safety

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.
- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.

- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 3-7 describes the lifecycle activities that can be implemented within the asset management strategy for Traffic Control & Safety assets. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in January 2024.

Table 3-7: Lifecycle Activities – Traffic Control & Safety

Lifecycle Type	Description of Activity	Frequency / Timing
Non-Infrastructure Solutions	Sign contracts for pricing and warranty of products.	Ongoing
Non-Infrastructure Solutions	General policy to reduce inventory variety to streamline maintenance.	Ongoing
Non-Infrastructure Solutions	Tying replacements and repairs to other capital projects to optimize investments.	Ongoing
Maintenance Activities	Regular Guide Rail inspections and rehabilitation.	Bi-annually
Maintenance Activities	Regular Sign inventory and reflectivity inspections.	Annually

Lifecycle Type	Description of Activity	Frequency / Timing
Maintenance Activities	Reuse parts from failed/replaced equipment, if possible.	As needed
Maintenance Activities	Regular scheduled inspection of traffic signal cabinets.	Annually
Maintenance Activities	Regular repair of poles and signals as needed due to collisions, extreme weather, or complaints.	Ongoing
Renewal / Rehabilitation Activities	Replacement of specific components as required.	As needed
Replacement / Construction Activities	Replace Streetlights when damaged, utility relocation or part of reconstruction.	As needed
Replacement / Construction Activities	Replacement of streetlight poles/lights at end of EUL	End of EUL
Replacement / Construction Activities	Full reconstruction of Traffic Signals at end of EUL	End of EUL
Disposal Activities	Recover costs with metal recycling (i.e., copper wire).	End of EUL

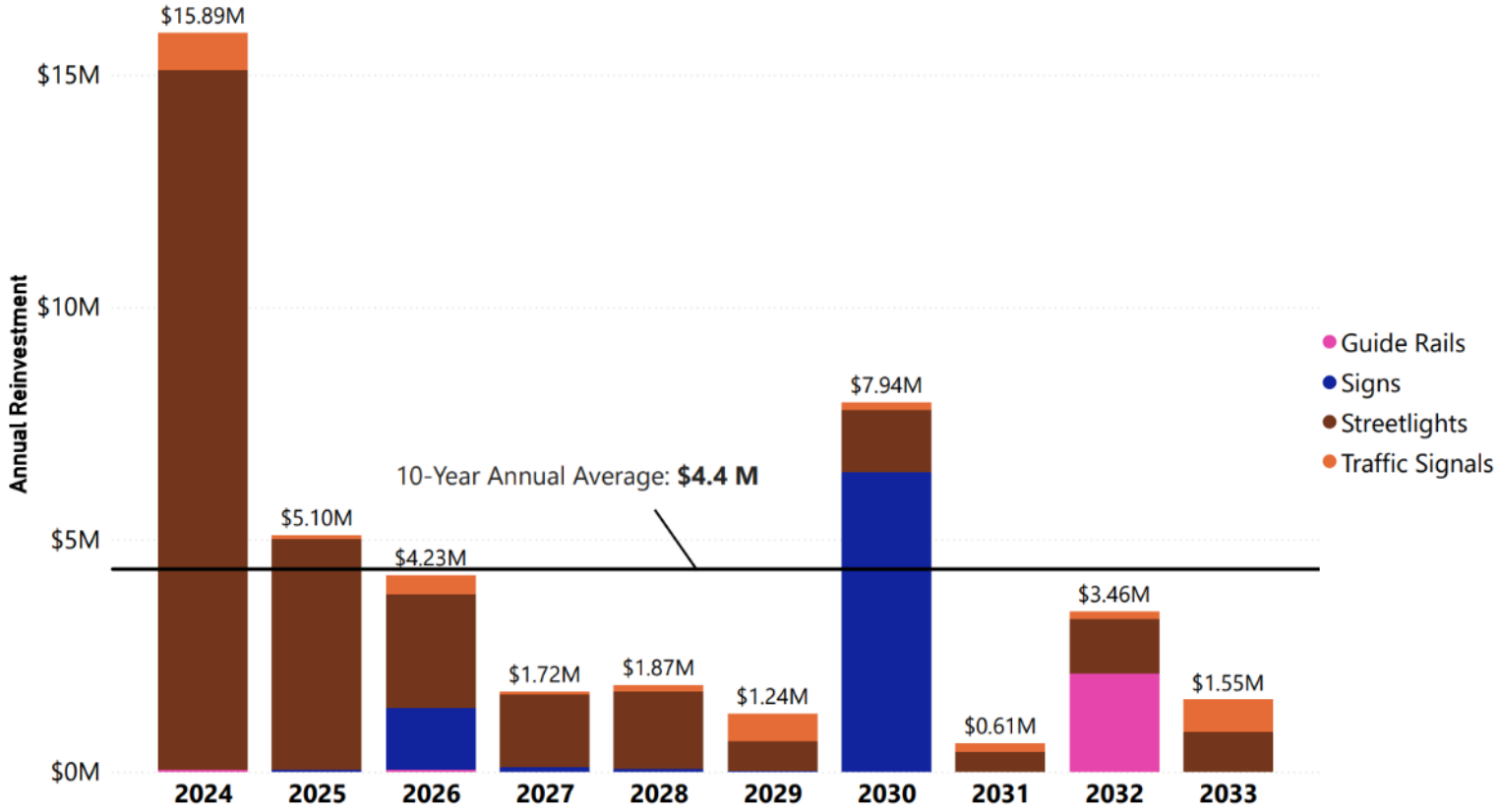
Lifecycle Type	Description of Activity	Frequency / Timing
Expansion / Growth / Service Improvement Activities	Centralized signals program, transit signal priority, communications based on studies or new development.	Ongoing
Expansion / Growth / Service Improvement Activities	Active transportation improvements as per ATMP such as dedicated bike & pedestrian signalization.	Ongoing
Expansion / Growth / Service Improvement Activities	Integrated Mobility Plan (IMP)	As needed
Expansion / Growth / Service Improvement Activities	Retrofit streetlight lamps with LED fixtures.	As needed
Expansion / Growth / Service Improvement Activities	Review of other infrastructure around intersection to ensure new features are incorporated (audible pedestrian signals, bike facilities, proper detection, centralized signals software).	During replacement/construction activities

3.4.2 Funding the Lifecycle Activities – Traffic Control & Safety

Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, EUL, replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of interest. Asset replacement forecasts within this subsection estimate the required reinvestment for Traffic Control & Safety assets over the next 10 years based on available asset inventory data.

There is a total of approximately **$43.6 million** to be reinvested into the Traffic Control & Safety assets owned by the City in the next 10 years. This translates to a 10-year annual average of approximately **$4.4 million**, as presented in **Figure 3-10**.

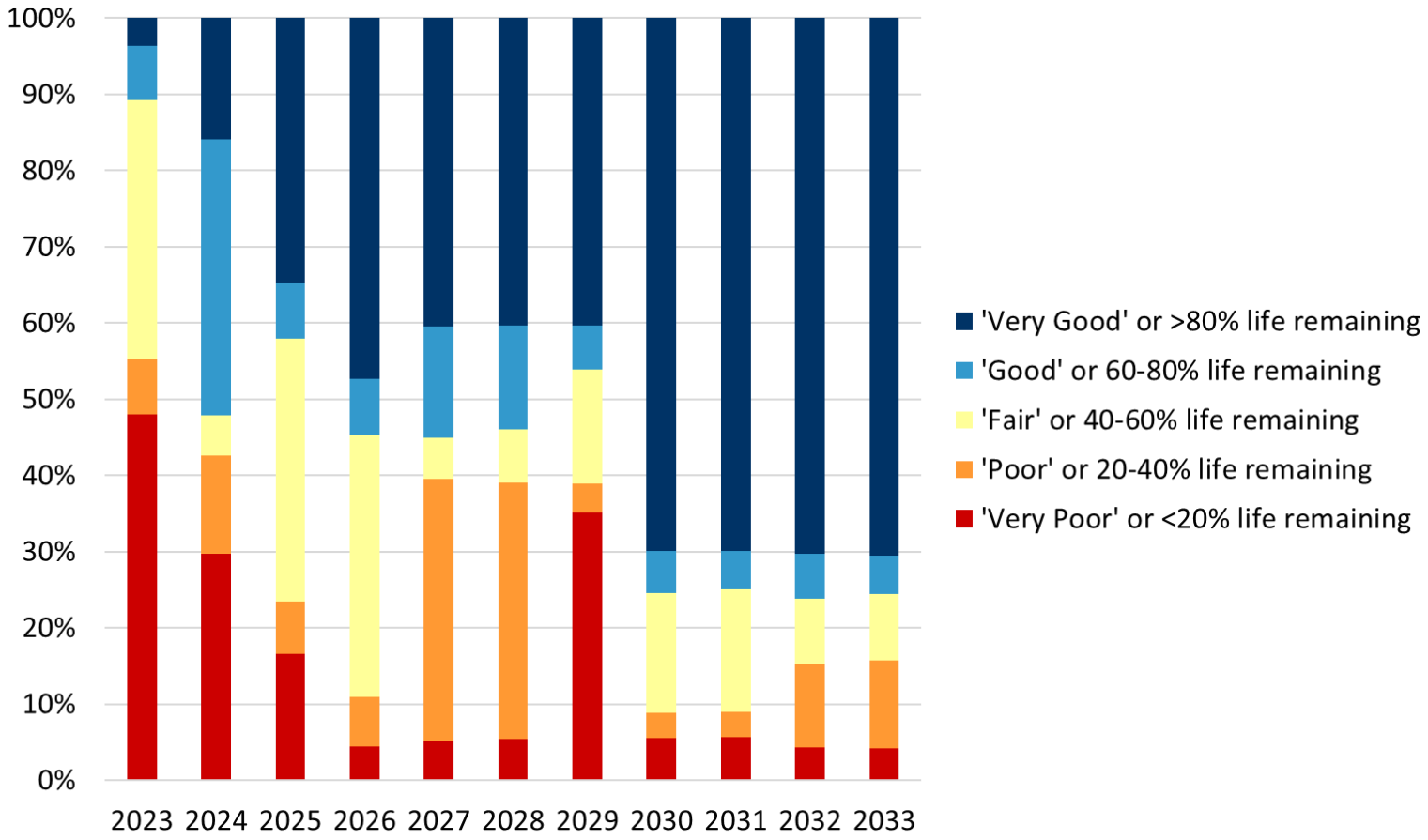
Figure 3-10: 10-Year Capital Reinvestment Needs – Traffic Control & Safety



It is important to note that forecasting in this lifecycle model relies heavily on age and EUL to determine renewal or replacement needs and that tracking of condition data for Traffic Control & Safety assets by the City will assist at refining forecasted expenditures in the decades to come. The LOS includes maintaining the current assets in poor or better condition (52%). From the lifecycle model, the percentage of Traffic Control & Safety assets in poor or better condition fluctuates throughout the next 10-years, reaching 96% in 2033.

Figure 3-11 shows an overview of the condition of Traffic Control & Safety over the next 10 years based on the lifecycle model.

Figure 3-11: Condition Overview by Year Based on Lifecycle Model – Traffic Control & Safety



4.0 Structures

The City's Structures assets include Sidewalks, Wildlife Mitigation Infrastructure, and Minor Culverts (< 3 m). The following section of the AMP includes assets that are under the Structures area.

Note: At the time of preparing this AMP, significant data gaps were present in the available data for Minor Culverts (< 3 m) impacting the ability to estimate replacement costing. More specifically, the construction material and size of most culverts (approximately 99%) was unknown and all assets without this information were assigned an “Unspecified” asset type. For estimating replacement costing of unspecified culverts, the average per metre unit cost estimated for culverts with known material and size was assumed. It is recommended that the City further refines their data for culverts including the collection of construction materials and sizing attributes to be considered in subsequent iterations of the AMP.

4.1 State of the Local Infrastructure

4.1.1 Asset Inventory and Valuation

For inventory purposes, Structures assets are summarized into asset classes, and further divided into applicable asset types. The asset classes, asset types, a count of assets therein, and the total replacement cost (in 2023 dollars) are show in **Table 4-1.** The total replacement cost (2023 dollars) is estimated at **$482.8 million** for the **11,218 assets** included in the inventory.

Table 4-1: Inventory Summary by Asset Type - Structures

Asset Class	Asset Type	Count	Length (km)	Total Replacement Cost (2023)
Sidewalks	Sidewalk – Asphalt	594	74.56	$7,980,700
Sidewalks	Sidewalk – Concrete/Brick	4,557	508.01	$97,856,320
Wildlife Mitigation Infrastructure	Wildlife Fencing	6	7.16	$1,302,420
Minor Culverts (< 3 m)	Minor Culvert – Concrete	4	0.08	$637,010
Minor Culverts (< 3 m)	Minor Culvert – Unspecified	6,017	69.71	$373,112,800
Minor Culverts (< 3 m)	Minor Culvert – Steel	40	0.55	$1,878,050
Overall	**N/A**	**11,218**	**660.06**	**$482,767,300**

4.1.2 Asset Age Summary

Table 4-2 summarizes the average age, average condition, expected useful life, and the average remaining useful life of assets pertaining to Structures. The overall average age of Structures assets is 74 years, and the average remaining useful life is six years.

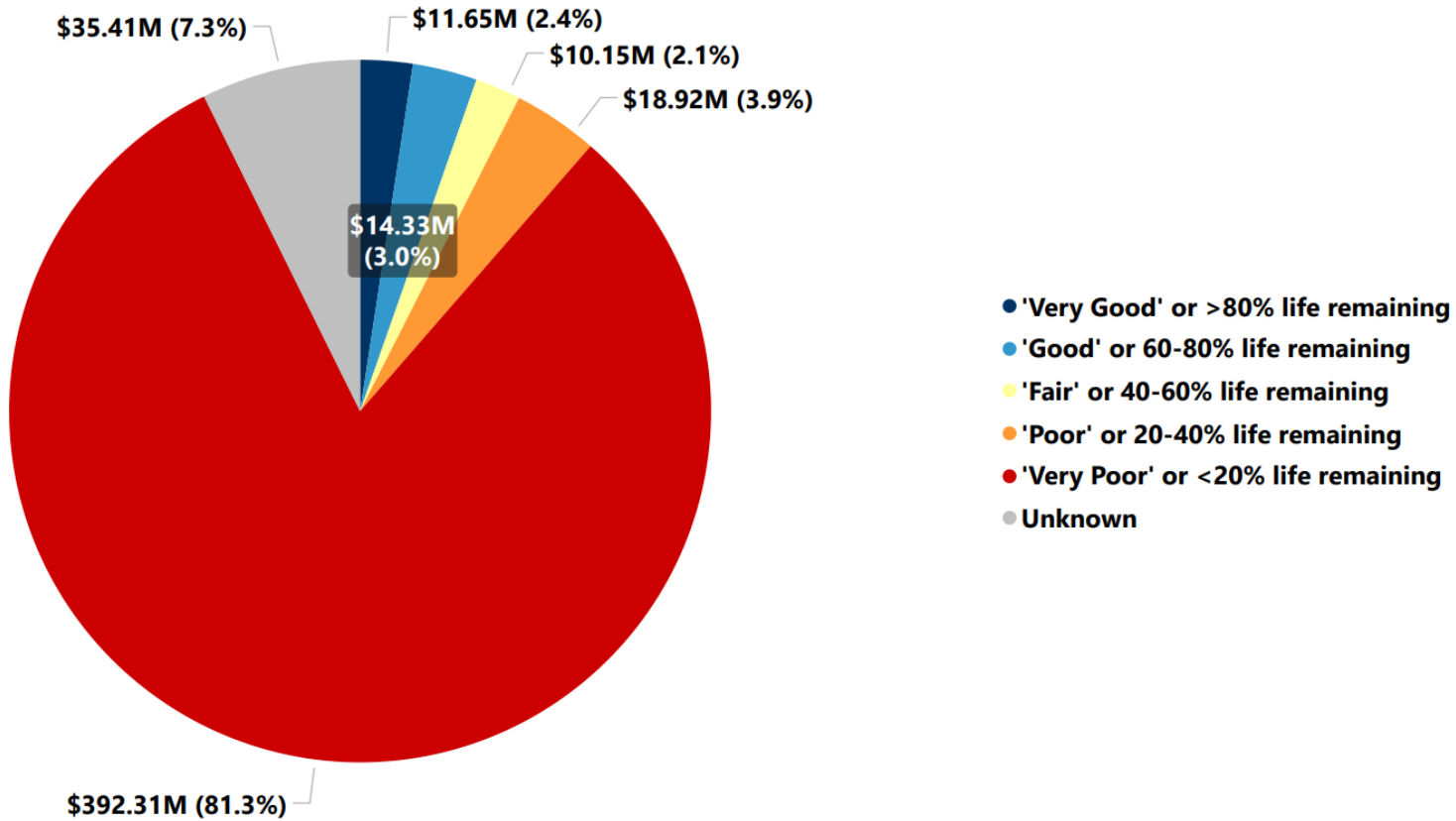
Table 4-2: Average Age, Average Condition, Expected Useful Life, and Remaining Useful Life - Structures

Asset Class	Asset Type	Average Age (Years)	Average Condition Rating	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Sidewalks	Sidewalk – Asphalt	33	Poor	30	9
Sidewalks	Sidewalk – Concrete/Brick	57	Poor	50	13
Wildlife Mitigation Infrastructure	Wildlife Fencing	4	Very Good	15 to 25	19
Minor Culverts (< 3 m)	Minor Culvert – Concrete	76	Very Poor	50	6
Minor Culverts (< 3 m)	Minor Culvert – Steel	62	Very Poor	30	0
Minor Culverts (< 3 m)	Minor Culvert – Unspecified	93	Very Poor	40	0
Overall	**N/A**	**74**	**Poor**	**15 to 50**	**6**

4.1.3 Asset Condition

An overall condition summary for Structures assets by replacement cost (in 2023 dollars) is shown in **Figure 4-1**. About 7.5% of the assets are in very good to fair condition, with 7.3% of the assets with unknown condition.

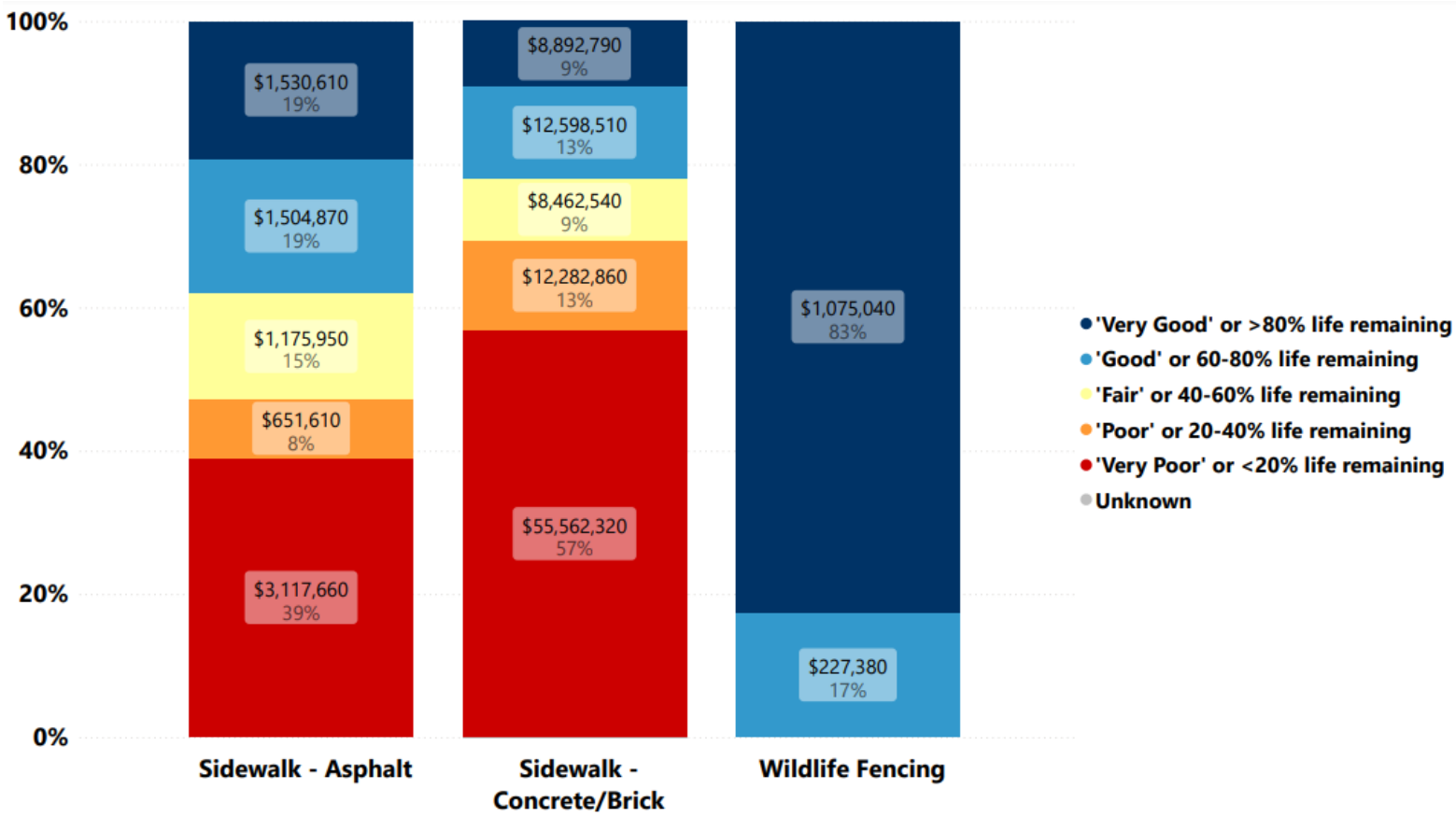
Figure 4-1: Condition Summary and 2023 Replacement Cost - Structures



Structures

A condition summary for Sidewalks and Wildlife Mitigation Infrastructure assets is provided in **Figure 4-2** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of the assets has been primarily determined based on age and expected useful life.

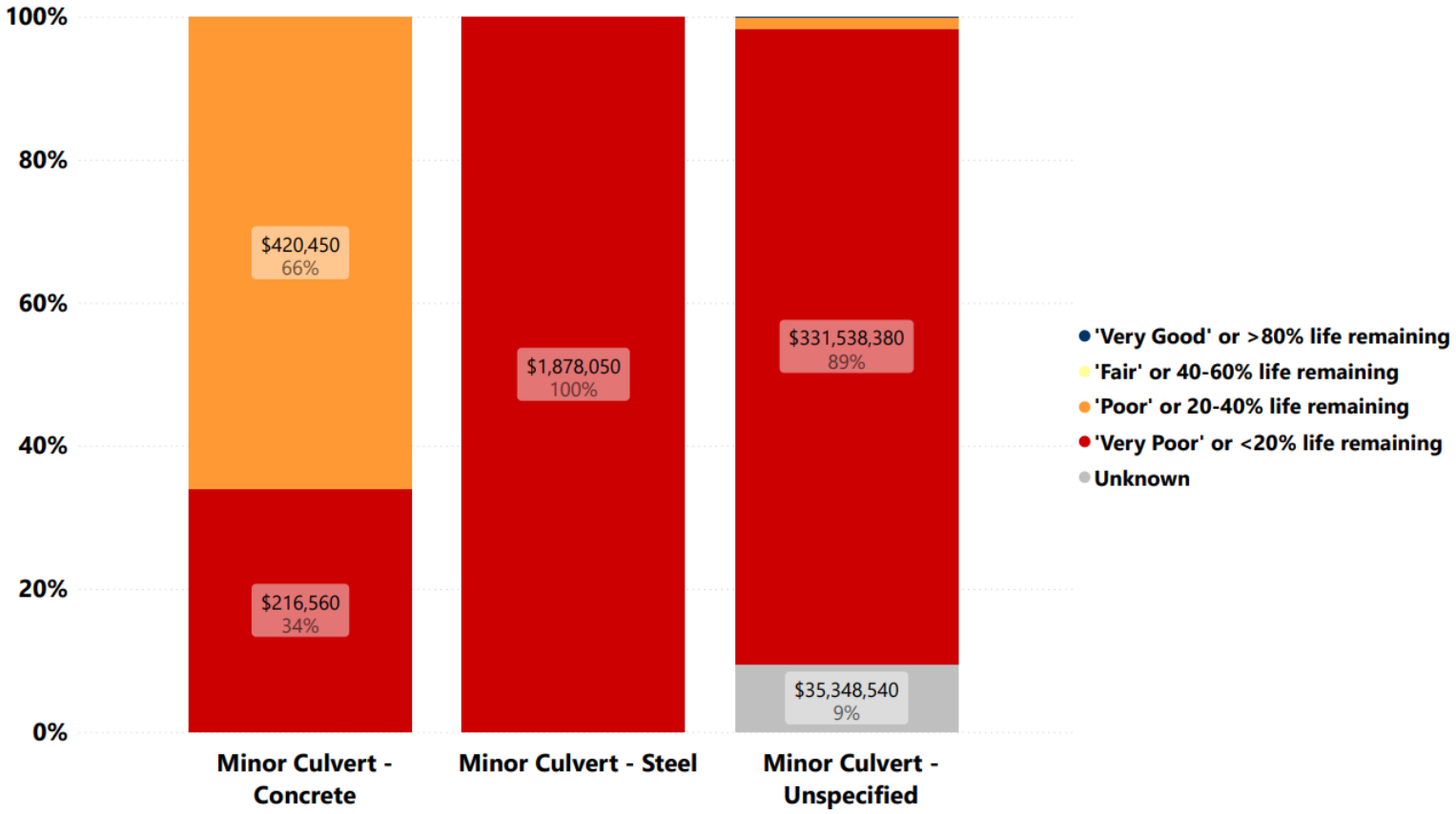
Figure 4-2: Condition Summary by Asset Type and 2023 Replacement Cost - Structures (Sidewalks and Wildlife Mitigation Infrastructure)



Structures

A condition summary for Minor Culverts is provided in **Figure 4-3** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of Minor Culverts has been primarily determined based on age and expected useful life. It is important to note that a significant portion of the minor culvert inventory pre-dates 1950 based on existing asset data resulting in many assets believed to be in very poor condition.

Figure 4-3: Condition Summary by Asset Type and 2023 Replacement Cost - Structures (Minor Culverts (< 3 m))



4.1.4 Data Sources and Confidence

The asset data for Structures assets is maintained by the City between two main data sources, data for Sidewalks and Minor Culverts (< 3 m) is maintained in a GIS-based repository and data for Wildlife Mitigation Infrastructure is stored in a Microsoft Excel-based inventory spreadsheet.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 4-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

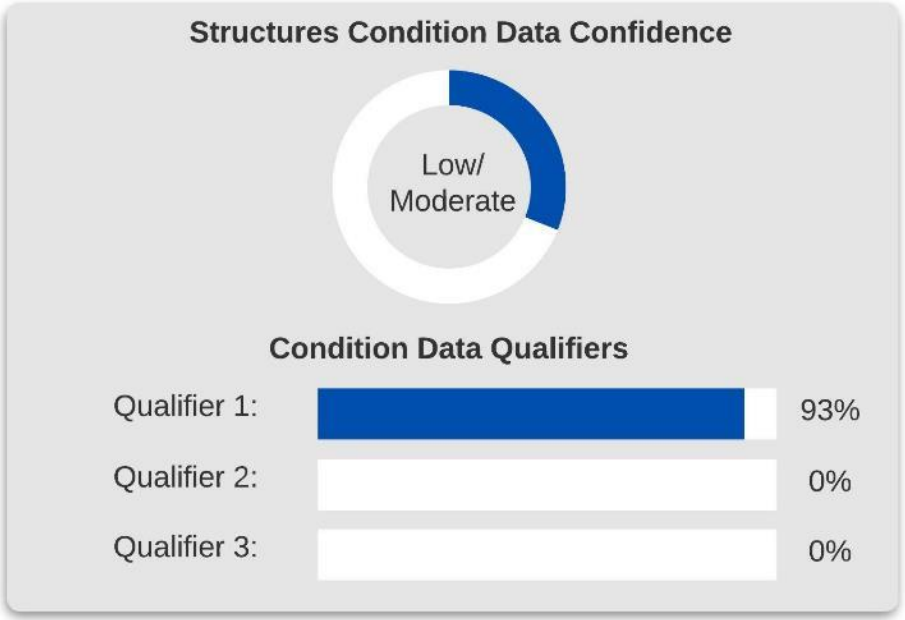
Table 4-3: Data Confidence Scale

Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data source is reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (93%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (0%); and,
- **Qualifier 3**: The percentage of the estimated overall Structures replacement value, in 2023 dollars, attributed to assets in the asset inventory where condition can be assessed using available data (i.e., based on condition assessment history and/or age-based condition) (0%).

Figure 4-4: SOLI Report Data Confidence – Structures



As summarized in **Figure 4-4**, the overall asset condition data confidence for Structures assets is estimated as Low/Moderate. Presently, all asset conditions for Structures assets are age-based. Data confidence can be increased by improving the documentation of condition assessment data as a result of a formal condition assessment program. Additionally, asset data for Structures assets should be refined to better inform asset management planning including addressing data gaps such as missing diameters for Minor Culverts (< 3 m).

4.2 Levels of Service

The City has developed the community and technical Levels of Service (LOS), based on contributions from the municipal staff. It was decided that Quality and Environmental Acceptability were key attributes in gauging the performance of the assets. **Table 4-4** and **Table 4-5** outline the City's community and technical levels of service for Structures.

Structures

Table 4-4: Community LOS - Structures

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Environmental Acceptability	Providing stormwater services that protect and benefit the environment	Percentage of community with stormwater quality control	To be determined

Table 4-5: Technical LOS - Structures

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Quality	Providing a transportation network that is reliable	Percentage of sidewalk assets in poor or better condition.	44%
Quality	Minor stormwater culverts (<3 m) are in good working condition.	Percentage of stormwater assets that are in poor or better condition.	22%

4.3 Risk Assessment

The risk ratings for Structures assets included Sidewalks, Wildlife Mitigation Infrastructure, and Minor Culverts. The risk scores were calculated using the risk methodology and approach outlined in the Introduction document. **Table 4-6** summarizes the risk factors for the Structures assets.

Table 4-6: Risk Factors - Structures

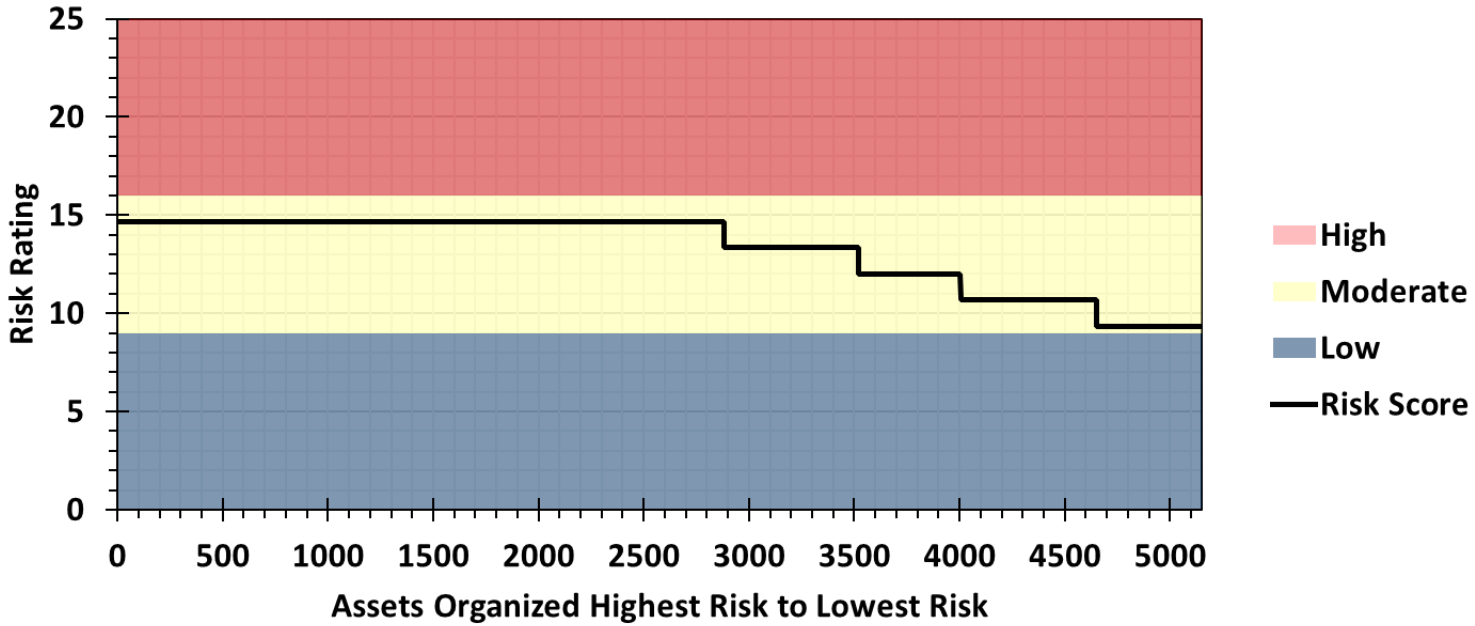
Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.
B - Performance	The performance of the Sidewalks assets was identified as "usually reliable" and assigned a score of 3 for calculating risk score. The Wildlife Mitigation Infrastructure and Minor Culvert assets was identified as “always reliable” and assigned a risk score of 1.
C - Climate Change	The climate change ratings were determined at the service category level by identifying climate change hazard interactions. The Sidewalks assets were identified as a “moderate” risk and assigned a rating of 3 for calculating the risk score. The Wildlife Mitigation Infrastructure and Minor Culvert assets were identified as a “high” risk and assigned a rating of 5 for calculating the risk score.
D - Impact	The Sidewalk and Minor Culvert assets was recognized as "moderate" impact and assigned a score of 1 for calculating risk score. The impact of the Wildlife Mitigation Infrastructure was identified as "low” impact and assigned a score of 0 for calculating risk score.
E - Importance	The Sidewalk assets was assigned a “high” importance and a score of 3 when calculating risk. A “moderate” importance rating was given to the Minor Culvert assets and a score of 2 was assigned for calculating risk score. The Wildlife Mitigation Infrastructure assets was assigned a “low” importance and score of 1 when calculating risk.

The individual risk ratings were used in calculating the risk score for each of the assets.

4.3.1 Risk Profile

The Risk profile for the Sidewalk assets is displayed in **Figure 4-5**. All 5,151 Sidewalk assets tracked in the asset inventory are considered as Moderate risk.

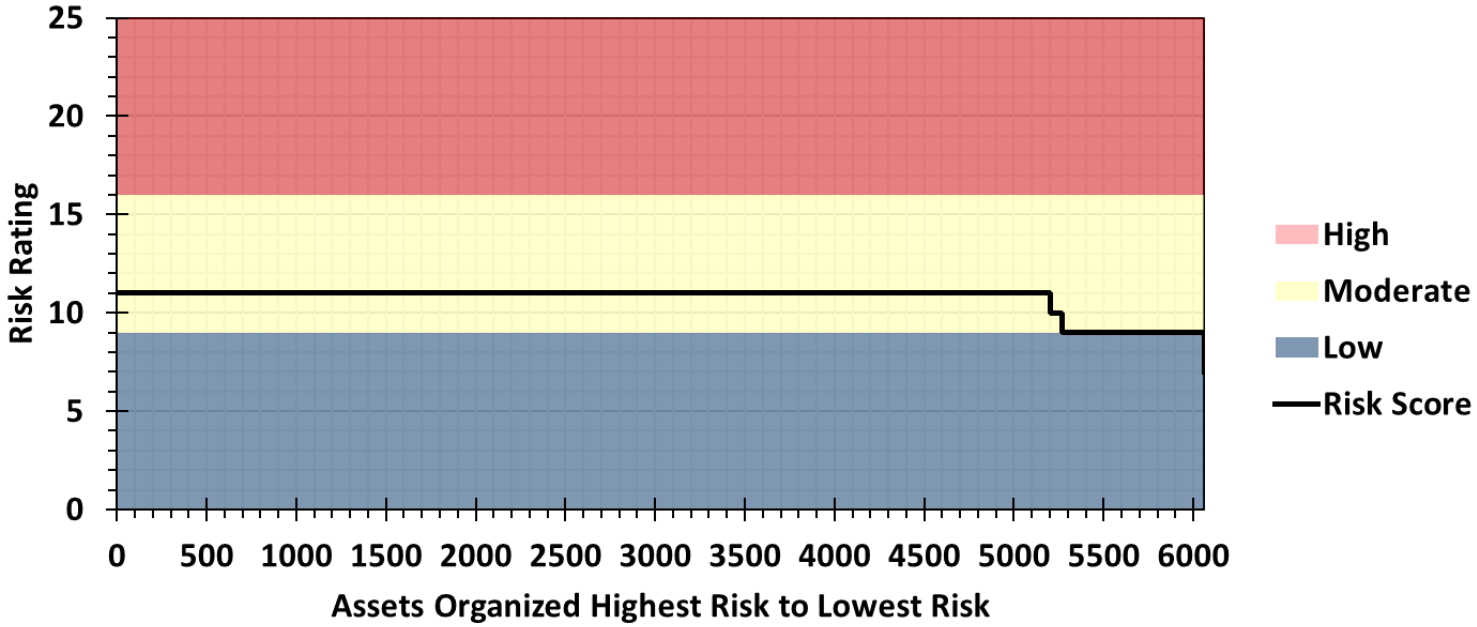
Figure 4-5: Risk Profile - Structures (Sidewalks)



All six (6) Wildlife Mitigation Infrastucture assets tracked in the asset inventory are considered as Low risk.

The Risk profile of the Minor Culvert assets is displayed in **Figure 4-6**. Of the 6,061 Minor Culvert assets tracked in the asset inventory, approximately 86.8% (5,267) assets are considered as Moderate risk. The reamining 13.1% (794) assets are conidered Low risk.

Figure 4-6: Risk Profile - Structures (Minor Culverts (< 3 m))



4.4 Asset Management Strategy

4.4.1 Lifecycle Activities - Structures

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.
- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.

- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 4-7 describes the lifecycle activities that can be implemented within the asset management strategy for Structures assets. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in January 2024.

Table 4-7: Lifecycle Activities - Structures

Lifecycle Type	Description of Activity	Frequency / Timing
Non-Infrastructure Solutions	Visual inspections by road patrol	Ongoing
Non-Infrastructure Solutions	Traffic counting program.	Ongoing
Maintenance Activities	Sidewalk inspections and hazard removals.	Annually
Renewal / Rehabilitation Activities	Localized rehabilitation of sidewalk sections.	As needed
Replacement / Construction Activities	Full reconstruction of sidewalks.	End of EUL
Replacement / Construction Activities	Replacement of minor culverts.	Prior to adjacent road resurfacing
Disposal Activities	Recycling of steel culverts.	End of EUL

Structures

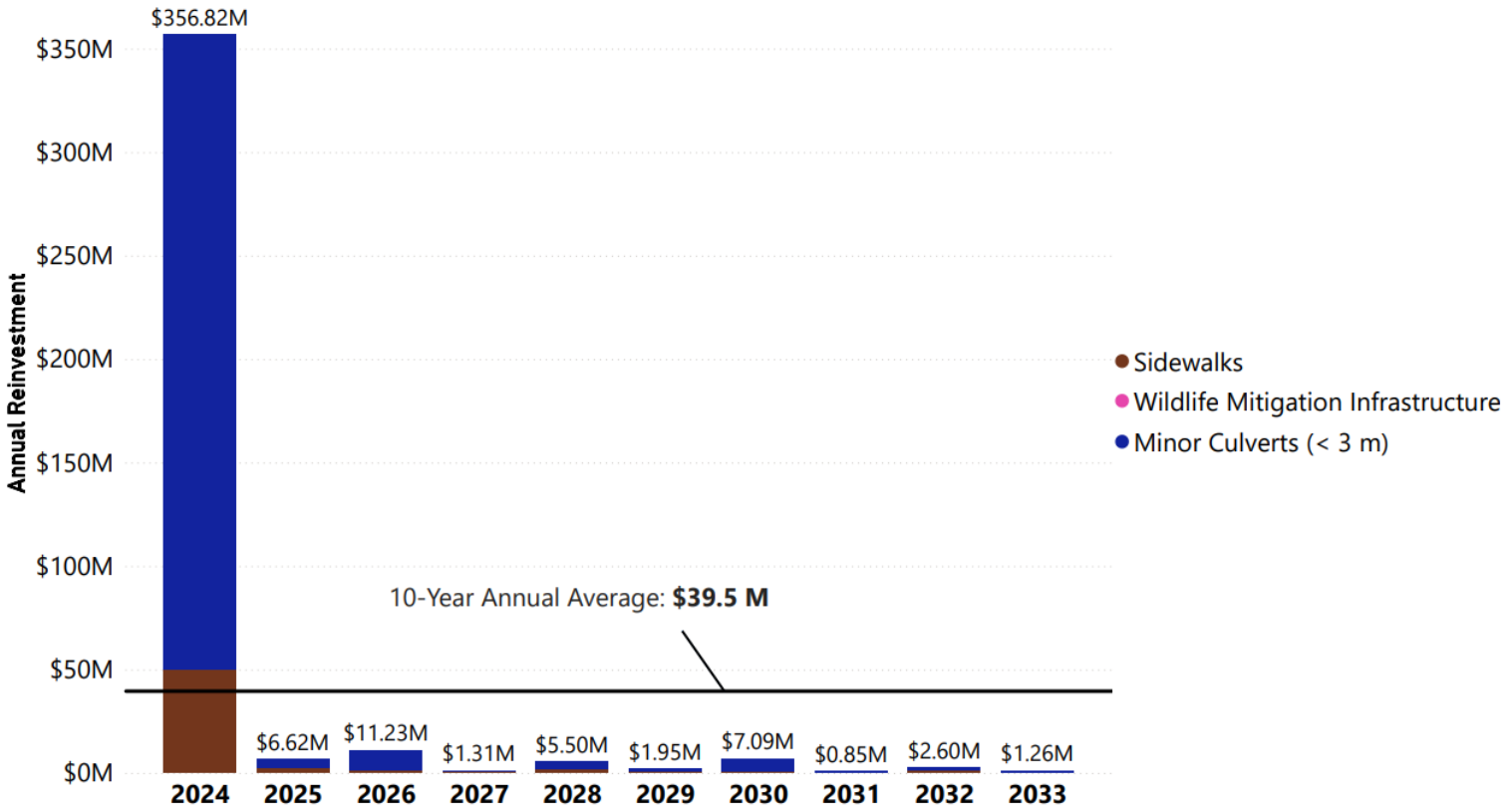
Lifecycle Type	Description of Activity	Frequency / Timing
Expansion / Growth / Service Improvement Activities	Expansion of asset inventory based on community masterplans (i.e., Integrated Mobility Plan).	Based on masterplan

4.4.2 Funding the Lifecycle Activities - Structures

Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, EUL, replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of interest. Asset replacement forecasts within this subsection estimate the required reinvestment for Structures assets over the next 10 years based on available asset inventory data. It is important to note that a significant portion of the Minor Culvert (< 3 m) inventory includes culverts documented to be over 100 years old resulting in significant backlog forecasted for 2024.

There is a total of approximately **$395.2 million** to be reinvested into the Structures assets owned by the City in the next 10 years. This translates to a 10-year annual average of approximately **$39.5 million**, as presented in **Figure 4-7**.

Figure 4-7: Condition Overview by Year Based on Lifecycle Model – Structures



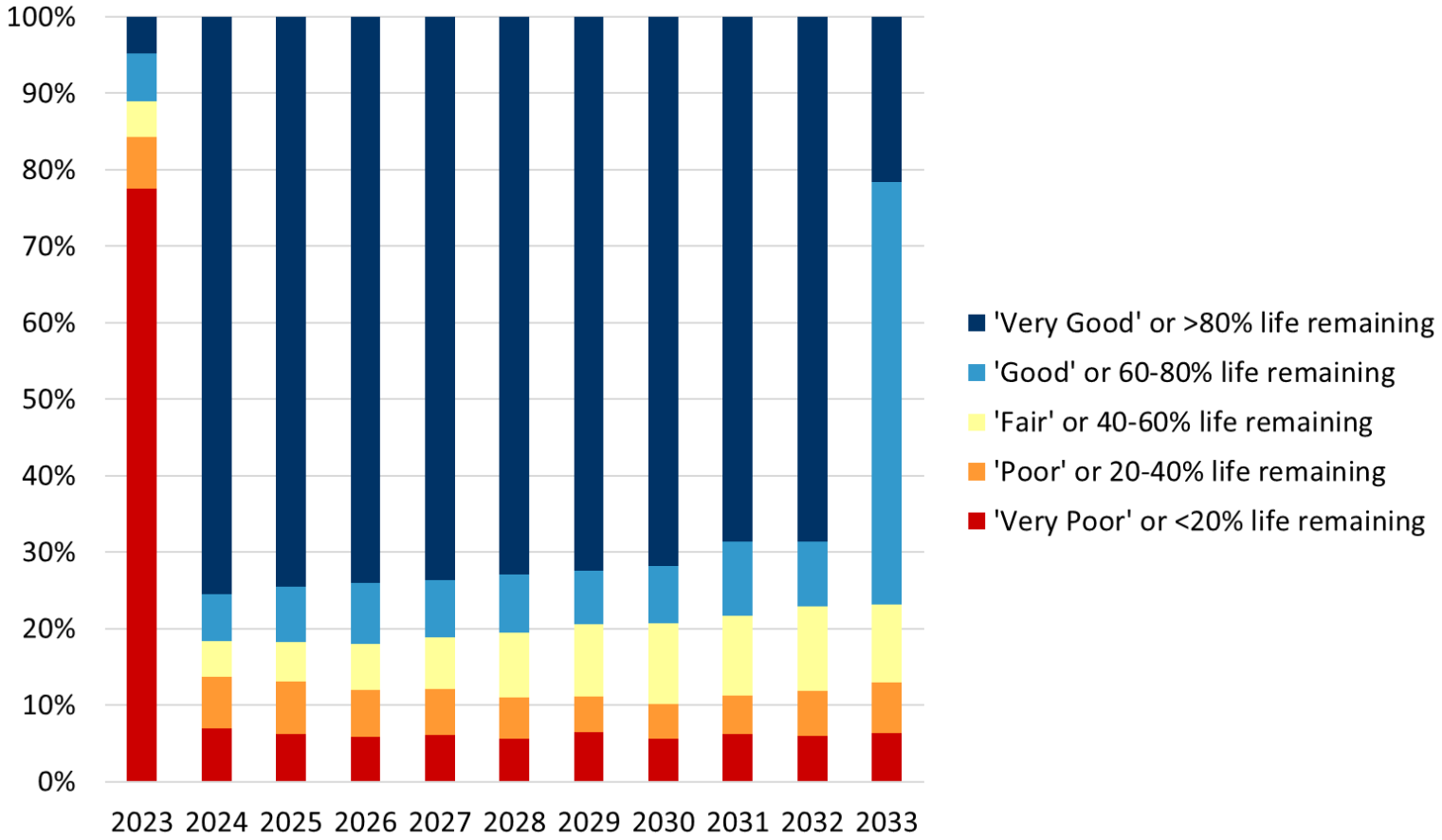
Note: At the time of preparing this AMP, no condition assessment data could be leveraged for Sidewalks and Minor Culverts (< 3 m) and forecasted reinvestment has been derived primarily based on age and expected useful life. Many of these assets are documented to pre-date 1950 which hints at potential inaccuracies within the age data. It is recommended that the City further refines their data for Sidewalks and Minor Culverts (< 3 m) including the collection of condition assessment data to be considered in subsequent iterations of the AMP.

Structures

It is important to note that forecasting in this lifecycle model relies heavily on age and EUL to determine renewal or replacement needs and that tracking of condition data for Structures assets by the City will assist at refining forecasted expenditures in the decades to come. The LOS includes maintaining the current assets in poor or better condition (22%). From the lifecycle model, the percentage of Structures assets in poor or better condition fluctuates throughout the next 10-years, reaching a high of 94% in 2025 and maintaining 94% through to 2033.

Figure 4-8 shows an overview of the condition of Structures over the next 10 years based on the lifecycle model.

Figure 4-8: Condition Overview by Year Based on Lifecycle Model - Structures



5.0 Urban Forestry

The City's Urban Forestry includes the City’s wealth of diverse tree species that contribute significantly to the overall health and aesthetics of the City’s urban environment. Public Works manages and maintains all public trees and related vegetation on City streets, parks, and other communal spaces, as well as implementing strategic tree planting programs. Regular tree health assessments are conducted with an emphasis on sustainable practices, balancing urban development with preservation of natural habitats. The City is committed to enhancing the urban canopy and biodiversity, contributing to its reputation as a sustainable, green City. The following section of the AMP includes assets that are under Forestry, particularly the trees comprising the City’s Tree Canopy. This AMP does not include any forestry on private property.

5.1 State of the Local Infrastructure

5.1.1 Asset Inventory and Valuation

The Urban Forestry section covers the City's Tree Canopy including many individual trees spread out over different geographical areas. The asset class, a count of assets therein, and the total replacement cost (in 2023 dollars) are show in **Table 5-1.** The total replacement cost (2023 dollars) is estimated at **$24.6 million** for the **40,972 assets** included in the inventory.

Table 5-1: Inventory Summary by Asset Type – Urban Forestry

Asset Class	Asset Type	Count	Total Replacement Cost (2023)
Tree Canopy	Trees	40,972	$24,583,200

5.1.2 Asset Age Summary

Table 5-2 summarizes the average age, average condition, expected useful life, and the average remaining useful life of assets pertaining to Urban Forestry. The overall average age of Urban Forestry assets is 74 years, and the average remaining useful life is 27 years.

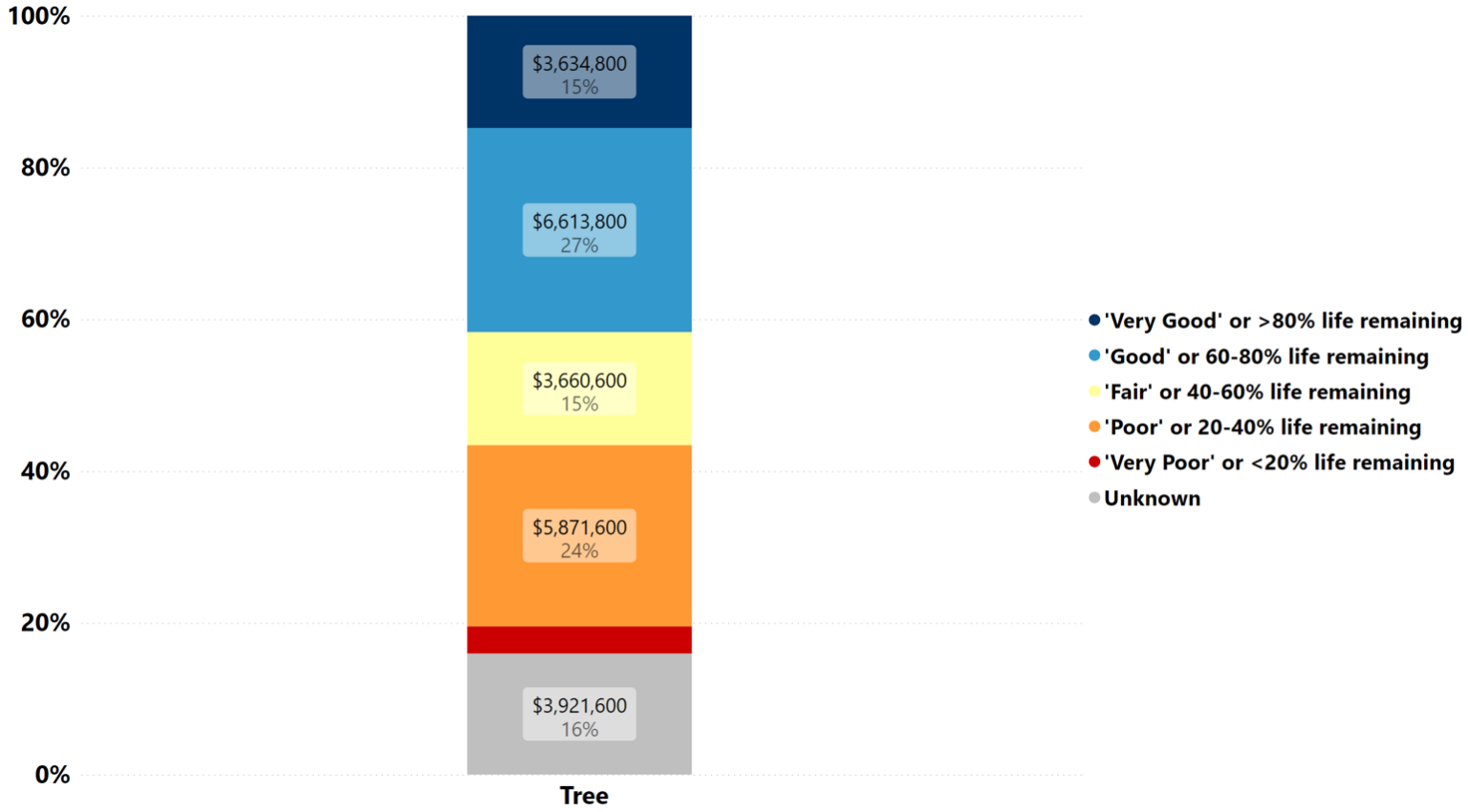
Table 5-2: Average Age, Average Condition, Expected Useful Life, and Remaining Useful Life – Urban Forestry

Asset Class	Asset Type	Average Age (Years)	Average Condition Rating	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Tree Canopy	Tree	74	Fair	50	27

5.1.3 Asset Condition

A condition summary for the Tree Canopy is provided in **Figure 5-1** by asset type. Condition has been determined primarily based on the resulting overall condition index for each tree based on tree health assessments completed by the City's forestry staff. About 57% of the assets are in very good to fair condition, with 16% of the assets with unknown condition.

Figure 5-1: Condition Summary by Asset Type – Urban Forestry (Tree Canopy)



5.1.4 Data Sources and Confidence

The asset data for trees is maintained by the City in a tree registry hosted in Cartegraph which served as the main data source for this AMP. The City has staff who regularly update the inventory data for trees once tree health assessments are completed. This suggests that the data source within this AMP can be assumed to be reliable.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 5-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

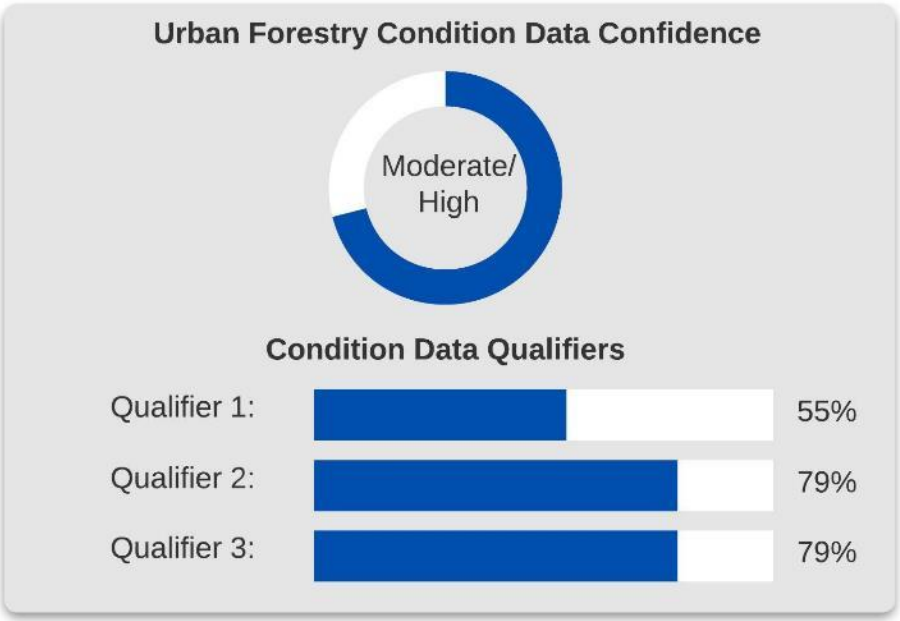
Table 5-3: Data Confidence Scale

Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data source is reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (55%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (79%); and,
- **Qualifier 3**: The percentage of the estimated overall replacement value, in 2023 dollars, attributed to assets in the asset inventory with documented condition assessment data (i.e., condition is not solely age-based) (79%).

Figure 5-2: SOLI Report Data Confidence – Urban Forestry



As summarized in **Figure 5-2**, the overall asset condition data confidence for Urban Forestry assets is estimated to be Moderate/High. Data confidence can be increased by improving the quality of the data and/or filling in data gaps.

5.2 Levels of Service

The City has developed the community and technical Levels of Service (LOS), based on contributions from the municipal staff. It was decided that Capacity and Quality were key attributes in gauging the performance of the assets. **Table 5-4** and **Table 5-5** outline the City's current community and technical levels of service for Urban Forestry.

Table 5-4: Community LOS – Urban Forestry

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Capacity	Provide a sufficient Tree Canopy around the City.	Percent Tree Canopy coverage.	30%

Table 5-5: Technical LOS – Urban Forestry

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Quality	Providing quality Urban Forestry services and healthy urban trees.	Percentage of trees that are in poor or better condition.	96%

5.3 Risk Assessment

The risk ratings for Urban Forestry assets include the Tree Canopy. The risk scores were calculated using the risk methodology and approach outlined in the Introduction document. **Table 5-6** summarizes the risk factors for the Urban Forestry assets.

Table 5-6: Risk Factors – Urban Forestry

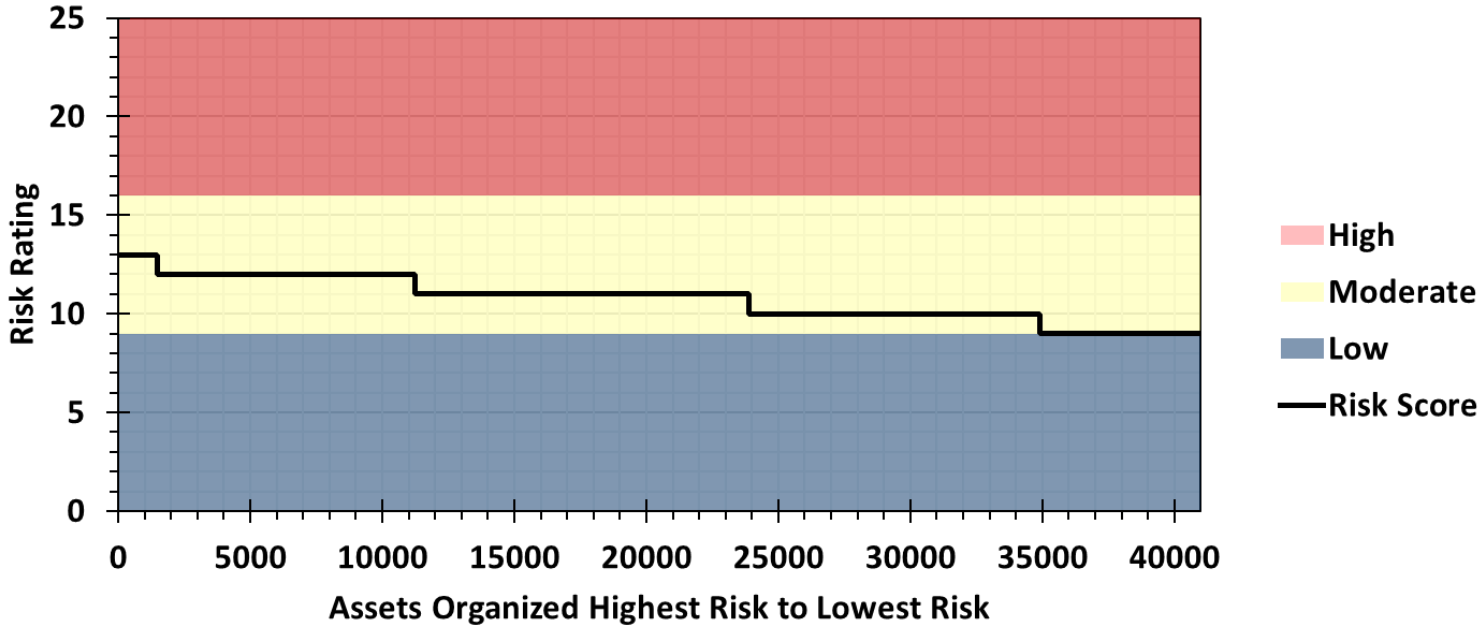
Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.
B - Performance	The performance of the asset class was identified as "usually reliable" and assigned a rating of 3 for calculating risk score.
C - Climate Change	The climate change ratings were determined at the asset class level by identifying climate change hazard interactions. The Tree Canopy assets were identified as a “high” risk and assigned a rating of 5 for calculating the risk score.
D - Impact	The Tree Canopy assets were recognized as "low" impact and assigned a rating of 0 for calculating risk score.
E - Importance	The Tree Canopy asset class was identified as “high” importance and assigned a rating of 3 when calculating risk.

The individual risk ratings were used in calculating the risk score for each of the assets.

Risk Profile

The Risk profile of the Tree Canopy assets is displayed in **Figure 5-3**. Of the 40,972 Trees tracked within the asset inventory, approximately 85.2% (34,914) are classified as Moderate risk and the remaining 14.7% (6,058) are Low risk.

Figure 5-3: Risk Profile – Urban Forestry (Tree Canopy)



5.4 Asset Management Strategy

5.4.1 Lifecycle Activities – Urban Forestry

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.
- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.
- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 5-7 describes the lifecycle activities that can be implemented within the asset management strategy for Urban Forestry assets. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in January 2024.

Table 5-7: Lifecycle Activities – Urban Forestry

Lifecycle Type	Description of Activity	Frequency / Timing
Non-Infrastructure Solutions	Tree by-law and Forestry Management Plan	Ongoing
Non-Infrastructure Solutions	Neighbourhood Tree Planting Program	Ongoing
Maintenance Activities	Mitigation maintenance pruning program.	Ongoing
Maintenance Activities	Routine inspection for all trees	High-Risk Trees: Annually Other Trees: Every 3 to 5 years

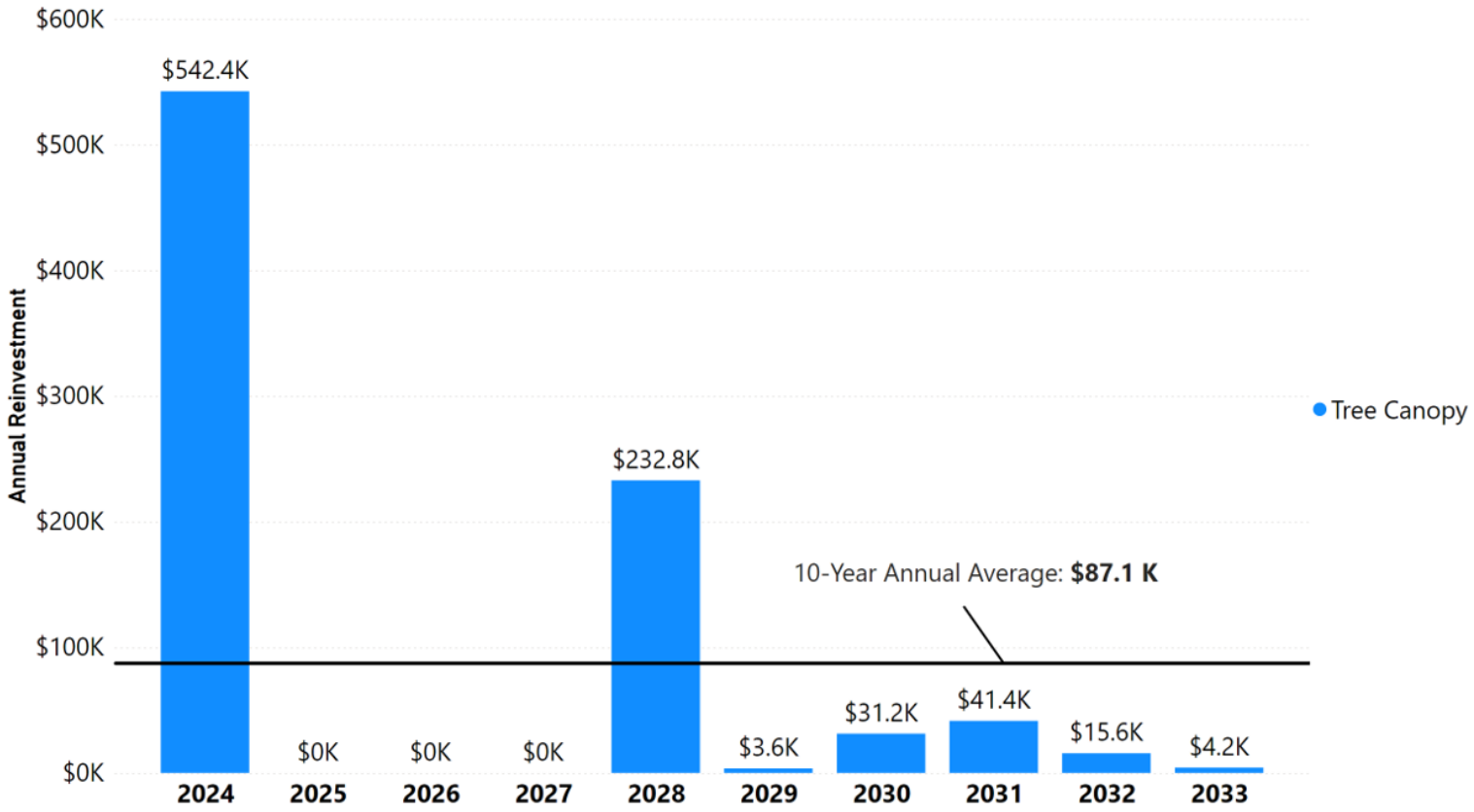
Lifecycle Type	Description of Activity	Frequency / Timing
Maintenance Activities	Ash Tree Preventative Treatment Program (part of annual tree inspections)	Annual program for remaining ash trees in inventory
Renewal / Rehabilitation Activities	Silva cells in new construction in areas with high percentages of hardscapes.	As needed
Replacement / Construction Activities	Where possible replace every tree removed with a new tree in the same spot or in another area.	End of EUL
Disposal Activities	Utilizing the mulch generated from removed trees for young tree protections.	End of EUL
Expansion / Growth / Service Improvement Activities	Goal to increase Tree Canopy to 30%, as per section 2.3.3. of the City of Kingston's Strategic Plan 2023-2026, by planting additional trees on public land in any area determined feasible. Also, support the planting of trees on private property without the City taking ownership of the tree.	Ongoing

5.4.2 Funding the Lifecycle Activities - Urban Forestry

Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, EUL, replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of interest. Asset replacement forecasts within this subsection estimate the required reinvestment for Urban Forestry assets over the next 10 years based on available asset inventory data.

There is a total of approximately **$871.2 thousand** to be reinvested into the Urban Forestry assets owned by the City in the next 10 years. This translates to a 10-year annual average of approximately **$87.1 thousand**, as presented in **Figure 5-4.**

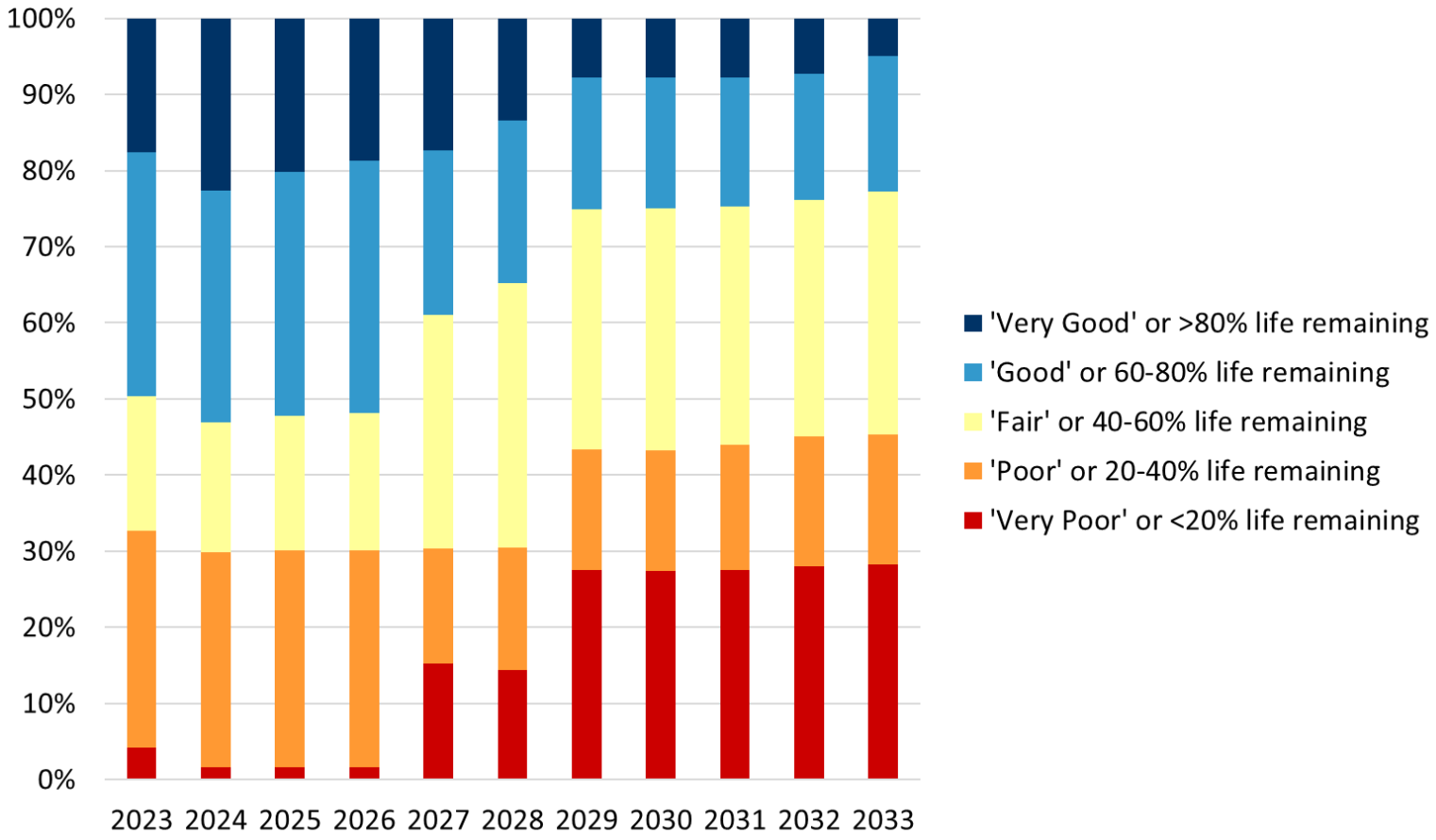
Figure 5-4: 10-Year Capital Reinvestment Needs - Urban Forestry



It is important to note that forecasting in this lifecycle model relies heavily on age and EUL to determine renewal or replacement needs and that tracking of condition data for tree assets by the City will assist at refining forecasted expenditures in the decades to come. The LOS includes maintaining the current assets in poor or better condition (96%). From the lifecycle model, the percentage of Urban Forestry assets in poor or better condition fluctuates throughout the next 10-years, reaching a high of 98% from 2024 to 2026 and eventually finishing at 72% in 2033.

Figure 5-5 shows an overview of the condition of Urban Forestry over the next 10 years based on the lifecycle model.

Figure 5-5: Condition Overview by Year Based on Lifecycle Model – Urban Forestry



6.0 Kingston Fire & Rescue

Kingston's Fire & Rescue manages and oversees the operation and maintenance of Facilities, Vehicles, and required equipment that support everyday operations. The following section of the AMP includes assets that are utilized by Kingston Fire & Rescue.

It is important to note that Kingston Fire & Rescue Facilities were included in the dedicated 2023 Facilities AMP developed by the City's Facilities Management & Construction Services (FMCS) department in consultation with GM BluePlan Engineering Limited. As a result, the details on these facilities in this AMP are limited to basic inventory information. For further detail on the facilities including data confidence and lifecycle modeling, please refer to the 2023 Facilities AMP.

6.1 State of the Local Infrastructure

6.1.1 Asset Inventory and Valuation

Kingston Fire & Rescue oversees many Fleet, Equipment, and Facility assets. For inventory purposes, these have been summarized into asset classes and further divided into applicable asset types. The asset classes, asset types, a count of assets therein, and the total replacement cost (in 2023 dollars) are show in **Table 6-1.** The total replacement cost (2023 dollars) is estimated at **$118.1 million** for the **168 assets** included in the inventory.

Table 6-1 Notes

[1] As reported in Facilities AMP (2023).

[2] To be updated in the 2025 AMP.

Table 6-1: Inventory Summary by Asset Type – Kingston Fire & Rescue

Asset Class	Asset Type	Count	Total Replacement Cost (2023)
Facilities[1]	Fire Stations, Towers, and Storage Buildings	25	$55,000,000[1]
Fleet	Light Vehicle	31	$2,170,000
Fleet	Heavy Vehicle	33	$50,832,720
Fleet	Boat	1	$1,898,840
Fleet	Trailer	1[2]	$6,500
Equipment	Equipment	77	$8,647,750
Overall	**N/A**	**168**	**$118,105,810**

6.1.2 Asset Age Summary

Table 6-2 summarizes the average age, average condition, expected useful life, and the average remaining useful life of assets pertaining to Kingston Fire & Rescue. For details regarding facilities, please refer to the Facilities AMP (2023). The overall average age of Kingston Fire & Rescue assets is 12 years, and the average remaining useful life is four years.

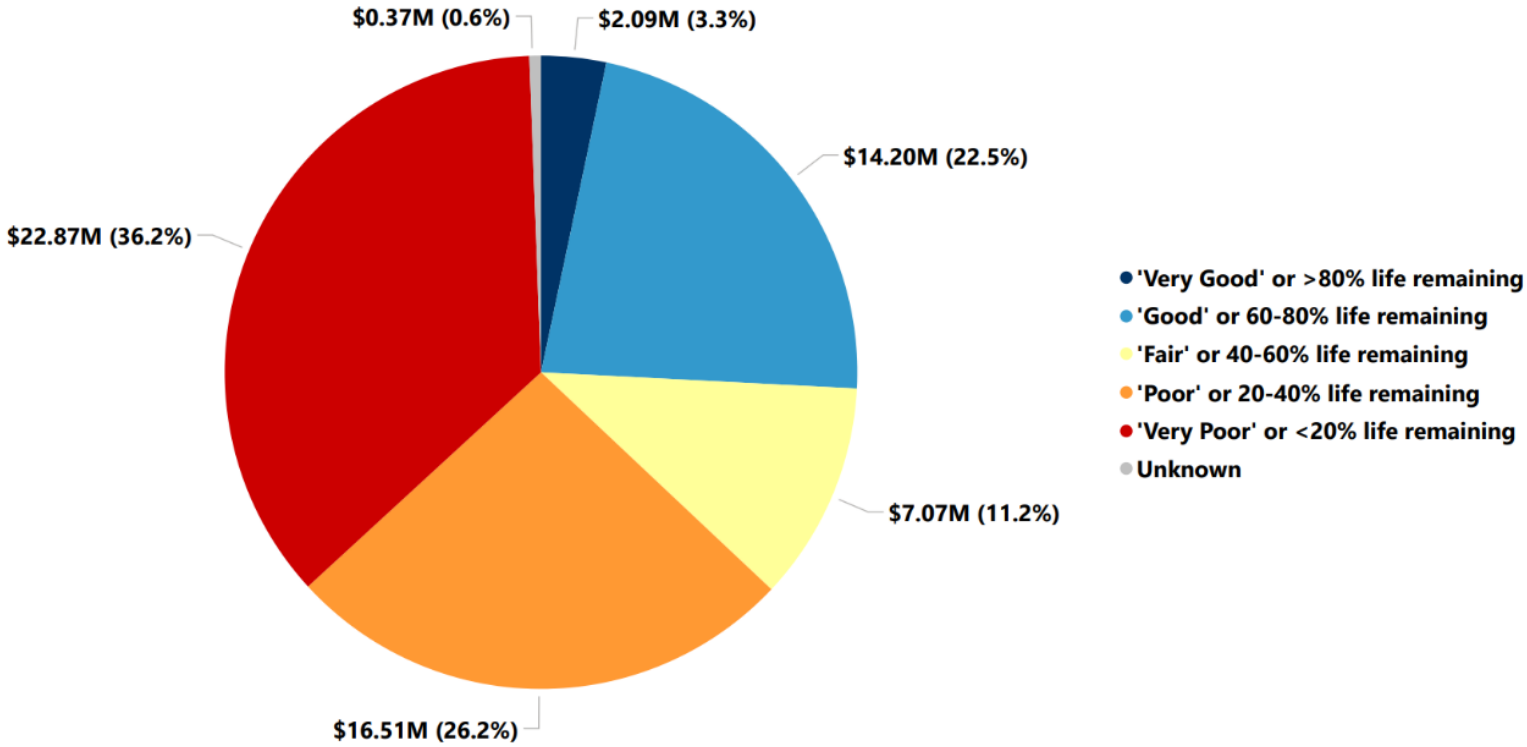
Table 6-2: Average Age, Average Condition, Expected Useful Life, and Remaining Useful Life - Kingston Fire & Rescue

Asset Class	Asset Type	Average Age (Years)	Average Condition Rating	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Fleet	Light Vehicle	10	Poor	10	2
Fleet	Heavy Vehicle	15	Poor	20	6
Fleet	Boat	5	Good	20	15
Fleet	Trailer	15	Very Poor	15	0
Equipment	Equipment	11	Poor	15	4
Overall	**N/A**	**12**	**Poor**	**10 to 20**	**4**

6.1.3 Asset Condition

An overall condition summary for Kingston Fire & Rescue assets by replacement cost (in 2023 dollars) is shown in **Figure 6-1**. About 37% of the assets are in very good to fair condition, with 0.6% of the assets with unknown condition.

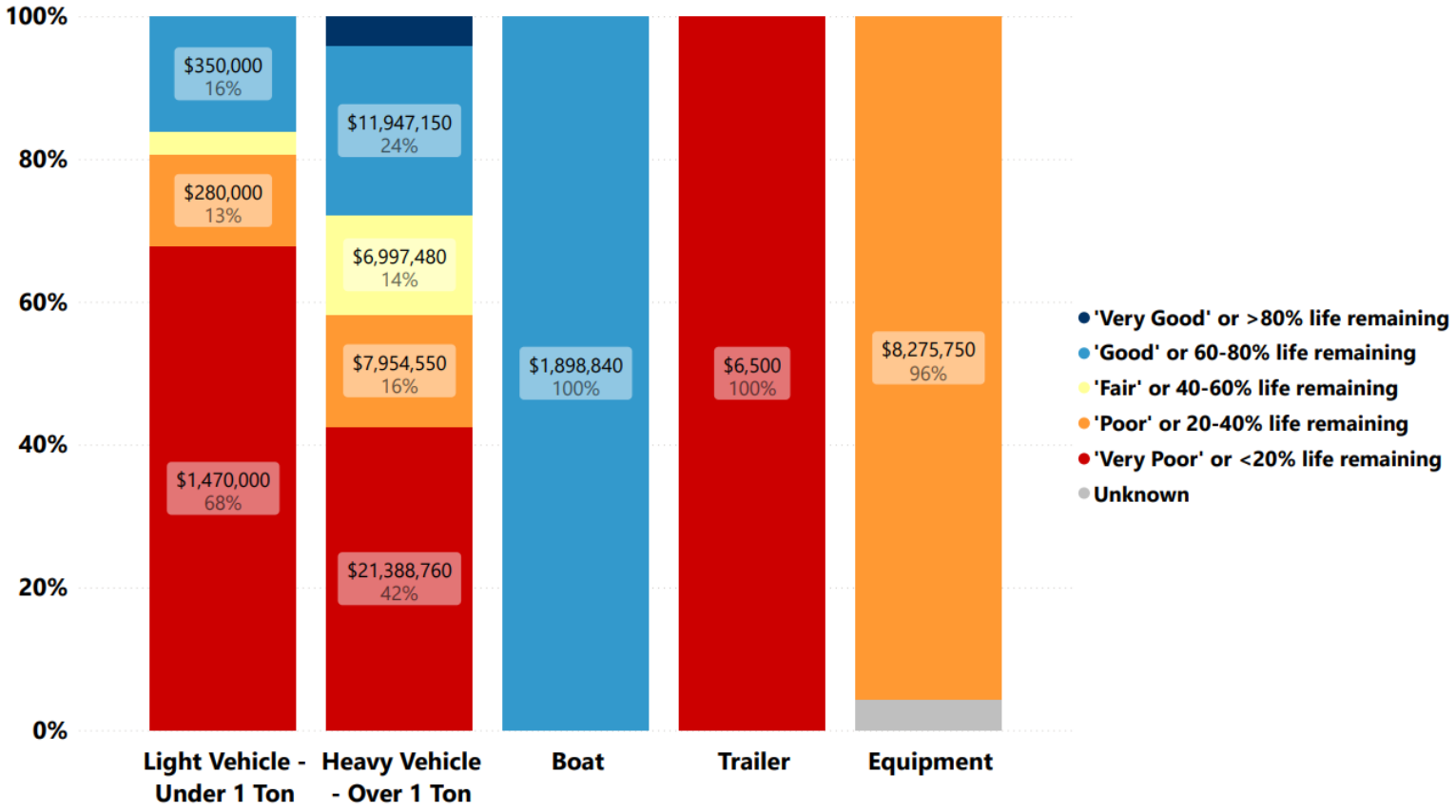
Figure 6-1: Condition Summary and 2023 Replacement Cost – Kingston Fire & Rescue



Based on Figure 14 of the Facilities AMP (2023), building and site elements that represent approximately 3% of the total replacement value of Kingston Fire & Rescue Facilities are in very poor condition; 25% are in poor condition, 32% are in fair condition, and 40% are in good condition. For further details regarding Kingston Fire & Rescue facilities, please refer to the Facilities AMP (2023).

A condition summary for Fleet and Equipment assets is provided in **Figure 6-2** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of Fleet and Equipment assets has been primarily determined based on age and expected useful life.

Figure 6-2: Condition Summary by Asset Type and 2023 Replacement Cost - Kingston Fire & Rescue (Fleet and Equipment)



6.1.4 Data Sources and Confidence

The asset data for Kingston Fire & Rescue Fleet assets is maintained by the City in a web-based fleet and equipment management solution from AssetWorks Inc. called FleetFocus M5 and served as the main data source of Fleet and Equipment assets for this AMP. The City has staff who regularly update the inventory data for Kingston Fire & Rescue assets hosted within the City's Enterprise Fleet Management Information System. This suggests that the data source within this AMP can be assumed to be reliable.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 6-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

For discussion on data confidence related to Kingston Fire & Rescue Facilities, please refer to the Facilities AMP (2023).

Table 6-3: Data Confidence Scale

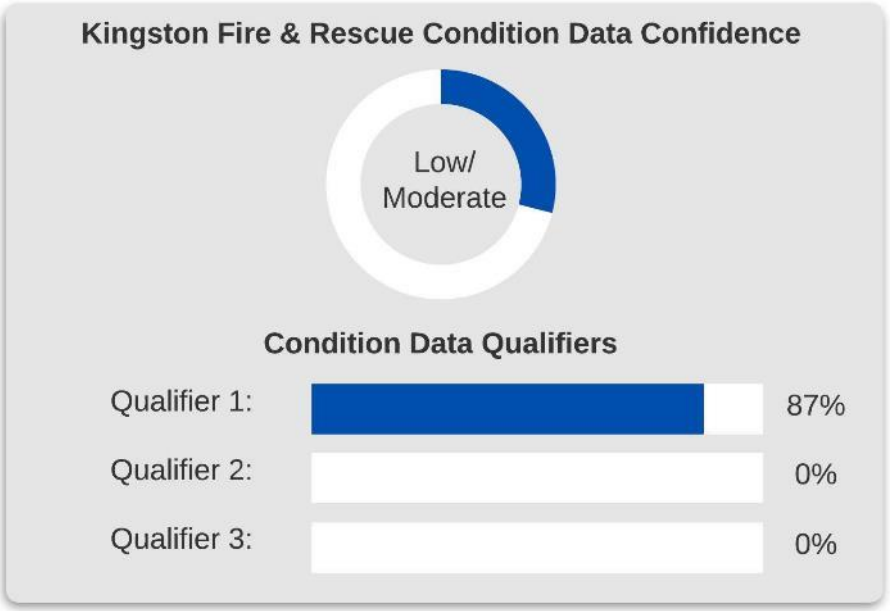
Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data source is reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (87%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (0%); and,

- **Qualifier 3**: The percentage of the estimated overall replacement value, in 2023 dollars, attributed to assets in the asset inventory with documented condition assessment data (i.e., condition is not solely age-based) (0%).

Figure 6-3: SOLI Report Data Confidence – Kingston Fire & Rescue



As summarized in **Figure 6-3**, the overall asset condition data confidence for Kingston Fire & Rescue assets is estimated to be Low/Moderate. Presently, all asset conditions for Kingston Fire & Rescue assets are age-based. Data confidence can be increased by improving the documentation of condition assessment data. For Fleet assets, this may include adding an additional attribute within FleetFocus M5 to track assigned asset condition ratings which can be assigned or updated when City staff perform regularly scheduled maintenance.

6.2 Levels of Service

Kingston Fire & Rescue developed a strategic plan in 2021 for a 5-year planning period. The plan was created to determine the current capabilities and the opportunities to improve the services to meet the Centre for Public Service Excellence (CPSE) standards. Within the strategic plan, there are five strategic goals which include:

1. Training program for both volunteer and professional firefighters, that includes evaluating current training methods, resources, and the composite service model;
2. Establish an internal communication plan and culture;
3. Create a CPSE accreditation with a focus on continuous improvement;
4. Implement a substantial public education and community outreach platform and programs; and,
5. Create the most optimal dispatch and apparatus management practices and protocols.

Each of these goals have their own objectives, timeframes, and critical tasks. These goals are for the overall services being provided by Kingston Fire & Rescue and were considered when reviewing the community Levels of Service (LOS) for the assets.

The City has developed the community and technical Levels of Service (LOS), based on input from municipal staff. It was decided that Quality and Environmental Acceptability were key attributes in gauging the performance of the assets **Table 6-4** and **Table 6-5** outline the City's current community and technical levels of service for Kingston Fire & Rescue.

Table 6-4: Community LOS – Kingston Fire & Rescue

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Capacity	Provide adequate response time.	Average response time (mins)	5.1

Table 6-5: Technical LOS - Kingston Fire & Rescue

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Quality	Fleet and Equipment are kept in good working condition.	Percentage of assets that are in poor or better condition.	63%

6.3 Risk Assessment

The risk ratings for Kingston Fire & Rescue assets included Fleet and Equipment. The risk scores were calculated using the risk methodology and approach outlined in Section 1.4 of the Introduction. **Table 6-6** summarizes the risk factors for the Kingston Fire & Rescue assets.

Table 6-6: Risk Factors - Kingston Fire & Rescue

Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.

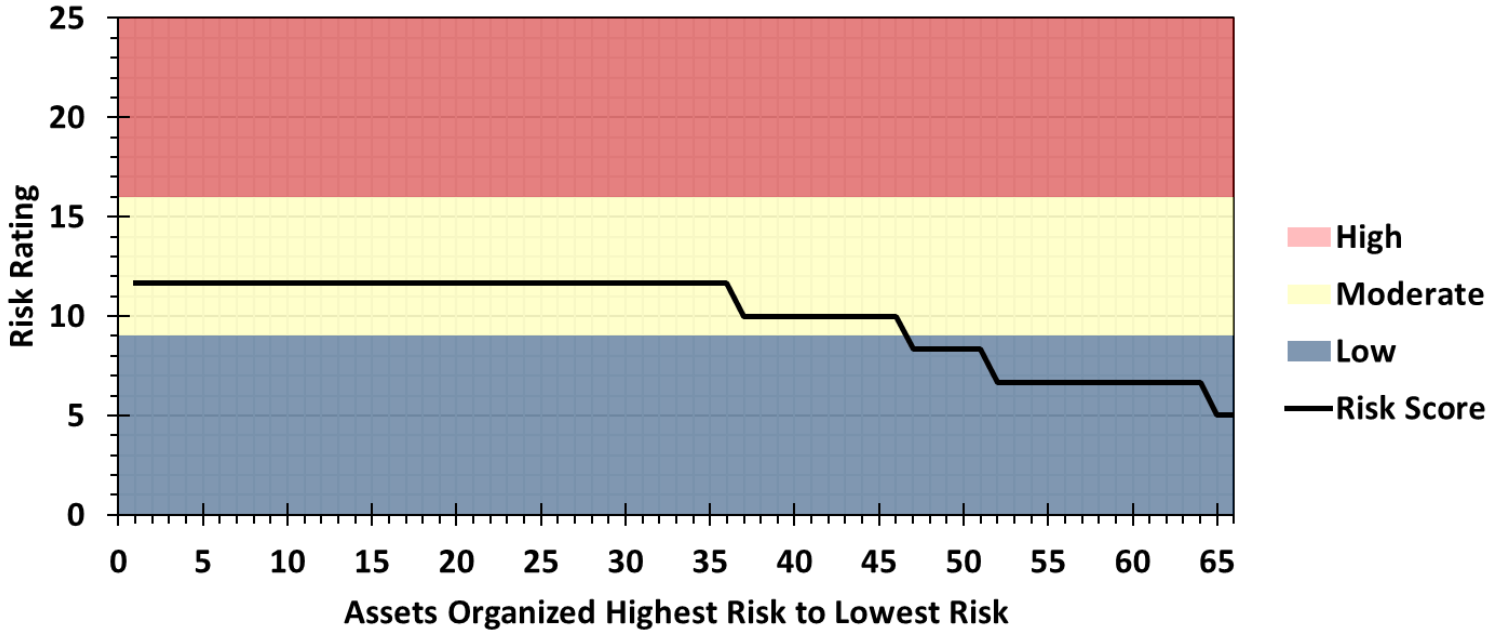
Factors	Risk Ratings
B - Performance	The performance of the Fleet assets was identified as "always reliable" and assigned a rating of 1 for calculating risk score. The Equipment assets was identified as “usually reliable” and assigned a rating of 3 for calculating risk score.
C - Climate Change	The climate change ratings were determined at the asset class level by identifying climate change hazard interactions. The Fleet and Equipment assets were identified as a “low” risk and assigned a rating of 1 for calculating the risk score.
D - Impact	The Fleet and Equipment assets were recognized as "high" impact and assigned a rating of 2 for calculating risk score.
E - Importance	The Fleet and Equipment assets were identified as “high” importance and assigned a rating of 3 when calculating risk.

The individual risk ratings were used in calculating the risk score for each of the assets.

6.3.1 Risk Profile

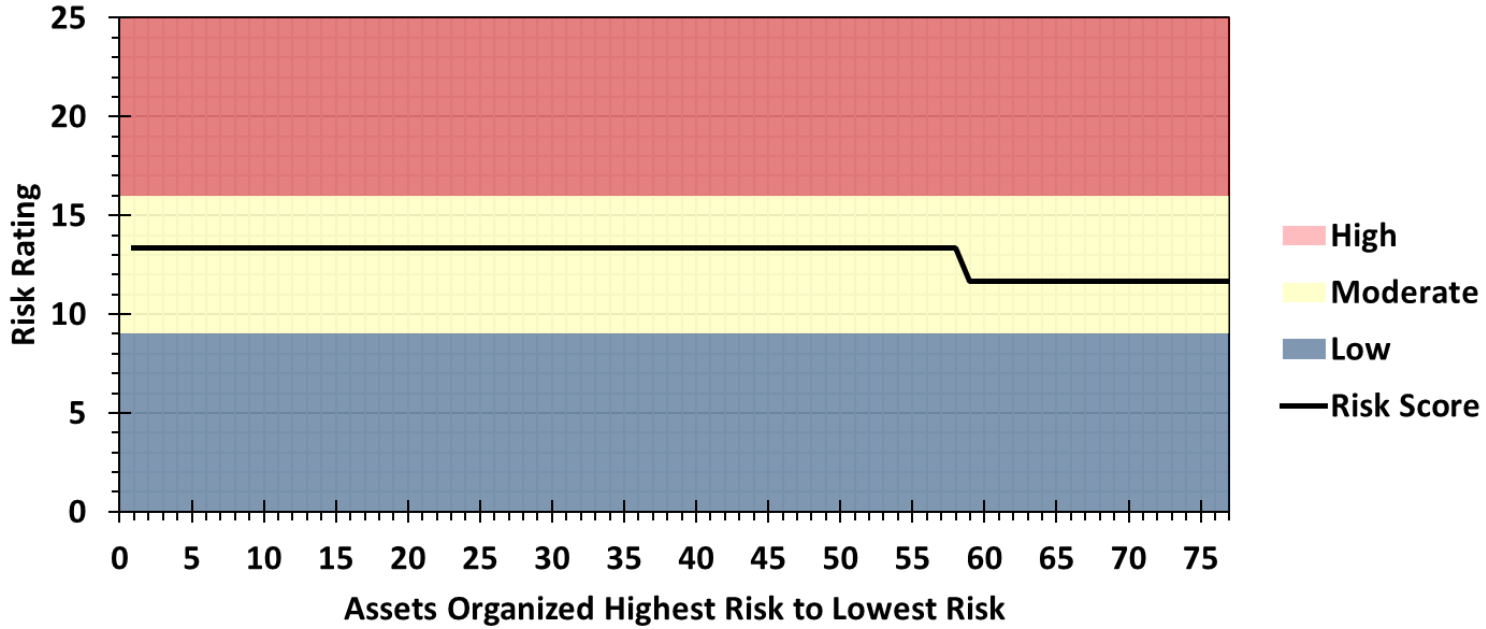
The Risk profile of the Fleet assets is displayed in **Figure 6-4**. Of the 66 Fleet tracked within the asset inventory, approximately 69.7% (46) are classified as Moderate risk and the remaining 30.3% (20) are Low risk.

Figure 6-4: Risk Profile - Kingston Fire & Rescue (Fleet)



The Risk profile of the Equipment assets is displayed in **Figure 6-5**. All 77 Equipment assets tracked in the asset inventory are considered as Moderate risk.

Figure 6-5: Risk Profile - Kingston Fire & Rescue (Equipment)



6.4 Asset Management Strategy

6.4.1 Lifecycle Activities – Kingston Fire & Rescue

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.
- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.

- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 6-7 describes the lifecycle activities that can be implemented within the asset management strategy for Kingston Fire & Rescue. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in January 2024.

Table 6-7: Lifecycle Activities - Kingston Fire & Rescue

Lifecycle Type	Description of Activity	Frequency / Timing
Non-Infrastructure Solutions	Policies and procedures for all Fleet and Equipment.	Based on applicable standards (including NFPA 1911)
Maintenance Activities	Regular scheduled inspection and maintenance as per all applicable legislation, standards, and manufacturer recommendations.	Based on applicable standards (including NFPA 1911)
Maintenance Activities	Preventative maintenance program for communications towers.	Annually, monthly, and as needed
Renewal / Rehabilitation Activities	Repairs/rehabilitation of communications towers.	As needed
Replacement / Construction Activities	Replacement of Fleet and Equipment	End of EUL (based on NFPA 1911)

Lifecycle Type	Description of Activity	Frequency / Timing
Disposal Activities	At the end of estimated service life, Kingston Fire & Rescue Fleet and Equipment assets are sold or disposed of following City policy, applicable regulations and environmental standards.	End of EUL
Expansion / Growth / Service Improvement Activities	As an Accredited fire service, we follow our Standards of Cover and Community Risk Assessment/Performance Gaps.	Ongoing
Expansion / Growth / Service Improvement Activities	Compliance report submitted CPSE for approval.	Annually

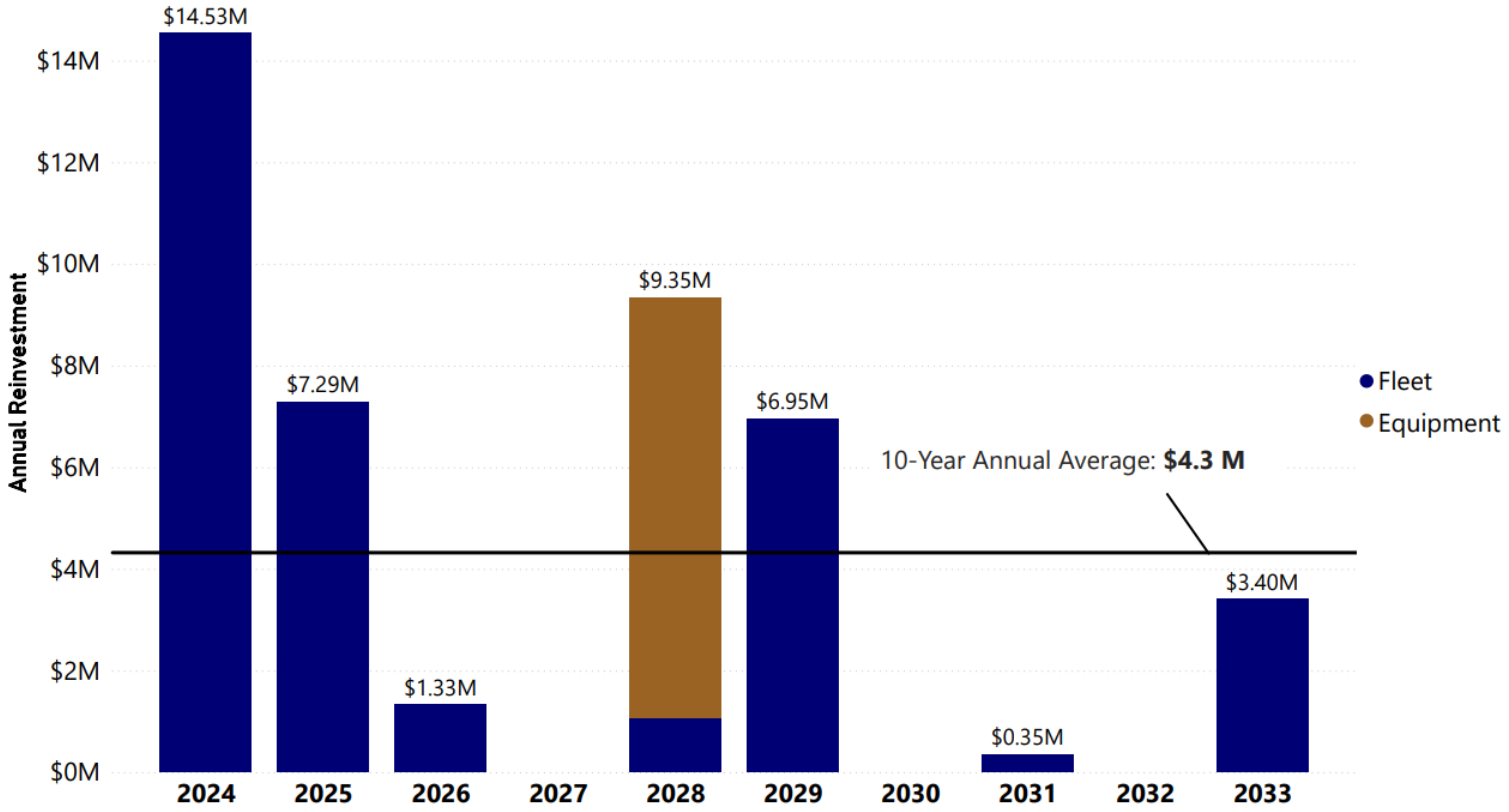
6.4.2 Funding the Lifecycle Activities - Kingston Fire & Rescue

Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, EUL, replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of interest. Asset replacement forecasts within this subsection estimate the required reinvestment for Kingston Fire & Rescue assets over the next 10 years based on available asset inventory data. It is important to note that reinvestment for Facilities is not included in this AMP, please refer to the Facilities AMP (2023).

Kingston Fire & Rescue

There is a total of approximately **$43.2 million** to be reinvested into the Kingston Fire & Rescue assets owned by the City in the next 10 years. This translates to a 10-year annual average of approximately **$4.3 million**, as presented in **Figure 6-6**. The $8.28 million reinvestment needs for equipment in 2028 is due to the 15-year expected useful life for all communication, video, & radio system assets.

Figure 6-6: 10-Year Capital Reinvestment Needs - Kingston Fire & Rescue

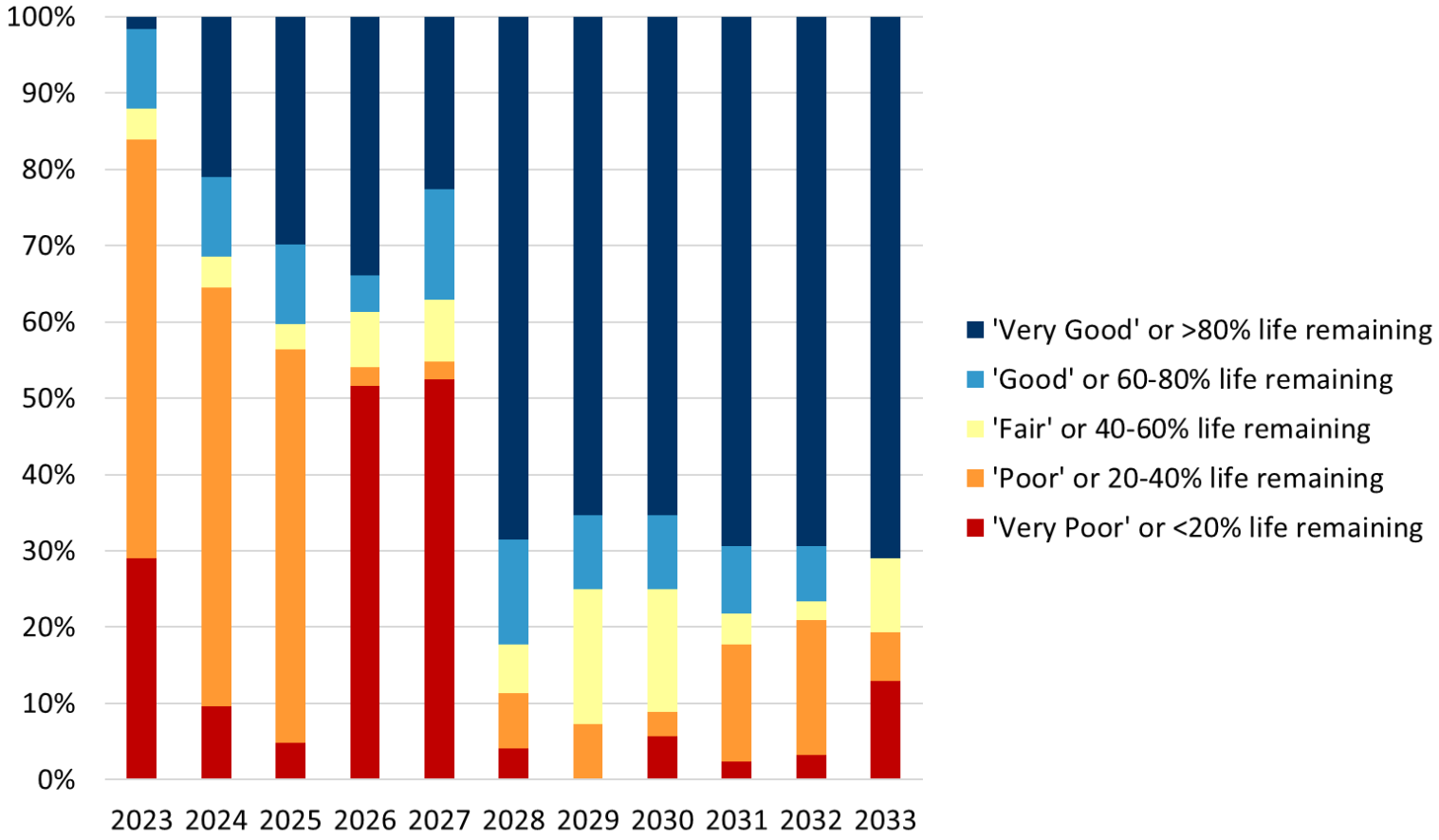


It is important to note that forecasting in this lifecycle model relies heavily on age and EUL to determine renewal or replacement needs and that tracking of condition data for Kingston Fire & Rescue assets by the City will assist at refining forecasted expenditures in future updates.

The LOS includes maintaining the current assets in poor or better condition (63%). From the lifecycle model, the percentage of Kingston Fire & Rescue assets in poor or better condition fluctuates throughout the next 10-years, reaching a high of 100% in 2029, eventually finishing at 87% in 2033.

Figure 6-7 shows an overview of the condition of Kingston Fire & Rescue over the next 10 years based on the lifecycle model.

Figure 6-7: Condition Overview by Year Based on Lifecycle Model – Kingston Fire & Rescue



7.0 Solid Waste

The City's Solid Waste Service, managed under the Public Works & Solid Waste Department, is responsible for the efficient and responsible collection, Disposal, and Diversion of Solid Waste to keep the City clean and sustainable. An array of services are included, such as regular curbside pickup of residential waste, recycling, and organic materials, seasonal collections of leaf and yard waste. To provide the Solid Waste service, the City manages and oversees the operation and maintenance of a variety of Solid Waste assets in addition to the fleet of collection trucks. The following section of the AMP includes assets that are under the Solid Waste service, **excluding** fleet and facility assets which are inventoried under Corporate Fleet in Volume 2 of this AMP and the Corporate Facilities 2023 AMP.

Note on Scope: At the time of preparing this AMP no data was available for one asset class, Diversion. As a result, this asset class is not included in this AMP. It is recommended that the City further develops an inventory of this asset class to be considered in subsequent iterations of the AMP.

7.1 State of the Local Infrastructure

7.1.1 Asset Inventory and Valuation

Table 7-1 summarizes the asset inventory for Solid Waste by asset class, asset type, asset count, total replacement cost (in 2023 dollars). All inventory counts and replacement costs of the assets are estimated based on service collection points. The total replacement cost (2023 dollars) is estimated at **$2.9 million** for the **203,833 assets** included in the inventory.

Table 7-1: Inventory Summary by Asset Type – Solid Waste

Asset Class	Asset Type	Count	Total Replacement Cost (2023)
Disposal	Solid Waste Blue/Grey Bins	150,750	$1,160,780
Disposal	Solid Waste Carts	2,826	$322,170
Disposal	Solid Waste Depot Bins	7	$30,100
Disposal	Solid Waste Green Bins	50,250	$1,344,190
Overall	**N/A**	**203,833**	**$2,857,240**

7.1.2 Asset Age Summary

Table 7-2 summarizes the average age, average condition, expected useful life, and the average remaining useful life of assets pertaining to Solid Waste. The overall average age of Solid Waste assets is two years, and the average remaining useful life is five years.

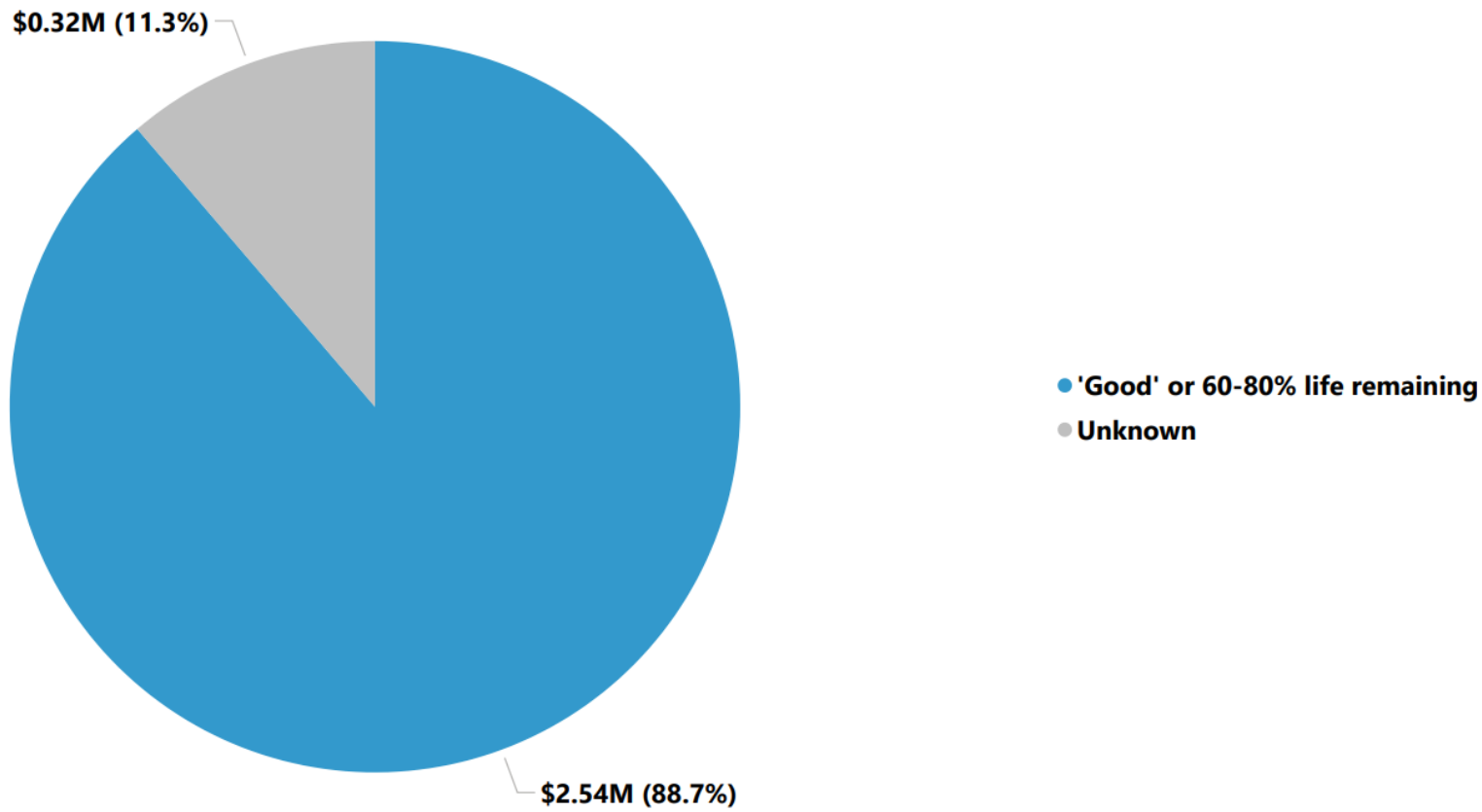
Table 7-2: Average Age, Average Condition, Expected Useful Life, and Remaining Useful Life – Solid Waste

Asset Class	Asset Type	Average Age (Years)	Average Condition Rating	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Disposal	Solid Waste Blue/Grey Bins	2	Good	8	6
Disposal	Solid Waste Carts	Unknown	Unknown	15	Unknown
Disposal	Solid Waste Depot Bins	3	Good	10	7
Disposal	Solid Waste Green Bins	2	Good	5	3
Overall	**N/A**	**2**	**Good**	**5 to 15**	**5**

7.1.3 Asset Condition

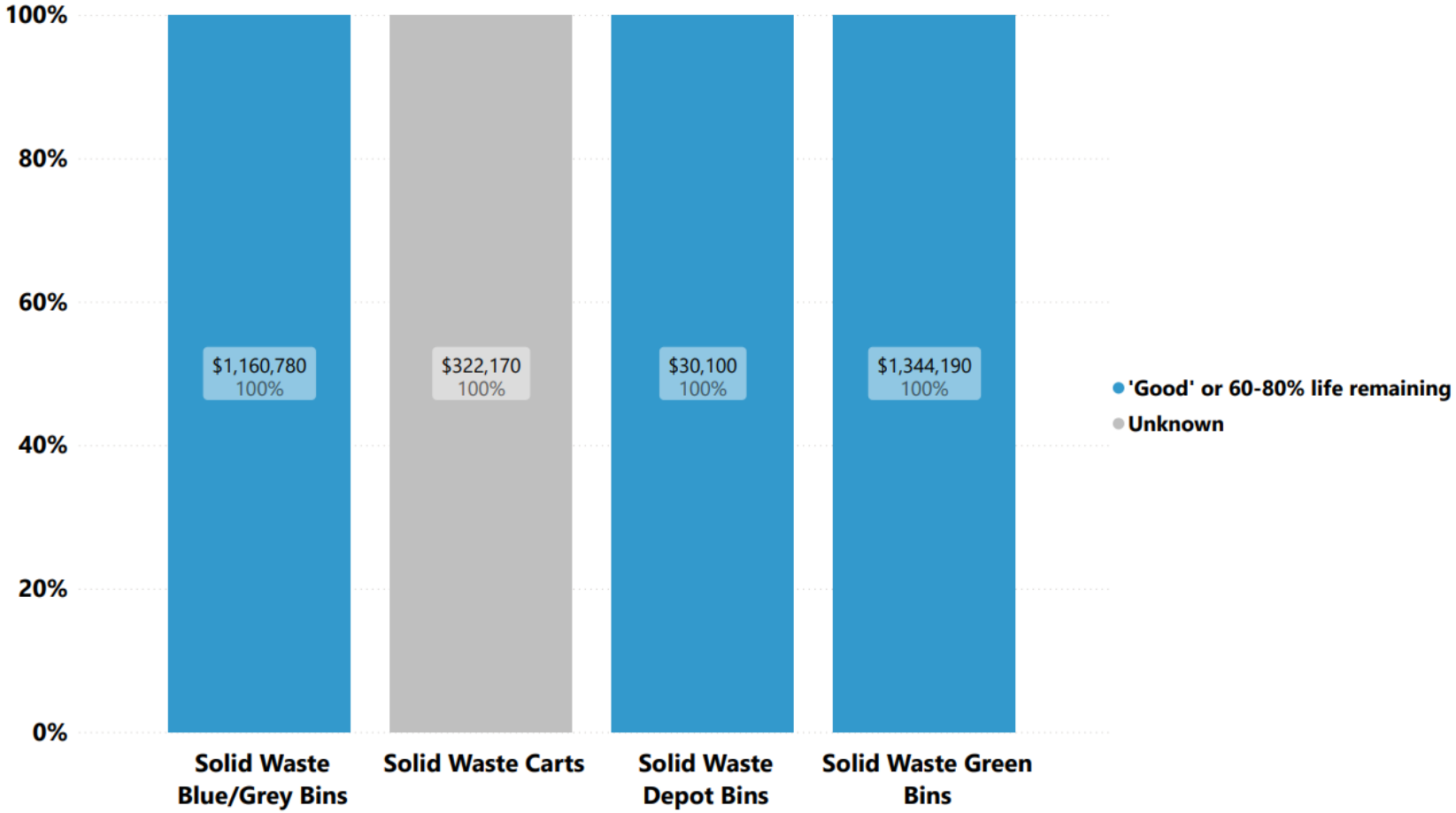
An overall condition summary for Solid Waste assets by replacement cost (in 2023 dollars) is shown in **Figure 7-1**. About 88.7% of the assets are in good, with 11.3% of the assets with unknown condition.

Figure 7-1: Condition Summary and 2023 Replacement Cost – Solid Waste



A condition summary for Disposal assets is provided in **Figure 7-2** by asset type and replacement cost (in 2023 dollars). In the absence of condition and age data, the condition of the assets has been primarily determined based on input from City staff.

Figure 7-2: Condition Summary by Asset Type and Replacement Cost – Solid Waste (Disposal)



7.1.4 Data Sources and Confidence

Asset data for Solid Waste assets was assembled in Microsoft Excel and at this time there is no centralized repository for Solid Waste asset information.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 7-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

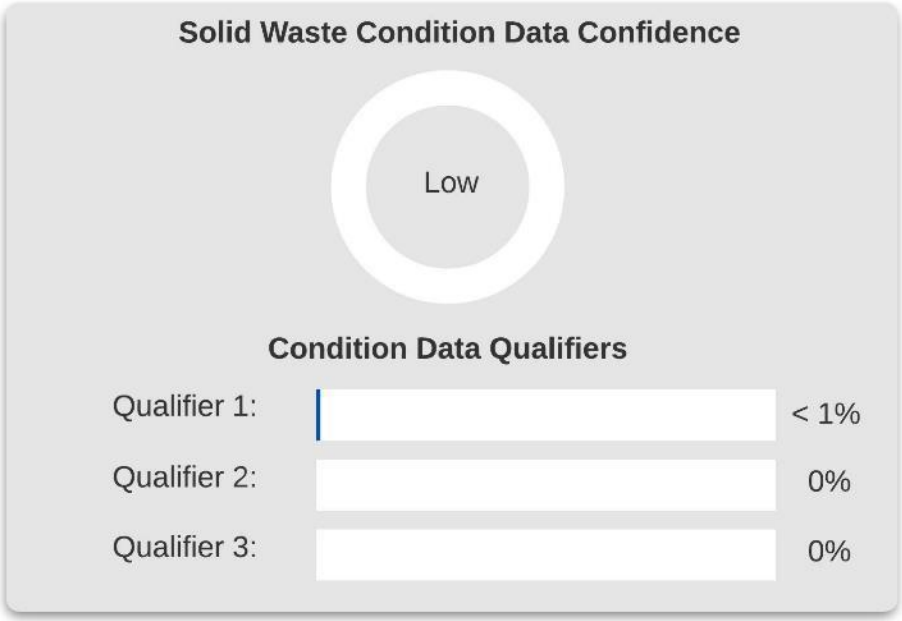
Table 7-3: Data Confidence Scale

Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data source is reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (< 1%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (0%); and,
- **Qualifier 3**: The percentage of the estimated overall replacement value, in 2023 dollars, attributed to assets in the asset inventory with documented condition assessment data (i.e., condition is not solely age-based) (0%).

Figure 7-3: SOLI Report Data Confidence – Solid Waste



As summarized in **Figure 7-3**, the overall asset condition data confidence for Solid Waste assets is estimated to be Low. Data confidence can be increased by improving the quality of the data and/or filling in data gaps. Currently, significant data gaps exist for Solid Waste assets including the unknown condition and age data. It is recommended that the City develops a formal asset inventory of Solid Waste assets to better inform future AMP iterations.

7.2 Levels of Service

The City has Solid Waste assets that provide service which will be undergoing changes in July of 2025 due to legislative impacts. Blue and grey boxes will no longer be municipal assets as of July 1, 2025 and green bins will be replaced over a 5-year period with new larger green bins. Due to these impacts, the City will not be collecting and providing recycling services. Therefore, there are no current level of service performance measure for this service.

As the City transitions to a cart-based waste collection program (2025 to 2030), asset management of the newly delivered Carts (garbage and green bin) will be built into the system. This will allow the City to track average life spans and replacement costs more effectively than is currently manageable.

7.3 Risk Assessment

The risk ratings for Solid Waste assets include all assets under the asset class of Disposal. The risk scores were calculated using the risk methodology and approach outlined in the Introduction document. **Table 7-4** summarizes the risk factors for the Solid Waste assets.

Table 7-4: Risk Factors – Solid Waste

Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.
B - Performance	The performance of the Disposal assets was identified as "usually reliable" and assigned a rating of 3 for calculating risk score.

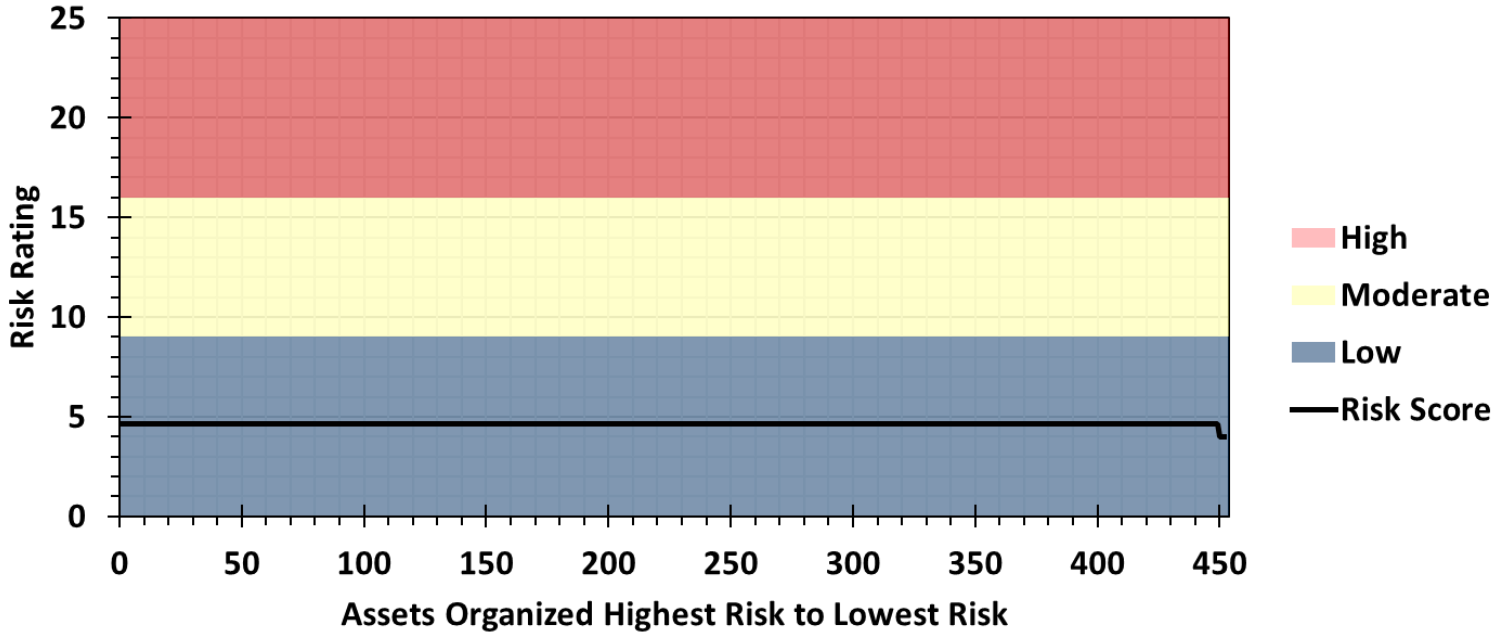
Factors	Risk Ratings
C - Climate Change	The climate change ratings were determined at the asset class level by identifying climate change hazard interactions. The Disposal assets were identified as a “low” risk and assigned a rating of 1 for calculating the risk score.
D - Impact	The Disposal assets was recognized as "moderate" impact and assigned a rating of 1 for calculating risk score.
E - Importance	The Disposal asset class was identified as “low” importance and assigned a rating of 1 when calculating risk.

The individual risk ratings were used in calculating the risk score for each of the assets.

7.3.1 Risk Profile

The Risk profile of the Disposal assets is displayed in **Figure 7-4**. It is important to note that inventory data for Disposal assets includes pooled assets. All of the 452 Disposal assets tracked within the asset inventory are of Low risk.

Figure 7-4: Risk Profile – Solid Waste (Disposal)



7.4 Asset Management Strategy

7.4.1 Lifecycle Activities – Solid Waste

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.

- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.
- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 7-5 describes the lifecycle activities that can be implemented within the asset management strategy for Solid Waste. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in February 2024.

Table 7-5: Lifecycle Activities – Solid Waste

Lifecycle Type	Description of Activity	Frequency / Timing
Maintenance Activities	Inspections & Diagnostics	Daily, weekly, monthly, and annually
Renewal / Rehabilitation Activities	Baler rebuilds (hydraulics, rams, flooring/walls).	Every 3 to 5 years
Renewal / Rehabilitation Activities	Conveyor belt repairs and rehabilitation.	Every 1 to 3 years

7.4.2 Funding the Lifecycle Activities – Solid Waste

Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, EUL, replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of interest. Asset replacement forecasts could not be developed for Solid Waste assets at the time of preparing this AMP due to significant data gaps.

8.0 Airport Operations

The City's Airport, named Kingston Norman Rogers Airport, provides essential air traffic service for its residents, visitors, and businesses in the Kingston area. The airport, which is owned and operated by the City, features a modern terminal, that in the past has served commercial airlines that offer regular scheduled flights to various domestic destinations. Since the pandemic, work is underway to reattract commercial air services. The airport also supports the local economy through general aviation services which include hangar rentals, cargo operations, charter services, and flight school operations. It is equipped with an instrument landing system, providing year-round accessibility. Its recent expansion included new passenger terminal building and runway extension, which has increased its capacity and made it more convenient for both leisure and business travellers. To provide Airport Operations, the City manages a wide range of assets, including Facilities, Site, Runway Pavement, Runway Lighting, and Other Equipment.

It is important to note that the Airport Facilities were included in the dedicated 2023 Facilities AMP developed by the City's Facilities Management & Construction Services (FMCS) department in consultation with GM BluePlan Engineering Limited. As a result, the details on Airport Facilities in this AMP are limited to basic inventory information. For further detail on the facilities including data confidence and lifecycle modeling, please refer to the 2023 Facilities AMP. Fleet assets required to support Airport Operations are also included in the Corporate Fleet AMP in Volume 2 of this AMP.

Note on Scope: At the time of preparing this AMP, no data was available for some Information & Technology assets related to Airport Operations. Those supported by the City's IS&T department would be included in Volume 2 of this AMP. As a result, the asset class is not included in this AMP. It is recommended that the City further develops an inventory of assets comprising the asset class to be considered in subsequent iterations of the AMP.

8.1 State of the Local Infrastructure

8.1.1 Asset Inventory and Valuation

Table 8-1 summarizes the asset inventory for Airport Operations by asset class, asset type, asset count, total replacement cost (in 2023 dollars). The total replacement cost (2023 dollars) is estimated at **$58.8 million** for the **41 assets** included in the inventory.

Table 8-1 Notes

[1] As reported in Facilities AMP (2023).

Table 8-1: Inventory Summary by Asset Type – Airport Operations

Asset Class	Asset Type	Count	Total Replacement Cost (2023)
Facilities[1]	Airport Buildings	4	$30,900,000[1]
Airport Site	Roadways – Asphalt	6	$1,368,250
Airport Site	Parking Lots – Asphalt	2	$728,000
Runway	Roadways – Asphalt	7	$16,146,000
Runway	Parking Lots – Asphalt	2	$6,968,000
Runway Lighting	Site Lighting	15	$2,620,000
Other Equipment	Video Wall	5	$57,310
Overall	**N/A**	**41**	**$58,787,560**

8.1.2 Asset Age Summary

Table 8-2 summarizes the average age, the average condition, the expected useful life, and the average remaining useful life of assets pertaining to Airport Operations. For details regarding Airport Operations facilities, please refer to the Facilities AMP (2023). The overall average age of Airport Operations assets is 18 years, and the average remaining useful life is eight years.

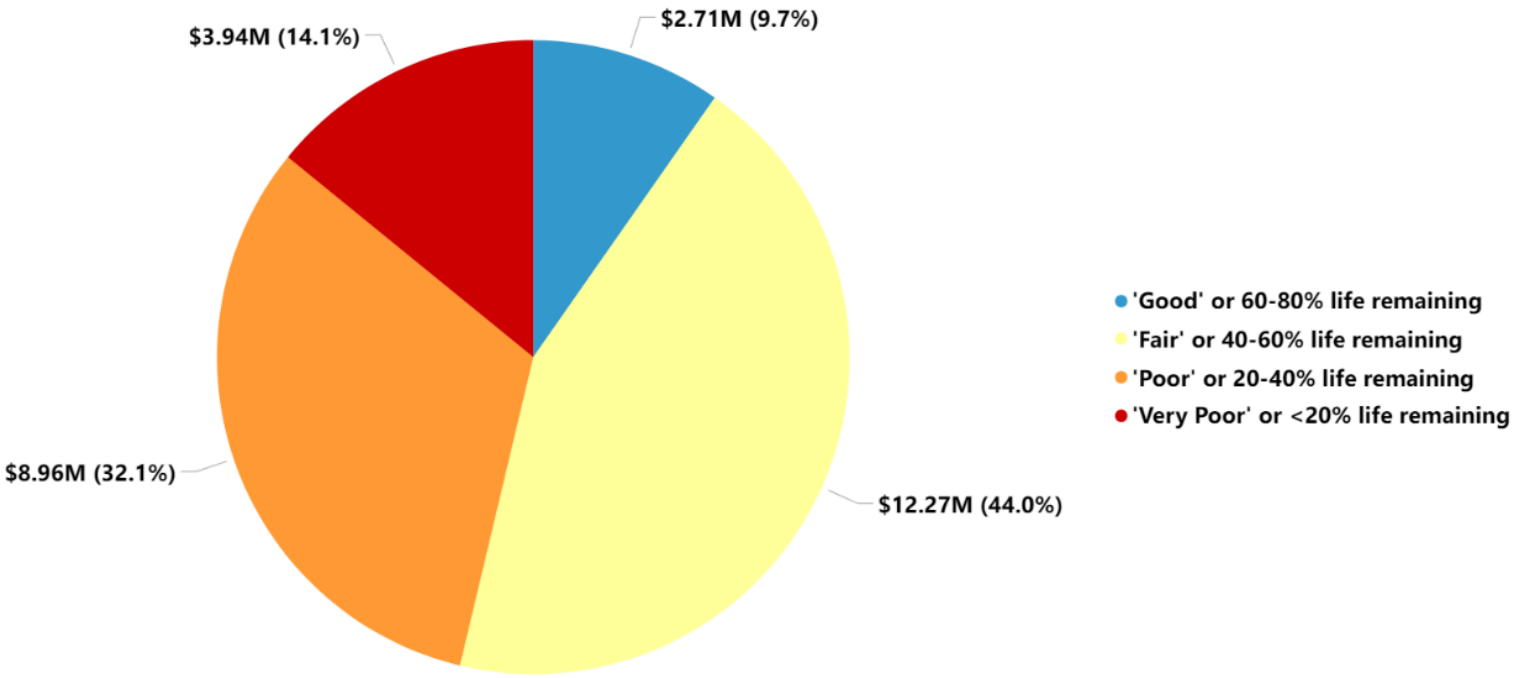
Table 8-2: Average Age, Average Condition, Expected Useful Life, and Remaining Useful Life – Airport Operations

Asset Class	Asset Type	Average Age (Years)	Average Condition Rating	Expected Useful Life (Years)	Average Remaining Useful Life (Years)
Airport Site	Roadways – Asphalt	Unknown	Poor	25	9
Airport Site	Parking Lots – Asphalt	Unknown	Poor	25	9
Runway	Roadways – Asphalt	25	Fair	25	9
Runway	Parking Lots – Asphalt	26	Poor	25	6
Runway Lighting	Site Lighting	18	Poor	20	10
Other Equipment	Video Wall	5	Fair	10	5
Overall	**N/A**	**18**	**Fair**	**10 to 25**	**8**

8.1.3 Asset Condition

An overall condition summary for Airport Operations assets by replacement cost (in 2023 dollars) is shown in **Figure 8-1**. About 53.7% of the assets are in good to fair condition.

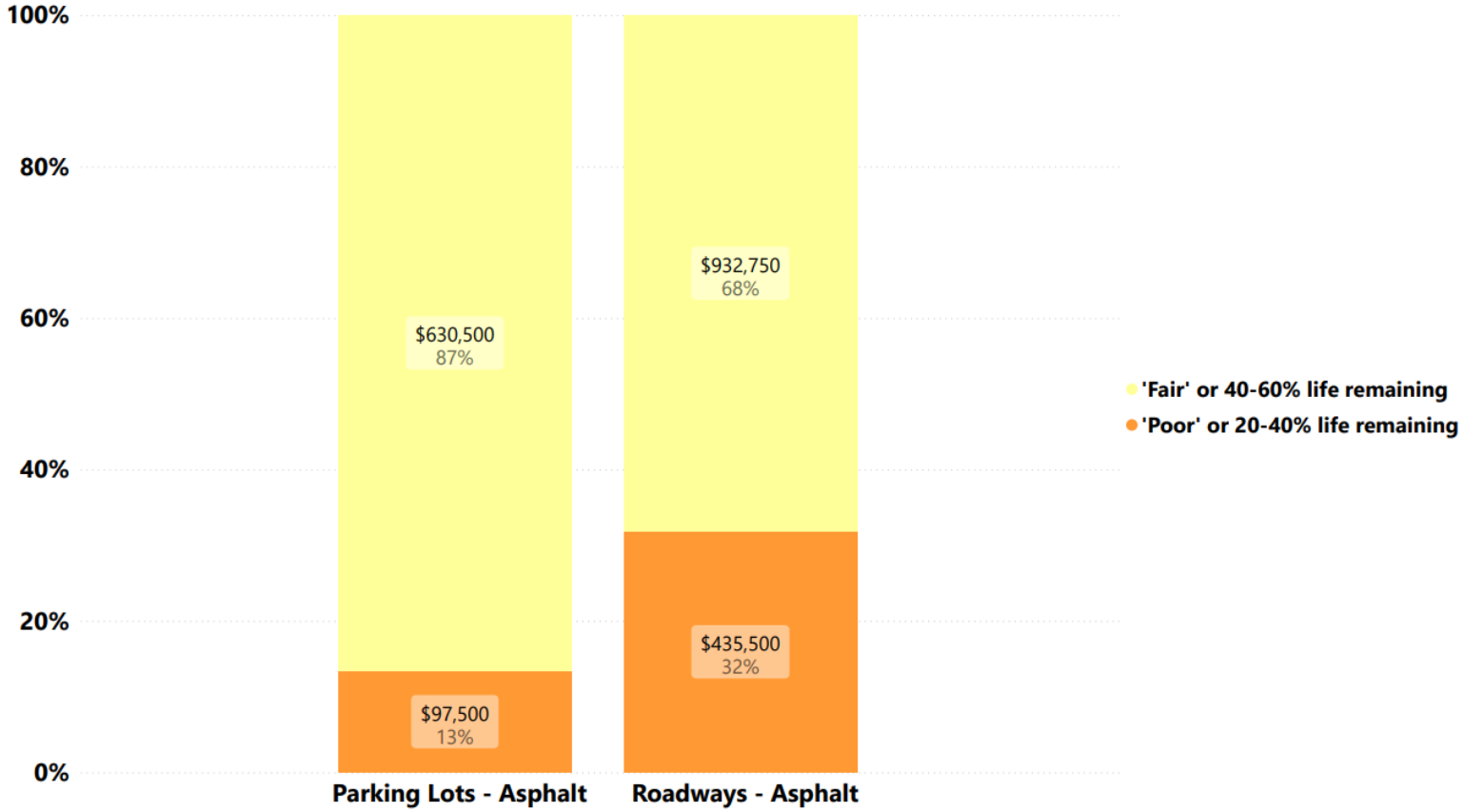
Figure 8-1: Condition Summary and 2023 Replacement Cost – Airport Operations



Based on Figure 14 of the Facilities AMP (2023), building and site elements that represent approximately 1% of the total replacement value of Airport facilities are in very poor condition; 32% are in poor condition, 29% are in fair condition, and 38% are in good condition. For details regarding airport facilities, please refer to the Facilities AMP (2023).

A condition summary for Airport Site assets is provided in **Figure 8-2** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of Airport Site assets has been primarily determined based on age and expected useful life.

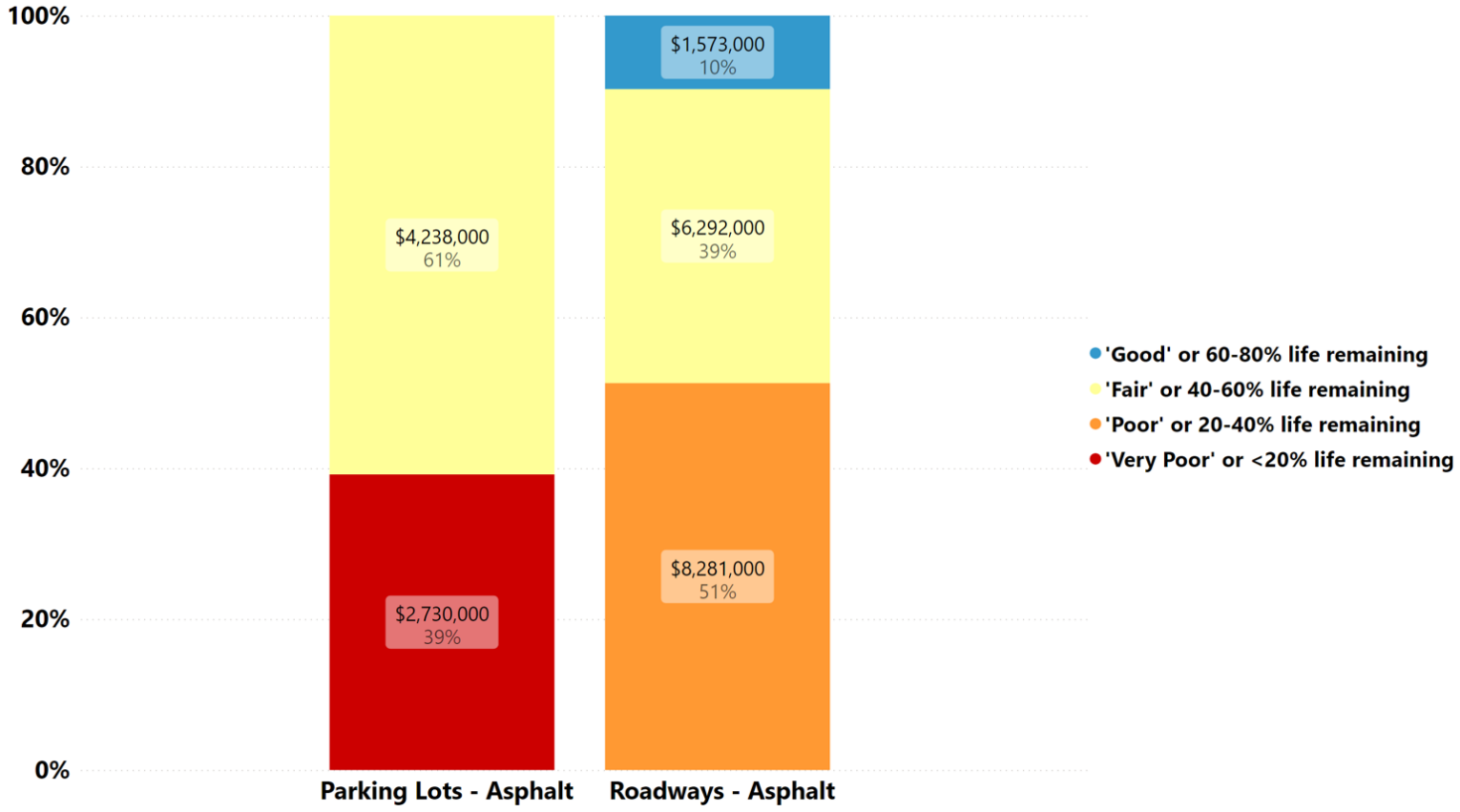
Figure 8-2: Condition Summary by Asset Type and 2023 Replacement Cost - Airport Operations (Airport Site)



Airport Operations

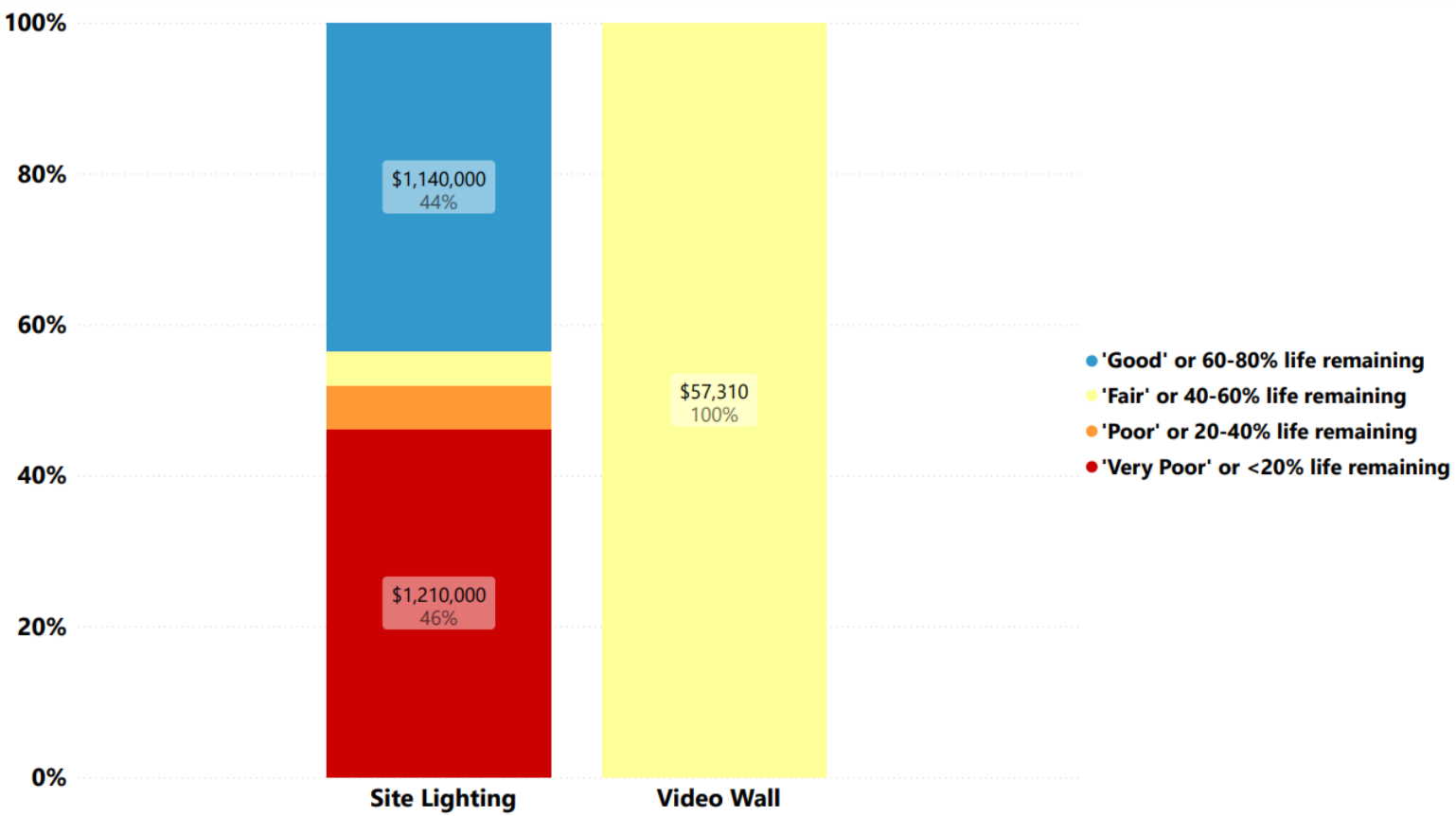
A condition summary for Runway assets is provided in **Figure 8-3.** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of Vehicle assets has been primarily determined based on age and expected useful life.

Figure 8-3: Condition Summary by Asset Type and 2023 Replacement Cost - Airport Operations (Runway)



A condition summary for Runway Lighting and Other Equipment assets is provided in **Figure 8-4** by asset type and replacement cost (in 2023 dollars). In the absence of condition assessment data, the condition of the assets has been primarily determined based on age and expected useful life.

Figure 8-4: Condition Summary by Asset Type and 2023 Replacement Cost - Airport Operations – (Runway Lighting and Other Equipment)



8.1.4 Data Sources and Confidence

Asset data for Airport Operations assets, outside airport facilities, is not maintained in a developed inventory. City staff provided a facility inventory assessment report (in Portable Document Format [PDF]) that was completed in 2022 to inform inventories in 2023, translating to the assumption within this AMP that the data source can be seen as reliable.

Data confidence can be estimated based on the confidence level of various qualifiers and can be presented on a scale from 0% (low) to 100% (high), as shown in **Table 8-3**. The qualifiers chosen for evaluation are specifically targeted for estimating overall confidence of condition reporting within the SOLI.

For discussion on data confidence related to Airport Operations facilities, please refer to the Facilities AMP (2023).

Table 8-3: Data Confidence Scale

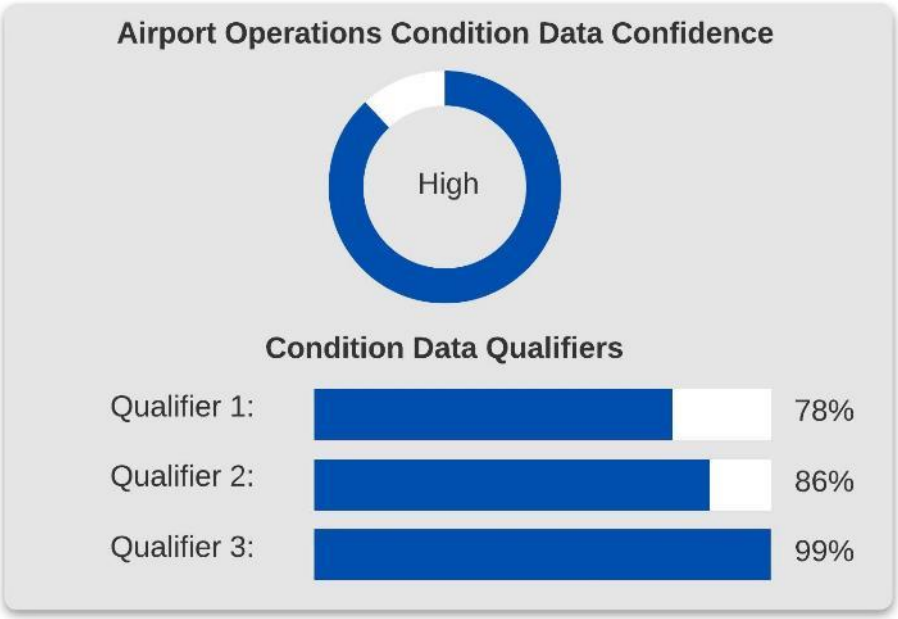
Confidence Level	Low	Low/ Moderate	Moderate	Moderate/ High	High
Average of Qualifiers	0% to 19%	20% to 39%	40% to 59%	60% to 79%	80% to 100%

Assuming the data source is reliable, the following qualifiers were considered to estimate data confidence regarding the data utilized in the creation of this SOLI report:

- **Qualifier 1**: The percentage of assets in the asset inventory where construction, installation, or acquisition years are documented (78%);
- **Qualifier 2**: The percentage of assets in the asset inventory that have condition assessment data documented (86%); and,

- **Qualifier 3**: The percentage of the estimated overall replacement value, in 2023 dollars, attributed to assets in the asset inventory with documented condition assessment data (i.e., condition is not solely age-based) (99%).

Figure 8-5: SOLI Report Data Confidence



As summarized in **Figure 8-5**, the overall asset condition data confidence for Airport Operations assets is estimated to be High. Most inventoried assets including runways, taxiways, aprons, and associated exterior lighting were assessed in 2022 resulting in recent asset condition assessment data that could be utilized in this AMP.

8.2 Levels of Service

The City is in the process of updating the 2007 Airport Master Plan to provide the overall vision for the airport with a systematic manner of development for the airport's infrastructure. In addition to the Master Plan, the City generated a Business Case in 2012 which was used for the expansion of the airport and conducted a Highest and Best Land Use plan in 2018. These plans were developed for growth and long-term planning.

For the existing airport assets, the City has developed community and technical Levels of Service (LOS), based on input from municipal staff. **Table 8-4** and **Table 8-5** outline the City's current community and technical levels of service for Airport Operations.

Table 8-4: Community LOS – Airport Operations

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Reliability	Provide reliable service as volume and movement increases	Aircraft movements per year	29,243 – increase of 29.5% from 2022
Suitability	Provide infrastructure to support airlines and airport land development	Runway Infrastructure able to support unrestricted operations by B737-900 aircraft and percentage of available lands serviced.	Q400-restricted operations, 1% vacant serviced land

Table 8-5: Technical LOS – Airport Operations

LOS Parameter	LOS Statement	Performance Measure	Current LOS (2023)
Quality	Roadways, Parking Lots, Site Lighting, Video Wall are kept in good working condition.	Percentage of assets that are in poor or better condition.	81%

8.3 Risk Assessment

The risk ratings for Airport Operations assets included Airport Site, Runway, Runway Lighting, and Other Equipment. The risk scores were calculated using the risk methodology and approach outlined in Section 1.4 of the Introduction. **Table 8-6** summarizes the risk factors for the Airport Operations assets.

Table 8-6: Risk Factors – Airport Operations

Factors	Risk Ratings
A - Condition	The condition of the assets was determined either by visual or age-based and can be found in the SOLI section of the AMP.
B - Performance	The performance of the Airport Site, Runway Lighting, and Other Equipment assets was identified as "always reliable" and assigned a rating of 1 for calculating risk score. The Runway assets were assigned a rating of 5 and identified as “not reliable” due to their current conditions limiting the allowable aircraft size.

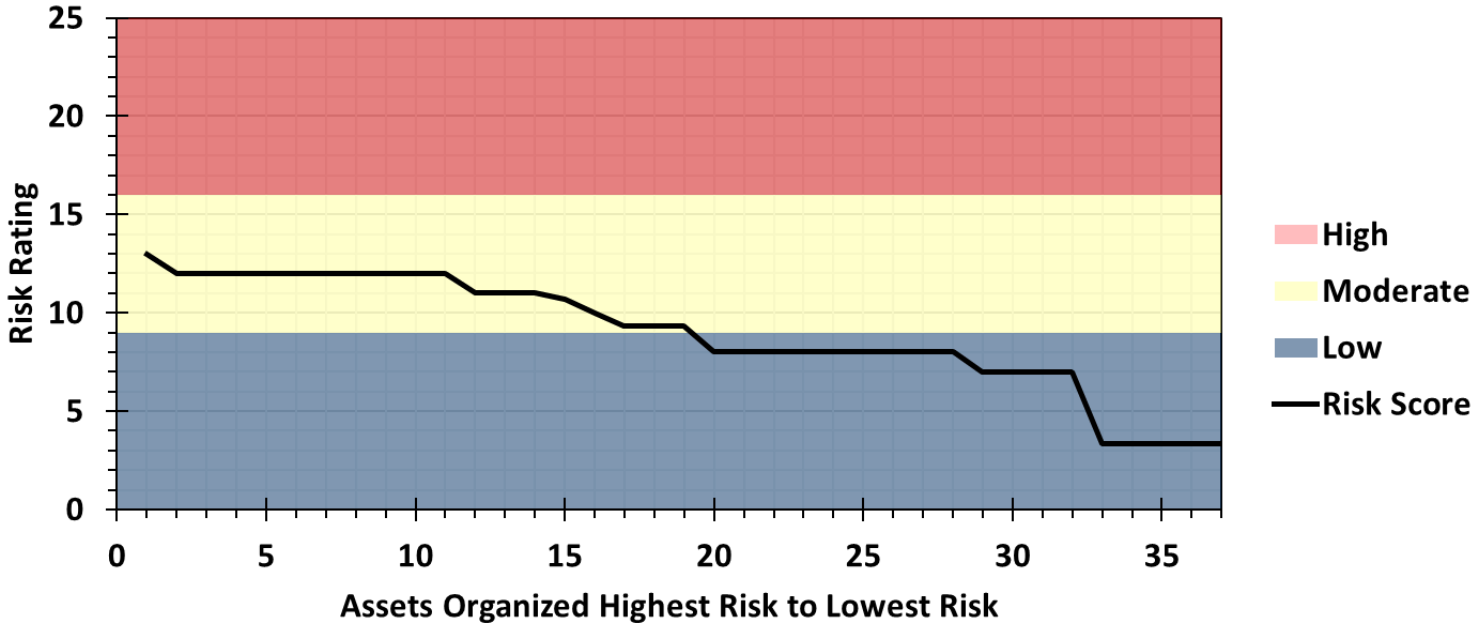
Factors	Risk Ratings
C - Climate Change	The climate change ratings were determined at the asset class level by identifying climate change hazard interactions. The Airport Site, Runway, and Runway Lighting were identified as a “moderate” risk and assigned a rating of 3 for calculating the risk score. The Other Equipment assets were identified as a “low” risk and assigned a rating of 1 for calculating the risk score.
D - Impact	The Airport Site, Runway, and Other Equipment assets was recognized as "low" impact and assigned a rating of 0 for calculating risk score. The impact of the Runway Lighting was identified as "moderate" impact and assigned a rating of 1 for calculating risk score.
E - Importance	The Airport Site, Runway, and Runway Lighting asset class was identified as “high” importance and assigned a rating of 3 when calculating risk. A “moderate” importance rating was given to the Other Equipment assets and a rating of 2 was assigned for calculating risk score.

The individual risk ratings were used in calculating the risk score for each of the assets.

8.3.1 Risk Profile

The Risk profile for the eight Airport Site assets tracked within the asset inventory are classified as Low risk, while the nine Runway pavement assets tracked were classified as Moderate risk. Of the 15 Runway Lighting assets, ten were classified as Moderate risk and the remaining five were classified as Low risk. The five Other Equipment assets were classified as Low risk. The Risk profile for all 37 Airport Operation assets is displayed in **Figure 8-6**.

Figure 8-6: Risk Profile - Airport Operations (All Asset Classes)



8.4 Asset Management Strategy

8.4.1 Lifecycle Activities – Airport Operations

The lifecycle activities considered include:

- **Non-Infrastructure Solutions**: Actions or policies that can lower costs and extend useful lives.
- **Maintenance Activities**: Regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events.
- **Renewal / Rehabilitation Activities**: Significant repairs designed to extend the life of the asset.
- **Replacement / Construction Activities**: Activities that are expected to occur once an asset has reached the end of its useful life and renewal/rehabilitation is no longer an option.

- **Disposal Activities**: Activities associated with disposing of an asset once it has reached the end of its useful life or is otherwise no longer needed.
- **Expansion / Growth / Service Improvement Activities**: Planned activities required to extend services to previously unserved areas or expand services to meet growth demands.

Table 8-7 describes the lifecycle activities that can be implemented within the asset management strategy for Airport Operations. The lifecycle activities presented below are existing activities performed by the City, identified during a workshop with City staff in January 2024.

Table 8-7: Lifecycle Activities – Airport Operations

Lifecycle Type	Description of Activity	Frequency / Timing
Non-Infrastructure Solutions	Pavement Condition Assessments	Every 3 years
Non-Infrastructure Solutions	Runway Friction Testing	Every 2 years (based on Transport Canada recommendations)
Non-Infrastructure Solutions	Aviation Regulatory Assessment	Annually
Maintenance Activities	Preventative maintenance and general upkeep including crack sealing, line painting, drainage control, snow clearing/runway de-icing, and wildlife control.	As needed
Replacement / Construction Activities	Replacement of Assets	End of EUL

Lifecycle Type	Description of Activity	Frequency / Timing
Disposal Activities	Demolition of Hangers	As needed
Expansion / Growth / Service Improvement Activities	Runway 01-19 Widening and Increasing of Bearing Strength	Ongoing
Expansion / Growth / Service Improvement Activities	Terminal Expansion	Ongoing
Expansion / Growth / Service Improvement Activities	Airport Masterplan	Every 10 years
Expansion / Growth / Service Improvement Activities	Air Service Plan	Every 5 years

8.4.2 Funding the Lifecycle Activities – Airport Operations

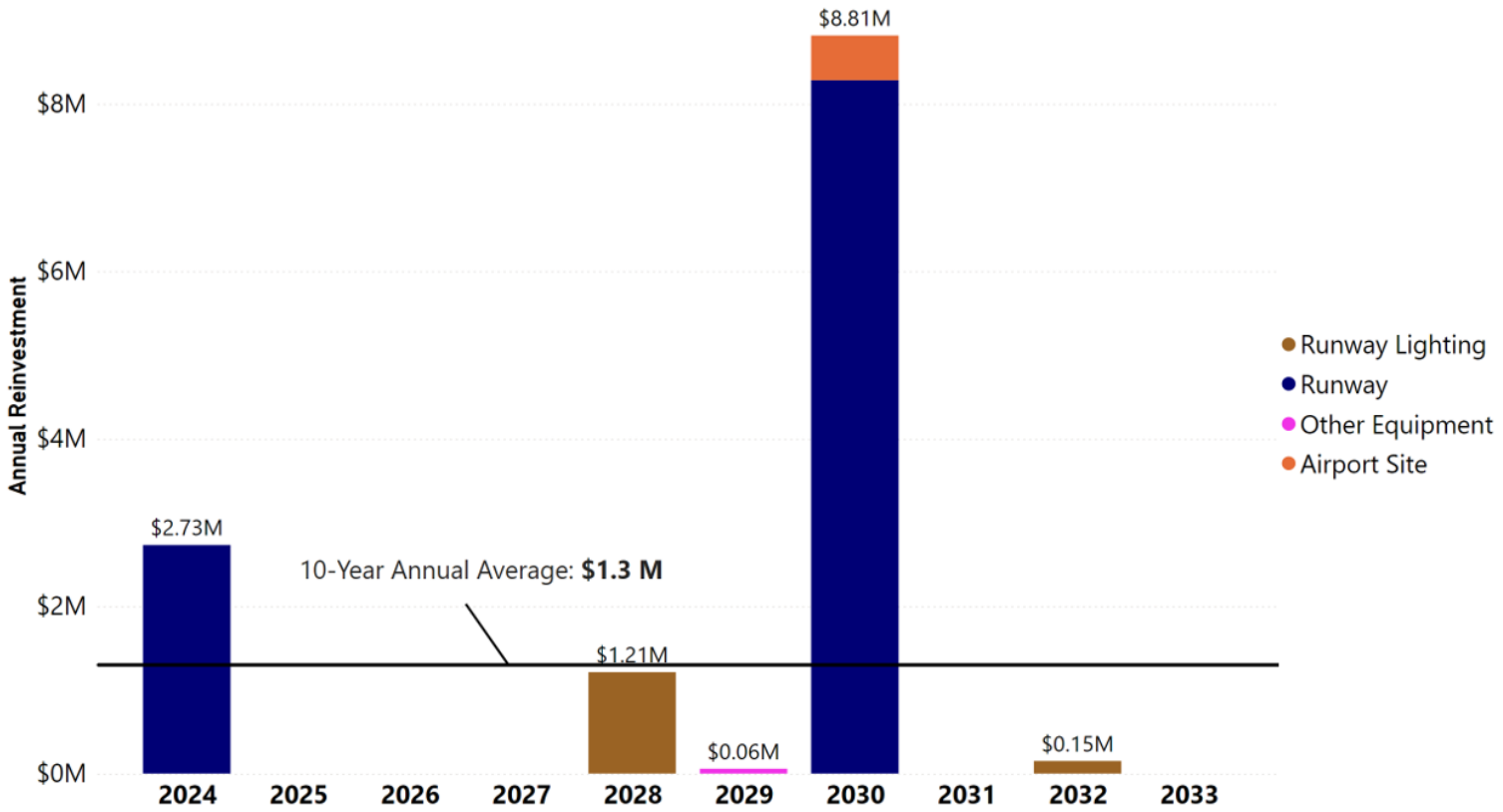
Lifecycle modeling allows for the City to understand the future reinvestment needs of their existing assets by generating a theoretical asset replacement forecast that considers available asset inventory data. The age, EUL, replacement cost, condition, and risk score of each asset can be leveraged within the lifecycle model to proactively plan for reinvestment over a period of interest. Asset replacement forecasts within this subsection estimate the required reinvestment for Airport Operations assets over the next 10 years based on available asset inventory data.

There is a total of approximately **$13 million** to be reinvested into the Airport Operations assets owned by the City in the next 10 years. This translates to a 10-year annual average of approximately **$1.3 million**, as presented in **Figure 8-7**.

Airport Operations

Note: At the time of preparing this AMP, there is currently a runway, taxiway, and apron surface assessment underway to identify what pavement upgrades would be required to support sustainable airline traffic. The results of this assessment were not available for this AMP and may impact the airport's capital investment requirement as outlined below.

Figure 8-7: 10-Year Capital Reinvestment Needs - Airport Operations



It is important to note that forecasting in this lifecycle model relies heavily on age and EUL to determine renewal or replacement needs and that tracking of condition data for Airport Operations assets by the City will assist at refining forecasted expenditures in the decades to come. The LOS includes maintaining the current assets in poor or better condition (81%). From the lifecycle model, the percentage of Airport Operations assets in poor or better condition fluctuates throughout the next 10-years, reaching a high of 100% in 2024 and eventually finishing at 73% in 2033.

Figure 8-8 shows an overview of the condition of Airport Operations over the next 10 years based on the lifecycle model.

Figure 8-8: Condition Overview by Year Based on Lifecycle Model – Airport Operations