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The 2017 Asset Management Plan for the

City of Kawartha Lakes

SUBMITTED BY THE PUBLIC SECTOR DIGEST INC. (PSD)
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Executive Summary

Infrastructure is inextricably linked to the economic, social and environmental advancement of a community. Municipalities own and manage nearly 60% of the public infrastructure stock in Canada. As analyzed in this asset management plan (AMP), the City of Kawartha Lakes' infrastructure portfolio comprises the following asset classes: road network, bridges & culverts, buildings, storm, water, sanitary, machinery & equipment, land improvements, vehicles and natural resources. The replacement cost of the City's asset portfolio is estimated to be about $3.2 billion, excluding social housing. Of this, only about $1.8 billion is physically depreciable and therefore fully analyzed within this AMP.

Strategic asset management is critical in extracting the highest total value from public assets at the lowest lifecycle cost. This AMP, the municipality's second following the completion of its first edition in 2013, details the state of infrastructure of the municipality's service areas and provides asset management and financial strategies designed to facilitate its pursuit of developing an advanced asset management program and mitigate long-term funding gaps.

In addition to observed field conditions, historical capital expenditures can assist the municipality in identifying impending infrastructure needs, and guide its medium- and long-term capital programs. The municipality has continuously invested in its infrastructure continuously over the decades. Investments fluctuated during the 1970s and 1980s and then peaked in the early 2000s. During this time, $215 million was invested with $94 million put into the road network. Since 2015, $50 million has been invested with a focus on roads, the water system and land improvements.

Based on 2016 replacement cost, and primarily condition data, over 70% of assets, with a valuation of $1.2 billion, are in good to very good condition; 18% are in poor to very poor condition. The municipality has provided condition information for 78% of assets based on 2016 replacement cost. Nearly 90% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 4%, with a valuation of $69 million, remain in operation beyond their established useful life. An additional 3% will reach the end of their useful life within the next five years.

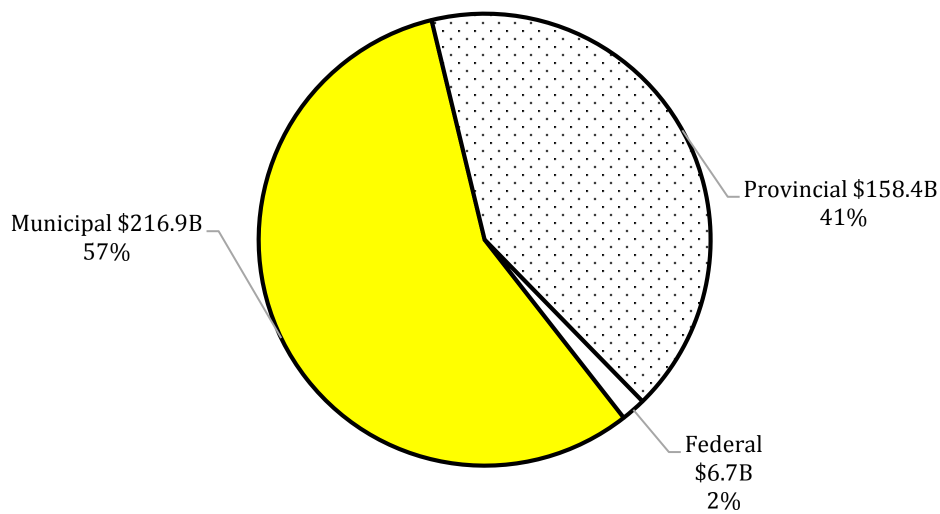
In order for an AMP to be effective, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow the municipality to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service, and projected growth requirements. The City has developed such a plan, attached hereto as Appendix 2, which eliminates the infrastructure deficit by 2021, phases in sustainable tax and water/wastewater rate support over 2018-2021 and builds healthy capital reserve balances by 2018.

A critical aspect of this AMP is the level of confidence the municipality has in the data used to develop the state of the infrastructure and form the appropriate financial strategies. The municipality has indicated a high degree of confidence in the accuracy, validity and completeness of the asset data for all categories analyzed in this AMP.

I. Introduction & Context

Across Canada, the municipal share of public infrastructure increased from 22% in 1955 to nearly 60% in 2013. The federal government's share of critical infrastructure stock, including roads, water and wastewater, declined by nearly 80% in value since 1963.[1]

Figure 1 Distribution of Net Stock of Core Public Infrastructure



Ontario's municipalities own more of the infrastructure assets in the province than both the provincial and federal government. The asset portfolios managed by Ontario's municipalities are also highly diverse. The City of Kawartha Lakes' capital asset portfolio, as analyzed in this AMP is valued at $3.1 billion using 2016 replacement costs. The municipality relies on these assets to provide residents, businesses, employees and visitors with safe access to important services, such as transportation, recreation, culture, economic development and much more. As such, it is critical that the municipality manage these assets optimally in order to produce the highest total value for taxpayers. This AMP will assist the municipality in the pursuit of judicious asset management for its capital assets.

[1] Larry Miller, Updating Infrastructure In Canada: An Examination of Needs And Investments Report of the Standing Committee on Transport, Infrastructure and Communities, June 2015

II. Asset Management

Asset management can be best defined as an integrated business approach within an organization with the aim to minimize the lifecycle costs of owning, operating, and maintaining assets, at an acceptable level of risk, while continuously delivering established levels of service for present and future customers. It includes the planning, design, construction, operation and maintenance of infrastructure used to provide services. By implementing asset management processes, infrastructure needs can be prioritized over time, while ensuring timely investments to minimize repair and rehabilitation costs and maintain municipal assets.

Table 1 Objectives of Asset Management

Objective	Description
Inventory	Capture all asset types, inventories and historical data.
Current Valuation	Calculate current condition ratings and replacement values.
Lifecycle Analysis	Identify Maintenance and Renewal Strategies & Lifecycle Costs.
Service Level Targets	Define measurable Levels of Service Targets.
Risk & Prioritization	Integrates all asset classes through risk and prioritization strategies.
Sustainable Financing	Identify sustainable Financing Strategies for all asset classes.
Continuous Processes	Provide continuous processes to ensure asset information is kept current and accurate.
Decision Making & Transparency	Integrate asset management information into all corporate purchases, acquisitions and assumptions.
Monitoring & Reporting	At defined intervals, assess the assets and report on progress and performance.

1. Overarching Principles

The Institute of Asset Management (IAM) recommends the adoption of seven key principles for a sustainable asset management program. According to IAM, asset management must be:[2]

Table 2 Principles of Asset Management

Principle	Description
Holistic	Asset management must be cross-disciplinary, total value focused.
Systematic	Rigorously applied in a structured management system.
Systemic	Looking at assets in their systems context, again for net, total value.
Risk-based	Incorporating risk appropriately into all decision-making.
Optimal	Seeking the best compromise between conflicting objectives, such as costs versus performance versus risks etc.
Sustainable	Plans must deliver optimal asset lifecycles, ongoing systems performance, environmental and other long term consequences.
Integrated	At the heart of good asset management lies the need to be joined-up. The total jigsaw puzzle needs to work as a whole - and this is not just the sum of the parts.

[2] "Key Principles", The Institute of Asset Management, *www.iam.org*

III. AMP Objectives and Content

This AMP is one component of Kawartha Lakes' overarching corporate strategy. It was developed to support the municipality's vision for its asset management practice and programs. It provides key asset attribute data, including current composition of the municipality's infrastructure portfolio, inventory, replacement costs, useful life etc., summarizes the physical health of the capital assets, enumerates the municipality's current capital spending framework, and outlines financial strategies to achieve fiscal sustainability in the long-term while reducing and eventually eliminating funding gaps (i.e. infrastructure deficits).

As with the first edition of the municipality's asset management plan in 2013, this AMP is developed in accordance with provincial standards and guidelines, and new requirements under the Federal Gas Tax Fund (GTF) stipulating the inclusion of all eligible asset classes. The following asset classes are analysed in this document: road network; bridges & culverts; water; wastewater; storm; facilities; machinery & equipment; land improvements; and vehicles. Natural resources and road base are included solely to show the value owned by the municipality.

IV. Data and Methodology

The municipality's dataset for the asset classes analyzed in this AMP are maintained in PSD's CityWide® Tangible Assets module. This dataset includes key asset attributes and PSAB 3150 data, such as historical costs, in-service dates, field inspection data (as available), asset health, and replacement costs.

1. Condition Data

Municipalities implement a straight-line amortization schedule approach to depreciate their capital assets. In general, this approach may not be reflective of an asset's actual condition and the true nature of its deterioration, which tends to accelerate toward the end of the asset's lifecycle. However, it is a useful approximation in the absence of standardized decay models and actual field condition data and can provide a benchmark for future requirements. We analyze each asset individually prior to aggregation and reporting; therefore, many imprecisions that may be highlighted at the individual asset level are attenuated at the class level.

As available, actual field condition data was used to make recommendations more meaningful and representative of the municipality's state of infrastructure. The value of condition data cannot be overstated as they provide a more accurate representation of the state of infrastructure than does age alone. The type of condition data used for each class is indicated in Chapter V, Section 2.

2. Financial Data

In this AMP, the average annual requirement is the amount, based on current replacement costs, that municipalities should set aside annually for each infrastructure class so that assets can be replaced upon reaching the end of their lifecycle.

To determine current funding capacity, all existing sources of funding are identified and combined to enumerate the total available funding; funding for the previous three years is analyzed as data is available. These figures are then assessed against the average annual requirements, and are used to calculate the annual funding shortfall (surplus) and for forming the financial strategies.

In addition to the annual shortfall, the majority of municipalities face significant infrastructure backlogs. The infrastructure backlog is the accrued financial investment needed in the short-term to bring the assets to a state of good repair. This amount is identified for each asset class.

3. Infrastructure Report Card

The AMP is a complex document, but one with direct implications on the public, a group with varying degrees of technical knowledge. To make communications more meaningful and the AMP more accessible, we've developed an Infrastructure Report Card that summarizes our findings in common language that municipalities can use for internal and external distribution. The report card is developed using two key, equally weighted factors: Financial Capacity and Asset Health.

A municipality's financial capacity grade is determined by the level of funding available (0-100%) for each asset class for the purpose of meeting the average annual investment requirements.

Using either field inspection data as available or age-based data, the asset health component of the report card uses condition (0-100%) to estimate how capable assets are in performing their required functions. We use replacement cost to determine the weight of each condition group within the asset class.

Table 3 Infrastructure Report Card Description

Letter Grade	Rating	Description
A	Very Good	The asset is functioning and performing well; only normal preventive maintenance is required. The municipality is fully prepared for its long-term replacement needs based on its existing infrastructure portfolio.
B	Good	The municipality is well prepared to fund its long-term replacement needs but requires additional funding strategies in the short-term to begin to increase its reserves.
C	Fair	The asset's performance or function has started to degrade and repair/rehabilitation is required to minimize lifecycle cost. The municipality is underpreparing to fund its long-term infrastructure needs. The replacement of assets in the short- and medium-term will likely be deferred to future years.
D	Poor	The asset's performance and function is below the desired level and immediate repair/rehabilitation is required. The municipality is not well prepared to fund its replacement needs in the short-, medium- or long-term. Asset replacements will be deferred and levels of service may be reduced.
F	Very Poor	The municipality is significantly underfunding its short-term, medium-term, and long-term infrastructure requirements based on existing funds allocation. Asset replacements will be deferred indefinitely. The municipality may have to divest some of its assets (e.g., bridge closures, arena closures) and levels of service will be reduced significantly.

4. Limitations and Assumptions

Several limitations continue to persist as municipalities advance their asset management practices.

- As available, we use field condition assessment data to illustrate the state of infrastructure and develop the requisite financial strategies. However, in the absence of observed data, we rely on the age of assets to estimate their physical condition.

- A second limitation is the use of inflation measures, for example using CPI/NRBCPI to inflate historical costs in the absence of actual replacement costs. While a reasonable approximation, the use of such multipliers may not be reflective of market prices and may over- or understate the value of a municipality's infrastructure portfolio and the resulting capital requirements.

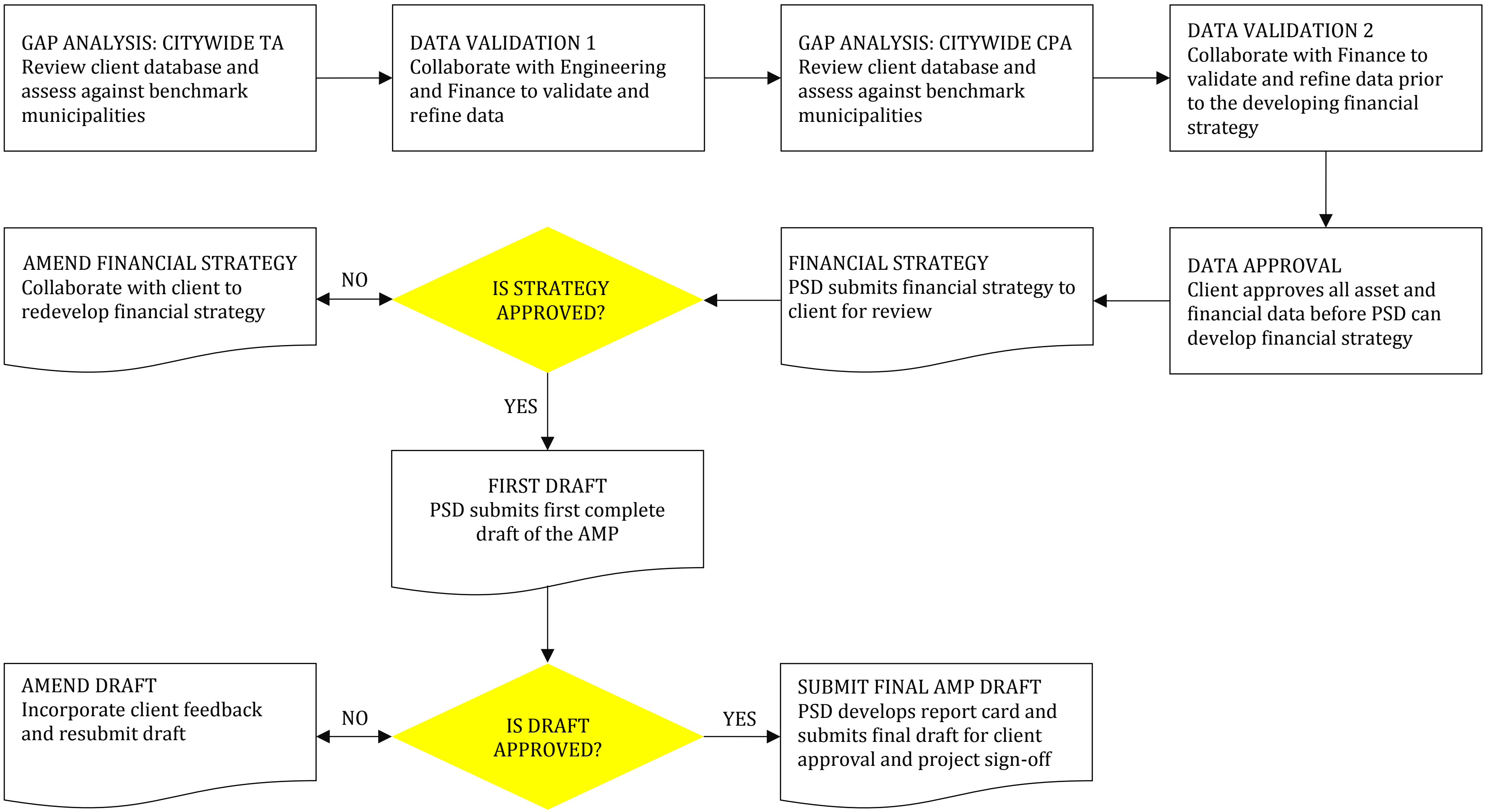
- Our calculations and recommendations will reflect the best available data at the time this AMP was developed.

- The focus of this plan is restricted to capital expenditures and does not capture O&M (operating and maintenance) expenditures on infrastructure.

5. Process

High data quality is the foundation of intelligent decision-making. Generally, there are two primary causes of poor decisions: inaccurate or incomplete data, and the misinterpretation of data used. The figure below illustrates an abbreviated version of our work order/work flow process between PSD and municipal staff. It is designed to ensure maximum confidence in the raw data used to develop the AMP, the interpretation of the AMP by all stakeholders, and ultimately, the application of the strategies outlined in this AMP.

Figure 2 Developing the AMP – Work Flow and Process



6. Data Confidence Rating

Staff confidence in the data used to develop the AMP can determine the extent to which recommendations are applied. Low confidence suggests uncertainty about the data and can undermine the validity of the analysis. High data confidence endorses the findings and strategies, and the AMP can become an important, reliable reference guide for interdepartmental communication as well as a manual for long-term corporate decision-making. Having a numerical rating for confidence also allows the municipality to track its progress over time and eliminate data gaps.

Data confidence in this AMP is determined using five key factors and is based on the City of Brantford's approach. Municipal staff provide their level of confidence (score) in each factor for major asset classes along a spectrum, ranging from 0, suggesting low confidence in the data, to 100 indicative of high certainty regarding inputs. The five factors used to calculate the municipality's data confidence ratings are:

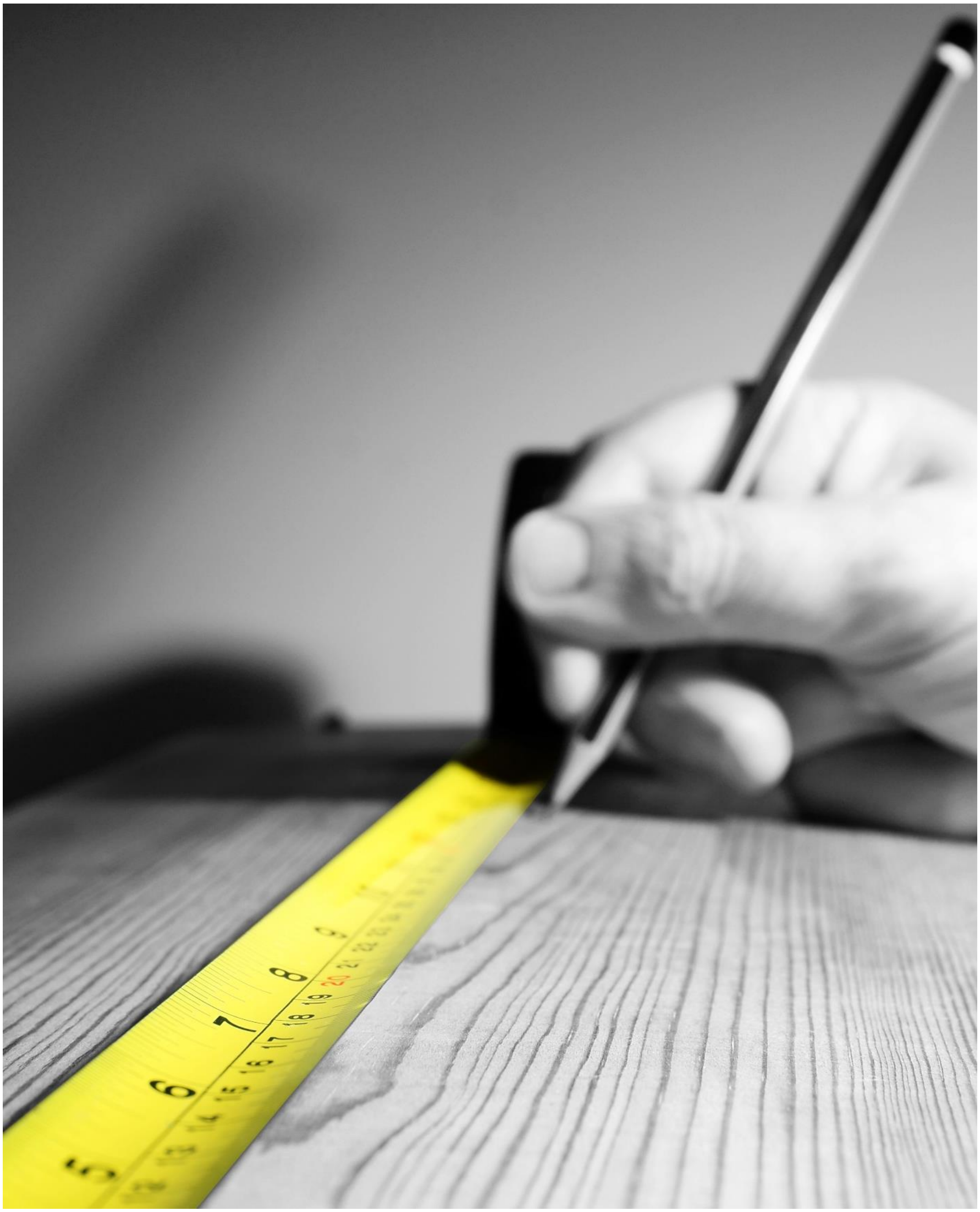
F1	F2	F3	F4	F5
The data is up to date.	The data is complete and uniform.	The data comes from an authoritative source	The data is error free.	The data is verified by an authoritative source.

The municipality's self-assessed score in each factor is then used to calculate data confidence in each asset class using Equation 1 below.

$$Asset\ Class\ Data\ Confidence\ Rating = \sum (Score\ in\ each\ factor)\ \times (\frac{1}{5})$$

V. Summary Statistics

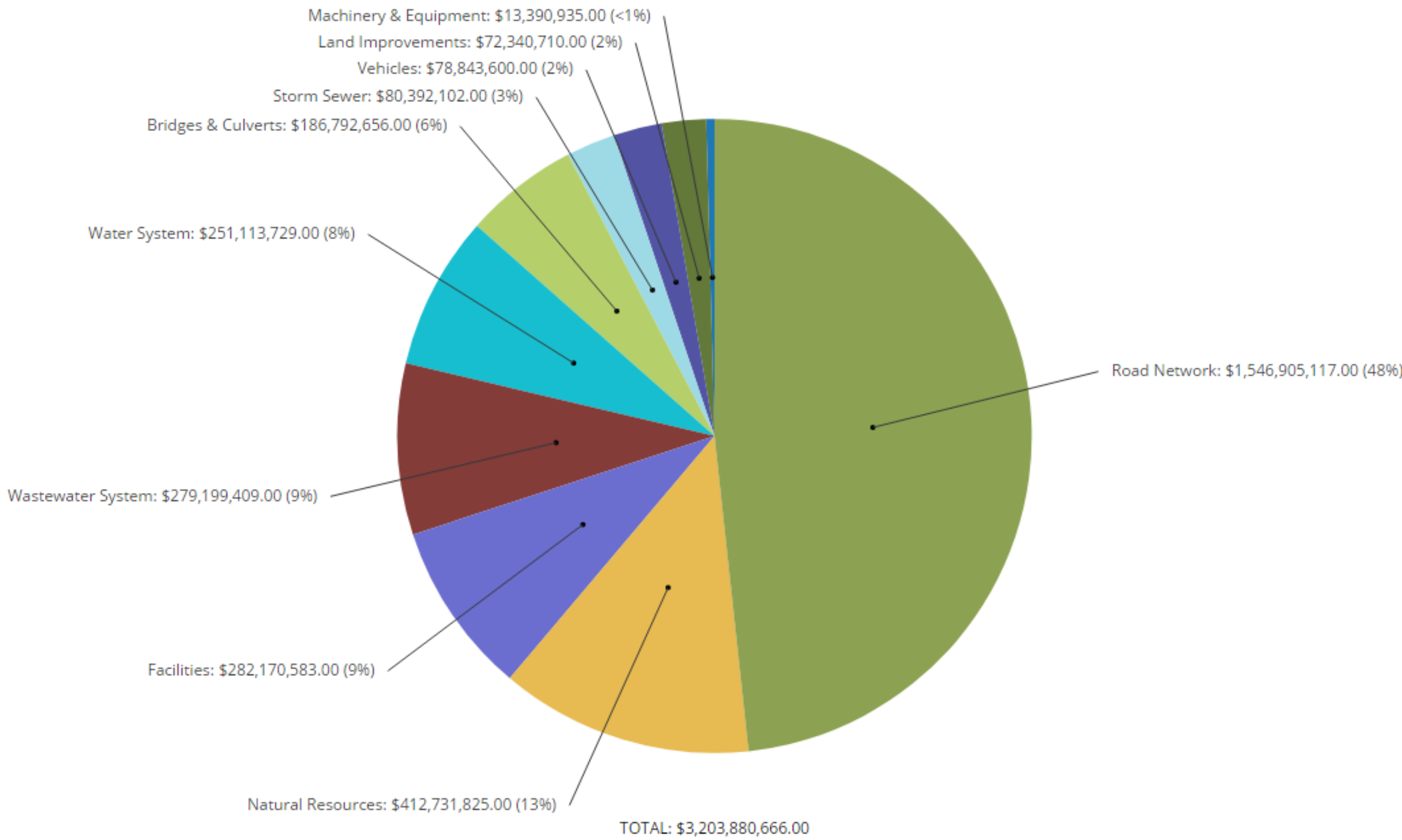
In this section, we aggregate technical and financial data across all asset classes analyzed in this AMP, and summarize the state of the infrastructure using key indicators, including asset condition, useful life consumption, and important financial measurements.



1. Asset Valuation

The asset classes analyzed in this AMP for the municipality had a total 2016 valuation of $3.2 billion, of which roads comprised 48%, followed by natural resources at 13%. The ownership per household (Figure 4) totaled $120,000 based on 38,444 households for all asset categories except for water services with 12,766 households and wastewater services with 11,104 households. Note that natural resources and road bases, which are part of the road network, are included solely to represent the total value of assets owned by the municipality.

Figure 3 Asset Valuation by Class



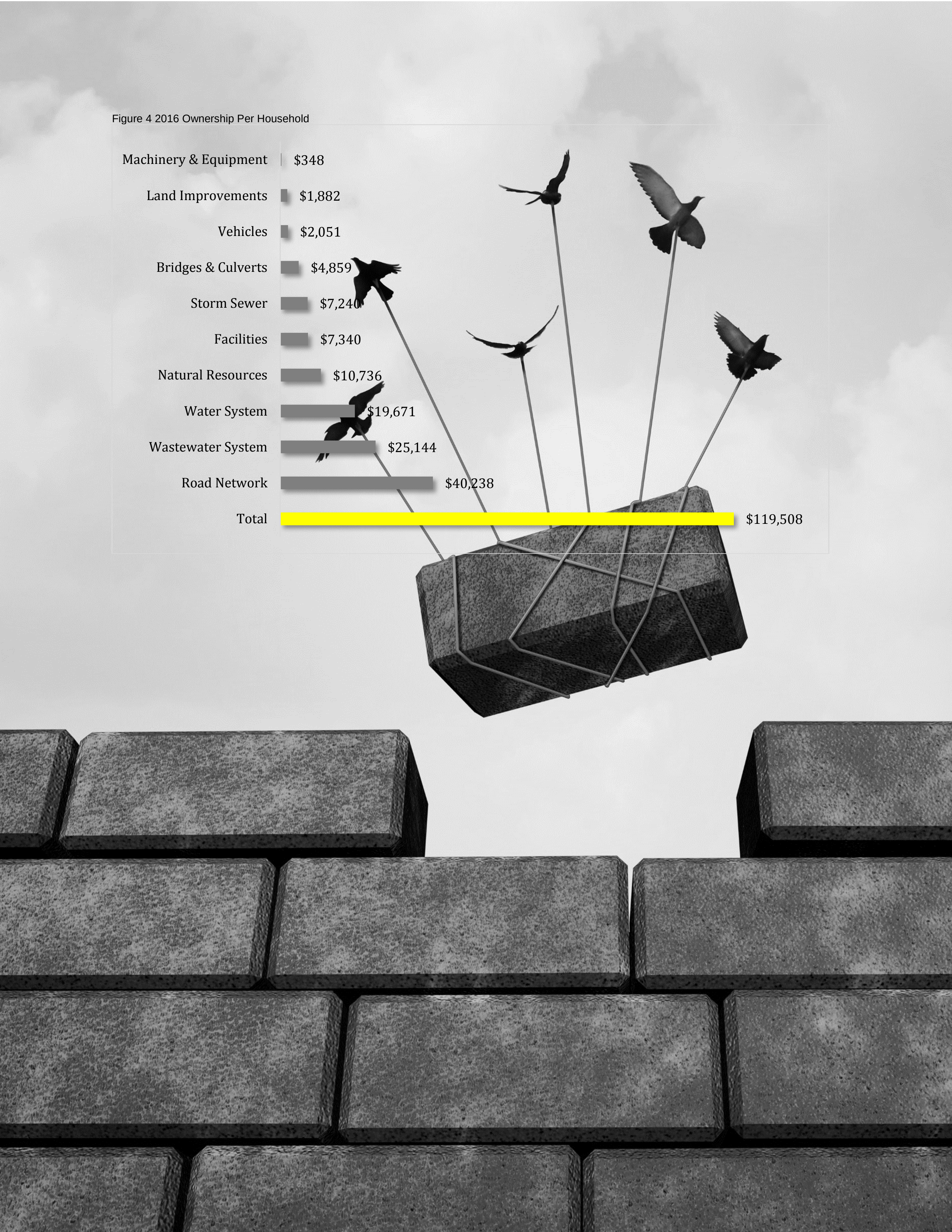


Figure 4 2016 Ownership Per Household

2. Source of Condition Data by Asset Class

Observed data will provide the most precise indication of an asset's physical health. In the absence of such information, the age of capital assets can be used as a meaningful approximation of the asset's condition. Table 4 indicates the source of condition data used for the various asset classes in this AMP. The municipality has condition data for 78% of all assets based on 2016 replacement cost.

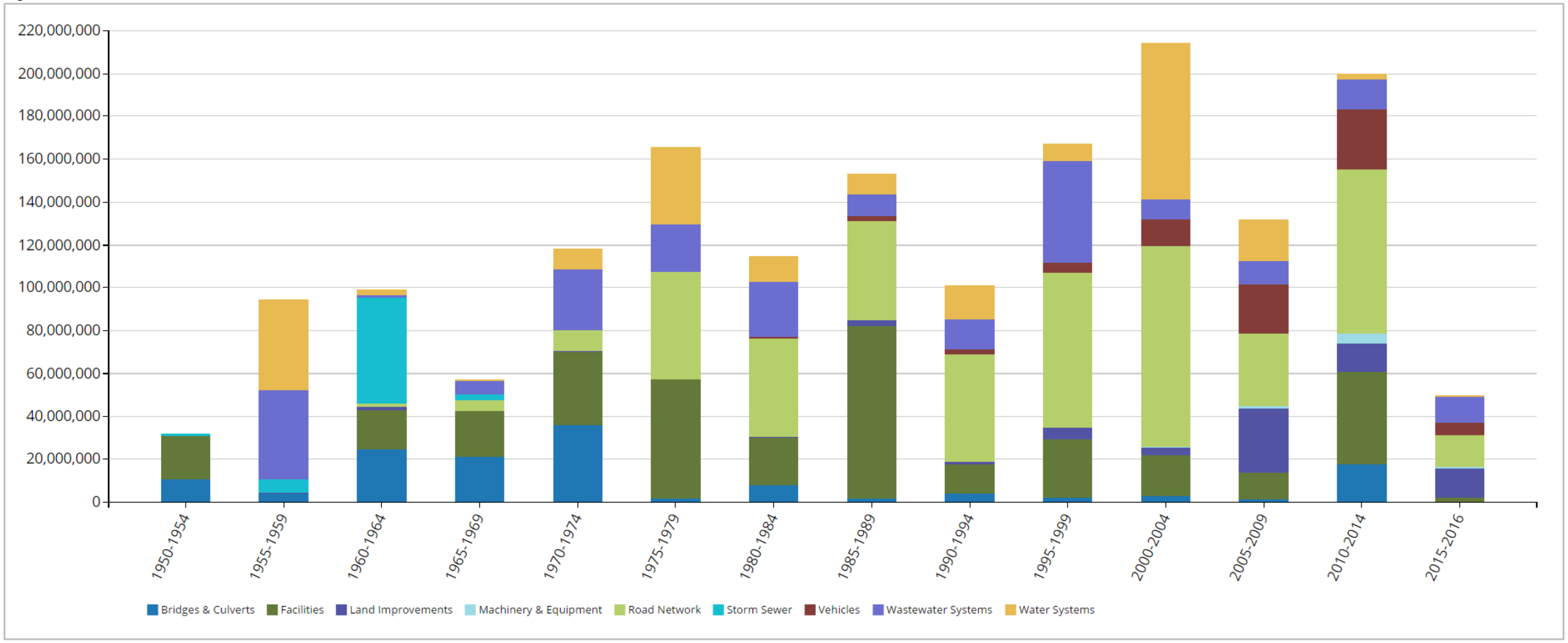
Table 4 Source of Condition Data by Asset Class

Asset class	Component	Source of Condition Data
Roads Network	Gravel	100% Assessed – 2016
	Guiderails	99% Assessed – 2016
	HCB	100% Assessed – 2016
	LCB	100% Assessed – 2016
	Remaining segments	Age-based
Bridges & Culverts	Bridges	Age-based
	Culverts	Age-based
Water System	All	100% Assessed – 2016
Sanitary Services	All	100% Assessed – 2016
Storm	All	Age-based
Buildings	Structure	96% Assessed – 2016
	Remaining segments	Age-based
Machinery & Equipment	Furniture	99% Assessed – 2016
	Gear & Devices	91% Assessed – 2016
	IT Systems	Age-based
Land Improvements	Airport Site works	100% Assessed – 2016
	General Site works	99% Assessed – 2016
	Landfill Site works	98% Assessed – 2016
	Airport Site works	100% Assessed – 2016
Vehicles	Fire Service	100% Assessed – 2016
	Remaining segments	Age-based

3. Historical Investment in Infrastructure – All Asset Classes

In conjunction with condition data, two other measurements can augment staff understanding of the state of infrastructure and impending and long-term infrastucture needs: installation year profile and useful life remaining. Using 2016 replacement costs, Figure 5 illustrates the historical invesments made in the asset classes analyzed in this AMP since 1950. Often, investment in critical infrastructure parallels population growth or other significant shifts in demographics; it can also fluctuate with provincial and federal stimulus programs. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 5 Historical Investment in Infrastructure – All Asset Classes

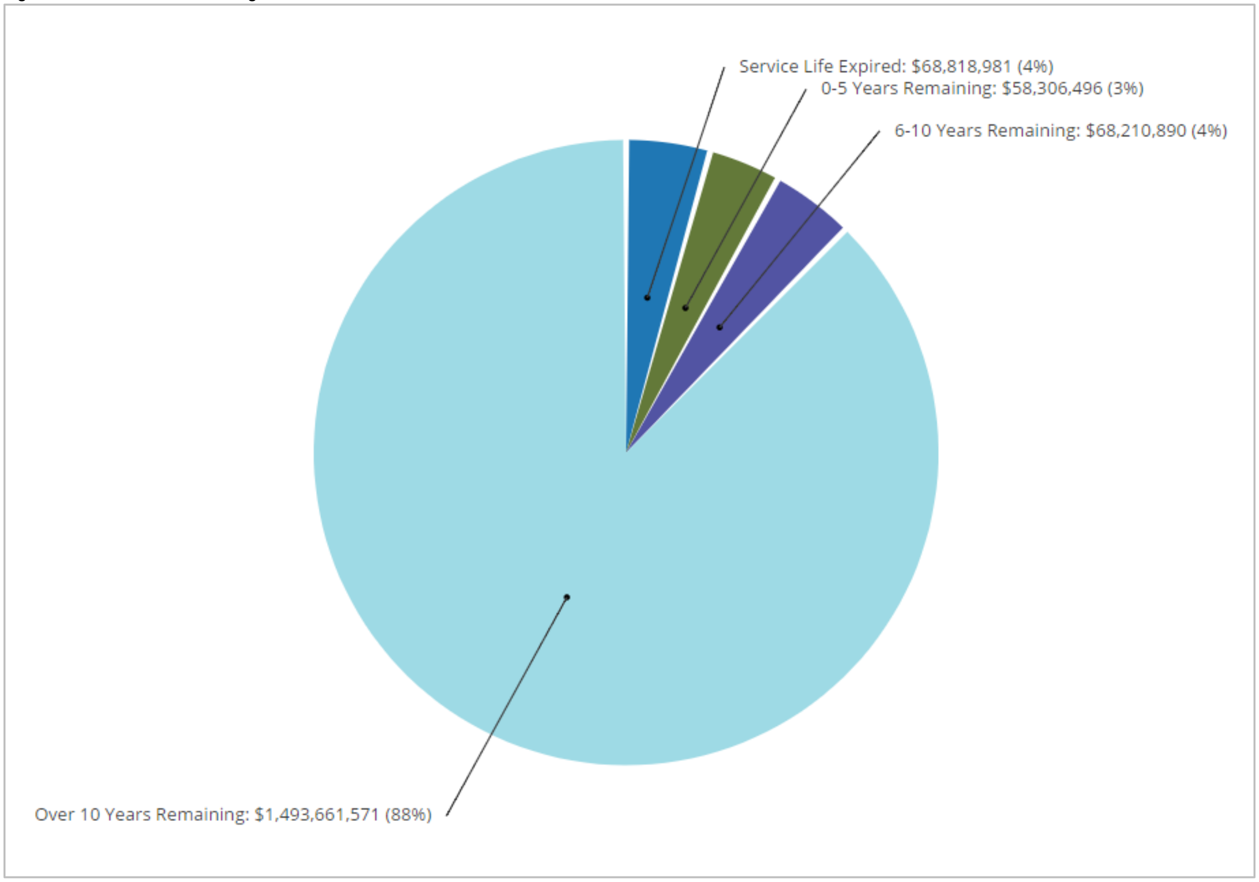


The municipality has invested in its infrastructure continuously over the decades. Investments fluctuated during the 1970s and 1980s and then peaked in the early 2000s. During this time, $215 million was invested with $94 million put into the road network. Since 2015, $50 million has been invested with a focus on roads, the water system and land improvements.

4. Useful Life Consumption – All Asset Classes

While age is not a precise indicator of an asset's health, in the absence of observed condition assessment data, it can serve as a high-level, meaningful approxmiation and help guide replacement needs and facilitate strategic budgeting. Figure 6 shows the distibution of assets based on the percentage of useful life already consumed.

Figure 6 Useful Life Remaining as of 2015 – All Asset Classes

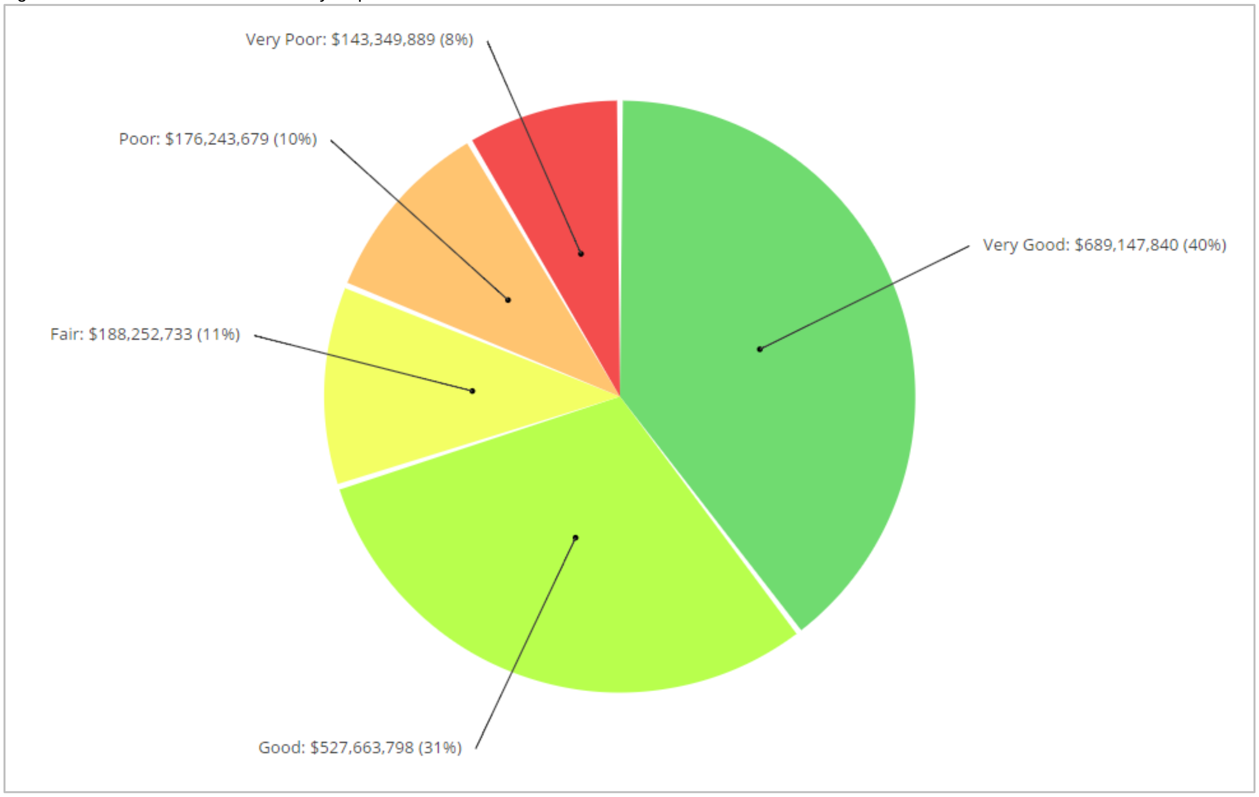


Nearly 90% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 4%, with a valuation of $69 million, remain in operation beyond their established useful life. An additional 3% will reach the end of their useful life within the next five years.

5. Overall Condition – All Asset Classes

Based on 2016 replacement cost, and primarily condition data, over 70% of assets, with a valuation of $1.2 billion, are in good to very good condition; 18% are in poor to very poor condition.

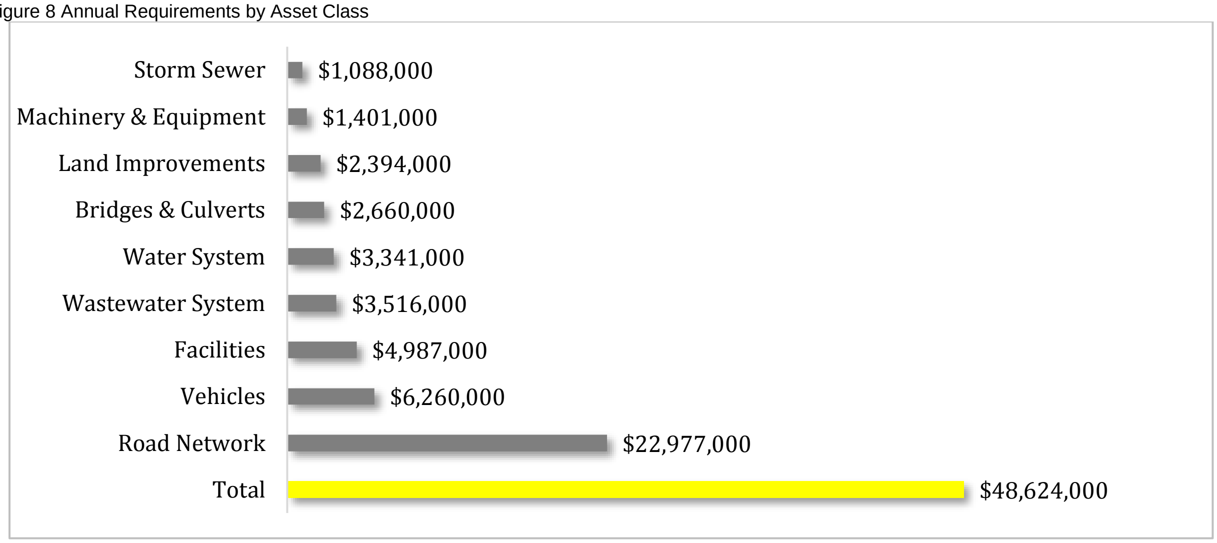
Figure 7 Asset Condition Distribution by Replacement Cost as of 2015 – All Asset Classes



6. Financial Profile

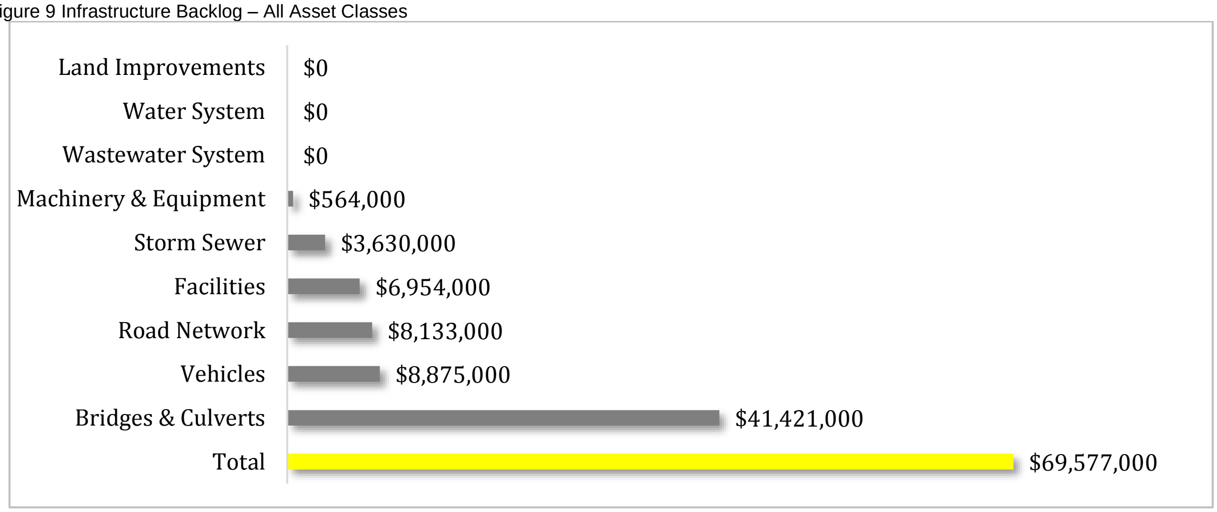
This section details key high-level financial indicators for the municipality's asset classes.

Figure 8 Annual Requirements by Asset Class



The annual requirements represent the amount the municipality should allocate annually to each of its asset classes to meet replacement needs as they arise, prevent infrastructure backlogs and achieve long-term sustainability. In total, the municipality must allocate $48.6 million annually for the assets covered in this AMP. In Appendix 2, this figure is adjusted to reflect the new information provided by the 2016 Roads Needs Study which, due to timing, could not be incorporated into the main body of this AMP.

Figure 9 Infrastructure Backlog – All Asset Classes

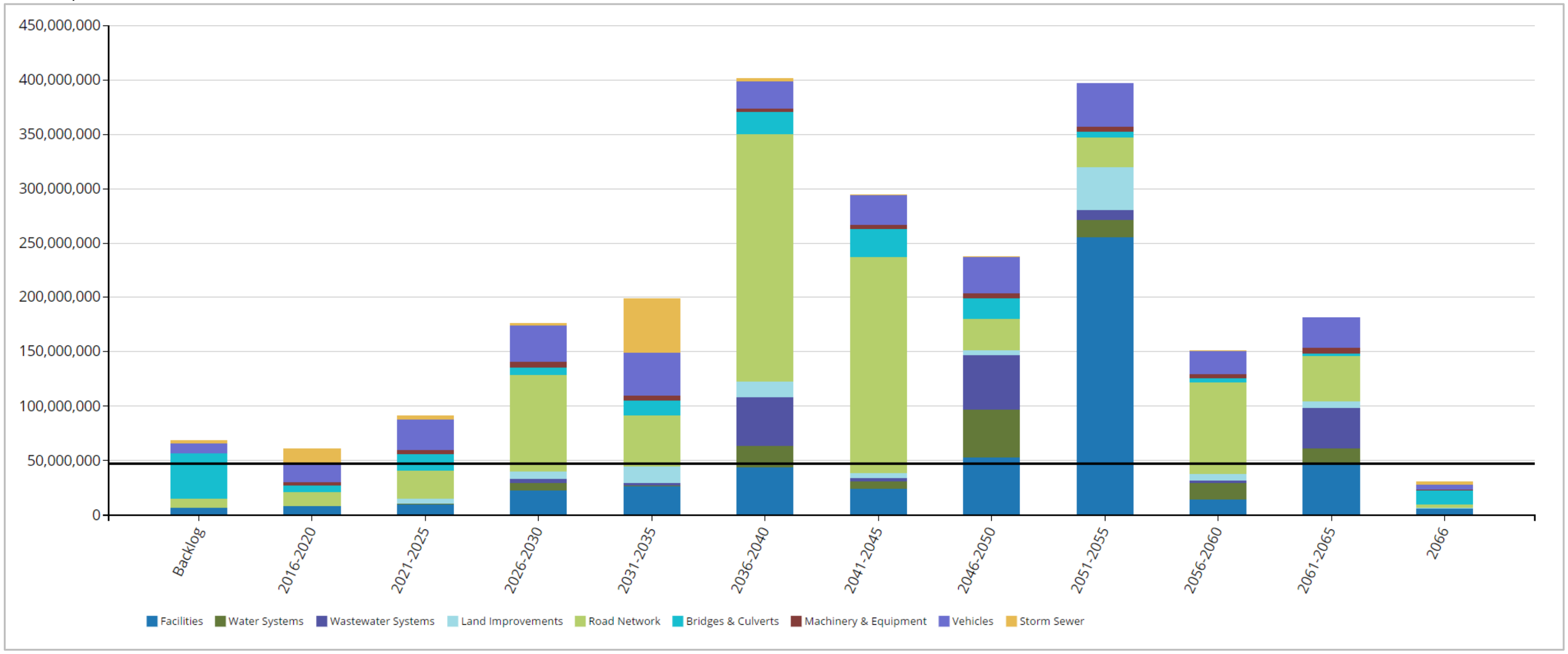


The municipality has a combined infrastructure backlog of $69.6 million, with bridges & culverts comprising 60%. The backlog represents the investment needed today to meet previously deferred replacement needs. In the absence of assessed data, the backlog represents the value of assets still in operation beyond their established useful life.

7. Replacement Profile – All Asset Classes

In this section, we illustrate the aggregate short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's asset classes. The backlog is the total investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 10 Replacement Profile – All Asset Classes



Based primarily on condition data, the municipality has a combined backlog of $69.6 million, of which bridges & culverts comprises $41 million. Aggregate replacement needs will total $62 million over the next five years. An additional $91 million will be required between 2021 and 2025. The municipality's aggregate annual requirements (indicated by the black line) total $48.6 million. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet the replacement needs for its various asset classes as they arise without the need for deferring projects and accruing annual infrastructure deficits. Further, while fulfilling the annual requirements will position the municipality to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

8. Data Confidence

The municipality has a high degree of confidence in the data used to develop this AMP, receiving a weighted confidence rating of 82%. This is indicative of significant effort in collecting and refining its data set.

Table 5 Data Confidence Ratings

Asset Class	The data is up-to-date.	The data is complete and uniform.	The data comes from an authoritative source.	The data is error free.	The data is verified by an authoritative source.	Average Confidence Rating
Road Network						
Bridges & Culverts						
Water Services						
Sanitary Services						
Storm Water						
Buildings & Facilities						
Machinery & Equipment						
Land Improvements						
Fleet						
Overall Weighted Average Data Confidence Rating						82%

VI. State of Local Infrastructure

The state of local infrastructure includes the full inventory, condition ratings, useful life consumption data and the backlog and upcoming infrastructure needs for each asset class. As available, assessed condition data was used to inform the discussion and recommendations; in the absence of such information, age-based data was used as the next best alternative.

1. Road Network

1.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

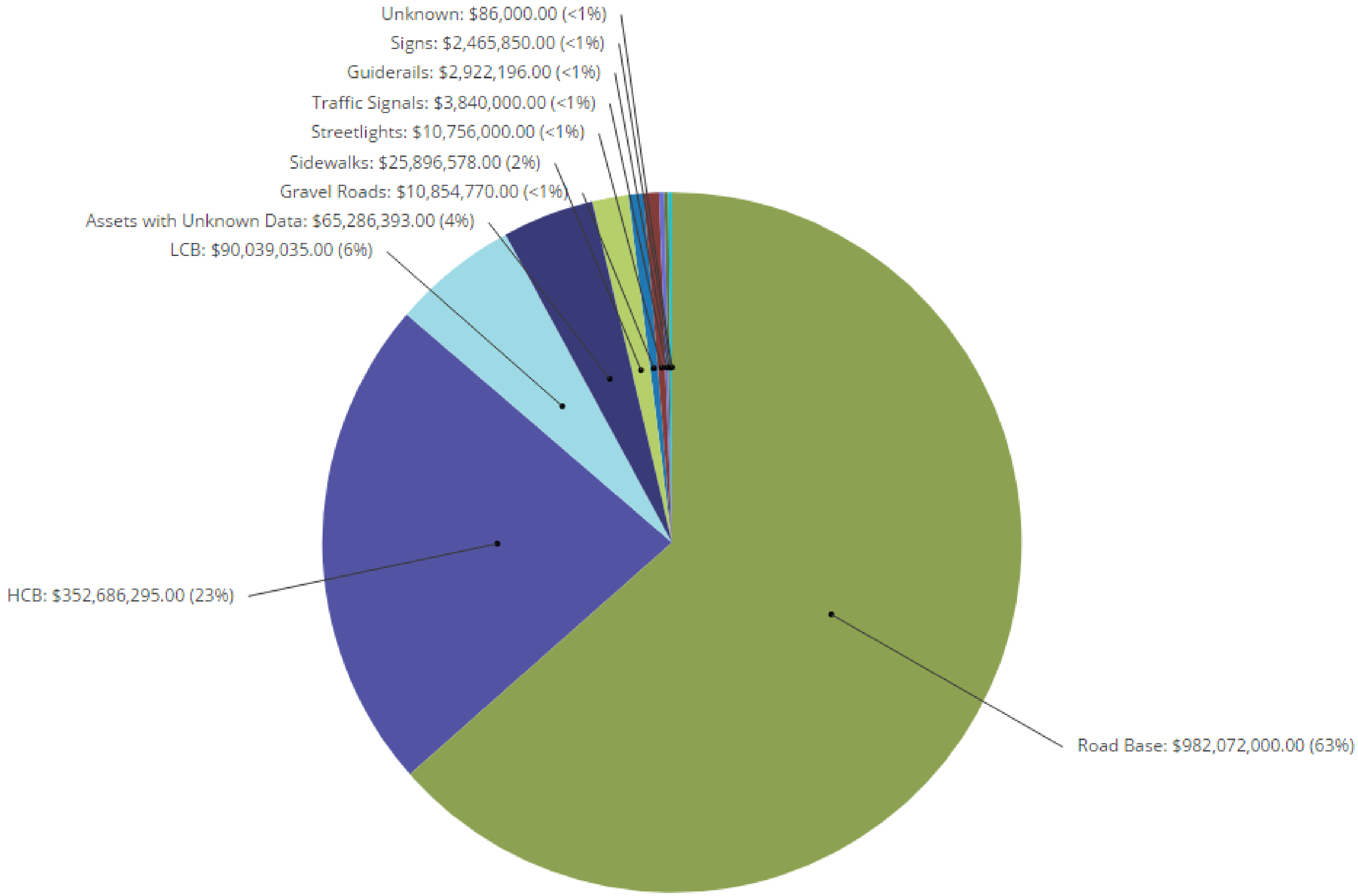
Table 6 illustrates key asset attributes for the municipality's road network, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's roads assets are valued at $1.5 billion based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality. It should be noted that timing did not permit the updated roads asset data from the 2016 Roads Needs Study to be incorporated into this section.

Table 6 Key Asset Attributes – Road Network

Asset Type	Asset Component	Quantity	Useful Life (Years)	2016 Unit Replacement Cost	2016 Overall Replacement Cost
Road Network	Gravel Roads	724km	10	User Defined	$10,854,770
	Guiderails	69898m	20, 25, 30	User Defined	$2,922,196
	HCB	738km	30	User Defined	$352,686,295
	LCB	948km	15	User Defined	$90,039,035
	Sidewalks	161854m	25, 35, 45	User Defined	$25,896,578
	Signs	16439	7	User Defined	$2,465,850
	Streetlights	4013	30	User Defined	$10,756,000
	Traffic Signals	21	25	User Defined	3,840,000
	Unknown	22	30	User Defined	$86,000
	Road Base	2698km	100	User Defined	$982,072,000
	Assets with Unknown Data	-	27	User Defined	$65,286,393
				Total	**$1,546,905,117**

Note that the Assets with Unknown Data are shown in the table above and Figure 11 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy.

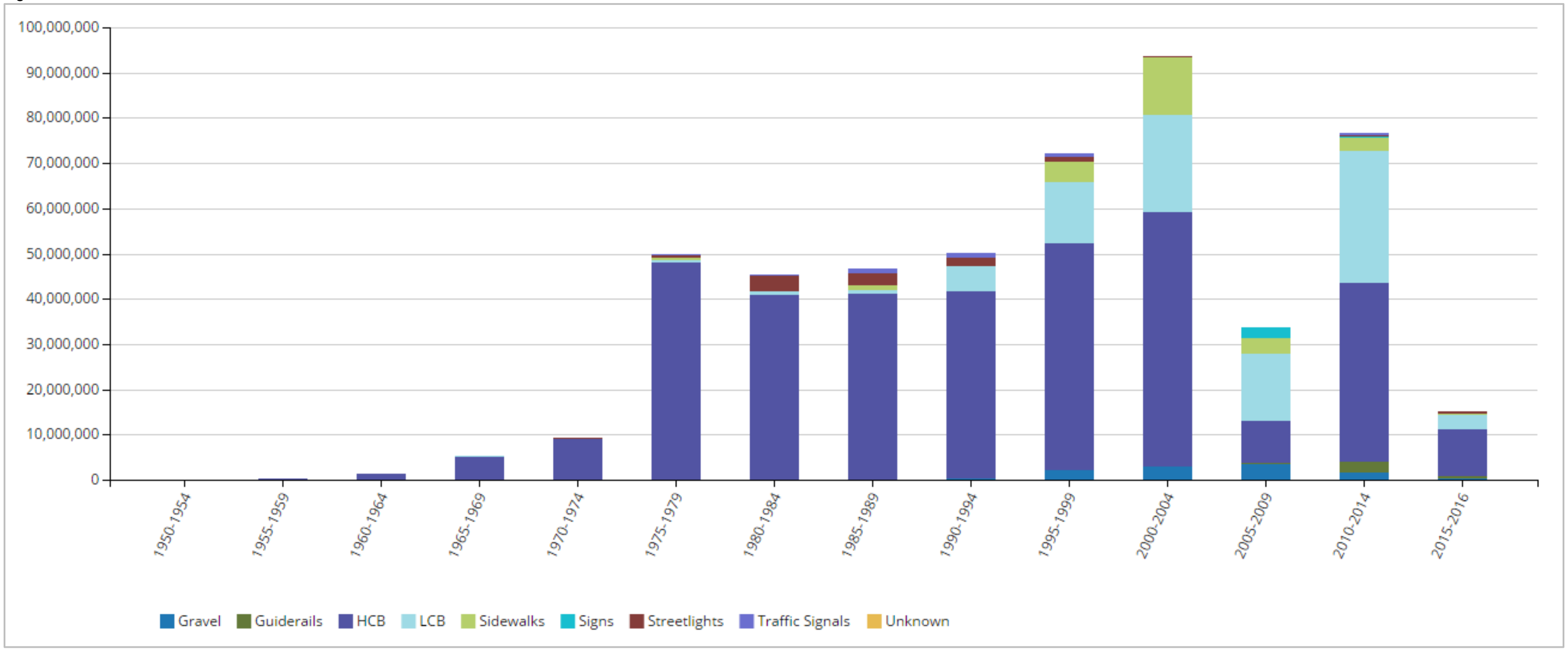
Figure 11 Asset Valuation – Road Network



1.2 Historical Investment in Infrastructure

Figure 12 shows the municipality's historical investments in its road network since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 1.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 12 Historical Investment – Road Network

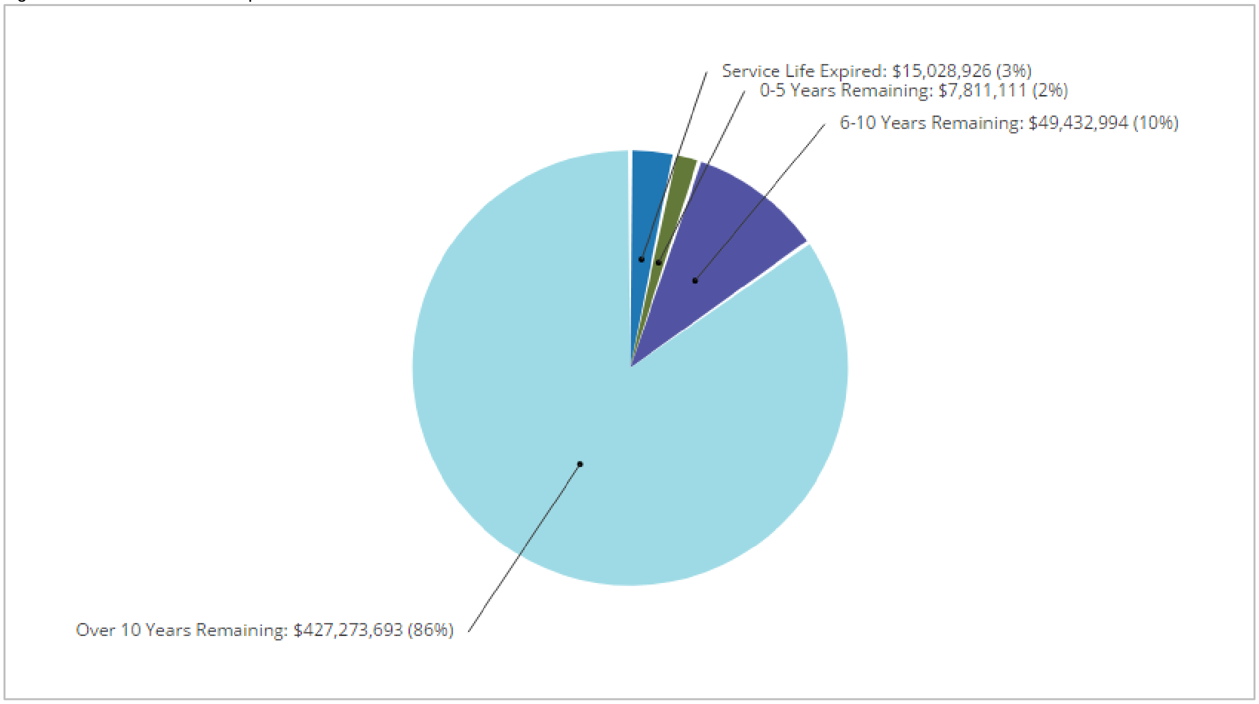


Investments in the municipality's road network have grown since 1950 with a large increase in the late 1970s. In the early 2000s, the period of largest investment, $94 million was invested with over $56 million put into HCB roads.

1.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 13 illustrates the useful life consumption levels as of 2016 for the municipality's road network.

Figure 13 Useful Life Consumption - Road Network

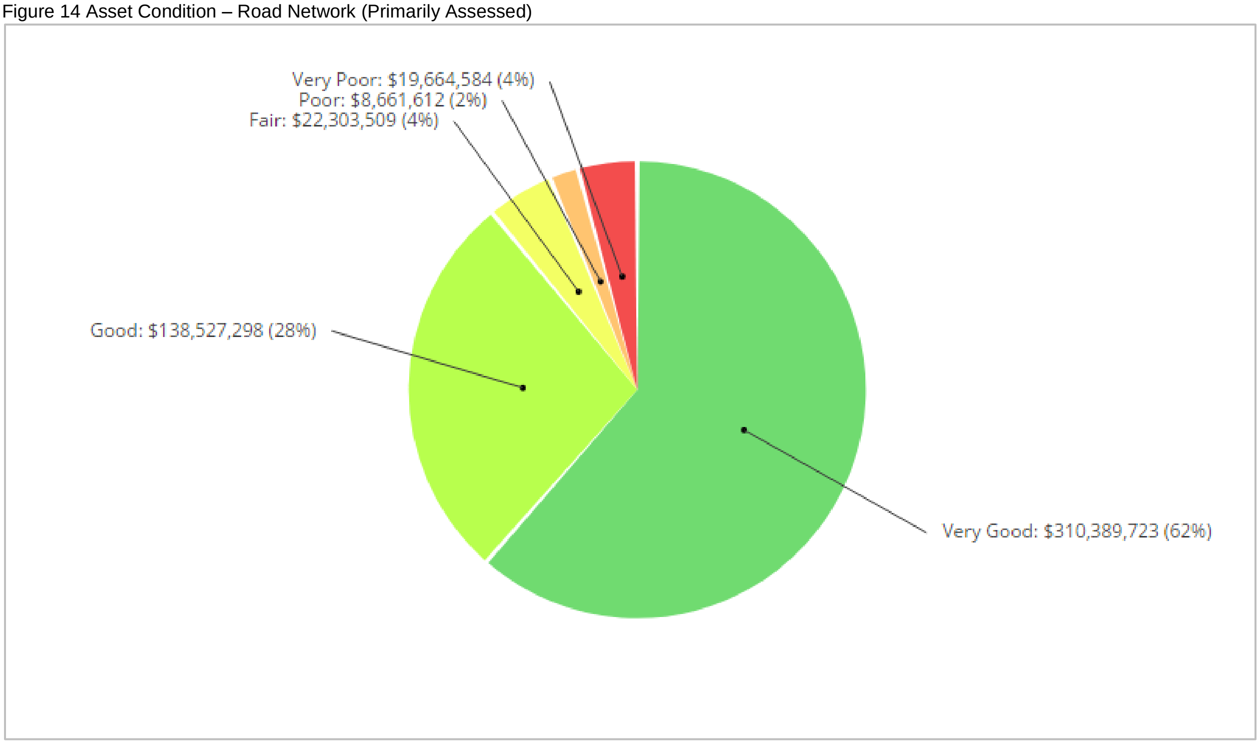


While 86% of the municipality's road network has at least 10 years of useful life remaining, 3%, with a valuation of $15 million, remain in operation beyond their useful life. An additional 2% will reach the end of their useful life within the next five years.

1.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's road network as of 2016. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for 100% of HCB, LCB and gravel road assets and for 99% of guiderail assets.

Figure 14 Asset Condition – Road Network (Primarily Assessed)

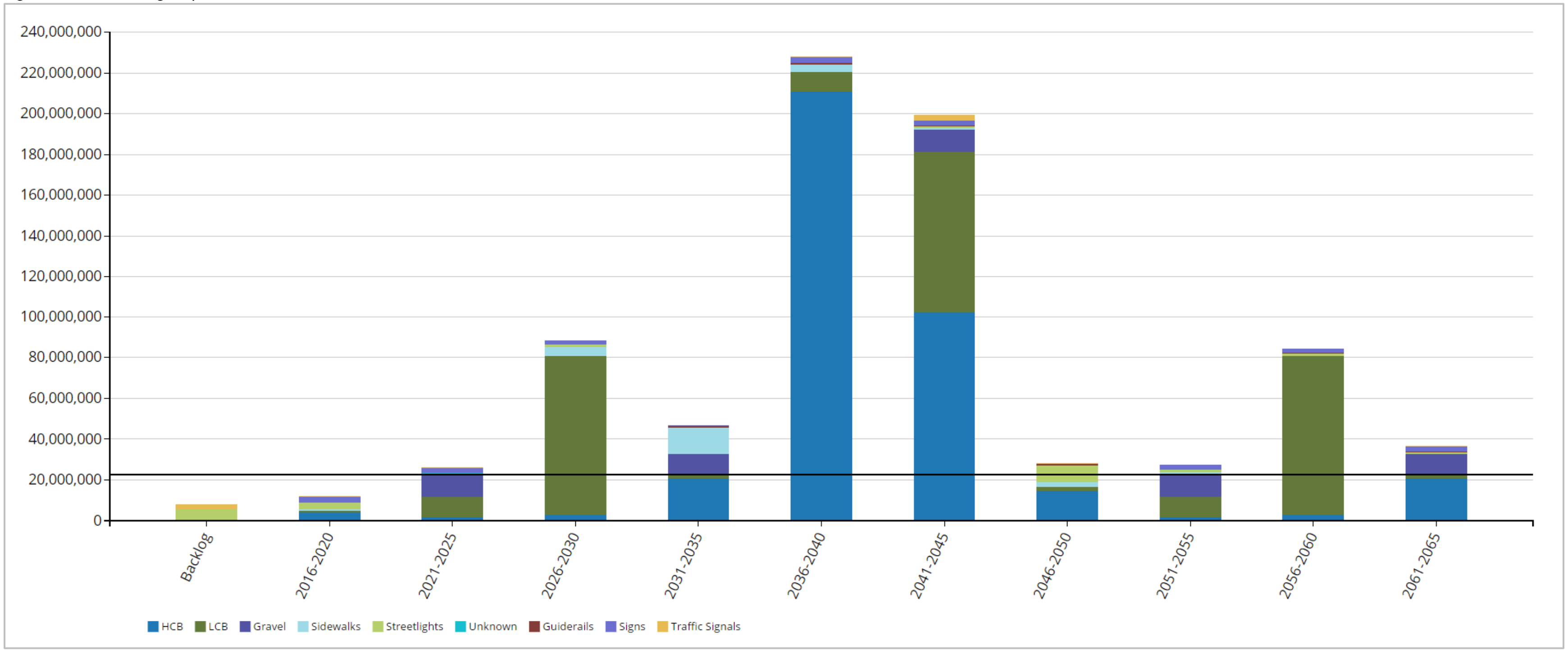


Based primarily on assessed condition data, 90% of assets, with a valuation of $449 million are in good to very good condition; 6% are in poor to very poor condition.

1.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's road network assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 15 Forecasting Replacement Needs – Road Network



In addition to a backlog of $8.1 million, replacement needs are forecasted to be $12 million in the next five years; an additional $26 million is forecasted in replacement needs between 2021-2025. The municipality's annual requirements (indicated by the black line) for its road network total $23 million. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

1.6 Recommendations – Road Network

- Primarily assessed condition data indicates a backlog of $8.1 million and significant 10-year replacement needs of $38 million. The municipality should continue its condition assessments of road surfaces (HCB and LCB), and expand the program to incorporate all assets in order to more precisely estimate its actual financial requirements and field needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of the backlog as well as short, medium, and long term replacement needs. See Section 4, 'Risk' in the 'Asset Management Strategies' chapter for more information.

- In addition to the above, a tailored lifecycle activity framework should also be developed to promote standard lifecycle management of the road network as outlined further within the "Asset Management Strategy" section of this AMP.

- Road network key performance indicators should be established and tracked annually as part of an overall level of service model. See Section 7 'Levels of Service'.

2. Bridges & Culverts

2.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

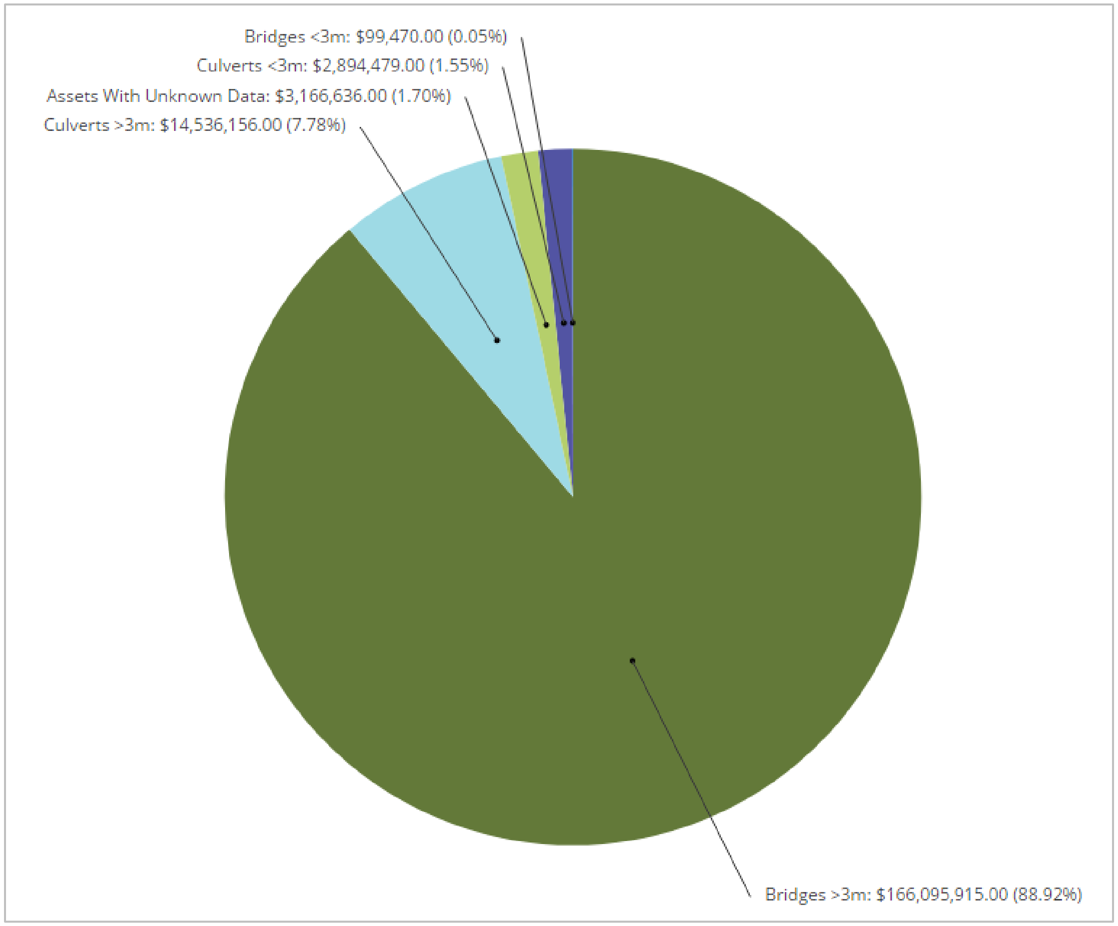
Table 7 illustrates key asset attributes for the municipality's bridges & culverts, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's bridges & culverts assets are valued at $187 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 7 Key Asset Attributes – Bridges & Culverts

Asset Type	Asset Component	Quantity	Useful Life (Years)	2016 Unit Replacement Cost	2016 Overall Replacement Cost
Bridges & Culverts	Bridges <3m	1	50	User Defined	$99,470
	Bridges >3m	165	50, 75	User Defined	$166,095,915
	Culverts <3m	55	50, 75	User Defined	$2,894,479
	Culverts >3m	74	50, 75	User Defined	$14,536,156
	Assets with Unknown Data	-	64	User Defined	$3,166,636
				Total	**$186,792,656**

Note that the Assets with Unknown Data are shown in the table above and Figure 16Figure 11 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy

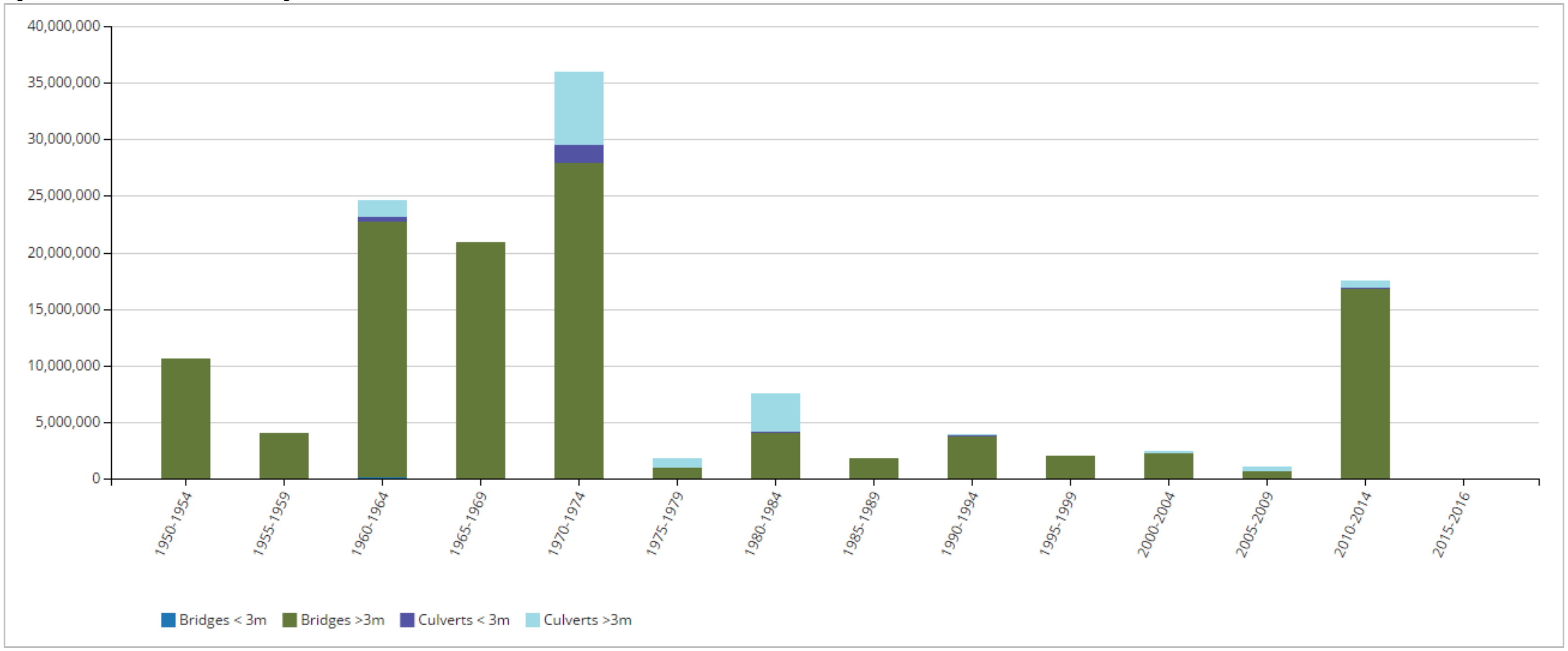
Figure 16 Asset Valuation – Bridges & Culverts



2.2 Historical Investment in Infrastructure

Figure 17 shows the municipality's historical investments in its bridges & culverts since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 2.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 17 Historical Investment – Bridges & Culverts

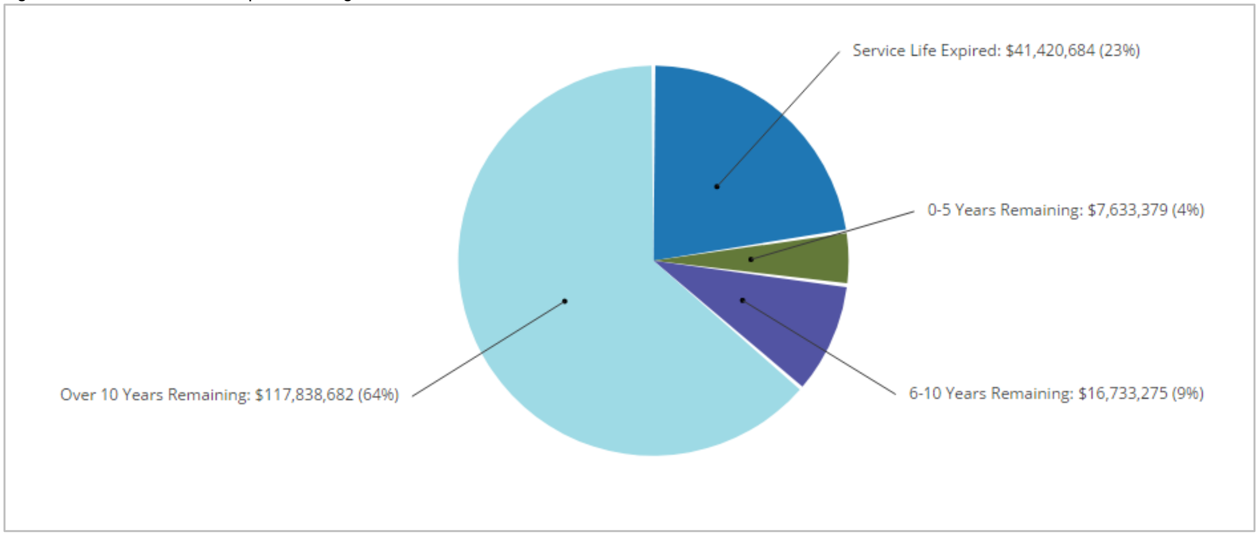


The municipality has invested sporadically in its bridges and culverts since 1950. In the early 1970s, the period of largest investment, $36 million was invested with $28 million put into bridges >3m.

2.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 18 illustrates the useful life consumption levels as of 2016 for the municipality's bridges & culverts.

Figure 18 Useful Life Consumption – Bridges & Culverts

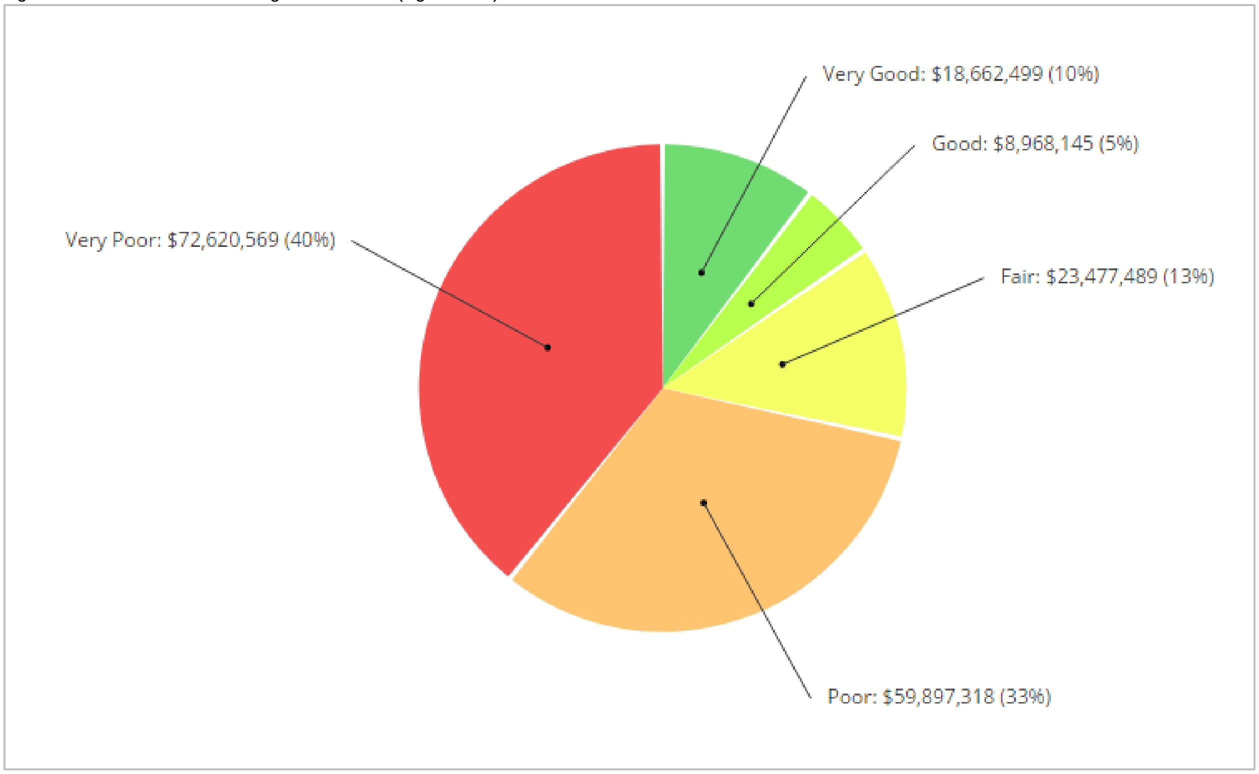


64% of the assets have at least 10 years of useful life remaining while 23%, with a valuation of $41 million, remain in operation beyond their useful life. An additional 4% will reach the end of their useful life within the next five years.

2.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's bridges & culverts as of 2016. By default, we rely on observed field data adapted from OSIM inspections as provided by the municipality. In the absence of such information, age-based data is used as a proxy. All assets are based on age-based data.

Figure 19 Asset Condition – Bridges & Culverts (Age-based)

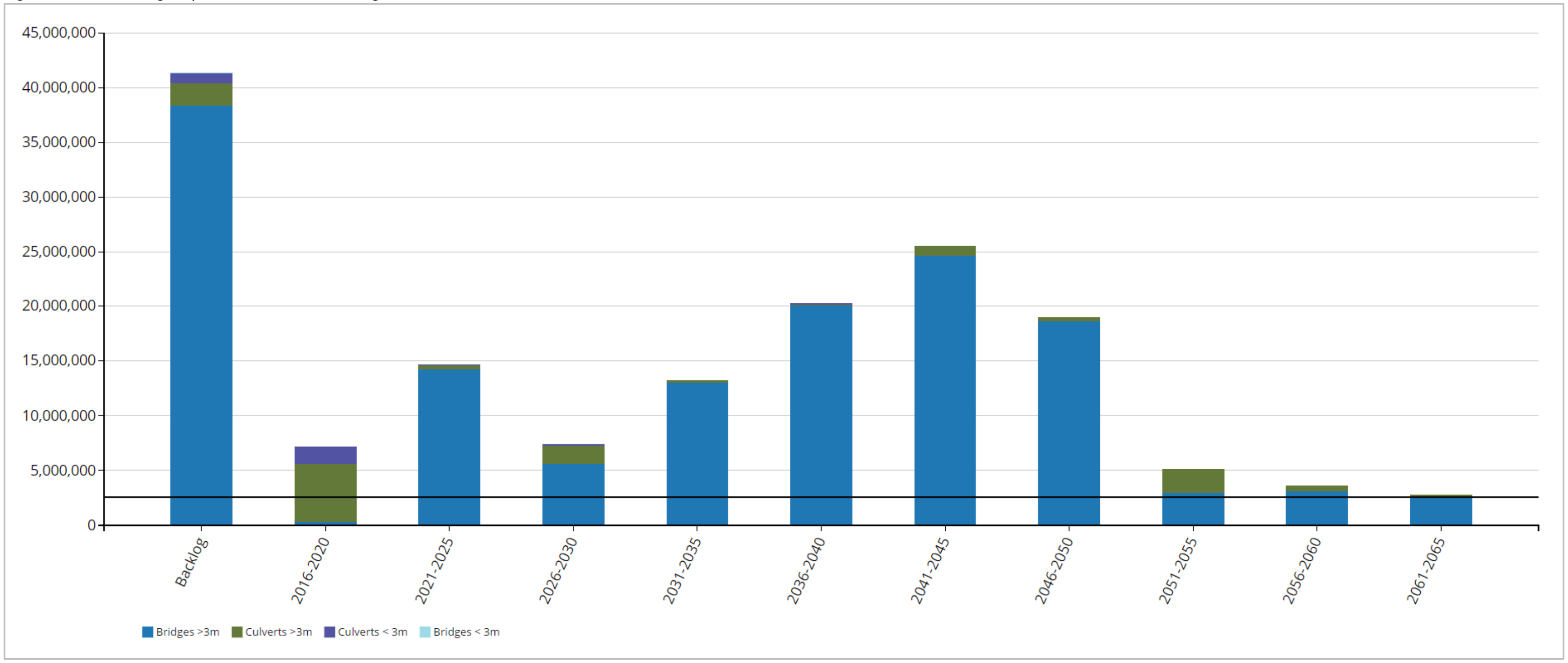


Age-based data indicates that while 15% of the municipality's bridges & culverts are in good to very good condition, 73%, with a valuation of $132.5 million, are in poor to very poor condition.

2.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's bridges & culverts. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 20 Forecasting Replacement Needs – Bridges & Culverts



In addition to a backlog of $41 million, replacement needs will total $7.1 million in the next five years; an additional $14.7 million will be required between 2021 and 2025. The municipality's annual requirements (indicated by the black line) for its bridges & culverts total $2,660,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

2.6 Recommendations – Bridges & Culverts

- Age-based data indicates a significant backlog of $41 million and 10-year replacement needs of $21.8 million. The results and recommendations from the OSIM inspections should be incorporated into the AMP analysis and used to generate the short-and long-term capital and maintenance budgets for the bridge and large culvert structures. See Section VIII, 'Asset Management Strategies'.

- Bridge & culvert structure key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII 'Levels of Service'.

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3. Water System

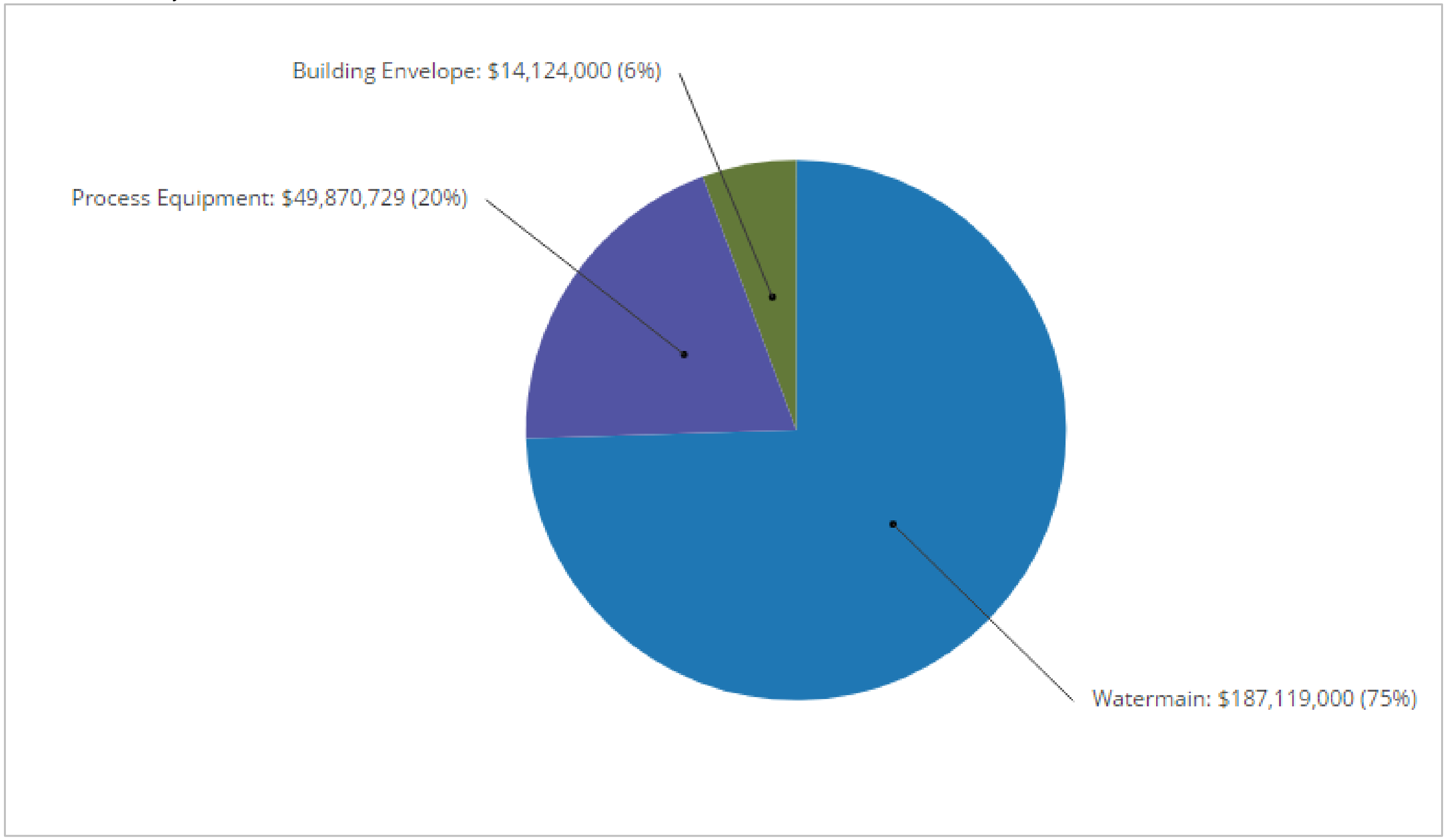
3.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the municipality's water system, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's water system assets are valued at $251 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 8 Key Asset Attributes – Water

Asset Type	Asset Component	Quantity	Useful Life (Years)	2016 Unit Replacement Cost	2016 Overall Replacement Cost
Water System	Building Envelope	29	60	User Defined	$14,124,000
	Process Equipment	2817	15, 20, 25, 30, 40, 50, 60, 80	User Defined	$49,870,729
	Watermains (AC)	43671m	80	User Defined	$36,724,000
	Watermains (CI)	28496m	100	User Defined	$20,588,000
	Watermains (CPP)	1736m	80	User Defined	$3,163,000
	Watermains (CU)	1547m	70	User Defined	$915,000
	Watermains (DI)	941m	80	User Defined	$713,000
	Watermains (HDPE)	1386m	120	User Defined	$922,000
	Watermains (PE)	660m	100	User Defined	$524,000
	Watermains (PVC)	177931m	120	User Defined	$123,535,000
	Watermains (WS)	44m	80	User Defined	$35,000
				Total	**$251,113,729**

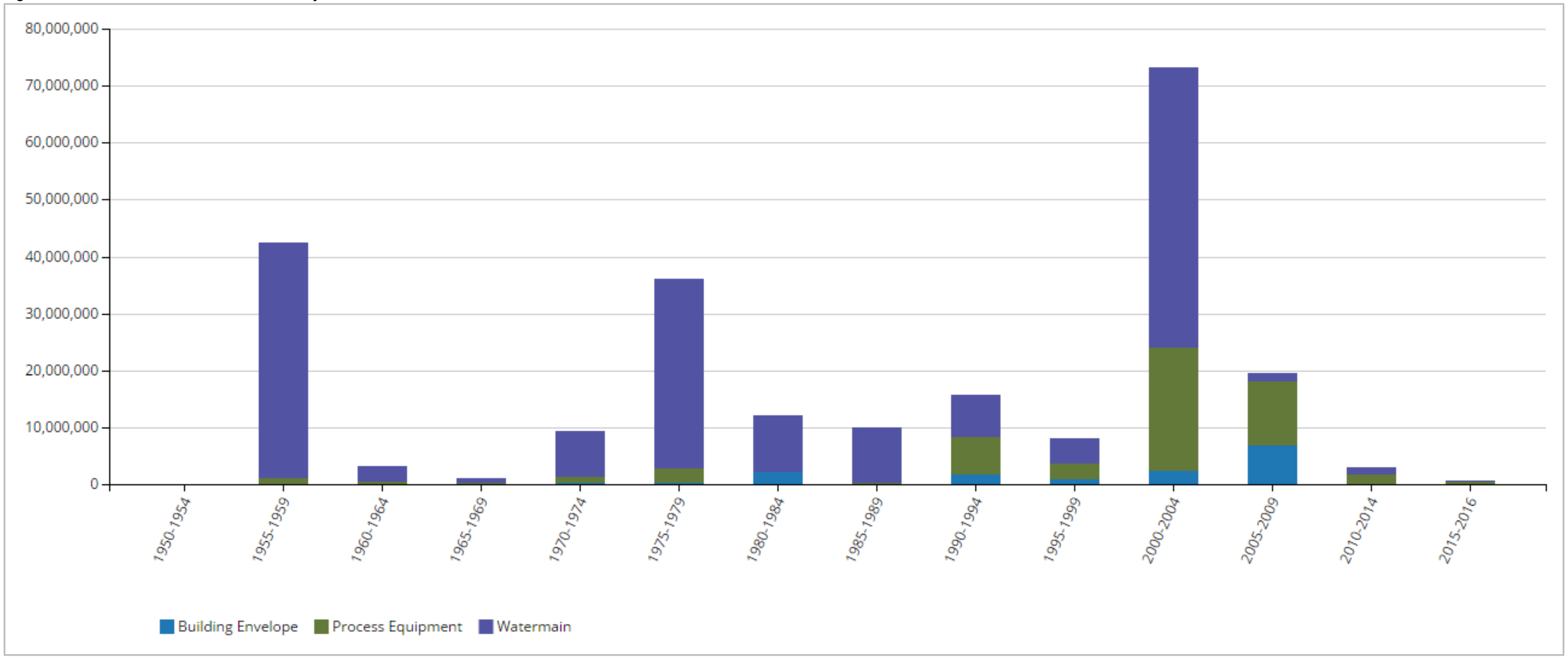
Figure 21 Asset Valuation – Water System



3.2 Historical Investment in Infrastructure

Figure 22 shows the municipality's historical investments in its water system since 1960. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 3.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 22 Historical Investment – Water System

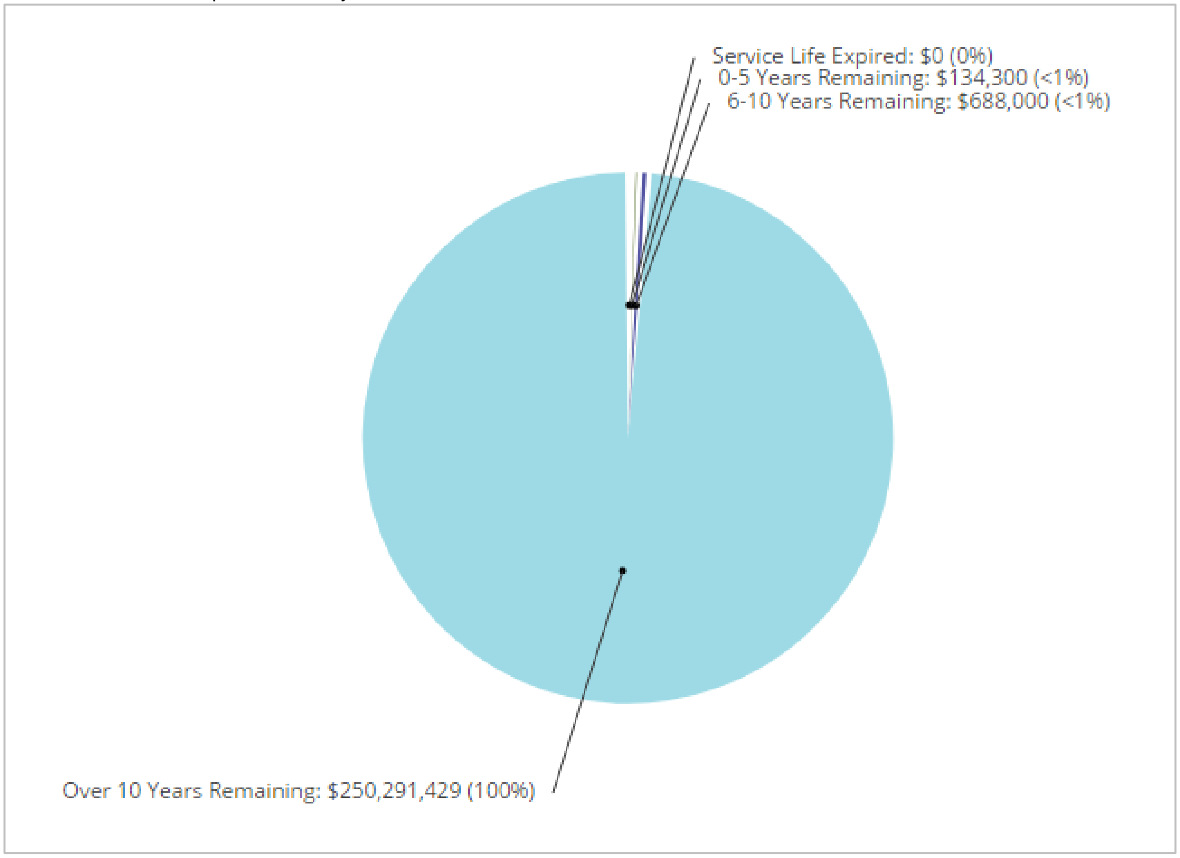


Investments in the water system have been sporadic since the late 1950s. In the early 2000s, the period of largest investment, $73 million was invested in the water systems with $49 million put into watermains.

3.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 23 illustrates the useful life consumption levels as of 2016 for the municipality's water system.

Figure 23 Useful Life Consumption – Water System

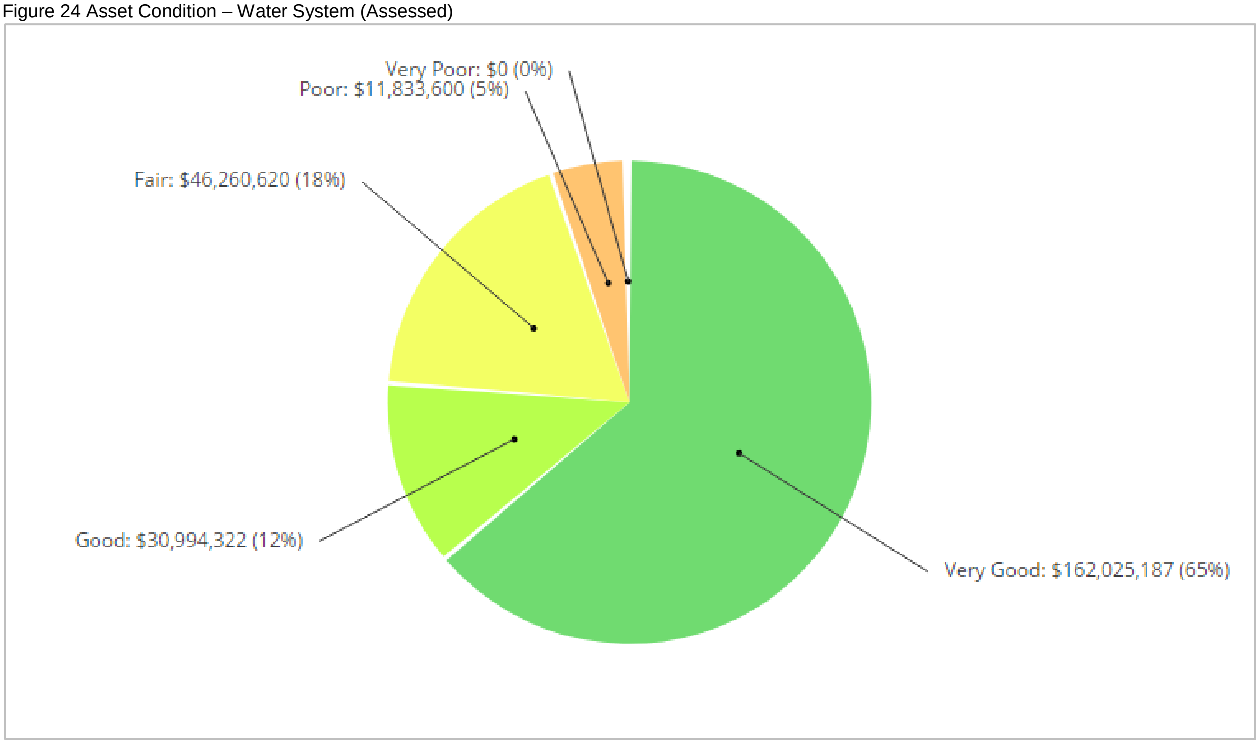


Virtually 100% of assets have at least 10 years of useful life remaining.

3.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's water services. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for all of its water assets.

Figure 24 Asset Condition – Water System (Assessed)

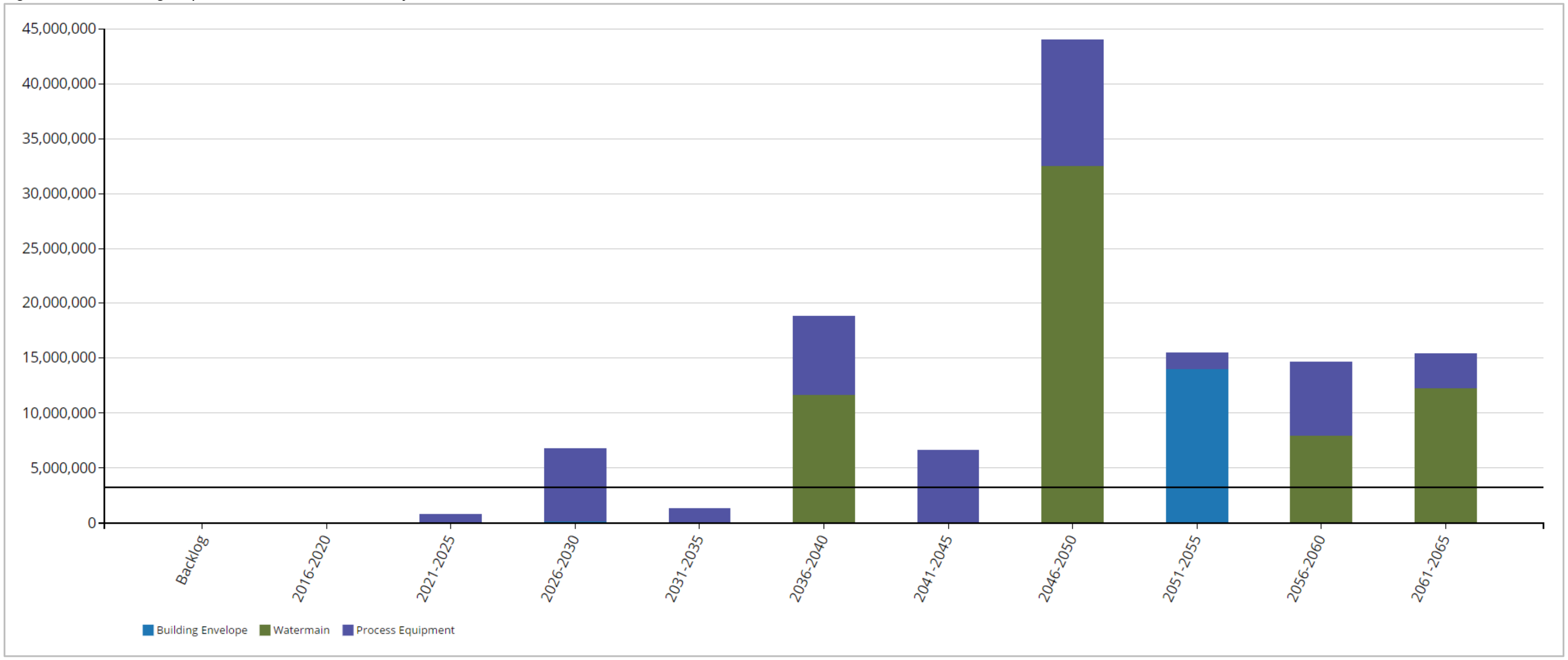


Based on assessed data, 77% of assets are in good to very good condition while 5%, with a valuation of $11.8 million, are in poor condition.

3.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's water system assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 25 Forecasting Replacement Needs – Water System



Assessed condition data shows no backlog and minimal 10-year replacement needs. The municipality's annual requirements (indicated by the black line) for its water system total $3,341,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

3.6 Recommendations – Water System

- Condition data shows no backlog and minimal 10-year replacement needs. The municipality should continue its condition assessment program of its water assets to precisely estimate its financial requirements and field needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of short, medium, and long term replacement needs. See Section 4, 'Risk' in the 'Asset Management Strategies' chapter for more information.

- In addition to the above, a tailored lifecycle activity framework should be developed to promote standard lifecycle management of the water system as outlined further within the "Asset Management Strategy" section of this AMP.

- Water distribution system key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII 'Levels of Service'.

- The municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.

- An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

4. Wastewater Systems

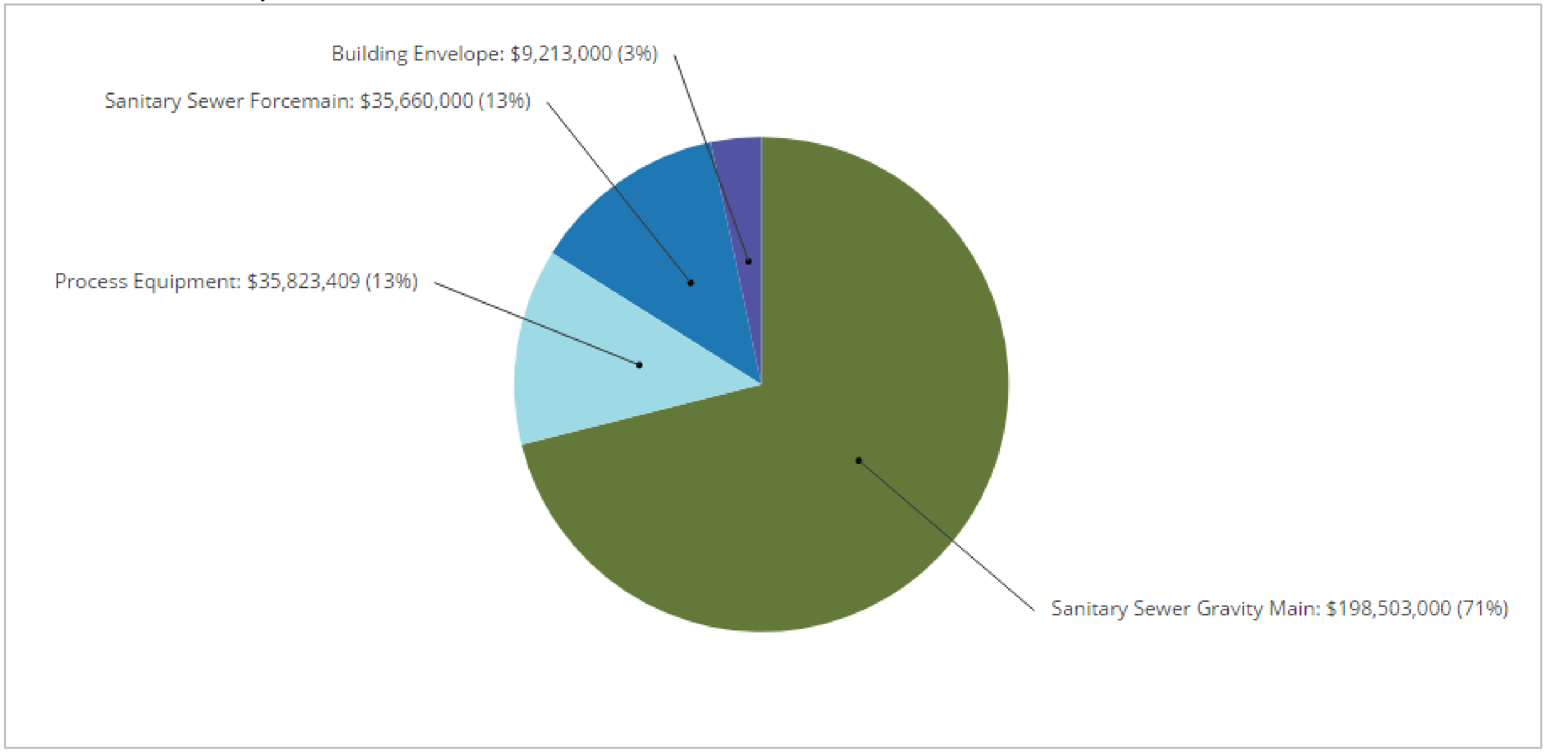
4.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 9 illustrates key asset attributes for the municipality's wastewater system portfolio, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the municipality's wastewater system assets are valued at $279 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 9 Asset Inventory – Wastewater Systems

Asset Type	Asset Component	Quantity	Useful Life (Years)	2016 Unit Replacement Cost	2016 Overall Replacement Cost
Wastewater Systems	Building Envelope	18	60	User Defined	$9,213,000
	Process Equipment	1651	15, 20, 25, 30, 40, 80	User Defined	$35,823,409
	Sanitary Sewer Forcemains (AC)	1026m	50	User Defined	$1,151,000
	Sanitary Sewer Forcemains (DI)	2704m	60	User Defined	$4,165,000
	Sanitary Sewer Forcemains (HDPE)	6250m	100	User Defined	$13,199,000
	Sanitary Sewer Forcemains (PE)	256m	50	User Defined	$192,000
	Sanitary Sewer Forcemains (PVC)	12992m	100	User Defined	$16,323,000
	Sanitary Sewer Forcemains (Steel Cement Lined)	629m	75	User Defined	$630,000
	Sanitary Sewer Gravity Mains (AC)	57888m	80	User Defined	$64,045,000
	Sanitary Sewer Gravity Mains (Concrete)	6625m	80	User Defined	$19,170,000
	Sanitary Sewer Gravity Mains (Corrugated HDPE)	89m	80	User Defined	$205,000
	Sanitary Sewer Gravity Mains (CSP)	7m	50	User Defined	$19,000
	Sanitary Sewer Gravity Mains (PVC)	76988m	100, 120	User Defined	$81,595,000
	Sanitary Sewer Gravity Mains (TRUSS)	17m	100	User Defined	$15,000
	Sanitary Sewer Gravity Mains (VCP)	30631m	100	User Defined	$33,454,000
				Total	**$279,199,409**

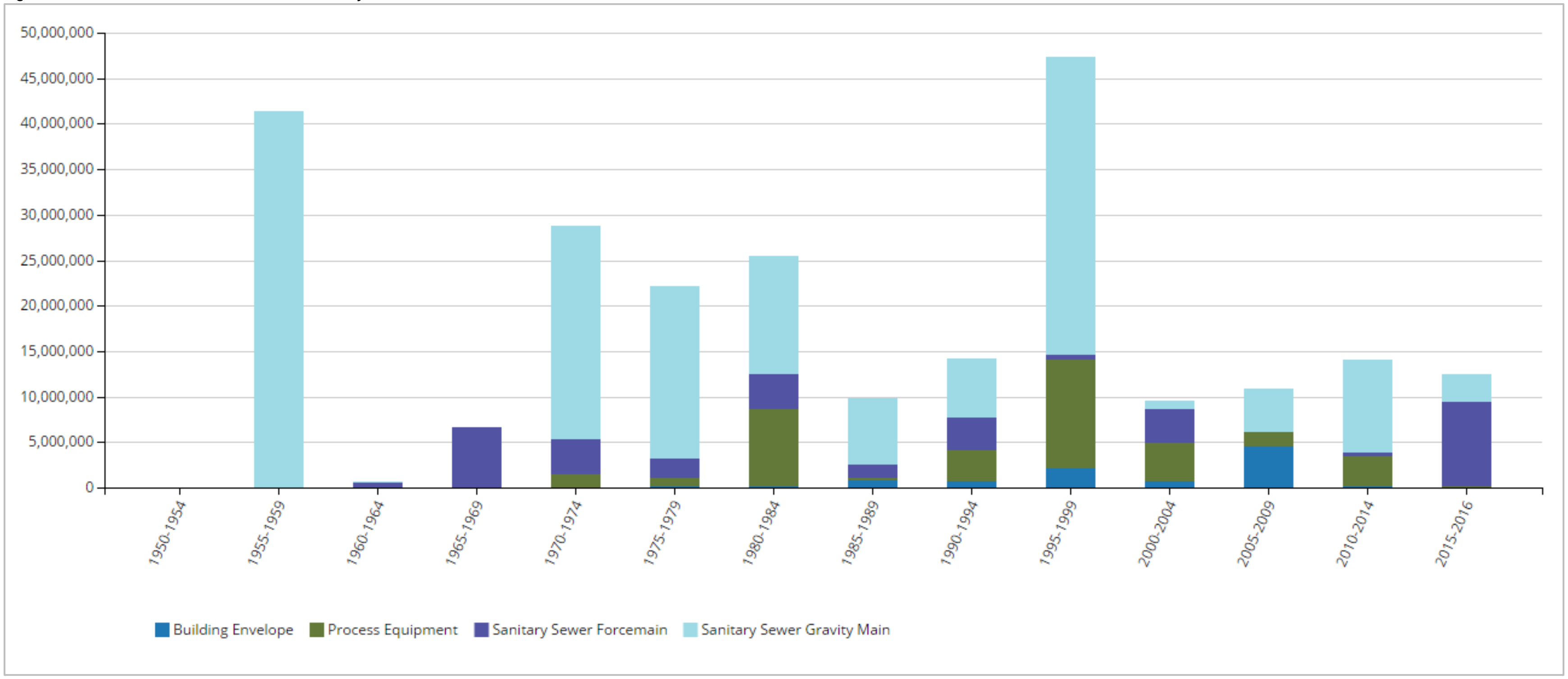
Figure 26 Asset Valuation – Wastewater System



4.2 Historical Investment in Infrastructure

Figure 27 shows the municipality's historical investments in its wastewater system since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 4.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 27 Historical Investment – Wastewater System

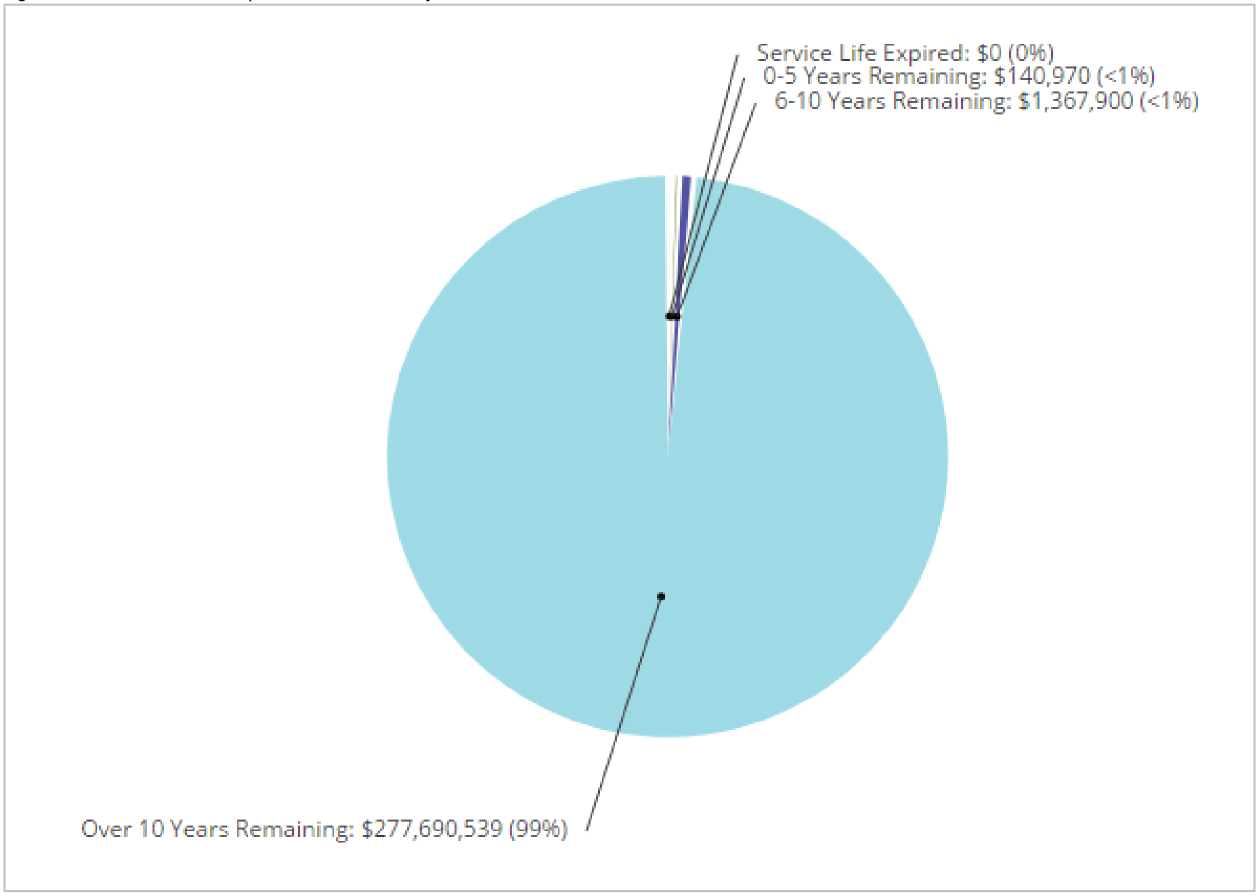


Major investments into the municipality's wastewaterassets began in the late 1950s. Investments then fluctuated and peaked in the late 1990s at $47 million. During this time $32.8 million was put into sanitary sewer gravity mains.

4.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 28 illustrates the useful life consumption levels as of 2016 for the municipality's wastewater system.

Figure 28 Useful Life Consumption – Wastewater System

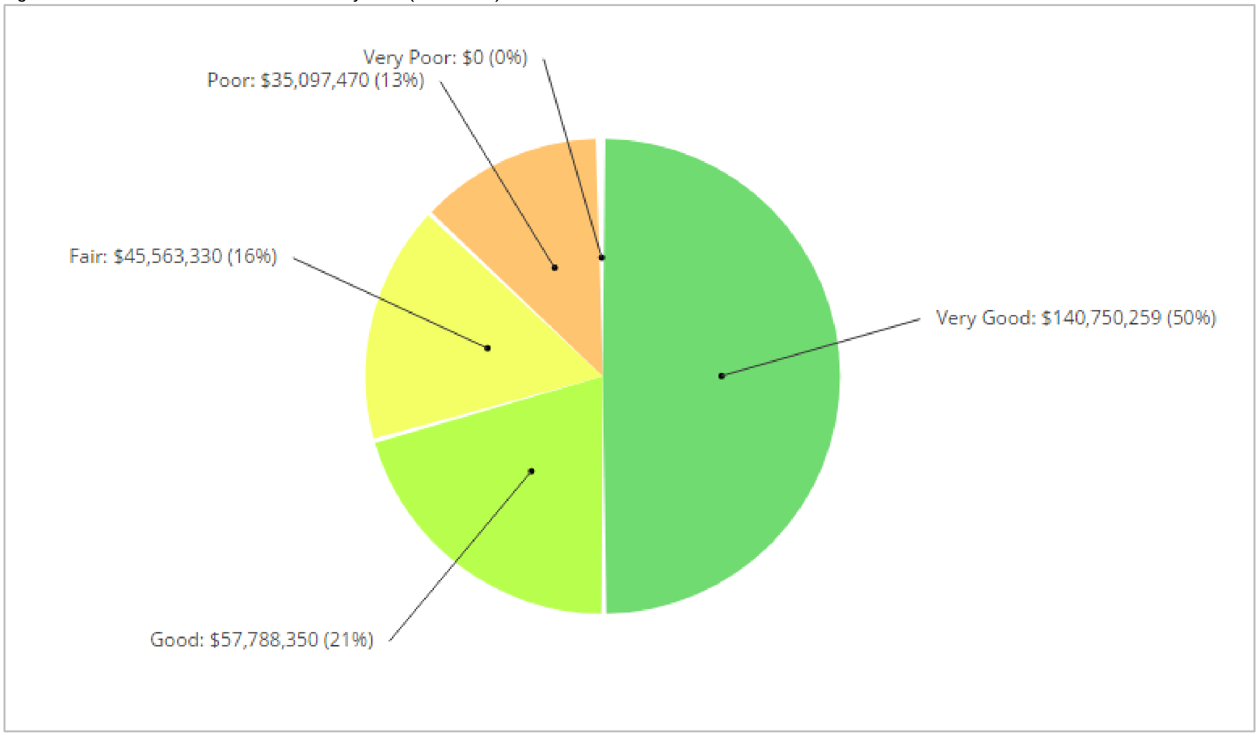


Virtually 100% of assets have over 10 years of useful life remaining.

4.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's sanitary services as of 2016. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for all wastewater system assets.

Figure 29 Asset Condition – Wastewater System (Assessed)

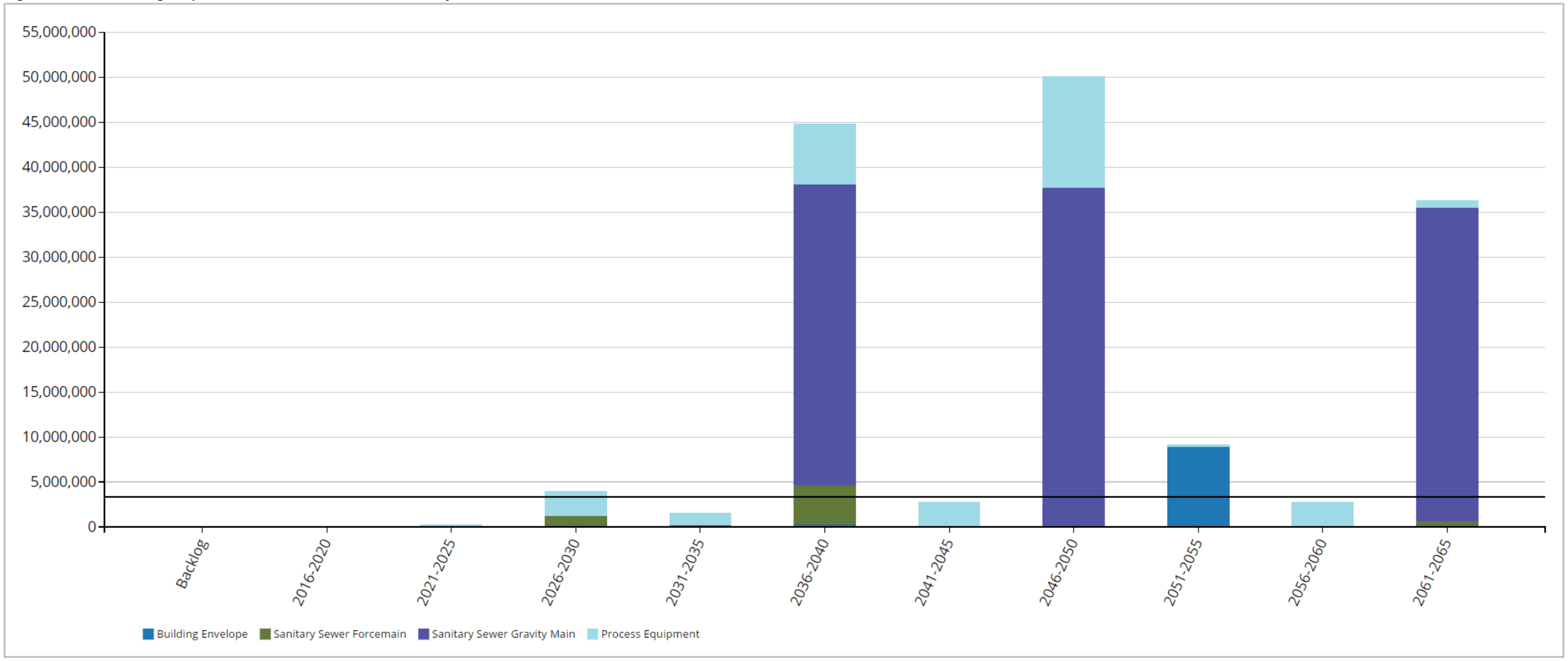


Assessed data indicates that 71% of the assets are in good to very good condition, while 13%, with a valuation of $35 million, are in poor condition.

4.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's wastewater system assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 30 Forecasting Replacement Needs – Wastewater System



Condition data indicates no backlog or 10-year replacement needs. The municipality's annual requirements (indicated by the black line) for its wastewater assets total $3,516,000. At this level, funding would be sustainable and replacement needs could be met as they arise without the need for deferring projects.

4.6 Recommendations – Wastewater System

- Condition data shows no backlog and minimal 10-year replacement needs. The municipality should continue its condition assessment program of its wastewater assets to precisely estimate its financial requirements and field needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of short, medium, and long term replacement needs. See Section 4, 'Risk' in the 'Asset Management Strategies' chapter for more information.

- In addition to the above, a tailored lifecycle activity framework should be developed to promote standard lifecycle management of the wastewater system as outlined further within the "Asset Management Strategy" section of this AMP.

- Wastewater collection system key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII 'Levels of Service'.

- The municipality should assess its short-, medium- and long-term operations and maintenance needs. An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

5. Storm Network

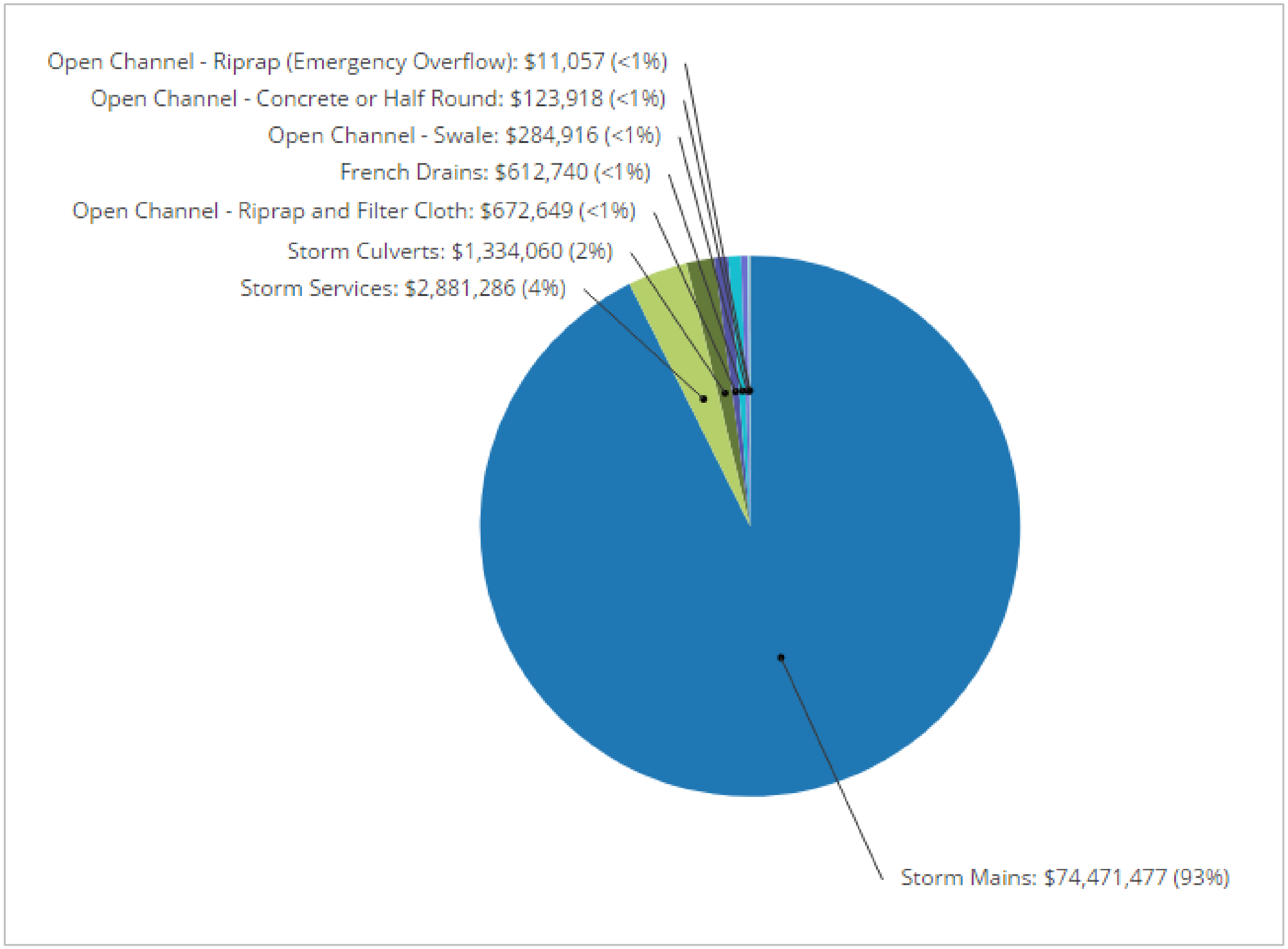
5.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 10 illustrates key asset attributes for the municipality's storm network, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's storm network assets are valued at $80 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality. As indicated in Appendix 2, storm assets are addressed through the Urban/Rural Reconstruction Program.

Table 10 Asset Inventory – Storm Network

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Storm Network	French Drains	1225m	75	User Defined	$612,739
	Open Channel – Concrete of Half Round	248m	75	User Defined	$123,918
	Open Channel – Riprap (Emergency Overflow)	22m	75	User Defined	$11,057
	Open Channel – Riprap and Filter Cloth	1345m	75	User Defined	$672,649
	Open Channel – Swale	570m	75	User Defined	$284,916
	Storm Culverts	2668m	50, 75	User Defined	$1,334,060
	Storm Mains	148943m	50, 75	User Defined	$74,471,477
	Storm Services	5763m	75	User Defined	$2,881,286
				Total	**$80,392,102**

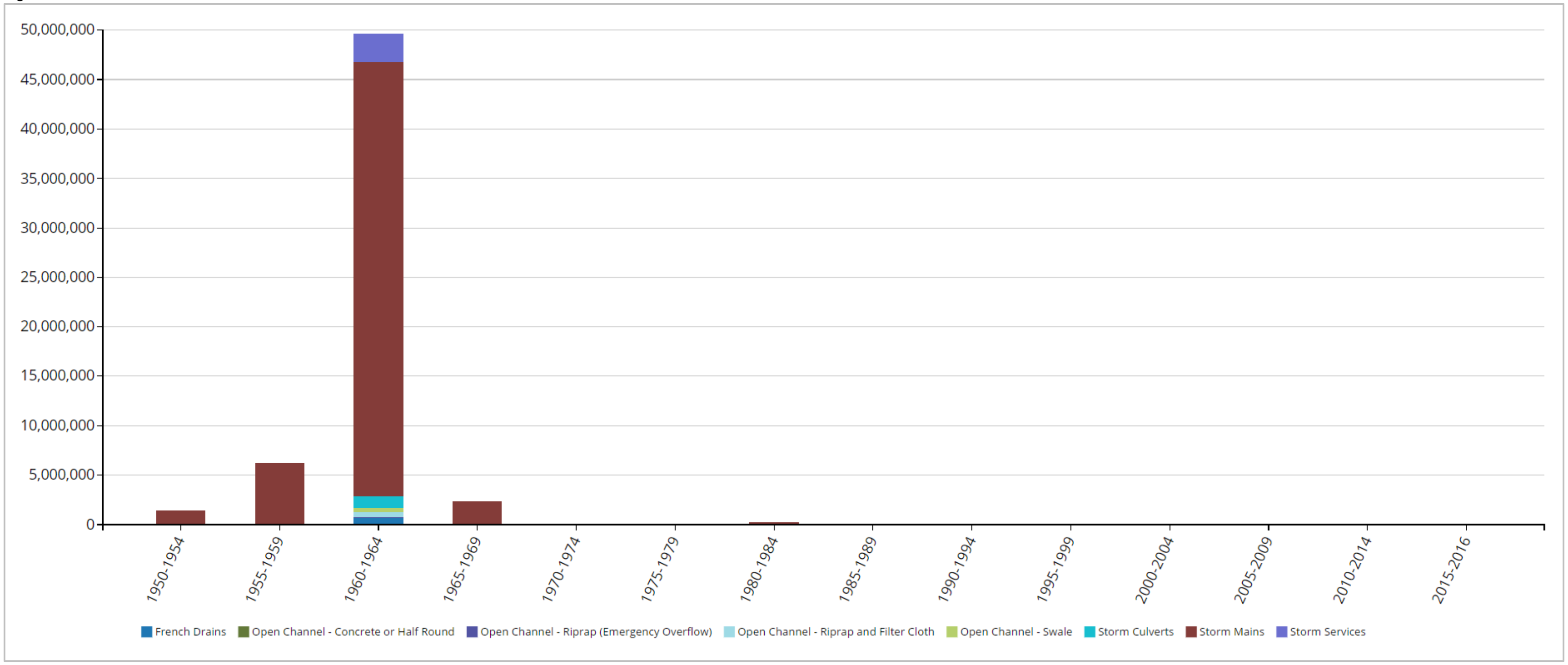
Figure 31 Asset Valuation – Storm Network



5.2 Historical Investment in Infrastructure

Figure 32 shows the municipality's historical investments in its storm network since 2000. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 5.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 32 Historical Investment – Storm Network

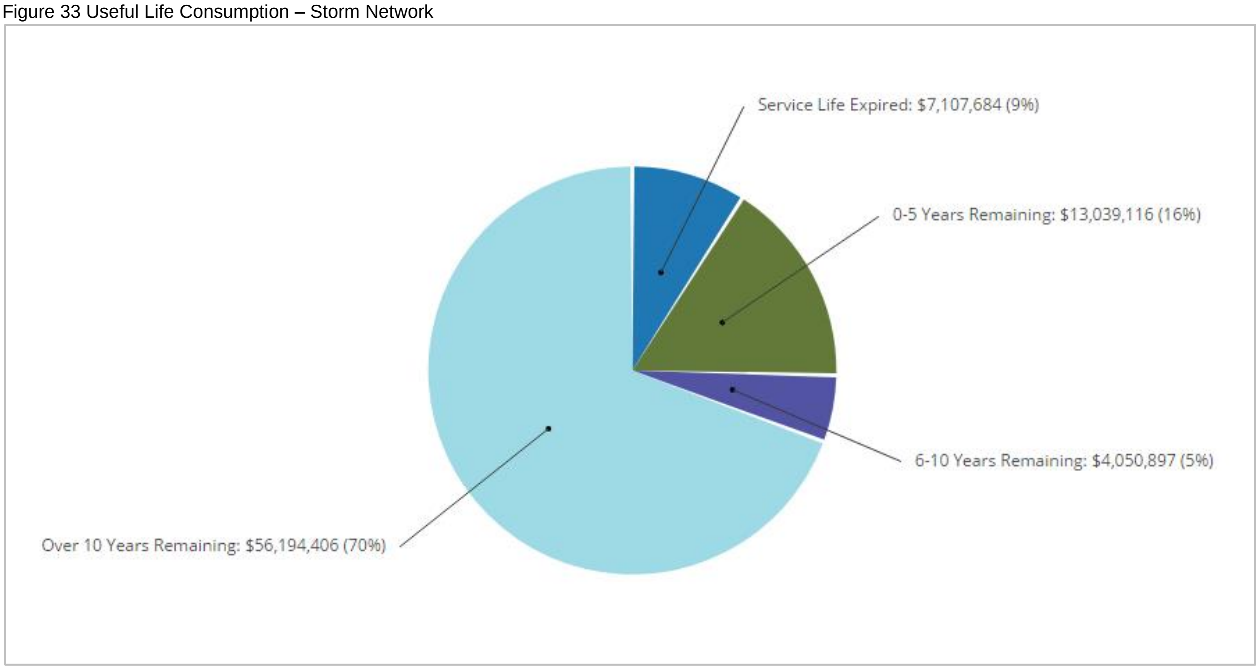


The storm water network was installed before 1985 with the largest investment taking place in the early 1960s with a valuation of $49.6 million with a focus on storm mains.

5.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 33 illustrates the useful life consumption levels as of 2016 for the municipality's storm assets.

Figure 33 Useful Life Consumption – Storm Network

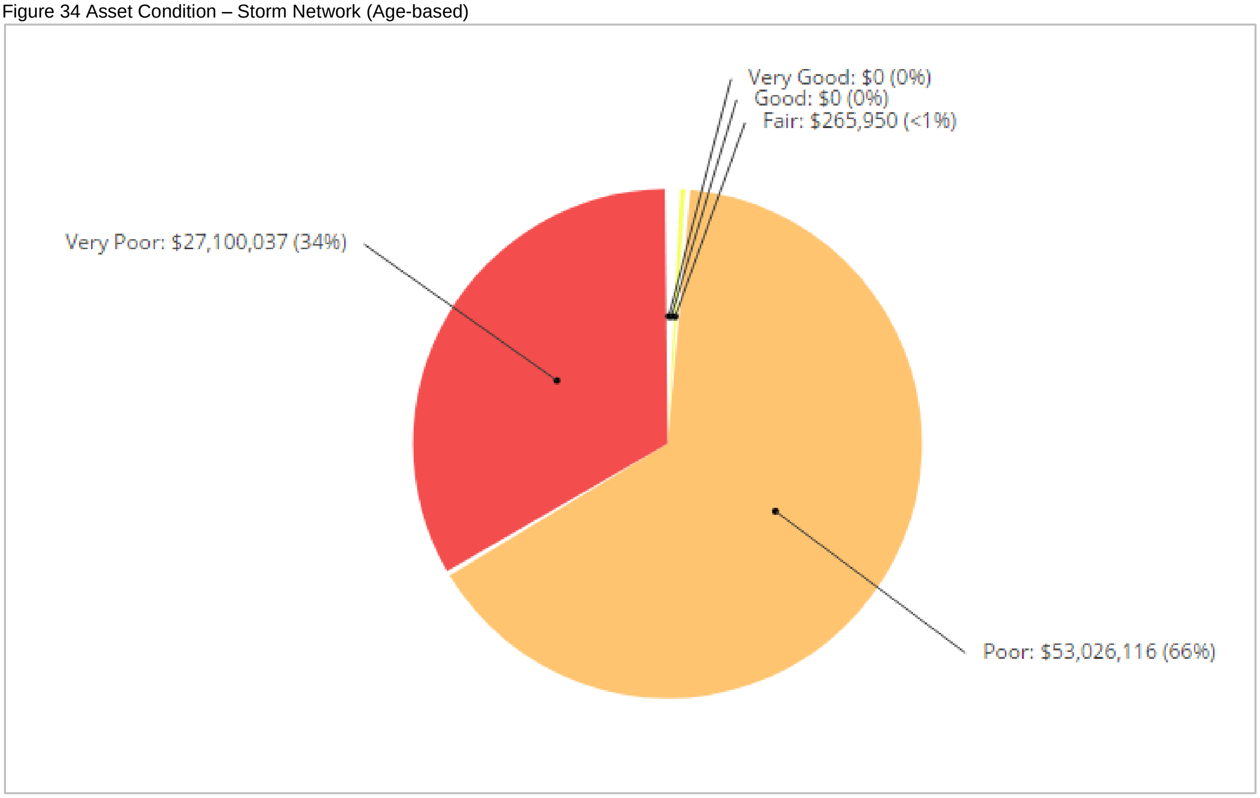


70% of the assets have at least 10 years of useful life remaining while 9%, with a valuation of $7.1 million, remain in operation beyond their useful life. An additional 16% will reach the end of their useful life within the next five years.

5.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's storm services. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has not provided condition data for its storm network assets.

Figure 34 Asset Condition – Storm Network (Age-based)

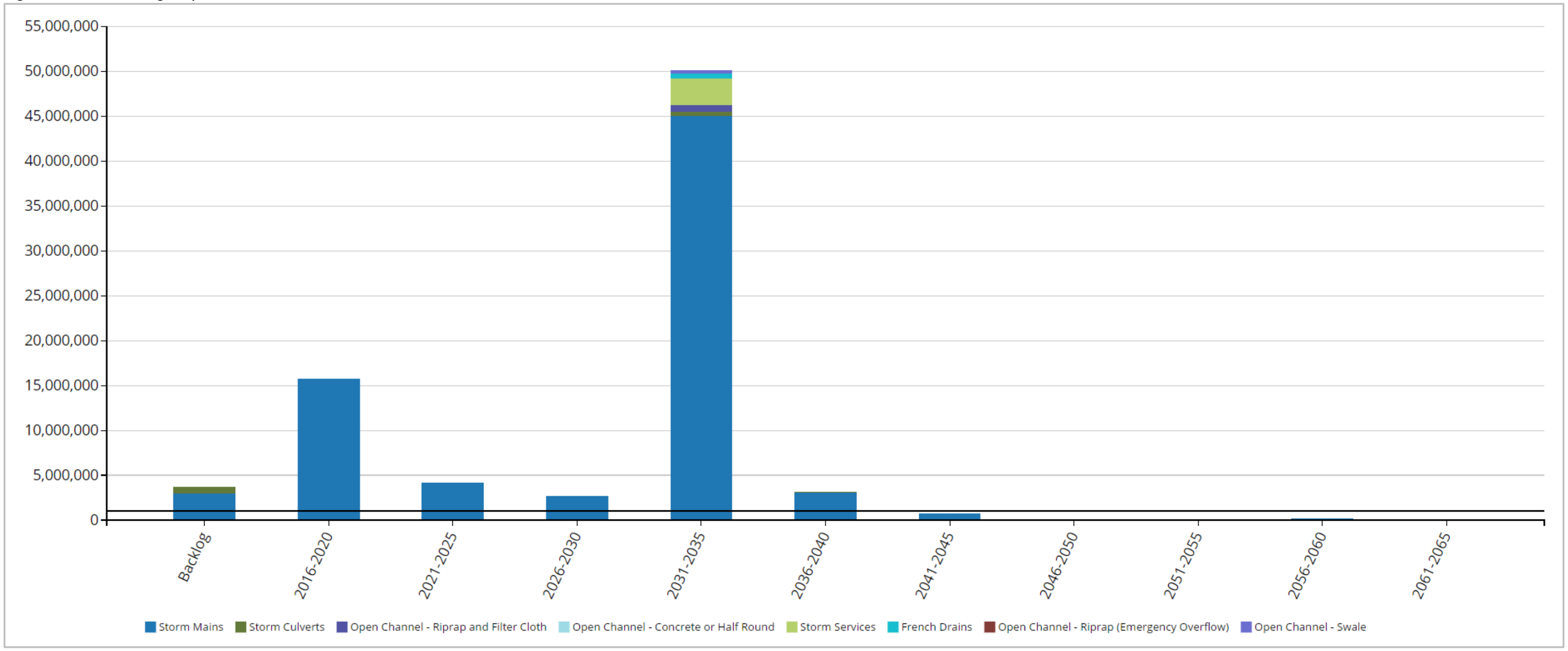


Based on age data, virtually all the storm network assets are in poor to very poor condition.

5.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's storm assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 35 Forecasting Replacement Needs – Storm Network



Age-based data shows a backlog of $3.6 million and five-year replacement needs of $15.7 million. An additional $4.2 million will be required between 2021-2025. The municipality's annual requirements (indicated by the black line) for storm assets total $1,088,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

5.6 Recommendations – Storm Network

- The municipality should implement a condition assessment program of its storm mains to further define field needs and to assist the prioritization of the short and long term capital budget. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.

- Using the above information, the municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.

- An appropriate percentage of the replacement value of the assets should then be allocated for the municipality’s O&M requirements.

- Storm network key performance indicators should be established and tracked annually as part of an overall level of service model. See Section VII ‘Levels of Service’.

6. Buildings & Facilities

6.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

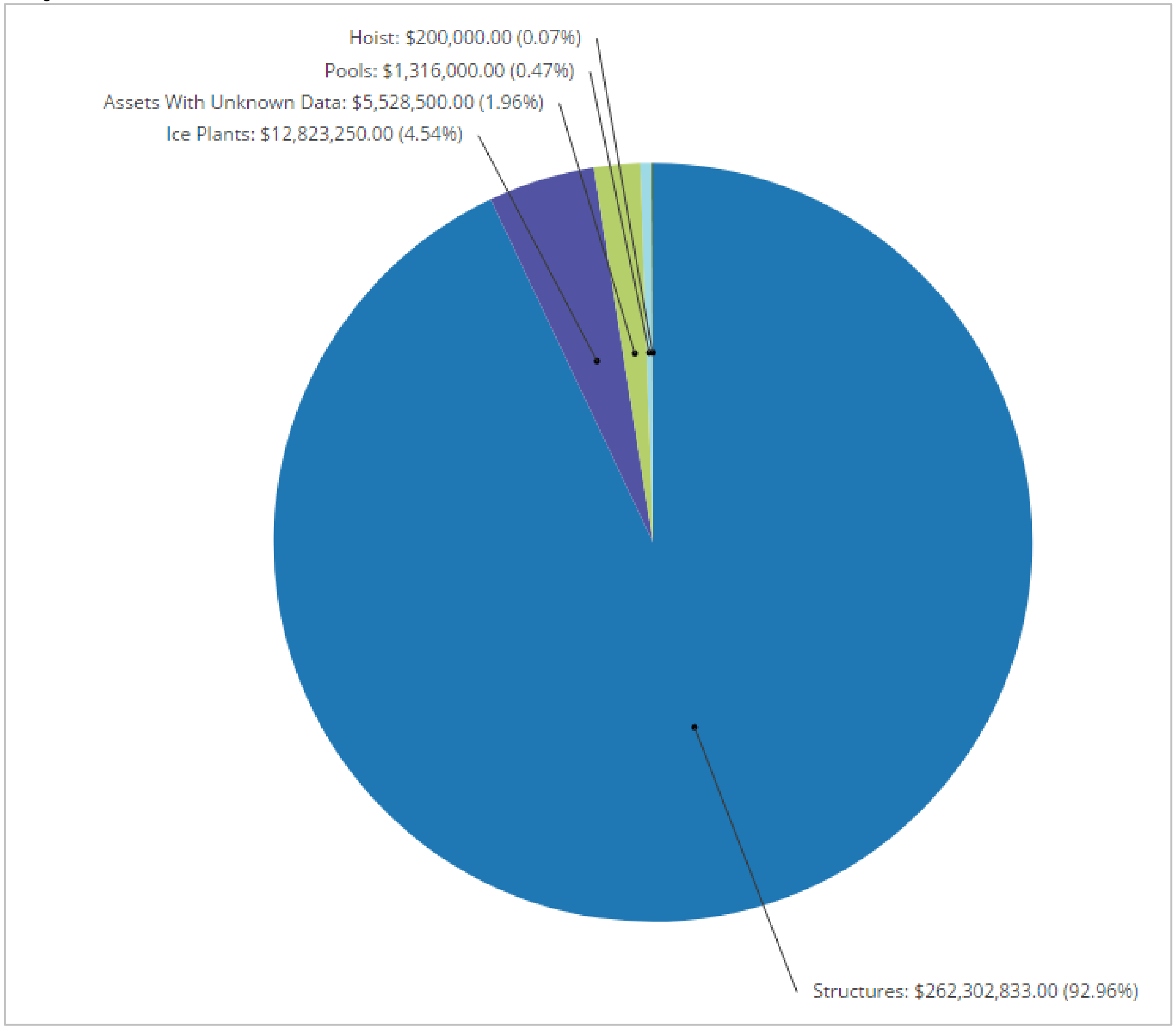
Table 11 illustrates key asset attributes for the municipality's buildings & facilities, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's buildings assets are valued at $282 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 11 Key Asset Attributes – Buildings & Facilities

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Buildings & Facilities	Structures	190	60	User Defined	$262,302,833
	Hoist	2	40	User Defined	$200,000
	Ice Plants	89	20, 25, 30	User Defined	$12,823,250
	Pools	3	40	User Defined	$1,316,000
	Assets with Unknown Data	-	46	User Defined	$5,528,500
				Total	$282,170,583

Note that the Assets with Unknown Data are shown in the table above and Figure 36 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy

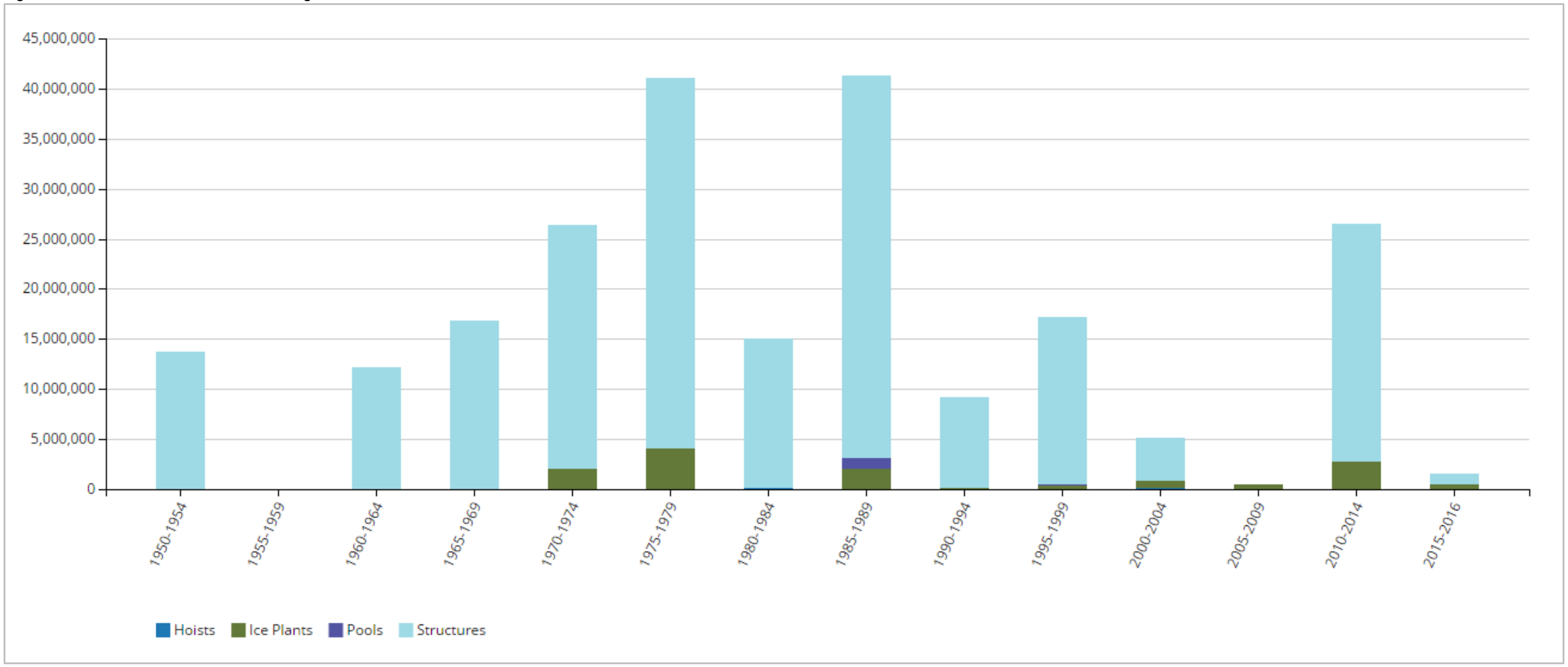
Figure 36 Asset Valuation – Buildings & Facilities



6.2 Historical Investment in Infrastructure

Figure 37 shows the municipality's historical investments in its buildings & facilities since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 6.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 37 Historical Investment – Buildings & Facilities

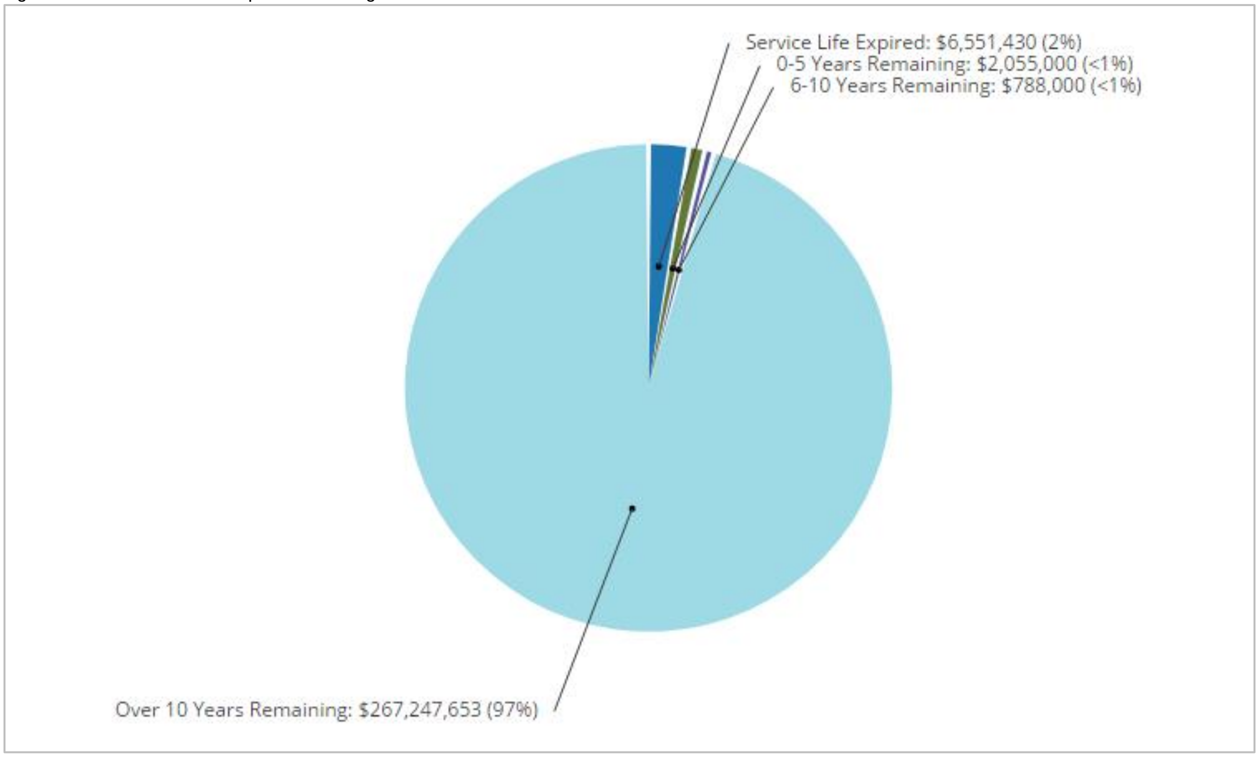


The municipality's investments into its building assets grew consistently starting in 1960 until 1979. Between 1985 and 1989, the period of largest investment, $41.2 million was invested into the building assets with a focus on structures.

6.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 38 illustrates the useful life consumption levels as of 2016 for the municipality's buildings assets.

Figure 38 Useful Life Consumption – Buildings & Facilities

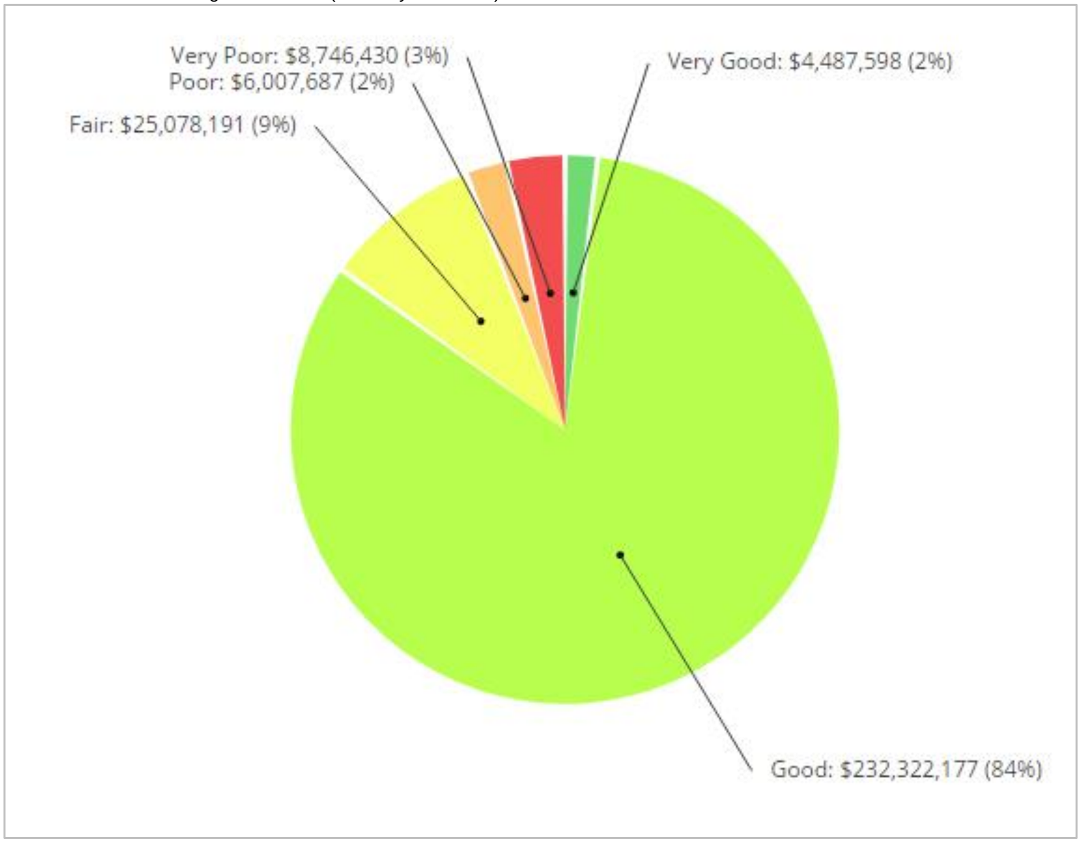


97% of buildings assets have at least 10 years of useful life remaining; 2%, with a valuation of $6.6 million remain in operation beyond their established useful life.

6.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's buildings assets. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for 96% of its structures.

Figure 39 Asset Condition – Buildings & Facilities (Primarily Assessed)

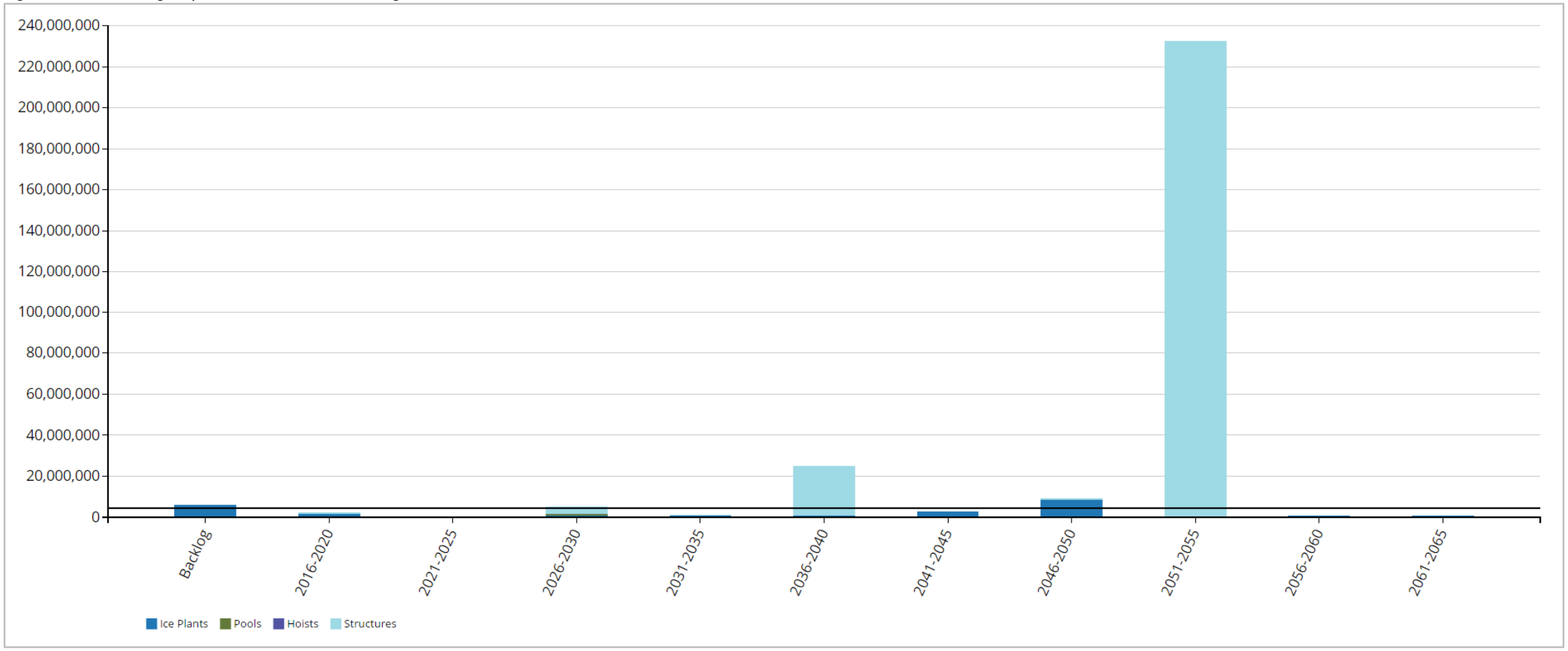


86% of buildings assets, with a valuation of $237 million, are in good to very good condition; 5% are in poor to very poor condition.

6.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's buildings assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 40 Forecasting Replacement Needs – Buildings & Facilities



Primarily condition data indicates a backlog of $7 million and minimal five-year replacement needs of $2.3 million. The municipality's annual requirements (indicated by the black line) for its buildings total $5 million. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

6.6 Recommendations – Buildings & Facilities

- The municipality should continue its condition inspection program for its buildings & facilities to precisely estimate future financial needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of short, medium, and long term replacement needs. See Section 4, 'Risk' in the 'Asset Management Strategies' chapter for more information.

- In addition to the above, a tailored lifecycle activity framework should be developed to promote standard lifecycle management of buildings & facilities as outlined further within the "Asset Management Strategy" section of this AMP.

- Using the above information, the municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.

- An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

- Facility key performance indicators should be established and tracked annually as part of an overall level of service model. See Chapter VII, 'Levels of Service'.

7. Machinery & Equipment

7.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

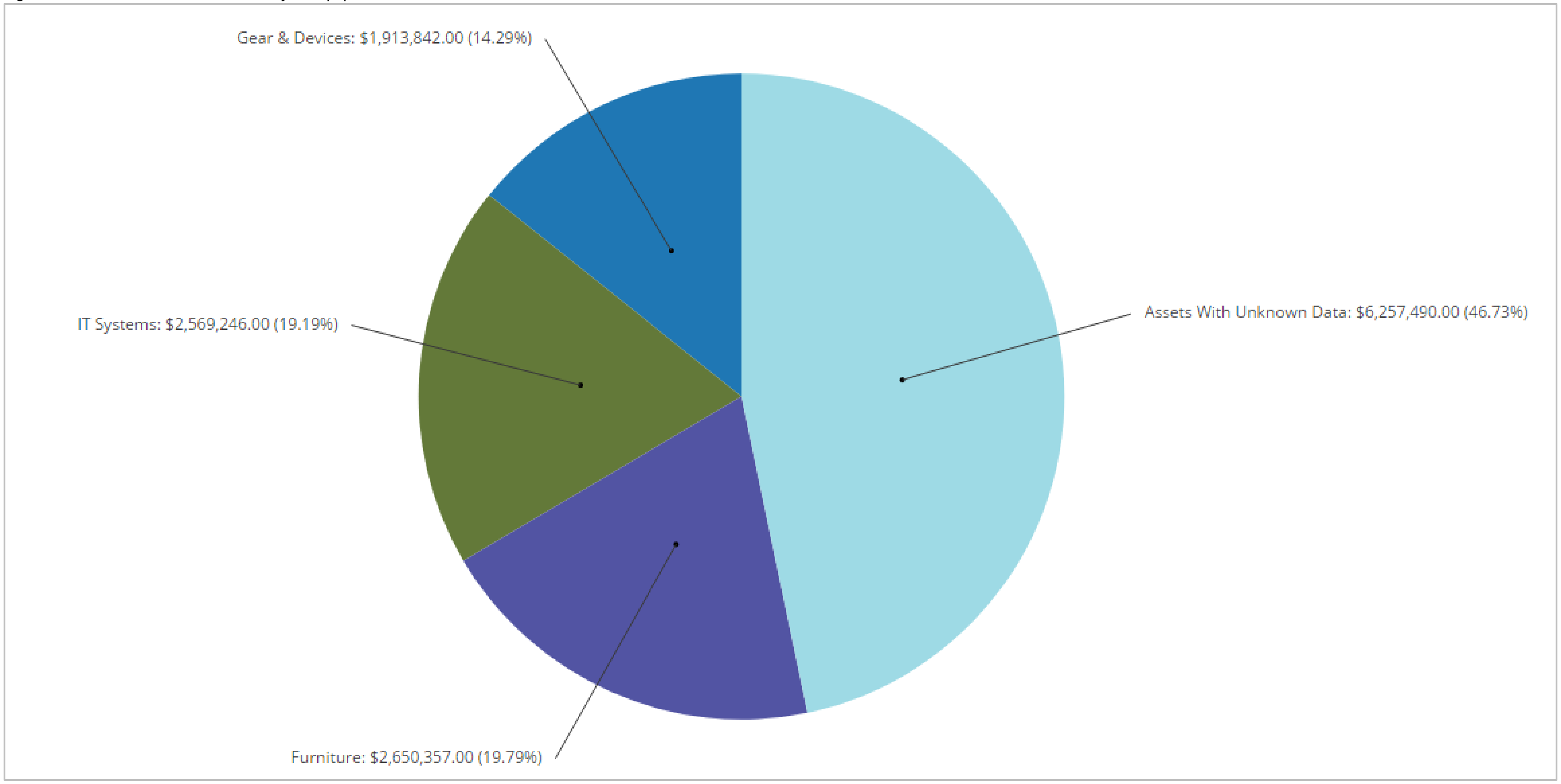
Table 12 illustrates key asset attributes for the municipality's machinery & equipment, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's machinery & equipment assets are valued at $13 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 12 Asset Inventory – Machinery & Equipment

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Machinery & Equipment	Gear & Devices	1057	4, 5, 6, 7, 10, 15, 25	User Defined	$1,913,842
	IT Systems	3110	4, 5, 7, 10, 20	User Defined	$2,569,246
	Furniture	1080	10, 15, 20, 50, 100	User Defined	$2,650,357
	Assets with Unknown Data	-	11	User Defined	$6,257,490
				Total	$13,390,935

Note that the Assets with Unknown Data are shown in the table above and Figure 41 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy

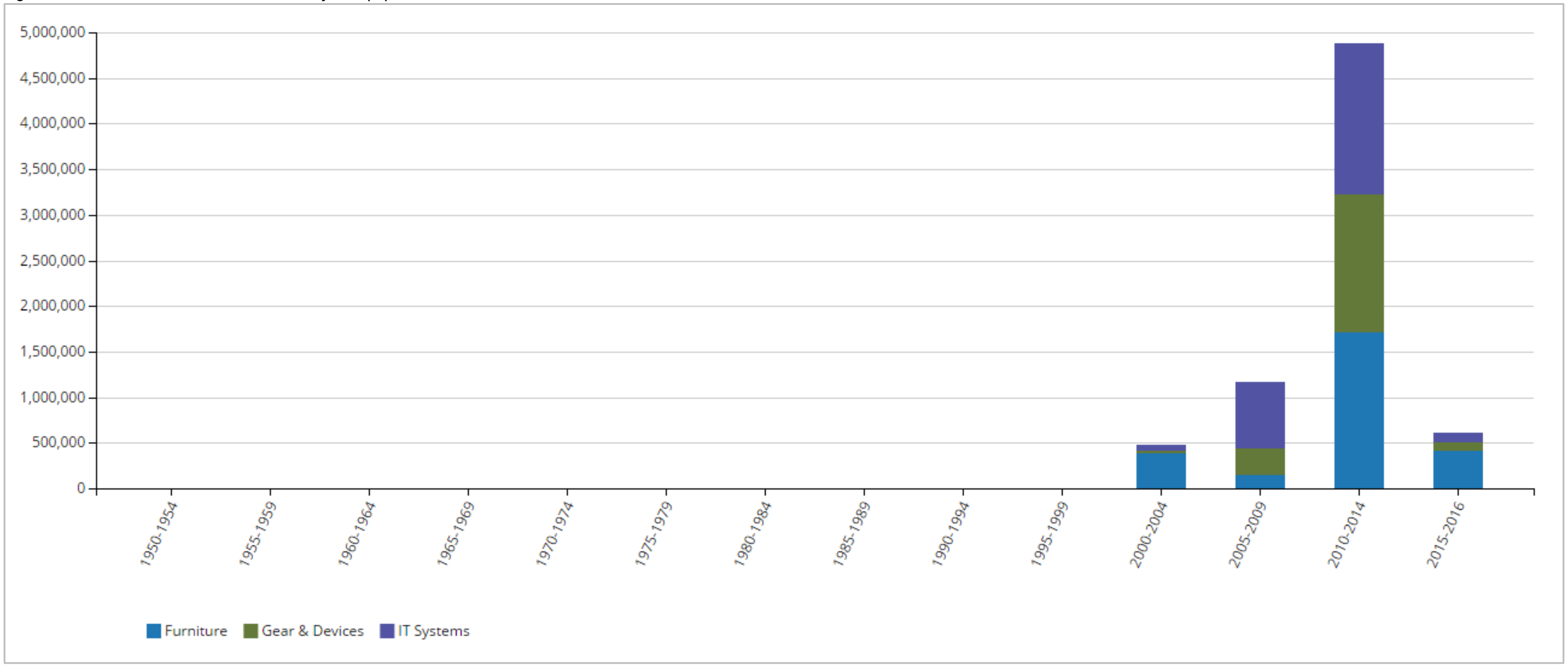
Figure 41 Asset Valuation – Machinery & Equipment



7.2 Historical Investment in Machinery & Equipment

Figure 42 shows the municipality's historical investments in its machinery & equipment since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 7.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 42 Historical Investment – Machinery & Equipment

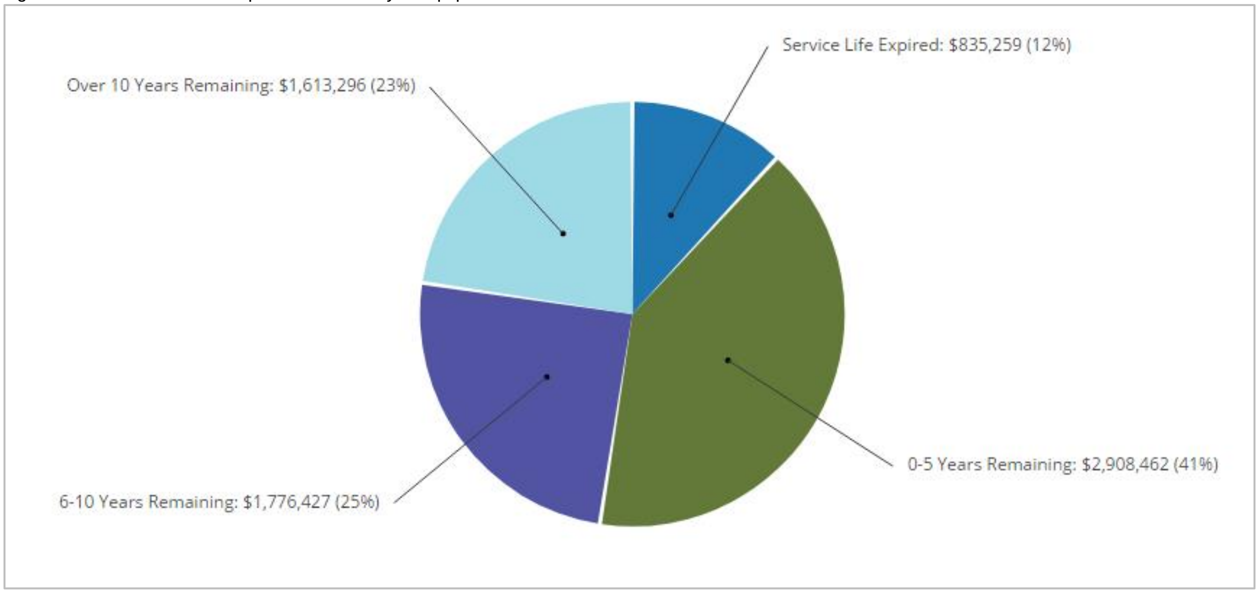


The municipality rapidly expanded its machinery & equipment portfolio beginning in the early 2000s. Between 2010 and 2014, the period of largest investment, $4.8 million was invested in the machinery and equipment category.

7.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 43 illustrates the useful life consumption levels as of 2016 for the municipality's machinery & equipment assets.

Figure 43 Useful Life Consumption – Machinery & Equipment

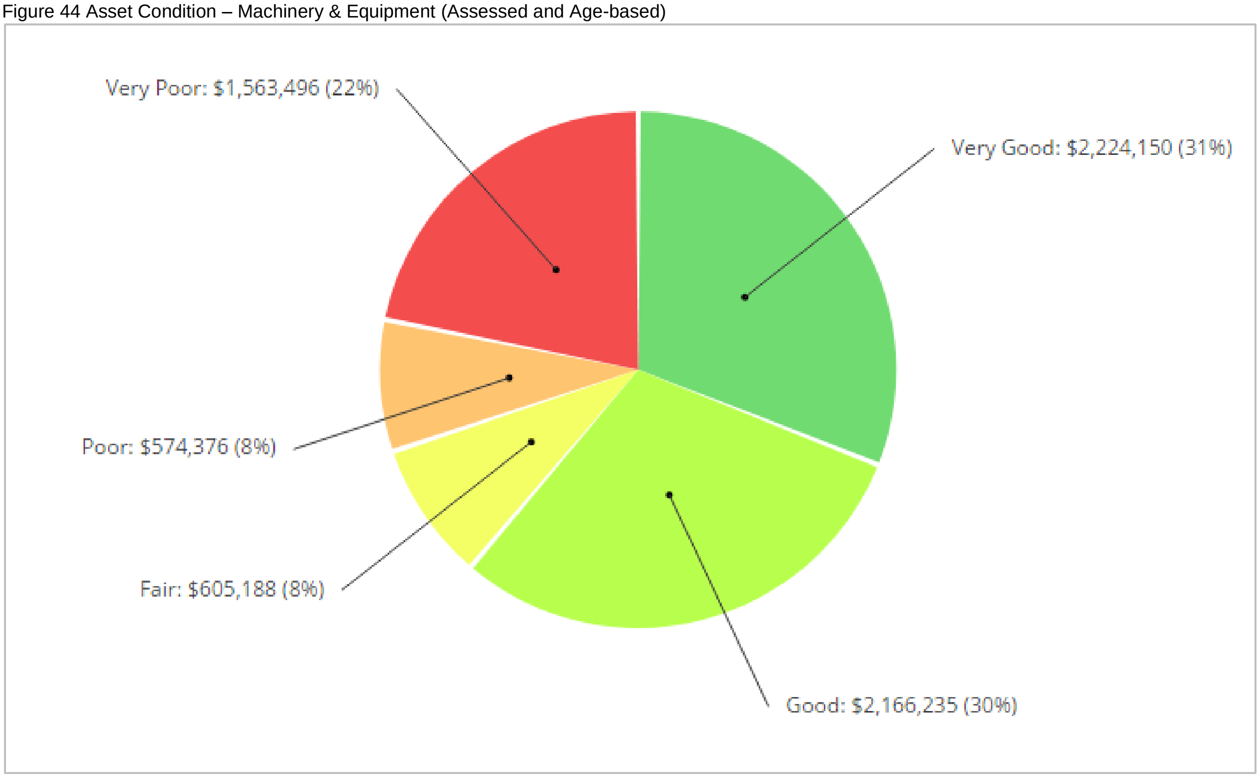


While 23% of assets have at least 10 years of useful life remaining, 12%, with a valuation of $835,000, remain in operation beyond their useful life. An additional 41% will reach the end of their useful life within the next five years.

7.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's machinery & equipment assets as of 2016. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for its furniture and gear & devices while IT systems rely on age-base data.

Figure 44 Asset Condition – Machinery & Equipment (Assessed and Age-based)

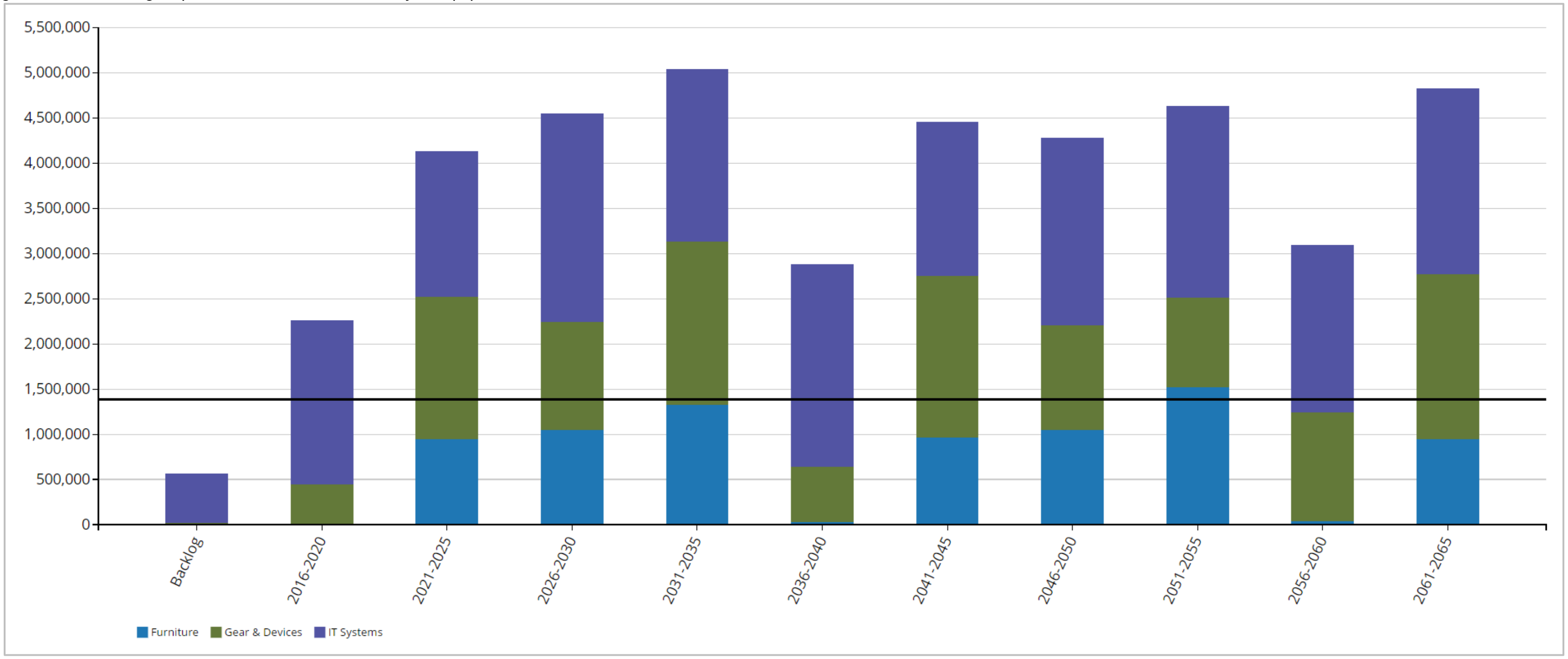


Based on a mix of assessed and age data, 30% of assets, with a valuation of $2.1 million, are in poor to very poor condition; 61% are in good to very good condition.

7.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's machinery & equipment assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 45 Forecasting Replacement Needs – Machinery & Equipment



In addition to a backlog of $564,000, the municipality's replacement needs total $2.3 million in the next five years. An additional $4.1 million will be required between 2021-2025. The municipality's annual requirements (indicated by the black line) for its machinery & equipment total $1,401,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

7.6 Recommendations – Machinery & Equipment

- The municipality should implement a component based condition inspection program for all machinery & equipment assets to better define financial requirements for its machinery and equipment. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.

- Using the above information, the municipality should assess its short-, medium- and long-term capital, and operations and maintenance needs.

- An appropriate percentage of the replacement costs should then be allocated for the municipality’s O&M requirements.

8. Land Improvements

8.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

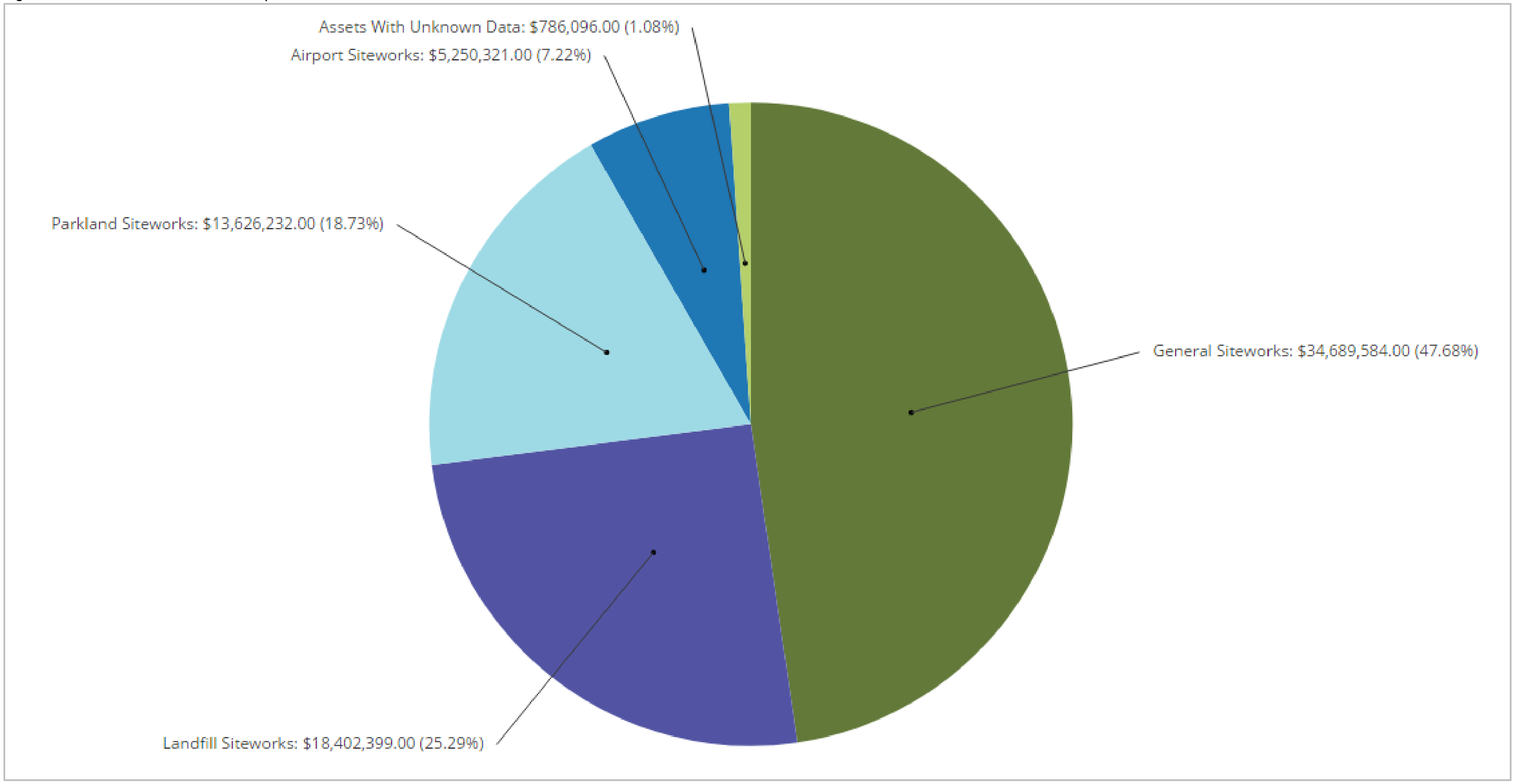
Table 13 illustrates key asset attributes for the municipality's land improvements, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's land improvements assets are valued at $72.3 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 13 Asset Inventory – Land Improvements

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Land Improvements	Airport Siteworks	106	20, 25, 30, 35, 40, 50, 60, 75, 100	User Defined	$5,250,321
	General Siteworks	1189	15, 20, 25, 30, 35, 40, 50, 60, 80, 100	User Defined	$34,689,584
	Landfill Siteworks	624	6, 12, 15, 20, 23, 25, 30, 40, 51, 80, 100	User Defined	$17,988,477
	Parkland Siteworks	915	15, 20, 25, 30, 35, 40, 50, 60	User Defined	$13,626,232
	Assets with Unknown Data	-	34	User Defined	$786,096
				Total	**$72,340,710**

Note that the Assets with Unknown Data are shown in the table above and Figure 46 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy

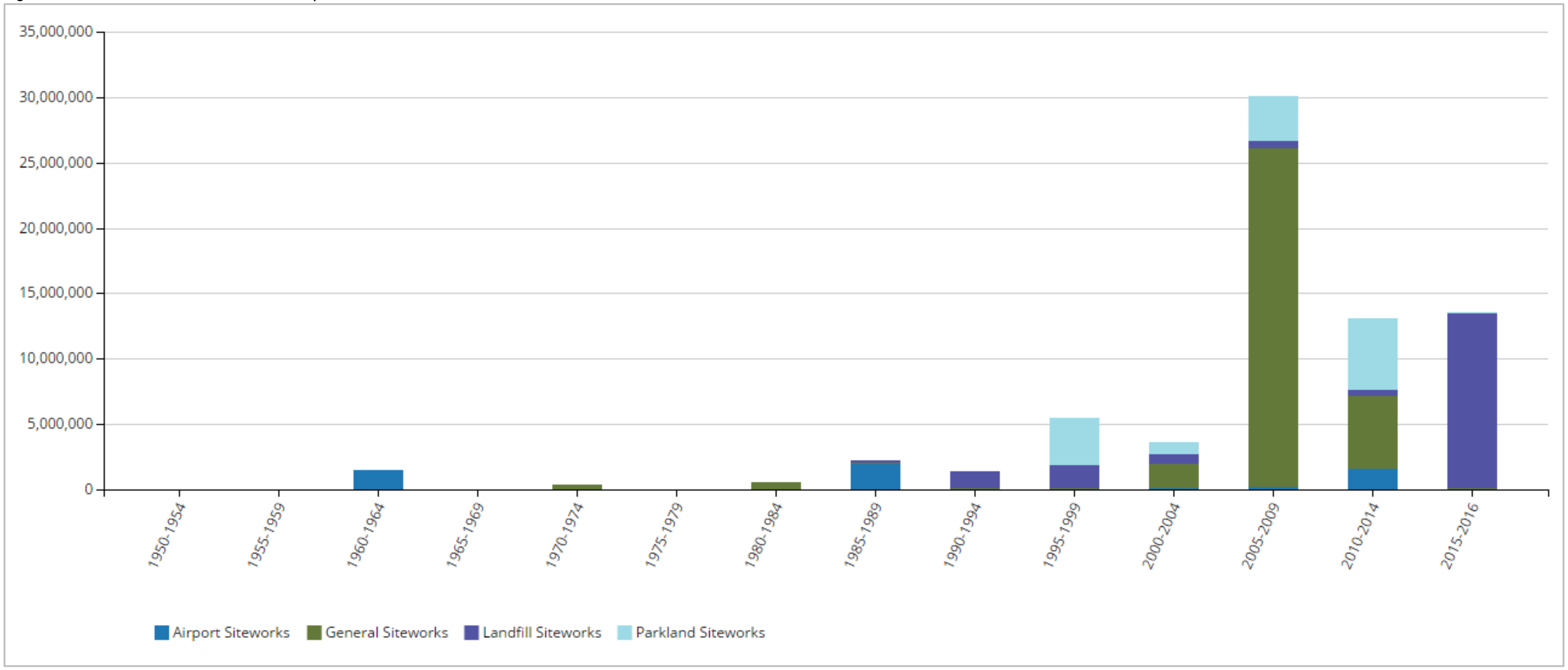
Figure 46 Asset Valuation – Land Improvements



8.2 Historical Investment in Infrastructure

Figure 47 shows the municipality's historical investments in its land improvements since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 8.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 47 Historical Investment – Land Improvements

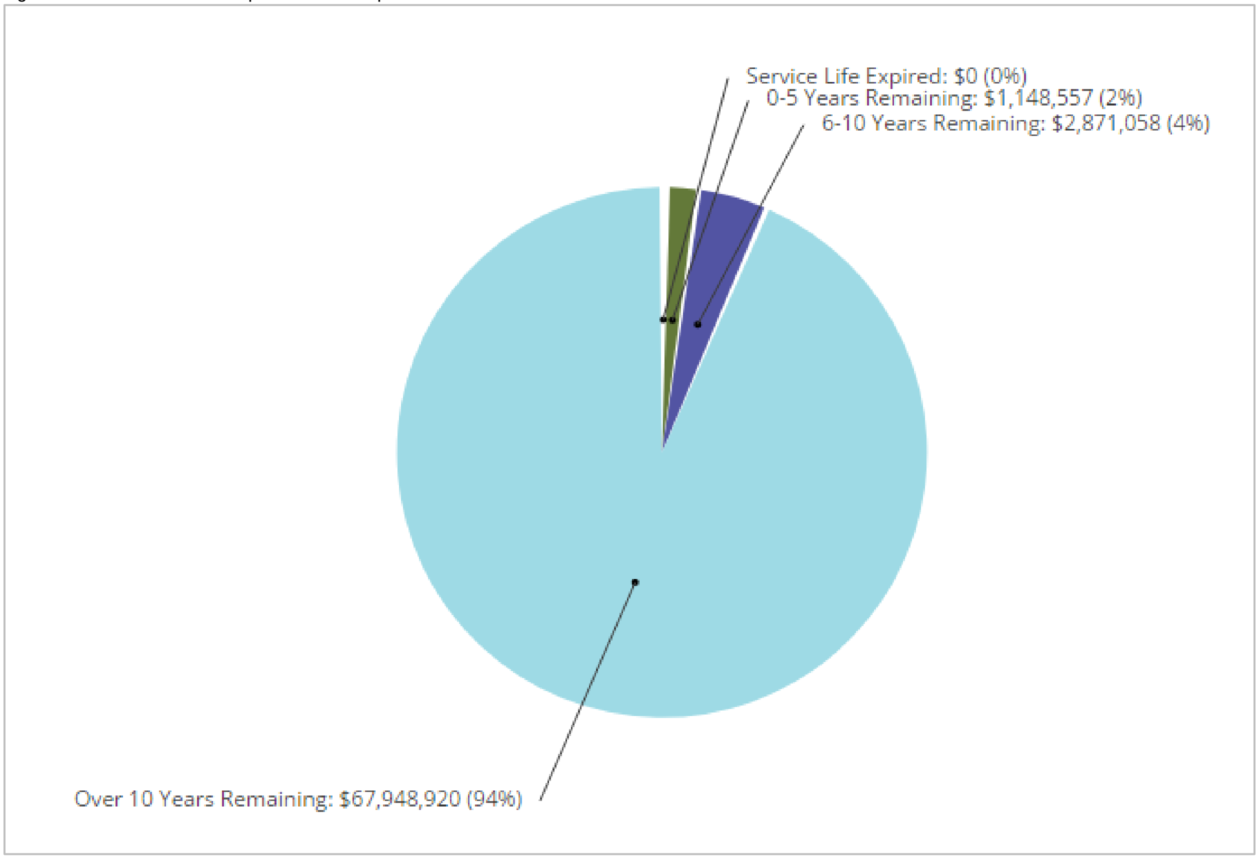


Expenditures in land improvements have fluctuated across the decades. Between 2005 and 2009, the period of largest investment, $30 million was invested with a focus on general siteworks.

8.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 48 illustrates the useful life consumption levels as of 2016 for the municipality's land improvement assets.

Figure 48 Useful Life Consumption – Land Improvements

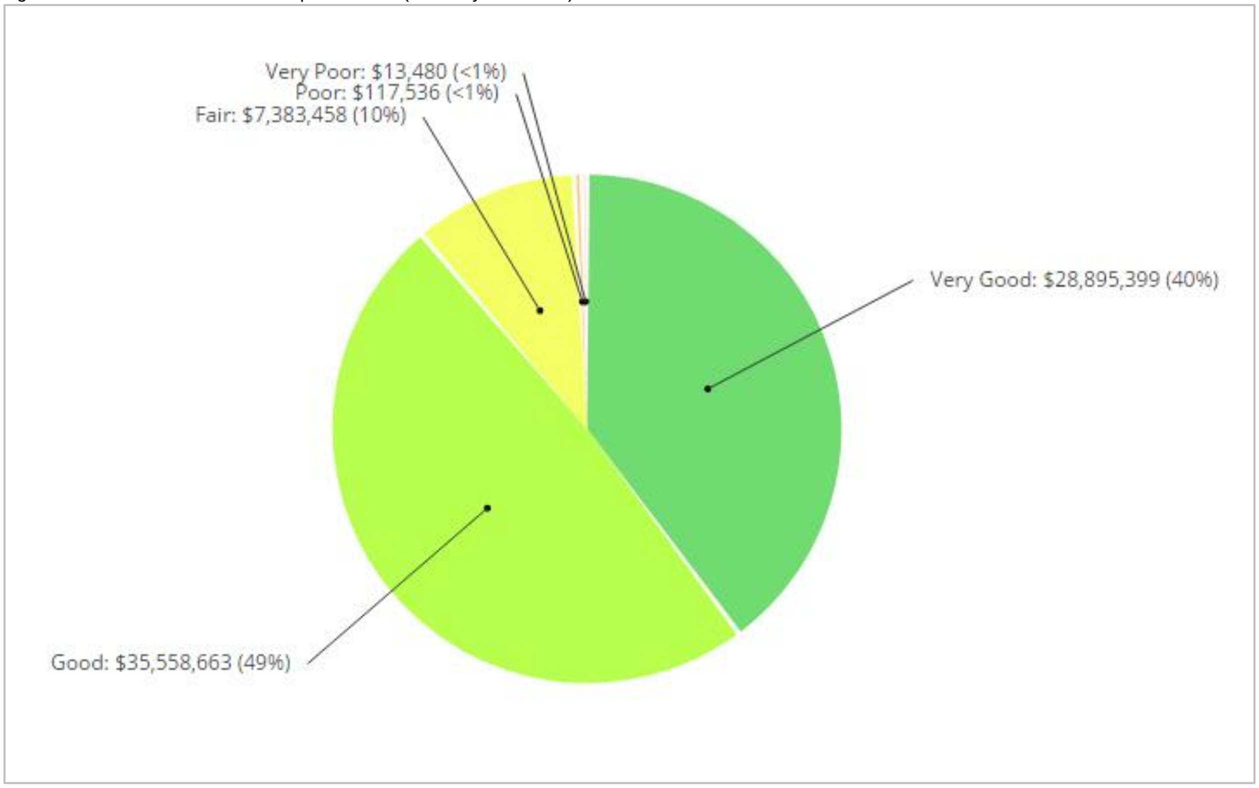


94% of the municipality's land improvement assets, with a valuation of $67.9 million, have at least 10 years of useful life remaining. An additional 2% will reach the end of their useful life within the next five years.

8.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the municipality's land improvement assets. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for nearly all land improvement assets.

Figure 49 Asset Condition - Land Improvements (Primarily Assessed)

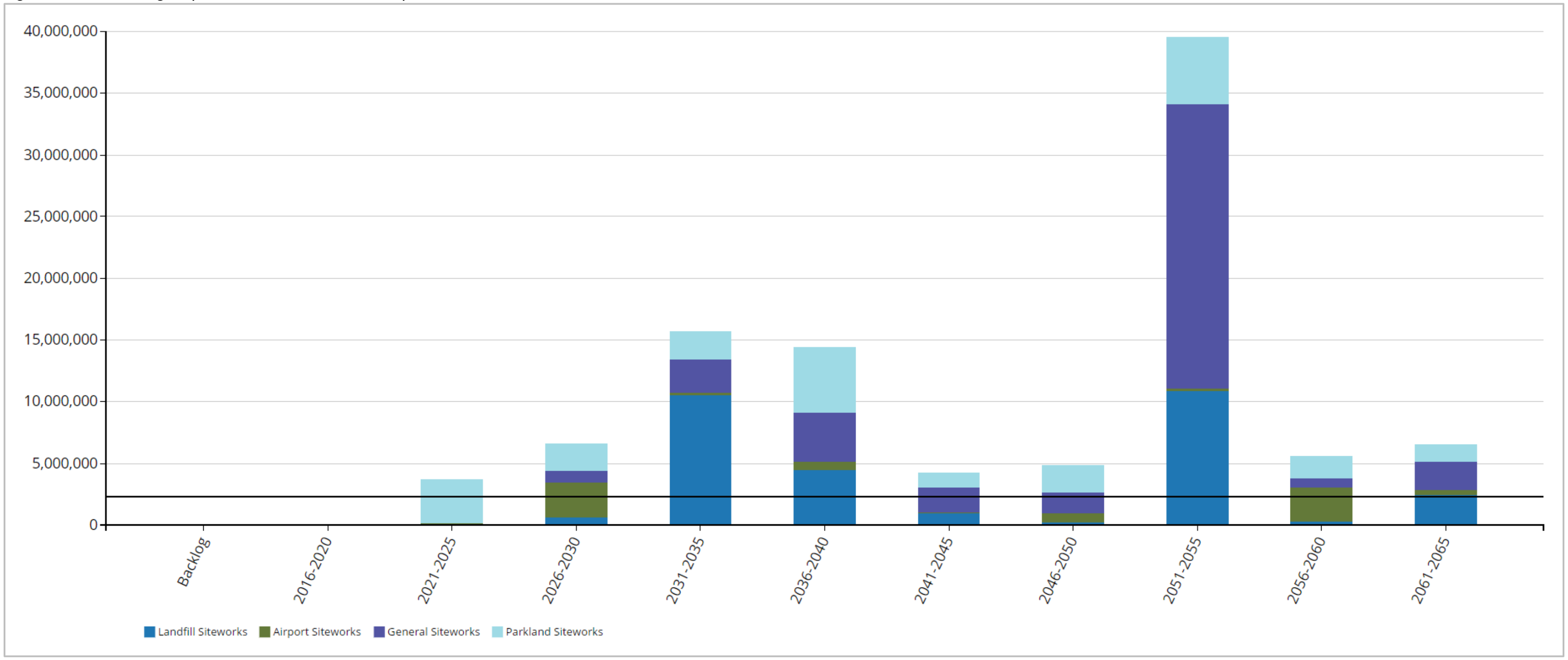


Based primarily assessed data, 89% of the municipality's land improvement assets, with a valuation of $64 million, are in good to very good condition; 1% are in poor to very poor condition.

8.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's land improvements assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 50 Forecasting Replacement Needs – Land Improvements



Primarily assessed based data shows no backlog or five-year replacement needs. However, replacement needs will total $3.7 million between 2021-2025. The municipality's annual requirements (indicated by the black line) for its land improvements total $2,394,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

8.6 Recommendations – Land Improvements

- The municipality should continue its condition assessment program for its land improvement assets to precisely estimate financial needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- The data collected through condition assessment programs should be integrated into a risk management framework which will guide prioritization of short, medium, and long term replacement needs. See Section 4, 'Risk' in the 'Asset Management Strategies' chapter for more information.

- Using the above information, the municipality should assess its short-, medium- and long-term capital and operations and maintenance needs.

- An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

9. Vehicles

9.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

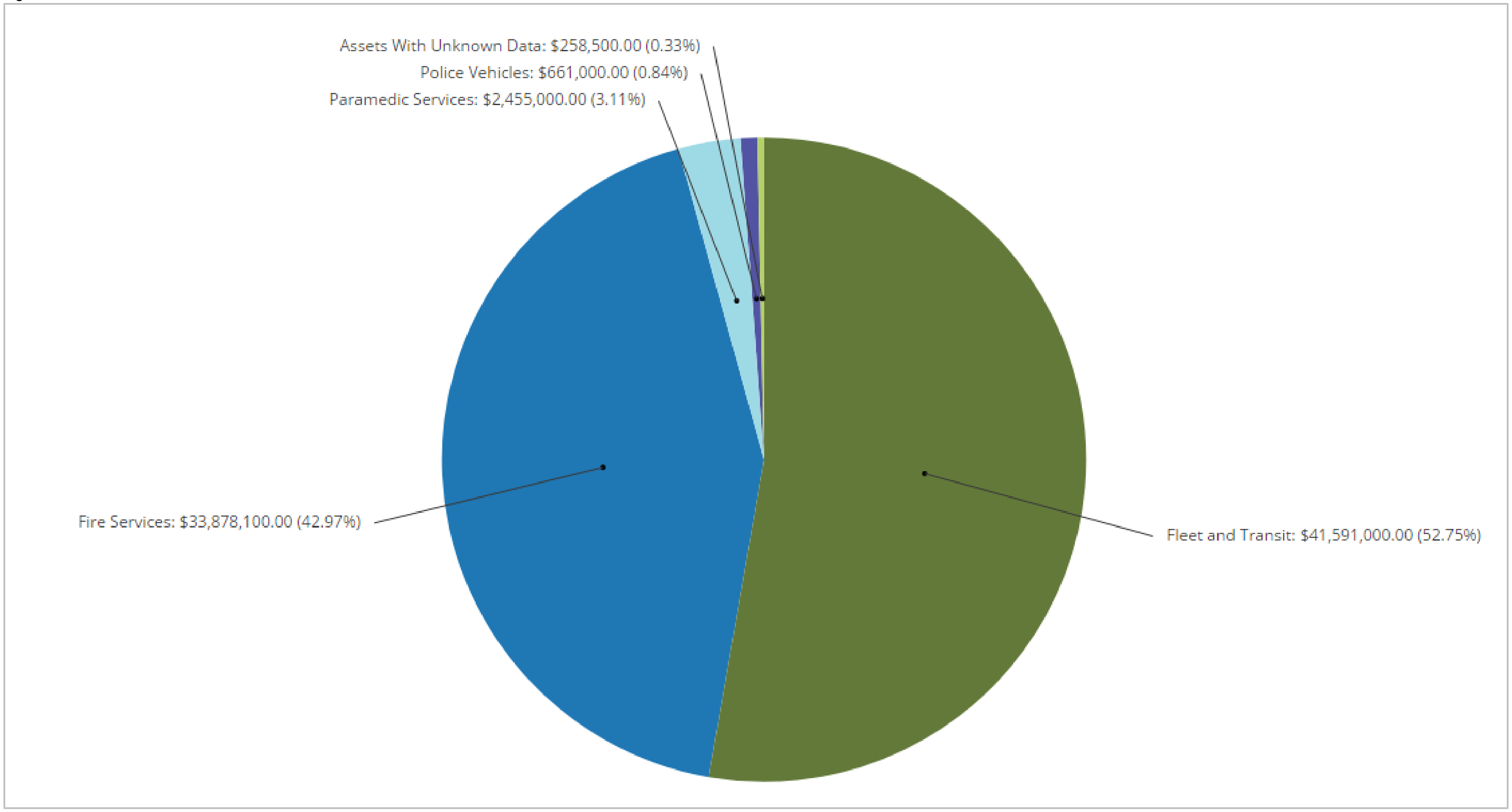
Table 14 illustrates key asset attributes for the municipality's vehicles portfolio, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's vehicles assets are valued at $78.8 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Table 14 Asset Inventory – Vehicles

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Vehicles	Fire Services	86	7, 10, 15, 20, 30	User Defined	$33,878,100
	Fleet and Transit	375	7, 9, 10, 12, 15, 20, 25	User Defined	$41,591,000
	Police Vehicles	18	7, 20	User Defined	$661,000
	Paramedic Services	20	5, 15	User Defined	$2,455,000
	Assets with Unknown Data	-	13	User Defined	$258,500
				Total	$78,843,600

Note that the Assets with Unknown Data are shown in the table above and Figure 51 to highlight the total valuation of owned assets. These assets are not included within the remaining figures in this section as they do not have sufficient data. However, these assets are accounted for within the annual requirements and financial strategy.

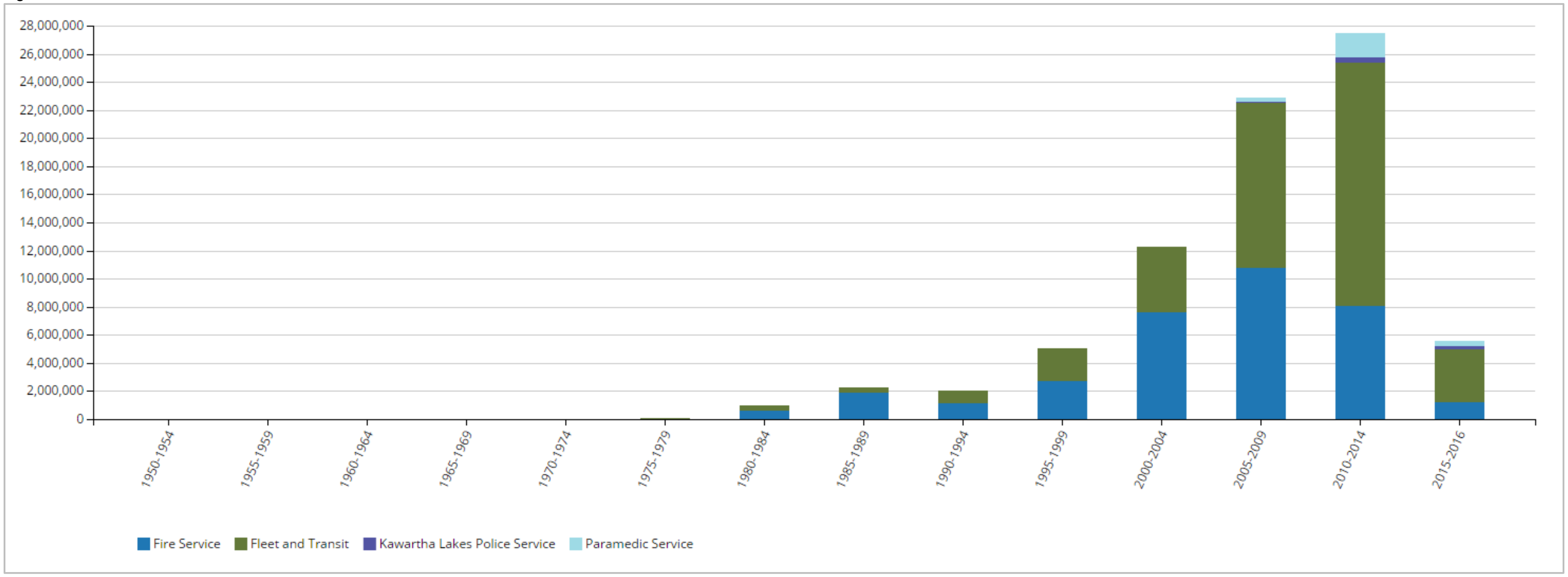
Figure 51 Asset Valuation – Vehicles



9.2 Historical Investment in Infrastructure

Figure 52 shows the municipality's historical investments in its vehicles portfolio since 1950. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 9.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2016.

Figure 52 Historical Investment – Vehicles

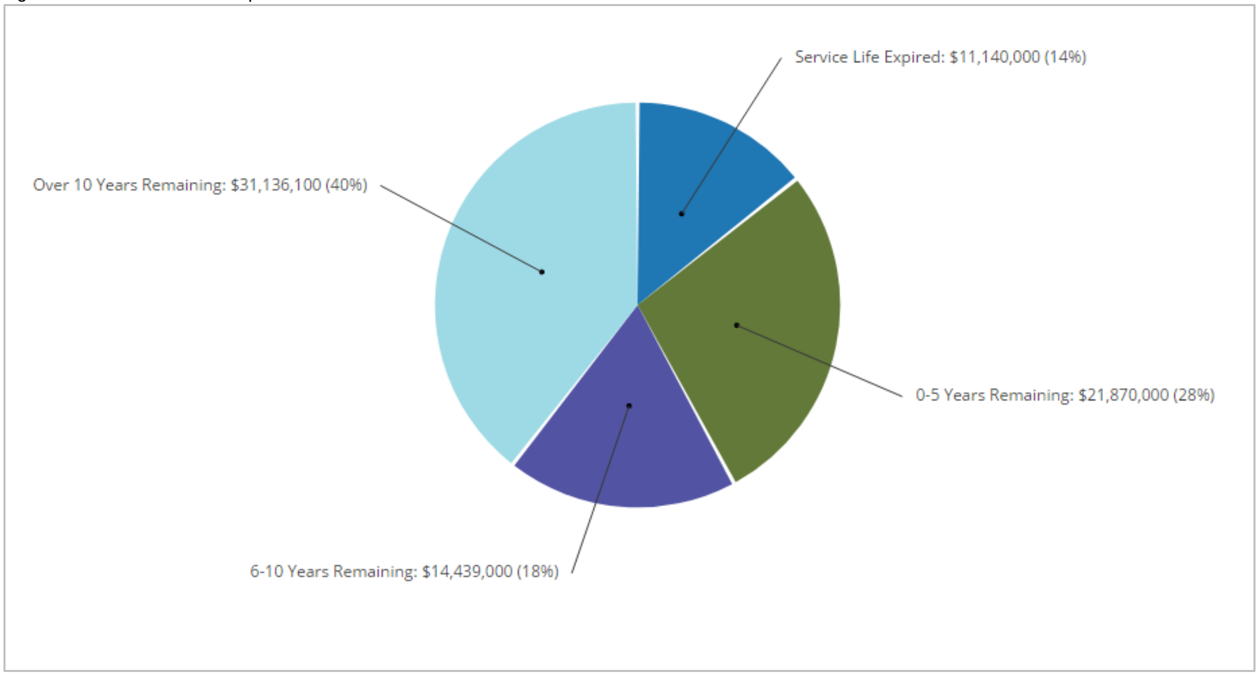


Investments in vehicles quickly increased starting in the 1990s. In 2010-2014, the period of largest investment, $27 million was invested with $17 million put into fleet and transit.

9.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 53 illustrates the useful life consumption levels as of 2016 for the municipality's vehicles.

Figure 53 Useful Life Consumption – Vehicles

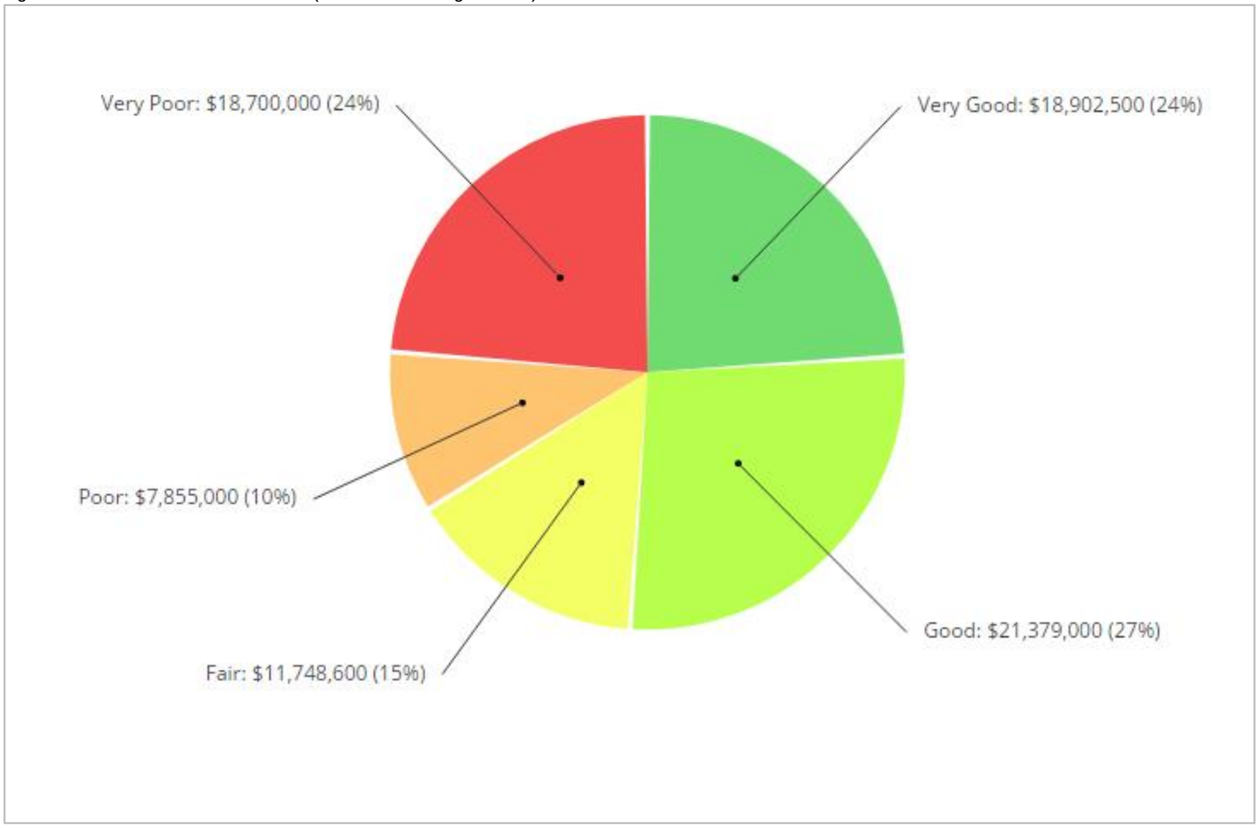


40% of assets have at least 10 years of useful life remaining; 14%, with a valuation of $11 million remain in operation beyond their useful life. An additional 28% will reach the end of their useful life within the next five years.

9.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's vehicles assets as of 2015. By default, we rely on observed field data as provided by the municipality. In the absence of such information, age-based data is used as a proxy. The municipality has provided condition data for its fire vehicles while the remaining assets rely on age-based data.

Figure 54 Asset Condition – Vehicles (Assessed and Age-based)

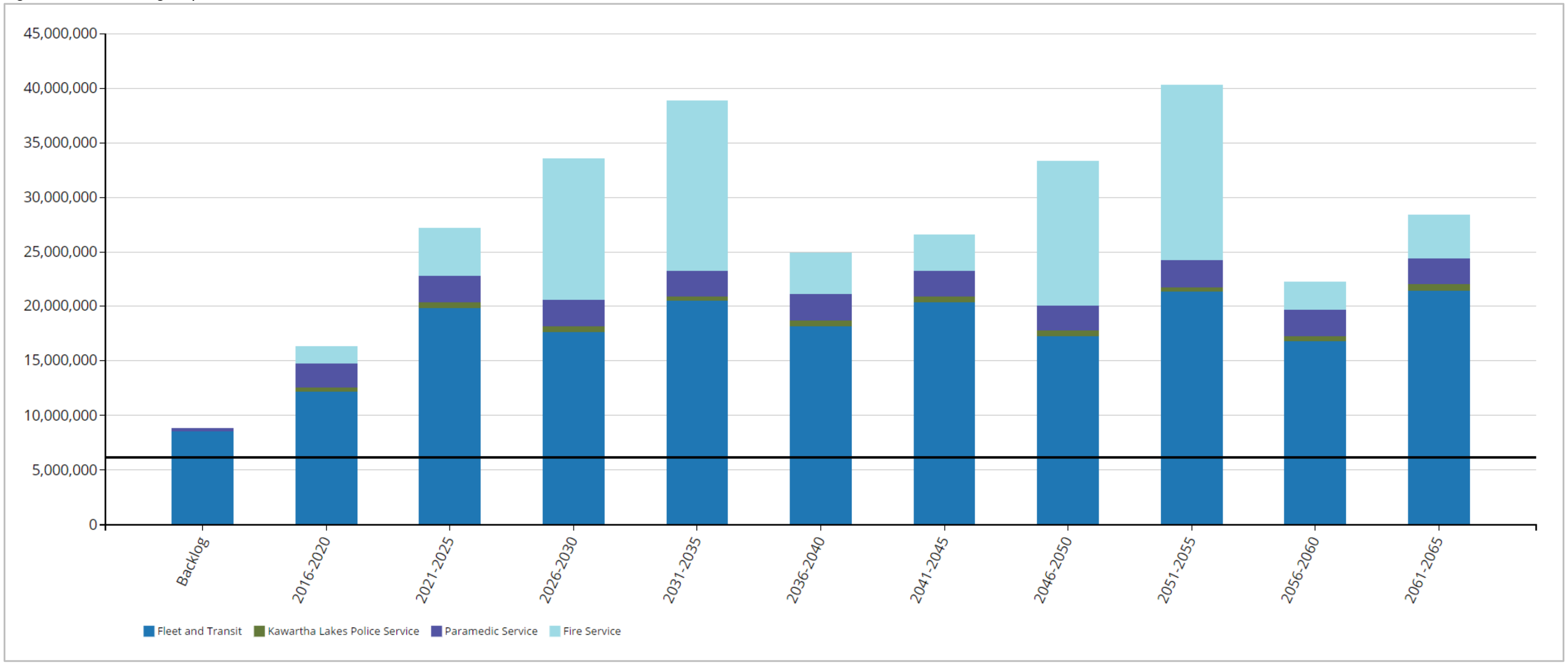


Age-based and assessed data shows that 34% of the municipality's vehicle assets are in poor to very poor condition; 51%, with a valuation of $40 million are in good to very good condition.

9.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the municipality's vehicles assets. The backlog is the aggregate investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 55 Forecasting Replacement Needs – Vehicles



In addition to a backlog of $8.9 million, replacement needs will total over $16 million over the next five years; an additional $27 million will be required between 2021-2025. The municipality's annual requirements (indicated by the black line) for its vehicles total $6,260,000. At this funding level, the municipality would be allocating sufficient funds on an annual basis to meet replacement needs as they arise without the need for deferring projects and accruing annual infrastructure deficits.

9.6 Recommendations – Vehicles

- A preventive maintenance and lifecycle assessment program should be established for all vehicle assets to gain a better understanding of current condition and performance as well as the short- and medium-term replacement needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

- Using the above information, the municipality should assess its short-, medium- and long-term capital and operations and maintenance needs.

- An appropriate percentage of the replacement costs should then be allocated for the municipality's O&M requirements.

10. Natural Resources

10.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

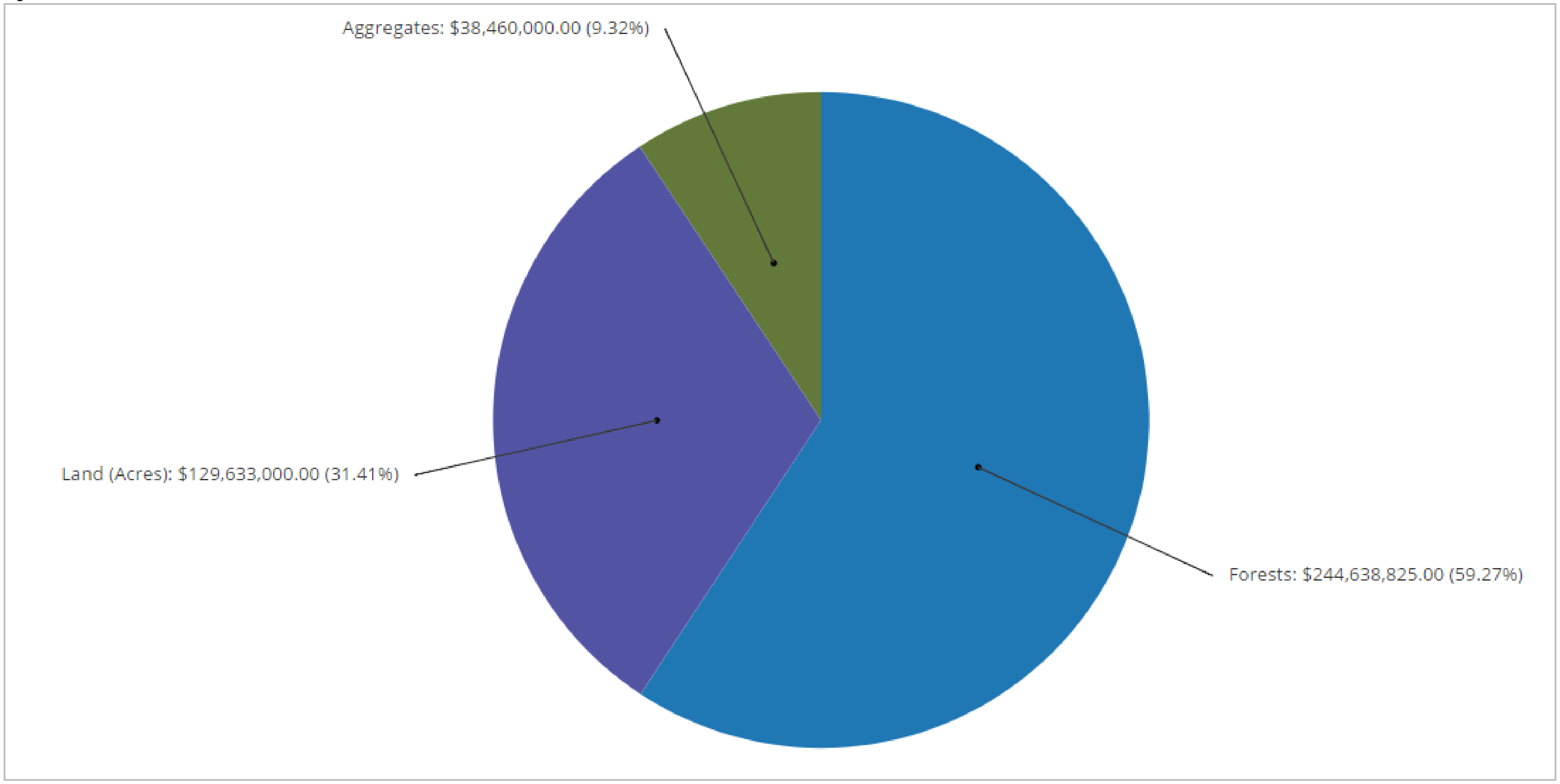
Table 15 illustrates key asset attributes for the municipality's natural resources, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the municipality's natural resources are valued at $412.7 million based on 2016 replacement costs. The useful life indicated for each asset type below was assigned by the municipality.

Note that these assets are included to highlight all of the assets that are owned by the municipality. A complete analysis on these assets is not provided since natural resources do not follow standard asset management techniques based on replacement.

Table 15 Asset Inventory – Natural Resources

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Natural Resources	Forests	3793 hectares	200	User Defined	$244,638,825
	Aggregates	22	N/A	User Defined	$38,460,000
	Land (Acres)	14190 Acres	N/A	User Defined	$129,633,000
				Total	$412,731,825

Figure 56 Asset Valuation – Natural Resources



VII. Levels of Service

The two primary risks to a municipality's financial sustainability are the total lifecycle costs of infrastructure, and establishing levels of service (LOS) that exceed its financial capacity. In this regard, municipalities face a choice: overpromise and underdeliver; under promise and overdeliver; or promise only that which can be delivered efficiently without placing an inequitable burden on taxpayers. In general, there is often a trade-off between political expedience and judicious, long-term fiscal stewardship.

Developing realistic LOS using meaningful key performance indicators (KPIs) can be instrumental in managing citizen expectations, identifying areas requiring higher investments, driving organizational performance and securing the highest value for money from public assets. However, municipalities face diminishing returns with greater granularity in their LOS and KPI framework. That is, the objective should be to track only those KPIs that are relevant and insightful and reflect the priorities of the municipality.

1. Guiding Principles for Developing LOS

Beyond meeting regulatory requirements, levels of service established should support the intended purpose of the asset and its anticipated impact on the community and the municipality. LOS generally have an overarching corporate description, a customer oriented description, and a technical measurement. Many types of LOS, e.g., availability, reliability, safety, responsiveness and cost effectiveness, are applicable across all service areas in a municipality. The following LOS categories are established as guiding principles for the LOS that each service area in the municipality should strive to provide internally to the municipality and to residents/customers. These are derived from the Town of Whitby's *Guide to Developing Service Area Asset Management Plans*.

Table 16 LOS Categories

LOS Category	Description
Reliable	Services are predictable and continuous; services of sufficient capacity are convenient and accessible to the entire community.
Cost Effective	Services are provided at the lowest possible cost for both current and future customers, for a required level of service, and are affordable.
Responsive	Opportunities for community involvement in decision making are provided; and customers are treated fairly and consistently, within acceptable timeframes, demonstrating respect, empathy and integrity.
Safe	Services are delivered such that they minimize health, safety and security risks.
Suitable	Services are suitable for the intended function (fit for purpose).
Sustainable	Services preserve and protect the natural and heritage environment.

2. Key Performance Indicators and Targets

In this section, we identify industry standard KPIs for major infrastructure classes that the municipality can incorporate into its performance measurement and for tracking its progress over future iterations of its AMP. The municipality should develop appropriate and achievable targets that reflect evolving demand on infrastructure, its fiscal capacity and the overall corporate objectives.

Table 17 Key Performance Indicators – Road Network and Bridges & Culverts

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to roads, and bridges & culverts)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for roads, and bridges & culverts – Maintenance cost per square metre – Revenue required to maintain annual network growth – Total cost of borrowing vs. total cost of service
Tactical	– Overall Bridge Condition Index (BCI) as a percentage of desired BCI – Percentage of road network rehabilitated/reconstructed – Percentage of paved road lane kilometres rated as poor to very poor – Percentage of bridges and large culverts rated as poor to very poor – Percentage of asset class value spent on O&M
Operational Indicators	– Percentage of roads inspected within the last five years – Percentage of bridges and large culverts inspected within the last two years – Operating costs for paved lane per kilometres – Operating costs for bridge and large culverts per square metre – Percentage of customer requests with a 24-hour response rate

Table 18 Key Performance Indicators – Buildings & Facilities

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to buildings & facilities)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Revenue required to meet growth related demand – Repair and maintenance costs per square metre – Energy, utility and water cost per square metre
Tactical	– Percentage of component value replaced – Percent of facilities rated poor or critical – Percentage of facilities replacement value spent on O&M – Facility utilization rate – $Utilization\ Rate = \frac{Occupied\ Space}{Facility\ Usable\ Area}$
Operational Indicators	– Percentage of facilities inspected within the last five years – Number/type of service requests – Percentage of customer requests addressed within 24 hours

Table 19 Key Performance Indicators – Vehicles

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to vehicles)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for vehicles – Revenue required to maintain annual fleet portfolio growth – Total cost of borrowing vs. total cost of service
Tactical	– Percentage of all vehicles replaced – Average age of vehicles – Percent of vehicles rated poor or critical – Percentage of vehicles replacement value spent on O&M
Operational Indicators	– Average downtime per vehicles category – Average utilization per vehicles category and/or each vehicle – Ratio of preventive maintenance repairs vs. reactive repairs – Percent of vehicles that received preventive maintenance – Number/type of service requests – Percentage of customer requests addressed within 24 hours

Table 20 Key Performance Indicators – Water, Sanitary and Storm Networks

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to water, sanitary and storm)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Total cost of borrowing compared to total cost of service – Revenue required to maintain annual network growth
Tactical	– Percentage of water, sanitary and storm network rehabilitated/reconstructed – Annual percentage of growth in water, sanitary and storm network – Percentage of mains where the condition is rated poor or critical for each network – Percentage of water, sanitary and storm network replacement value spent on O&M
Operational Indicators	– Percentage of water, sanitary and storm network inspected – Operating costs for the collection of wastewater per kilometre of main – Number of wastewater main backups per 100 kilometres of main – Operating costs for storm water management (collection, treatment, and disposal) per kilometre of drainage system. – Operating costs for the distribution/transmission of drinking water per kilometre of water distribution pipe – Number of days when a boil water advisory issued by the medical officer of health, applicable to a municipal water supply, was in effect – Number of water main breaks per 100 kilometres of water distribution pipe in a year – Number of customer requests received annually per water, sanitary and storm – Percentage of customer requests addressed within 24 hours per water, sanitary and storm network

Table 21 Key Performance Indicators – Machinery & Equipment

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to machinery & equipment)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for machinery & equipment – Revenue required to maintain annual portfolio growth – Total cost of borrowing vs. total cost of service
Tactical	– Percentage of all machinery & equipment replaced – Average age of machinery & equipment assets – Percent of machinery & equipment rated poor or critical – Percentage of vehicles replacement value spent on O&M
Operational Indicators	– Average downtime per machinery & equipment asset – Ratio of preventive maintenance repairs vs. reactive repairs – Percent of machinery & equipment that received preventive maintenance – Number/type of service requests

Table 22 Key Performance Indicators – Land Improvements

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to land improvements)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for supplying parks, playgrounds, etc. – Repair and maintenance costs per square metre
Tactical	– Percent of land improvements rated poor or critical – Percentage of replacement value spent on O&M – Parkland per capita
Operational Indicators	– Percentage of land improvements inspected within the last five years – Number/type of service requests – Percentage of customer requests addressed within 24 hours

3. Future Performance

In addition to a municipality's financial capacity and legislative requirements, many factors, internal and external, can influence the establishment of LOS and their associated KPIs. These can include the municipality's overarching mission as an organization, the current state of its infrastructure and the wider social, political and macroeconomic context. The following factors should inform the development of most LOS targets and their associated KPIs:

Strategic Objectives and Corporate Goals
The municipality's long-term direction is outlined in its corporate and strategic plans. This direction will dictate the types of services it aims to deliver to its residents and the quality of those services. These high-level goals are vital in identifying strategic (long-term) infrastructure priorities and as a result, the investments needed to produce desired LOS.

State of the Infrastructure
The current state of capital assets will determine the quality of services the municipality can deliver to its residents. As such, LOS should reflect the existing capacity of assets to deliver those services, and may vary (increase) with planned maintenance, rehabilitation or replacement activities and timelines.

Community Expectations
The general public will often have qualitative and quantitative insights regarding the LOS a particular asset or a network of assets should deliver, e.g., what a road in 'good' condition should look like or the travel time between destinations. The public should be consulted in establishing LOS; however, the discussions should be centered on clearly outlining the lifecycle costs associated with delivering any improvements in LOS.

Economic Trends
Macroeconomic trends will have a direct impact on the LOS for most infrastructure services. Fuel costs, fluctuations in interest rates and the purchasing power of the Canadian dollar can impede or accelerate any planned growth in infrastructure services.

Demographic Changes
The composition of residents in a municipality can also serve as an infrastructure demand driver, and as a result, can change how a municipality allocates its resources (e.g., an aging population may require diversion of resources from parks and sports facilities to additional wellness centers). Population growth is also a significant demand driver for existing assets (lowering LOS), and may require the municipality to construct new infrastructure to parallel community expectations.

Environmental Change
Forecasting for infrastructure needs based on climate change remains an imprecise science. However, broader environmental and weather patterns have a direct impact on the reliability of critical infrastructure services.

4. Monitoring, Updating and Actions

The municipality should collect data on its current performance against the KPIs listed and establish targets that reflect the current fiscal capacity of the municipality, its corporate and strategic goals, and as feasible, changes in demographics that may place additional demand on its various asset classes. For some asset classes, e.g., minor equipment, furniture, etc., cursory levels of service and their respective KPIs will suffice. For major infrastructure classes, detailed technical and customer-oriented KPIs can be critical. Once this data is collected and targets are established, the progress of the municipality should be tracked annually.

VIII. Asset Management Strategies

The asset management strategy section will outline an implementation process that can be used to identify and prioritize renewal, rehabilitation and maintenance activities. This will assist in the development of a 10-year capital plan, including growth projections, to ensure the best overall health and performance of the municipality's infrastructure. This section includes an overview of condition assessment, the lifecycle interventions required, and prioritization techniques, including risk, to determine which capital projects should move forward into the budget first.

1. Non-Infrastructure Solutions & Requirements

The municipality should explore, as requested through the provincial requirements, which non-infrastructure solutions should be incorporated into the budgets for its infrastructure services. Non-infrastructure solutions are such items as studies, policies, condition assessments, consultation exercises, etc., that could potentially extend the life of assets or lower total asset program costs in the future without a direct investment into the infrastructure.

Typical solutions for a municipality include linking the asset management plan to the strategic plan, growth and demand management studies, infrastructure master plans, better integrated infrastructure and land use planning, public consultation on levels of service and condition assessment programs. As part of future asset management plans, a review of these requirements should take place, and resources should be dedicated to these items.

It is recommended, under this category of solutions, that the municipality develop and implement holistic condition assessment programs for all asset classes. This will advance the understanding of infrastructure needs, improve budget prioritization methodologies and provide a clearer path of what is required to achieve sustainable infrastructure programs.

2. Condition Assessment Programs

The foundation of an intelligent asset management practice is based on comprehensive and reliable information on the current condition of the infrastructure. Municipalities need to have a clear understanding regarding the performance and condition of their assets, as all management decisions regarding future expenditures and field activities should be based on this knowledge. An incomplete understanding of an asset may lead to its untimely failure or premature replacement.

Some benefits of holistic condition assessment programs within the overall asset management process are listed below:

- understanding of overall network condition leads to better management practices
- allows for the establishment of rehabilitation programs
- prevents future failures and provides liability protection
- potential reduction in operation/maintenance costs
- accurate current asset valuation
- allows for the establishment of risk assessment programs
- establishes proactive repair schedules and preventive maintenance programs
- avoids unnecessary expenditures
- extends asset service life therefore improving level of service
- improves financial transparency and accountability
- enables accurate asset reporting which, in turn, enables better decision making

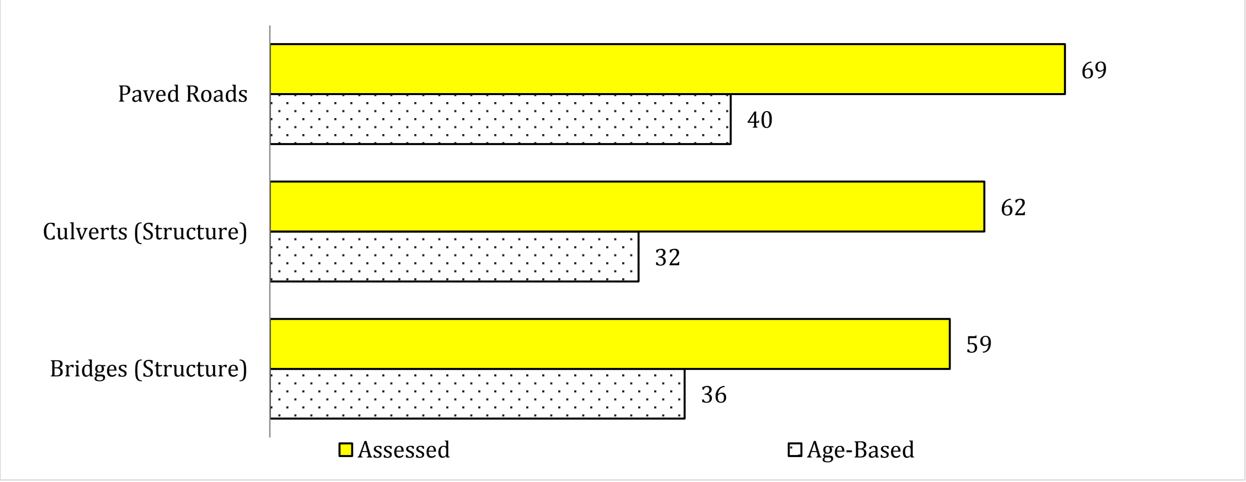
Condition assessment can involve different forms of analysis such as subjective opinion, mathematical models, or variations thereof, and can be completed through a detailed or cursory approach. When establishing the condition assessment for an entire asset class, a cursory approach (metrics such as good, fair, poor, very poor) is used. This is an economical strategy that will still provide up-to-date information, and will allow for detailed assessment or follow-up inspections on those assets captured as poor or critical condition.

The Impact of Condition Assessments

In 2015, PSD published a study in partnership with the Association of Municipalities of Ontario (AMO). The report, *The State of Ontario's Roads and Bridges: An Analysis of 93 Municipalities*, enumerated the infrastructure deficits, annual investment gaps, and the physical state of roads, bridges and culverts with a 2013 replacement value of $28 billion.

A critical finding of the report was the dramatic difference in the condition profile of the assets when comparing age-based estimates and actual field inspection observations. For each asset group, field data based condition ratings were significantly higher than age-based condition ratings, with paved roads, culverts, and bridges showing an increase in score (0-100) of +29, +30, and +23 points respectively. In other words, age-based measurements maybe underestimating the condition of assets by as much as 30%.

Figure 57 Comparing Age-based and Assessed Condition Data



2.1 Pavement Network

Typical industry pavement inspections are performed by consulting firms using specialized assessment vehicles equipped with various electronic sensors and data capture equipment. The vehicles will drive the entire road network and typically collect two different types of inspection data: surface distress data and roughness data.

Surface distress data involves the collection of multiple industry standard surface distresses, which are captured either electronically using sensing detection equipment mounted on the van, or visually by the van's inspection crew. Roughness data capture involves the measurement of the roughness of the road, measured by lasers that are mounted on the inspection van's bumper, calibrated to an international roughness index.

Another option for a cursory level of condition assessment is for municipal road crews to perform simple windshield surveys as part of their regular patrol. Many municipalities have created data collection inspection forms to assist this process and to standardize what presence of defects would constitute a good, fair, poor, or critical score. Lacking any other data for the complete road network, this can still be seen as a good method and will assist greatly with the overall management of the road network.

It is recommended that the municipality continue its pavement condition assessment program and that a portion of capital funding is dedicated to this. We also recommend expansion of this program to incorporate additional components.

2.2 Bridges & Culverts

Ontario municipalities are mandated by the Ministry of Transportation to inspect all structures that have a span of 3 metres or more, according to the OSIM (Ontario Structure Inspection Manual).

Structure inspections must be performed by, or under the guidance of, a structural engineer, must be performed on a biennial basis (once every two years), and include such information as structure type, number of spans, span lengths, other key attribute data, detailed photo images, and structure element by element inspection, rating and recommendations for repair, rehabilitation, and replacement.

The best approach to develop a 10-year needs list for the municipality’s structure portfolio relies on the structural engineer who performs the inspections to also produce a maintenance requirements report, and rehabilitation & replacement requirements report as part of the overall assignment. In addition to defining the overall needs requirements, the structural engineer should identify those structures that will require more detailed investigations and non-destructive testing techniques. Examples of these investigations are:

- Detailed deck condition survey
- Non-destructive delamination survey of asphalt covered decks
- Substructure condition survey
- Detailed coating condition survey
- Underwater investigation
- Fatigue investigation
- Structure evaluation

Through the OSIM recommendations and additional detailed investigations, a 10-year needs list can be developed for the municipality's bridges.

2.3 Buildings & Facilities

The most popular and practical type of buildings & facilities assessment involves qualified groups of trained industry professionals (engineers or architects) performing an analysis of the condition of a group of facilities and their components, that may vary in terms of age, design, construction methods and materials. This analysis can be done by walk-through inspection (the most accurate approach), mathematical modeling or a combination of both. The following asset classifications are typically inspected:

- **Site Components** – property around the facility and outdoor components such as utilities, signs, stairways, walkways, parking lots, fencing, courtyards and landscaping
- **Structural Components** – physical components such as the foundations, walls, doors, windows, roofs
- **Electrical Components** – all components that use or conduct electricity such as wiring, lighting, electric heaters, and fire alarm systems
- **Mechanical Components** – components that convey and utilize all non-electrical utilities within a facility such as gas pipes, furnaces, boilers, plumbing, ventilation, and fire extinguishing systems
- **Vertical Movement** – components used for moving people between floors of buildings such as elevators, escalators and stair lifts

Once collected, this information can be uploaded into the CityWide®, the municipality's asset management and asset registry software database in order for short- and long-term repair, rehabilitation and replacement reports to be generated to assist with programming the short- and long-term maintenance and capital budgets.

It is recommended that the municipality continue its inspection of structures and expand its condition assessment program for other segments. It is also recommended that a portion of capital or operating funding is dedicated to this.

2.4 Vehicles and Machinery & Equipment

The typical approach to optimizing the maintenance expenditures of vehicles and machinery & equipment, is through routine vehicle and component inspections, routine servicing, and a routine preventive maintenance program. Most makes and models of vehicles and machinery assets are supplied with maintenance manuals that define the appropriate schedules and routines for typical maintenance and servicing, and also more detailed restoration or rehabilitation protocols.

The primary goal of sound maintenance is to avoid or mitigate the consequence of failure of equipment or parts. An established preventive maintenance program serves to ensure this, as it will consist of scheduled inspections and follow up repairs of vehicles and machinery & equipment in order to decrease breakdowns and excessive downtimes.

A good preventive maintenance program will include partial or complete overhauls of equipment at specific periods, including oil changes, lubrications, fluid changes and so on. In addition, workers can record equipment or part deterioration so they can schedule to replace or repair worn parts before they fail.

The ideal preventive maintenance program would move progressively further away from reactive repairs and instead towards the prevention of all equipment failure before it occurs.

It is recommended that a preventive maintenance routine is defined and established for all vehicles and machinery & equipment assets, and that a software application is utilized for the overall management of the program.

2.5 Water System

Unlike sewer mains, it is often prohibitively difficult to inspect water mains from the inside due to the constant and high-pressure flow of water. A physical inspection requires a disruption of service to residents, can be an expensive exercise and is time consuming to set up. It is recommended practice that physical inspection of water mains typically occurs only for high-risk, large transmission mains within the system, and only when there is a requirement. There are a number of high tech inspection techniques in the industry for large diameter pipes but these should be researched first for applicability as they are quite expensive. Examples include remote eddy field current (RFEC), ultrasonic and acoustic techniques, impact echo (IE), and Georadar.

For the majority of pipes within the distribution network, gathering key information in regards to the main and its environment can supply the best method to determine a general condition. Key data that may be used, along with weighting factors, to determine an overall condition score include age, material type, breaks, hydrant flow inspections and soil condition.

It is recommended that the municipality continue its watermain assessment program, and that funds are budgeted for this.

2.6 Sewer Network Inspection (Sanitary and Storm)

The most popular and practical type of sanitary and storm sewer assessment is the use of Closed Circuit Television Video (CCTV). The process involves a small robotic crawler vehicle with a CCTV camera attached that is lowered down a maintenance hole into the sewer main to be inspected.

The vehicle and camera then travel the length of the pipe, providing a live video feed to a truck on the road above where a technician/inspector records defects and information regarding the pipe. A wide range of construction or deterioration problems can be captured, including open/displaced joints, presence of roots, infiltration & inflow, cracking, fracturing, exfiltration, collapse, deformation of pipe and more. Therefore, sewer CCTV inspection is an effective tool for locating and evaluating structural defects and general condition of underground pipes.

Even though CCTV is an excellent option for inspection of sewers, it is a fairly costly process and does take significant time to inspect a large volume of pipes.

Another option in the industry today is the use of Zoom Camera equipment. This is very similar to traditional CCTV, however, a crawler vehicle is not used. Rather, in its place, a camera is lowered down a maintenance hole attached to a pole like piece of equipment. The camera is then rotated towards each connecting pipe and the operator above progressively zooms in to record all defects and information about each pipe. The downside to this technique is the further down the pipe the image is zoomed, the less clarity is available to accurately record defects and measurement. The upside is the process is far quicker and significantly less expensive, and an assessment of the manhole can be provided as well. Also, it is important to note that 80% of pipe deficiencies generally occur within 20 metres of a manhole.

It is recommended that the municipality continue its wastewater main assessment program, and expand it to include storm sewer mains. A portion of capital or operating funding should be dedicated to this.

2.7 Parks and Land Improvements

CSA standards provide guidance on the process and protocols in regards to the inspection of parks and their associated assets, e.g., play spaces and equipment. The land improvements inspection will involve qualified groups of trained industry professionals (operational staff or landscape architects) performing an analysis of the condition of a group of land improvement assets and their components. The most accurate way of determining the condition requires a walk-through to collect baseline data. The following key asset classifications are typically inspected:

- **Physical Site Components –** physical components on the site of the park such as fences, utilities, stairways, walkways, parking lots, irrigation systems, monuments, fountains
- **Recreation Components –** physical components such as playgrounds, bleachers, back stops, splash pads, and benches
- **Land Site Components** – land components on the site of the park such as landscaping, sports fields, trails, natural areas, and associated drainage systems
- **Minor Park Facilities –** small facilities within the park site such as: sun shelters, washrooms, concession stands, change rooms, storage sheds

It is recommended that the municipality continue its parks condition assessment program and that a portion of capital or operating funding is dedicated to this.

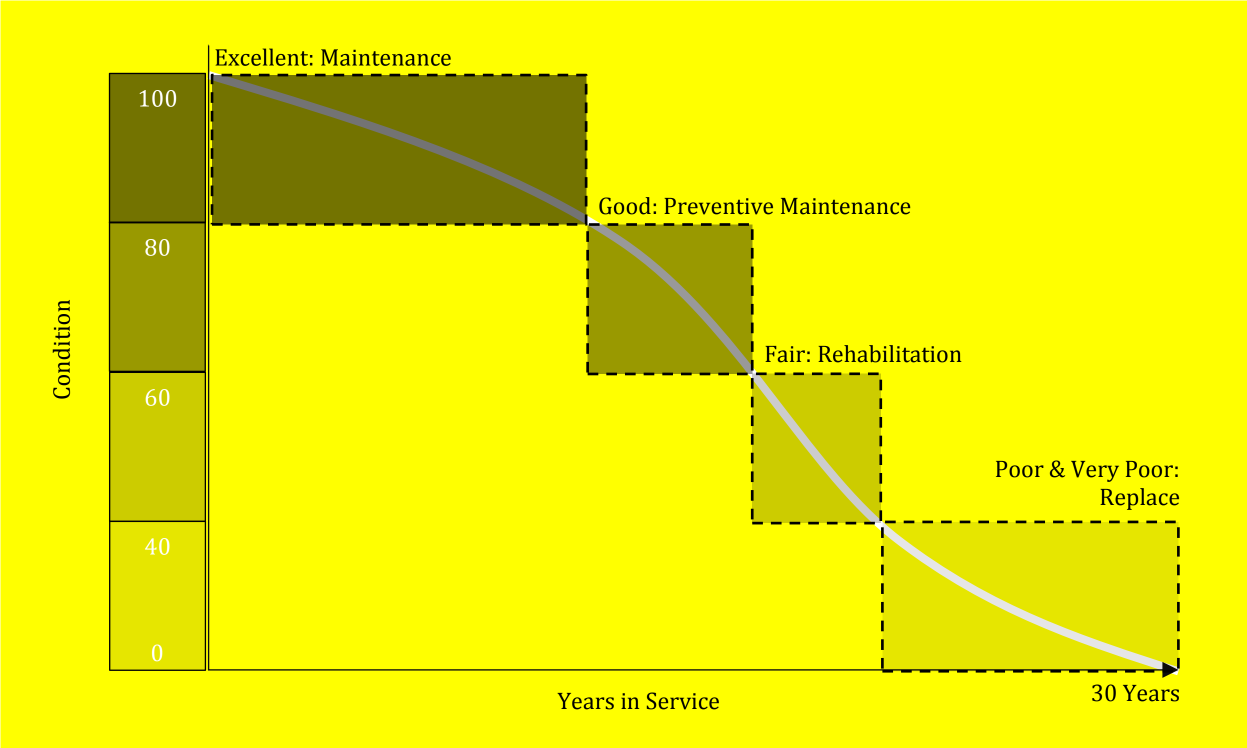
3. Lifecycle Analysis Framework

An industry review was conducted to determine which lifecycle activities can be applied at the appropriate time in an asset's life, to provide the greatest additional life at the lowest cost. In the asset management industry, this is simply put as doing the right thing to the right asset at the right time. If these techniques are applied across entire asset networks or portfolios (e.g., the entire road network), the municipality can gain the best overall asset condition while expending the lowest total cost for those programs.

3.1 Paved Roads

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for paved roads. With future updates of this asset management strategy, the municipality may wish to run the same analysis with a detailed review of peer municipality activities used for roads and the associated local costs for those work activities. All of this information can be entered into the CityWide® software suite in order to perform updated financial analysis as more detailed information becomes available. The following diagram depicts a general deterioration profile of a road with a 30-year life.

Figure 58 Paved Road General Deterioration Profile



As shown above, during the road's lifecycle, there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; preventive maintenance; rehabilitation; and replacement or reconstruction.

The windows or thresholds for when certain work activities should be applied coincide approximately with the condition state of the asset as shown below:

Table 23 Asset Condition and Related Work Activity for Paved Roads

Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only
Good (Preventive maintenance phase)	61-80	– Crack sealing – Emulsions
Fair (Rehabilitation phase)	41-60	– Resurface - mill & pave – Resurface - asphalt overlay – Single & double surface treatment (for rural roads)
Poor (Reconstruction phase)	21-40	– Reconstruct - pulverize and pave – Reconstruct - full surface and base reconstruction
Very Poor (Reconstruction phase)	0-20	– Critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the 'poor' category above.

With future updates of this asset management strategy, the municipality may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the municipality's work program and/or levels of service. These thresholds and condition ranges can be updated and a revised financial analysis can be done. These adjustments will be an important component of future AMPs, as the province requires each municipality to present various management options within the financing plan.

It is recommended that the municipality establish a lifecycle activity framework for the various classes of paved road within the transportation network.

3.2 Bridges & Culverts

The best approach to develop a 10-year needs list for the municipality's bridge structure portfolio relies on the structural engineer who performs the inspections to develop a maintenance requirements report, a rehabilitation and replacement requirements report and identify additional detailed inspections as required.

3.3 Buildings & Facilities

The best approach to develop a 10-year needs list for the municipality's facilities portfolio would be to have the engineers, operational staff or architects who perform the facility inspections to also develop a complete portfolio maintenance requirements report and rehabilitation and replacement requirements report, and also identify additional detailed inspections and follow up studies as required. This may be performed as a separate assignment once all individual facility audits/inspections are complete.

The above reports could be considered the beginning of a 10-year maintenance and capital plan; however, within the facilities industry, there are other key factors that should be considered to determine over all priorities and future expenditures. Some examples would be functional and legislative requirements, energy conservation programs and upgrades, customer complaints and health and safety concerns, and customer expectations balanced with willingness-to-pay initiatives.

It is recommended that the municipality establish a prioritization framework for the facilities asset class that incorporates the key components outlined above.

3.4 Vehicles and Machinery & Equipment

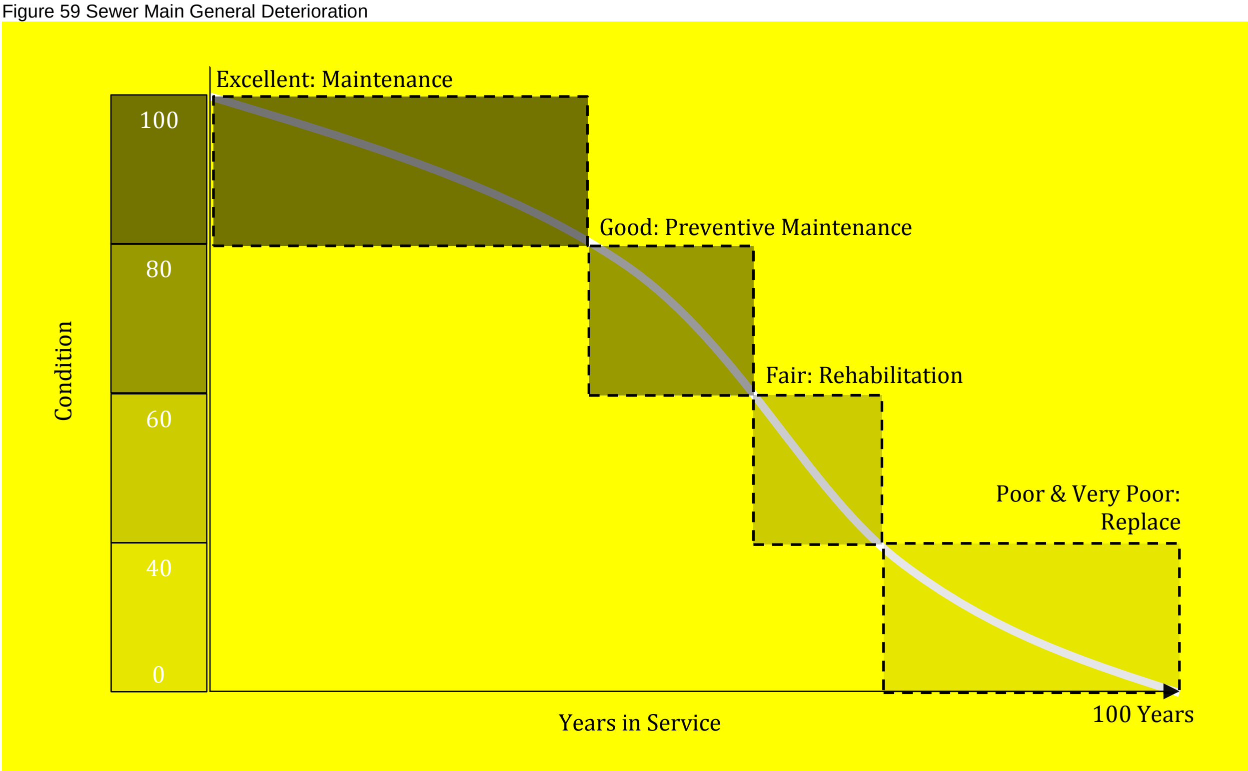
The best approach to develop a 10-year needs list for the municipality's vehicles and machinery & equipment portfolio would first be through a defined preventive maintenance program, and secondly, through an optimized lifecycle vehicle replacement schedule. The preventive maintenance program would serve to determine budget requirements for operating and minor capital expenditures for renewal of parts, and major refurbishments and rehabilitations. An optimized replacement program will ensure a vehicle or equipment asset is replaced at the correct point in time in order to minimize overall cost of ownership, minimize costly repairs and downtime, while maximizing potential re-sale value. There is significant benchmarking information available within the vehicles industry in regard to vehicle lifecycles which can be used to assist in this process. Once appropriate replacement schedules are established, the short- and long-term budgets can be funded accordingly.

There are, of course, functional aspects of vehicles management that should also be examined in further detail as part of the long-term management plan, such as vehicles utilization and incorporating green vehicles, etc. It is recommended that the municipality establish a prioritization framework for the vehicles asset class that incorporates the key components outlined above.

3.5 Sanitary and Storm Sewers

The following analysis has been conducted at a fairly high level, using industry standard activities and costs for sanitary and storm sewer rehabilitation and replacement. With future updates of this asset management strategy, the municipality may wish to run the same analysis with a detailed review of activities used for sewer mains and the associated local costs for those work activities. This information can be input into the CityWide® software suite in order to perform updated financial analysis as more detailed information becomes available. The following diagram depicts a general deterioration profile of a sewer main with a 100-year life.

Figure 59 Sewer Main General Deterioration



As shown above, during the sewer main's lifecycle there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction. The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown below:

Table 24 Asset Condition and Related Work Activity for Sewer Mains

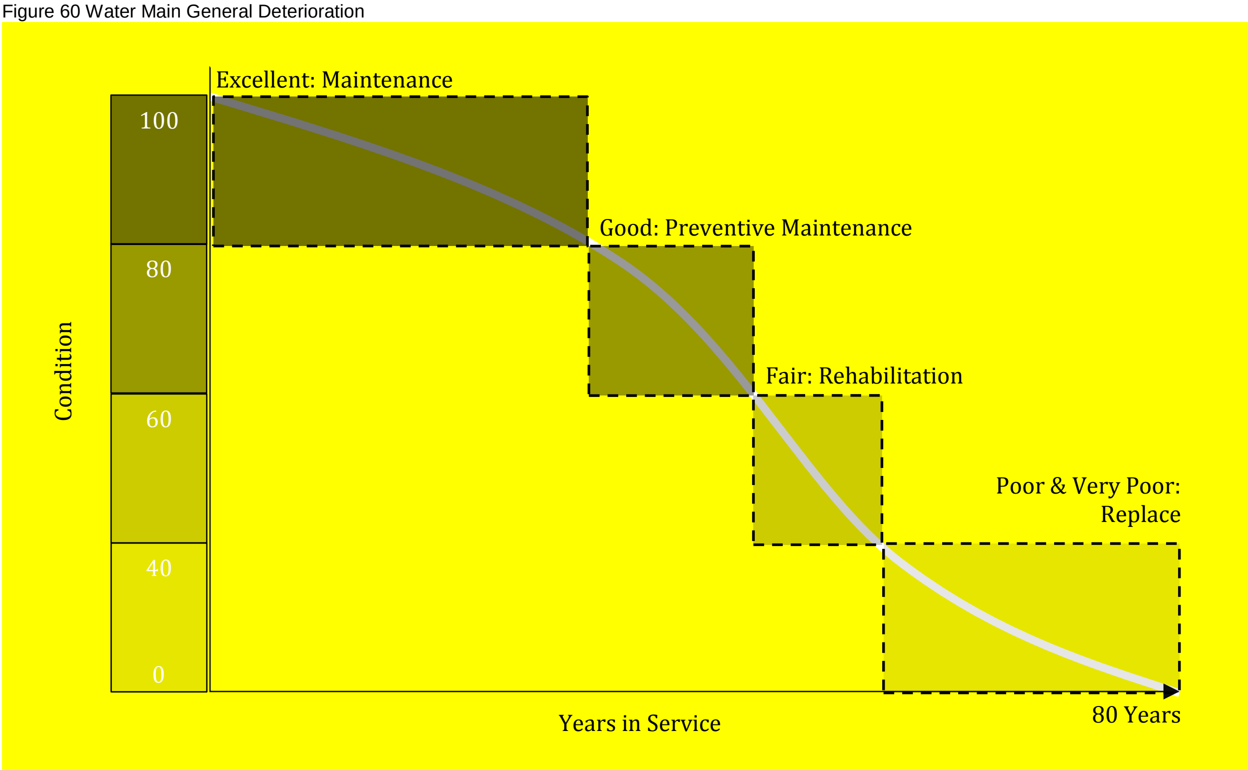
Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only (cleaning & flushing etc.)
Good (Preventive maintenance phase)	61-80	– Manhole repairs – Small pipe section repairs
Fair (Rehabilitation phase)	41-60	– Structural relining
Poor (Reconstruction phase)	21-40	– Pipe replacement
Very Poor (Reconstruction phase)	0-20	– Critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the "poor" category above.

With future updates of this asset management strategy the municipality may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the municipality's work program. Also note: when adjusting these thresholds, it actually adjusts the level of service provided and ultimately changes the amount of money required. These adjustments will be an important component of future asset management plans, as the province requires each municipality to present various management options within the financing plan.

3.6 Water System

As with roads and sewers, the following analysis has been conducted at a high level, using industry standard activities and costs for water main rehabilitation and replacement. The following diagram depicts a general deterioration profile of a water main with an 80-year life.

Figure 60 Water Main General Deterioration



As shown above, during the water main's lifecycle, there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction. The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown in Table 25.

Table 25 Asset Condition and Related Work Activity for Water Mains

Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only (cleaning & flushing etc.)
Good (Preventive maintenance phase)	61-80	– Water main break repairs – Small pipe section repairs
Fair (Rehabilitation phase)	41-60	– Structural water main relining
Poor (Reconstruction phase)	21-40	– Pipe replacement
Very Poor (Reconstruction phase)	0-20	– Critical includes assets beyond their useful lives which make up the backlog. They require the same interventions as the “poor” category above.

4. Growth and Demand

Growth is a critical infrastructure demand driver for most infrastructure services. As such, the municipality must not only account for the lifecycle cost for its existing asset portfolio, but those of any anticipated and forecasted capital projects associated specifically with growth. Based on the 2016 census, the population for Kawartha Lakes has increased 3% since 2011 to reach 75,423. Population changes will require the municipality to determine the impact to expected levels of service and if any changes to the existing asset inventory may be required.

5. Project Prioritization and Risk Management

Generally, infrastructure needs exceed municipal capacity. As such, municipalities rely heavily on provincial and federal programs and grants to finance important capital projects. Fund scarcity means projects and investments must be carefully selected based on the state of infrastructure, economic development goals, and the needs of an evolving and growing community. These factors, along with social and environmental considerations will form the basis of a robust risk management framework.

5.1 Defining Risk Management

From an asset management perspective, risk is a function of the consequences of failure (e.g., the negative economic, financial, and social consequences of an asset in the event of a failure); and, the probability of failure (e.g., how likely is the asset to fail in the short- or long-term). The consequences of failure are typically reflective of:

– **An asset's importance in an overall system**:
  For example, the failure of an individual computer workstation for which there are readily available substitutes is much less consequential and detrimental than the failure of a network server or telephone exchange system.

– **The criticality of the function performed**:
  For example, a mechanical failure on a road construction equipment may delay the progress of a project, but a mechanical failure on a fire pumper truck may lead to immediate life safety concerns for fire fighters, and the public, as well as significant property damage.

– **The exposure of the public and/or staff to injury or loss of life**:
  For example, a single sidewalk asset may demand little consideration and carry minimum importance to the municipality's overall pedestrian network and performs a modest function. However, members of the public interact directly with the asset daily and are exposed to potential injury due to any trip hazards or other structural deficiencies that may exist.

The probability of failure is generally a function of an asset's physical condition, which is heavily influenced by the asset's age and the amount of investment that has been made in the maintenance and renewal of the asset throughout its life.

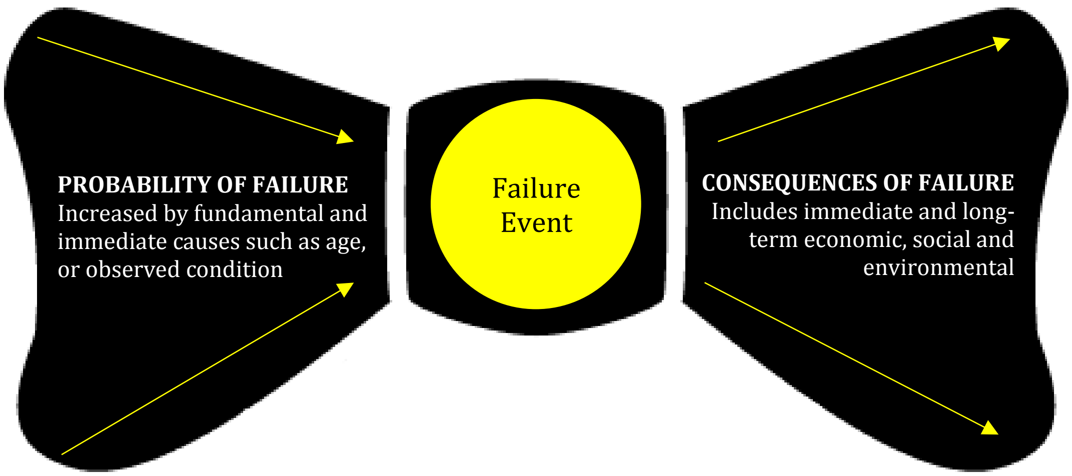
Risk mitigation is traditionally thought of in terms of safety and liability factors. In asset management, the definition of risk should heavily emphasize these factors but should be expanded to consider the risks to the municipality's ability to deliver targeted levels of service

- The impact that actions (or inaction) on one asset will have on other related assets
- The opportunities for economic efficiency (realized or lost) relative to the actions taken

5.2 Risk Matrices

Using the logic above, a risk matrix will illustrate each asset's overall risk, determined by multiplying the probability of failure (PoF) scores with the consequence of failure (CoF) score, as illustrated in the table that follow. This can be completed as a holistic exercise against any data set by determining which factors (or attributes) are available and will contribute to the PoF or CoF of an asset. Figure 61 (known as a bowtie model in the risk industry) illustrates this concept. The probability of failure is increased as more and more factors collude to cause asset failure.

Figure 61 Bow Tie Risk Model



Probability of Failure

In this AMP, the probability of a failure event is predicted by the condition of the asset.

Table 26 Probability of Failure – All Assets

Asset Classes	Condition Rating	Probability of Failure
ALL	0-20 Very Poor	5 – Very High
	21-40 Poor	4 – High
	41-60 Fair	3 – Moderate
	61-80 Good	2 – Low
	81-100 Excellent	1 – Very Low

Consequence of Failure

The consequence of failure for the asset classes analyzed in this AMP will be determined either by the replacement costs of assets, or other attributes as relevant. These attributes include material types, classifications, or size. Asset classes for which replacement cost is used include: bridges & culverts, buildings & facilities, land improvements, vehicles, and machinery & equipment. This approach is premised on the assumption that the higher the replacement cost, the larger (and likely more important) the asset, requiring a higher risk scoring.

Assets for which other attributes are used include: water, wastewater, storm and roads. Attributes are selected based on their impact on service delivery. For linear infrastructure, pipe diameter is used to estimate a suitable consequence of failure score as it reflects the potential upstream service area affected. Scoring for roads, the risk is based on classification as it reflects the traffic volumes and number of people affected.

Table 27 Consequence of Failure – Roads

Road Classification	Consequence of failure
Gravel	Score of 1
LCB	Score of 3
HCB	Score of 5

Table 28 Consequence of Failure – Bridges & Culverts

Replacement Value	Consequence of failure
Up to $200k	Score of 1
$201 to $400k	Score of 2
$401 to $800k	Score of 3
$801 to $1.5 Million	Score of 4
$.5 Million and over	Score of 5

Table 29 Consequence of Failure – Water Mains

Pipe Diameter	Consequence of Failure
Less than 100mm	Score of 1
101–200mm	Score of 2
201–300mm	Score of 3
301–400mm	Score of 4
400mm and over	Score of 5

Table 30 Consequence of Failure – Sanitary Sewers

Pipe Diameter	Consequence of failure
Less than 200mm	Score of 1
200-300mm	Score of 2
301-400mm	Score of 3
401-600mm	Score of 4
601mm and over	Score of 5

Table 31 Consequence of Failure – Storm Sewers

Pipe Diameter	Consequence of Failure
Less than 200mm	Score of 1
251-500mm	Score of 2
501-700mm	Score of 3
701-1,000mm	Score of 4
1,001mm and over	Score of 5

Table 32 Consequence of Failure – Buildings & Facilities

Replacement Value	Consequence of failure
Up to $50k	Score of 1
$51k to $100k	Score of 2
$101k to $600k	Score of 3
$601k to $2 million	Score of 4
Over $2 million	Score of 5

Table 33 Consequence of Failure – Machinery & Equipment

Replacement Value	Consequence of failure
Up to $10k	Score of 1
$11k to $15k	Score of 2
$16k to $20k	Score of 3
$21k to $30k	Score of 4
Over $30k	Score of 5

Table 34 Consequence of Failure – Land Improvements

Replacement Value	Consequence of failure
Up to $25k	Score of 1
$26k to $50k	Score of 2
$51k to $100k	Score of 3
$101k to $250k	Score of 4
Over $250k	Score of 5

Table 35 Consequence of Failure – Vehicles

Replacement Value	Consequence of failure
Up to $25k	Score of 1
$26k to $60k	Score of 2
$61k to $100k	Score of 3
$101k to $350k	Score of 4
Over $350k	Score of 5

The risk matrices that follow show the distribution of assets within each asset class according to the probability and likelihood of failure scores as discussed above.

Figure 62 Distribution of Assets Based on Risk – All Asset Classes

Consequence \ Probability	1	2	3	4	5
5	1201 Assets $300,041,783	581 Assets $336,807,367	65 Assets $44,222,807	90 Assets $38,904,620	98 Assets $35,656,796
4	96 Assets $29,289,832	162 Assets $95,681,232	131 Assets $49,564,033	297 Assets $31,787,447	270 Assets $34,496,800
3	1031 Assets $83,770,104	842 Assets $96,814,739	327 Assets $47,888,823	453 Assets $30,760,455	313 Assets $22,344,973
2	1501 Assets $119,730,143	464 Assets $31,707,117	508 Assets $43,596,824	1982 Assets $57,114,648	949 Assets $29,079,864
1	7658 Assets $154,749,507	4703 Assets $58,862,496	2886 Assets $47,061,025	2389 Assets $18,487,067	21144 Assets $27,719,988

Figure 63 Distribution of Assets Based on Risk – Road Network

Consequence \ Probability	1	2	3	4	5
5	1124 Assets $244,099,832	484 Assets $96,514,720	38 Assets $6,187,380	7 Assets $1,741,600	14 Assets $4,142,764
4	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0
3	788 Assets $51,476,397	495 Assets $35,092,383	69 Assets $2,879,260	12 Assets $582,825	1 Assets $8,170
2	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0	0 Assets $0
1	1264 Assets $14,813,494	494 Assets $6,920,194	638 Assets $13,236,869	1319 Assets $6,337,187	19138 Assets $15,513,651

Figure 64 Distribution of Assets Based on Risk – Bridges & Culverts

Consequence \ Probability	1	2	3	4	5
5	4 Assets $13,647,514	1 Assets $1,783,352	1 Assets $13,226,780	12 Assets $32,886,780	9 Assets $28,691,264
4	1 Assets $969,919	5 Assets $5,219,911	4 Assets $4,258,758	13 Assets $13,545,235	8 Assets $9,819,315
3	4 Assets $2,326,665	2 Assets $1,427,459	6 Assets $3,356,248	17 Assets $9,515,651	25 Assets $12,959,512
2	3 Assets $919,151	1 Assets $273,626	6 Assets $2,088,608	10 Assets $2,998,603	44 Assets $12,813,793
1	6 Assets $799,250	2 Assets $263,797	5 Assets $547,095	9 Assets $951,049	97 Assets $8,336,685

Figure 65 Distribution of Assets Based on Risk – Water System

Consequence \ Probability	1	2	3	4	5
5	5 Assets $1,681,000	1 Assets $5,004,000	8 Assets $2,079,000	0 Assets $0	0 Assets $0
4	5 Assets $701,000	14 Assets $8,556,000	10 Assets $1,626,000	0 Assets $0	0 Assets $0
3	118 Assets $16,812,000	26 Assets $5,280,000	123 Assets $17,239,000	22 Assets $3,145,000	0 Assets $0
2	1062 Assets $86,709,000	87 Assets $6,881,000	283 Assets $23,647,000	93 Assets $6,289,000	0 Assets $0
1	2614 Assets $56,122,187	358 Assets $5,273,322	64 Assets $1,669,620	31 Assets $2,399,600	0 Assets $0

Figure 66 Distribution of Assets Based on Risk – Sanitary Services

Consequence	1	2	3	4	5
5	16 Assets $8,222,000	25 Assets $8,583,000	0 Assets $0	0 Assets $0	0 Assets $0
4	47 Assets $20,104,000	29 Assets $11,273,000	50 Assets $6,730,000	18 Assets $2,918,000	0 Assets $0
3	79 Assets $8,594,000	56 Assets $9,935,000	49 Assets $7,272,000	21 Assets $3,045,000	0 Assets $0
2	330 Assets $28,368,000	87 Assets $7,887,000	109 Assets $11,588,000	296 Assets $25,105,000	0 Assets $0
1	2159 Assets $75,462,259	373 Assets $20,110,350	362 Assets $19,973,330	62 Assets $4,029,470	0 Assets $0

Probability

Figure 67 Distribution of Assets Based on Risk – Storm

Consequence	1	2	3	4	5
5	0 Assets $0	0 Assets $0	1 Assets $33,380	66 Assets $1,447,366	68 Assets $1,224,625
4	0 Assets $0	0 Assets $0	0 Assets $0	243 Assets $4,404,382	194 Assets $3,519,262
3	0 Assets $0	0 Assets $0	0 Assets $0	340 Assets $6,860,010	254 Assets $5,073,070
2	0 Assets $0	0 Assets $0	9 Assets $217,935	1549 Assets $20,834,523	808 Assets $12,587,111
1	0 Assets $0	0 Assets $0	0 Assets $0	128 Assets $788,766	117 Assets $493,295

Probability

Figure 68 Distribution of Assets Based on Risk – Buildings & Facilities

Consequence \ Probability	1	2	3	4	5
5	0 Assets $0	31 Assets $178,308,165	1 Assets $2,080,000	0 Assets $0	0 Assets $0
4	2 Assets $2,000,000	38 Assets $44,499,371	18 Assets $19,594,775	4 Assets $3,388,030	8 Assets $7,875,000
3	3 Assets $1,065,540	26 Assets $7,097,793	9 Assets $2,438,576	9 Assets $1,996,469	1 Assets $355,180
2	10 Assets $691,017	20 Assets $1,515,586	6 Assets $399,790	1 Assets $70,560	3 Assets $221,250
1	23 Assets $731,041	28 Assets $901,262	15 Assets $565,050	17 Assets $552,628	11 Assets $295,000

Figure 69 Distribution of Assets Based on Risk – Machinery & Equipment

Consequence \ Probability	1	2	3	4	5
5	17 Assets $555,000	10 Assets $665,000	2 Assets $78,377	1 Assets $53,874	5 Assets $198,143
4	8 Assets $219,563	12 Assets $360,000	2 Assets $60,000	0 Assets $0	2 Assets $45,624
3	2 Assets $33,400	11 Assets $198,000	0 Assets $0	0 Assets $0	1 Assets $15,041
2	18 Assets $250,040	8 Assets $115,700	2 Assets $28,183	0 Assets $0	16 Assets $196,910
1	674 Assets $1,166,147	877 Assets $827,535	853 Assets $438,628	504 Assets $520,502	1605 Assets $1,107,778

Figure 70 Distribution of Assets Based on Risk – Land Improvements

Consequence \ Probability	1	2	3	4	5
5	9 Assets $15,826,438	5 Assets $23,239,030	6 Assets $5,975,080	0 Assets $0	0 Assets $0
4	25 Assets $3,420,350	19 Assets $2,536,150	5 Assets $601,000	0 Assets $0	0 Assets $0
3	30 Assets $2,272,102	49 Assets $3,574,005	2 Assets $142,720	0 Assets $0	0 Assets $0
2	65 Assets $2,200,280	88 Assets $3,007,876	7 Assets $248,328	2 Assets $73,900	0 Assets $0
1	889 Assets $5,176,229	434 Assets $3,201,602	59 Assets $416,330	10 Assets $43,636	2 Assets $13,480

Figure 71 Distribution of Assets Based on Risk – Vehicles

Consequence \ Probability	1	2	3	4	5
5	26 Assets $16,010,000	22 Assets $12,630,000	5 Assets $2,520,000	4 Assets $2,775,000	2 Assets $1,400,000
4	8 Assets $1,875,000	28 Assets $6,485,000	33 Assets $7,410,000	14 Assets $3,630,000	57 Assets $12,555,000
3	4 Assets $350,000	17 Assets $1,310,000	8 Assets $665,000	8 Assets $605,000	23 Assets $1,860,000
2	9 Assets $338,000	12 Assets $444,400	23 Assets $847,600	17 Assets $685,000	62 Assets $2,213,000
1	22 Assets $329,500	31 Assets $509,600	18 Assets $306,000	9 Assets $160,000	37 Assets $672,000

IX. Financial Strategy

1. General Overview

In order for an AMP to be effective and meaningful, it must be integrated with financial planning and long-term budgeting. The development of a comprehensive financial plan will allow the municipality to identify the financial resources required for sustainable asset management based on existing asset inventories, desired levels of service and projected growth requirements.

Figure 72 Cost Elements

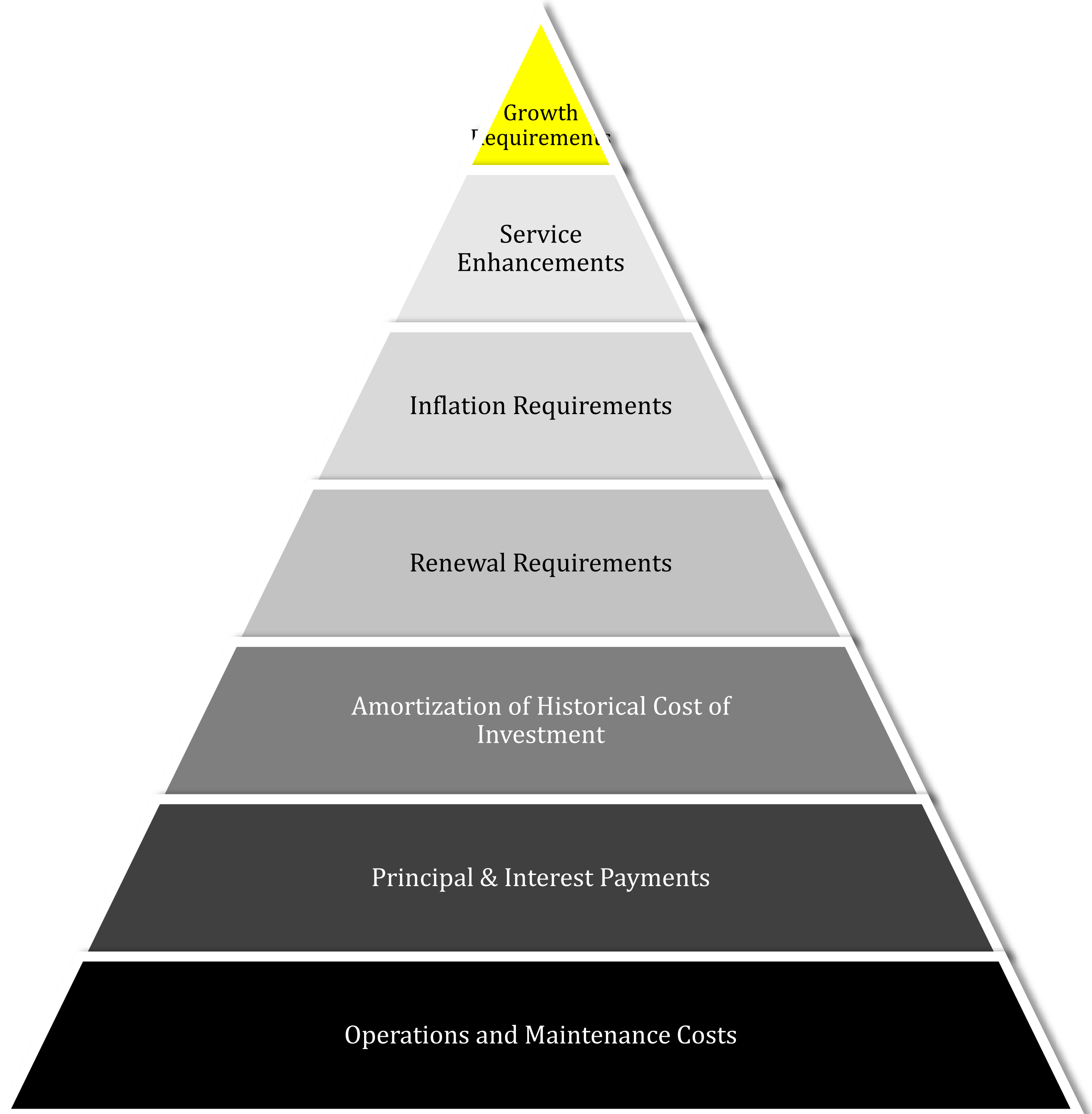


Figure 72 depicts the various cost elements and resulting funding levels that should be incorporated into AMPs that are based on best practices. Municipalities meeting their operational and maintenance needs, and debt obligations are funding only their cash cost. Funding at this level is severely deficient in terms of lifecycle costs.

Meeting the annual amortization expense based on the historical cost of investment will ensure municipalities adhere to accounting rules implemented in 2009; however, funding is still deficient for long-term needs. As municipalities graduate to the next level and meet renewal requirements, funding at this level ensures that need and cost of full replacement is deferred. If municipalities meet inflation requirements, they're positioning themselves to meet replacement needs at existing levels of service. In the final level, municipalities that are funding for service enhancement and growth requirements are fiscally sustainable and cover future investment needs.

Typically, the balance of this section would outline a long-term financial strategy to bring annual asset replacement expenditure up to the average level required. In lieu of this, however, City has decided to develop a more refined and detailed 10-year financial strategy directly, which appears in Chapter XII (Appendix 2).

X. 2016 Infrastructure Report Card

The following infrastructure report card illustrates the municipality's performance on the two key factors: Asset Health and Financial Capacity. Appendix 1 provides the full grading scale and conversion chart, as well as detailed descriptions, for each grading level.

Table 36 2016 Infrastructure Report Card

Asset class	Asset Health Grade	Funding Percentage	Financial Capacity Grade	Average Asset Class Grade	Comments
Roads	B	-	-	B	Based on 2016 replacement cost, and primarily condition data, over 70% of assets, with a valuation of $1.2 billion, are in good to very good condition; 18% are in poor to very poor condition.
Bridges & Culverts	D	-	-	D	
Water System	B	-	-	B	
Wastewater Services	B	-	-	B	
Storm	F	-	-	F	
Buildings & Facilities	C	-	-	C	
Machinery & Equipment	C	-	-	C	
Land Improvements	B	-	-	B	
Vehicles	C	-	-	C	
		Average Asset Health Grade	C		
		Average Financial Capacity Grade	-		
		Overall Grade for the Municipality	C		

Appendix 1: Grading and Conversion Scales

Table 37 Asset Health Scale

Letter Grade	Rating	Description
A	Excellent	Asset is new or recently rehabilitated
B	Good	Asset is no longer new, but is fulfilling its function. Preventive maintenance is beneficial at this stage.
C	Fair	Deterioration is evident but asset continues to full its function. Preventive maintenance is beneficial at this stage.
D	Poor	Significant deterioration is evident and service is at risk.
F	Very Poor	Asset is beyond expected life and has deteriorated to the point that it may no longer be fit to fulfill its function.

Table 38 Financial Capacity Scale

Letter Grade	Rating	Funding percent	Timing Requirements	Description
A	Excellent	90-100 percent	☑ Short Term ☑Medium Term ☑Long Term	The municipality is fully prepared for its short-, medium- and long-term replacement needs based on existing infrastructure portfolio.
B	Good	70-89 percent	☑Short Term ☑Medium Term ☒Long Term	The municipality is well prepared to fund its short-term and medium-term replacement needs but requires additional funding strategies in the long-term to begin to increase its reserves.
C	Fair	60-69 percent	☑Short Term ☒Medium Term ☒Long Term	The municipality is underprepared to fund its medium- to long-term infrastructure needs. The replacement of assets in the medium-term will likely be deferred to future years.
D	Poor	40-59 percent	☒/☑ Short Term ☒Medium Term ☒Long Term	The municipality is not well prepared to fund its replacement needs in the short-, medium- or long-term. Asset replacements will be deferred and levels of service may be reduced.
F	Very Poor	0-39 percent	☒Short Term ☒Medium Term ☒Long Term	The municipality is significantly underfunding its short-term, medium-term, and long-term infrastructure requirements based on existing funds allocation. Asset replacements will be deferred indefinitely. The municipality may have to divest some of its assets (e.g., bridge closures, arena closures) and levels of service will be reduced significantly.

Appendix 2: Financial Strategy

This section contains the forecasts from the City's 10-Year Financial Plan. For the full plan, please see City of Kawartha Lakes Council Report CORP2017-020.

City of Kawartha Lakes Tax-Supported 10-Year Financial Plan

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Opening Tax Levy										
Operating Support	91,815,261	101,558,447	105,212,643	107,963,143	111,245,913	114,335,576	117,345,982	121,083,384	124,937,249	128,911,157
Capital Support	11,586,000	7,923,243	10,290,541	13,892,716	17,312,018	19,364,672	21,702,276	22,136,322	22,579,048	23,030,629
Total	103,401,261	109,481,690	115,503,183	121,855,858	128,557,931	133,700,248	139,048,258	143,219,705	147,516,297	151,941,786
Status Quo Tax Increase										
General Operating	4,532,939	3,654,195	2,750,500	2,756,748	2,224,918	2,286,712	2,346,920	2,421,668	2,498,745	2,578,223
Property Reserve Support	640,000									
WSIB Premium	350,000									
Winter Control Infusion	1,000,000									
Contribution to Capital	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	434,046	442,726	451,581	460,613
Assessment Growth (1%)	(1,034,013)	(1,094,817)	(1,155,032)	(1,218,559)	(1,285,579)	(1,337,002)	(1,390,483)	(1,432,197)	(1,475,163)	(1,519,418)
Total	6,488,926	3,559,378	2,595,468	2,538,190	1,939,339	1,949,709	1,390,483	1,432,197	1,475,163	1,519,418
Total (%)	**6.28%**	**3.25%**	**2.25%**	**2.08%**	**1.51%**	**1.46%**	**1.00%**	**1.00%**	**1.00%**	**1.00%**
AMP-Related Tax Increase										
Contribution to Capital	(4,662,757)	1,367,298	2,602,175	2,419,302	1,052,654	1,337,604	0	0	0	0
Transfer to/(from) Capital Reserve	0	0	0	0	0	97,363	1,110,497	715,994	1,178,127	1,367,454
Debt Servicing										
Transitional for Sustainability	2,826,887									
Scugog River Bridge				526,022						
Lindsay Roads Operations Depot					864,745					
Other Growth-Related Needs							279,985		297,036	
Victoria Manor						626,332				
Administration Centre								716,203		
Cultural Centre										151,964
Total	(1,835,869)	1,367,298	2,602,175	2,945,324	1,917,399	2,061,298	1,390,483	1,432,197	1,475,163	1,519,418
Total (%)	**-1.78%**	**1.25%**	**2.25%**	**2.42%**	**1.49%**	**1.54%**	**1.00%**	**1.00%**	**1.00%**	**1.00%**

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Tax Increase Summary										
Status Quo Tax Increase	6,488,926	3,559,378	2,595,468	2,538,190	1,939,339	1,949,709	1,390,483	1,432,197	1,475,163	1,519,418
AMP-Related Tax Increase	(1,835,869)	1,367,298	2,602,175	2,945,324	1,917,399	2,061,298	1,390,483	1,432,197	1,475,163	1,519,418
Total	4,653,057	4,926,676	5,197,643	5,483,514	3,856,738	4,011,007	2,780,965	2,864,394	2,950,326	3,038,836
Total (%)	**4.50%**	**4.50%**	**4.50%**	**4.50%**	**3.00%**	**3.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**
Tax Levy Growth Summary										
Tax Increase	4,653,057	4,926,676	5,197,643	5,483,514	3,856,738	4,011,007	2,780,965	2,864,394	2,950,326	3,038,836
Assessment Growth (1%)	1,034,013	1,094,817	1,155,032	1,218,559	1,285,579	1,337,002	1,390,483	1,432,197	1,475,163	1,519,418
Prior Deficit(s) Carry-Forward	393,360									
Total	6,080,429	6,021,493	6,352,675	6,702,072	5,142,317	5,348,010	4,171,448	4,296,591	4,425,489	4,558,254
Total (%)	**5.88%**	**5.50%**	**5.50%**	**5.50%**	**4.00%**	**4.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**
Closing Tax Levy										
Operating Support	101,558,447	105,212,643	107,963,143	111,245,913	114,335,576	117,345,982	121,083,384	124,937,249	128,911,157	133,008,798
Capital Support	7,923,243	10,290,541	13,892,716	17,312,018	19,364,672	21,702,276	22,136,322	22,579,048	23,030,629	23,491,241
Total	109,481,690	115,503,183	121,855,858	128,557,931	133,700,248	139,048,258	143,219,705	147,516,297	151,941,786	156,500,039
Capital Budget Financing										
Tax Support	7,923,243	10,290,541	13,892,716	17,312,018	19,364,672	21,702,276	22,136,322	22,579,048	23,030,629	23,491,241
Capital Reserve	9,231,960	6,425,566	3,970,710	3,547,532	1,912,069	0	0	0	0	0
Grants, Debenture and Other Reserves	13,019,456	16,667,208	18,844,820	19,293,271	19,679,136	20,072,719	20,474,173	20,883,657	21,301,330	21,727,357
Total	30,174,660	33,383,315	36,708,246	40,152,821	40,955,877	41,774,995	42,610,495	43,462,705	44,331,959	45,218,598
Capital Reserve Continuity										
Opening Balance	25,240,000	16,512,840	10,417,530	6,655,171	3,240,742	1,393,488	1,518,721	2,756,955	4,735,948	7,932,647
Contribution to Capital	(9,231,960)	(6,425,566)	(3,970,710)	(3,547,532)	(1,912,069)	0	0	0	0	0
Contribution from Operating	0	0	0	0	0	97,363	1,207,860	1,923,854	3,101,980	4,469,434
Interest (2%)	504,800	330,257	208,351	133,103	64,815	27,870	30,374	55,139	94,719	158,653
Closing Balance	16,512,840	10,417,530	6,655,171	3,240,742	1,393,488	1,518,721	2,756,955	4,735,948	7,932,647	12,560,734
Transitional Debenture Continuity										
Opening Remaining Principal	25,000,000	22,500,000	20,000,000	17,500,000	15,000,000	12,500,000	10,000,000	7,500,000	5,000,000	2,500,000
Principal Payment	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)	(2,500,000)
Closing Remaining Principal	22,500,000	20,000,000	17,500,000	15,000,000	12,500,000	10,000,000	7,500,000	5,000,000	2,500,000	0

City of Kawartha Lakes Water/Wastewater 10-Year Financial Plan

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Opening Rate Levy										
Operating Support	17,756,618	18,185,290	18,548,996	18,919,976	19,298,375	19,684,343	20,158,208	20,795,140	21,331,433	21,881,462
Capital Support	1,078,431	1,403,161	1,822,993	2,266,893	2,630,034	3,011,561	3,218,572	3,282,944	3,348,603	3,415,575
Total	18,835,049	19,588,451	20,371,989	21,186,869	21,928,409	22,695,903	23,376,780	24,078,084	24,680,036	25,297,037
Status Quo Rate Increase										
General Operating	355,132	363,706	370,980	378,400	385,968	393,687	403,164	415,903	426,629	437,629
Contribution to Capital	21,569	28,063	36,460	45,338	52,601	60,231	64,371	65,659	66,972	68,311
Conservation (-1%)	188,350	195,885	203,720	211,869	219,284	226,959	233,768	240,781	246,800	252,970
Customer Growth (1%)	(188,350)	(195,885)	(203,720)	(211,869)	(219,284)	(226,959)	(233,768)	(240,781)	(246,800)	(252,970)
Total	376,701	391,769	407,440	423,737	438,568	453,918	467,536	481,562	493,601	505,941
Total (%)	**2.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**	**2.00%**
AMP-Related Rate Increase										
Contribution to Capital	303,161	391,769	407,440	317,803	328,926	146,780	(0)	(0)	0	0
Transfer to/(from) Capital Reserve	0	0	0	0	0	80,179	233,768	120,390	123,400	0
Debt Servicing										
Transitional for Sustainability	0									
Water Meter Technology Upgrade	73,540									
Total	376,701	391,769	407,440	317,803	328,926	226,959	233,768	120,390	123,400	0
Total (%)	**2.00%**	**2.00%**	**2.00%**	**1.50%**	**1.50%**	**1.00%**	**1.00%**	**0.50%**	**0.50%**	**0.00%**
Rate Increase Summary										
Status Quo Rate Increase	376,701	391,769	407,440	423,737	438,568	453,918	467,536	481,562	493,601	505,941
AMP-Related Rate Increase	376,701	391,769	407,440	317,803	328,926	226,959	233,768	120,390	123,400	0
Total	753,402	783,538	814,880	741,540	767,494	680,877	701,303	601,952	617,001	505,941
Total (%)	**4.00%**	**4.00%**	**4.00%**	**3.50%**	**3.50%**	**3.00%**	**3.00%**	**2.50%**	**2.50%**	**2.00%**
Rate Levy Growth Summary										
Rate Increase	753,402	783,538	814,880	741,540	767,494	680,877	701,303	601,952	617,001	505,941
Conservation and Customer Growth	0	0	0	0	0	0	0	0	0	0
Prior Deficit(s) Carry-Forward										
Total	753,402	783,538	814,880	741,540	767,494	680,877	701,303	601,952	617,001	505,941
Total (%)	**4.00%**	**4.00%**	**4.00%**	**3.50%**	**3.50%**	**3.00%**	**3.00%**	**2.50%**	**2.50%**	**2.00%**
Closing Rate Levy										

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Operating Support	18,185,290	18,548,996	18,919,976	19,298,375	19,684,343	20,158,208	20,795,140	21,331,433	21,881,462	22,319,091
Capital Support	1,403,161	1,822,993	2,266,893	2,630,034	3,011,561	3,218,572	3,282,944	3,348,603	3,415,575	3,483,886
Total	19,588,451	20,371,989	21,186,869	21,928,409	22,695,903	23,376,780	24,078,084	24,680,036	25,297,037	25,802,978
Capital Budget Financing										
Rate Support	1,403,161	1,822,993	2,266,893	2,630,034	3,011,561	3,218,572	3,282,944	3,348,603	3,415,575	3,483,886
Capital Reserve	843,339	324,912	(568)	(281,086)	143,902	0	0	0	0	0
Grants, Debenture and Other Reserves	4,748,660	4,987,158	5,011,440	5,074,372	4,416,323	4,504,650	4,594,743	4,686,638	4,780,370	4,875,978
Total	6,995,160	7,135,063	7,277,764	7,423,320	7,571,786	7,723,222	7,877,686	8,035,240	8,195,945	8,359,864
Capital Reserve Continuity										
Opening Balance	1,875,398	1,069,567	766,046	781,936	1,078,660	956,331	1,055,636	1,390,695	1,852,846	2,447,640
Contribution to Capital	(843,339)	(324,912)	568	281,086	(143,902)	0	0	0	0	0
Contribution from Operating	0	0	0	0	0	80,179	313,946	434,337	557,737	557,737
Interest (2%)	37,508	21,391	15,321	15,639	21,573	19,127	21,113	27,814	37,057	48,953
Closing Balance	1,069,567	766,046	781,936	1,078,660	956,331	1,055,636	1,390,695	1,852,846	2,447,640	3,054,330
Transitional Debenture Continuity										
Opening Remaining Principal	0	0	0	0	0	0	0	0	0	0
Principal Payment	0	0	0	0	0	0	0	0	0	0
Closing Remaining Principal	0	0	0	0	0	0	0	0	0	0