AMP2016

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The 2016 Asset Management Plan for the

Township of Mulmur

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 Municipality of Mulmur's infrastructure portfolio comprises nine distinct infrastructure categories: road network, bridges & culverts, buildings, storm, water, land improvements, vehicles, and machinery & equipment. Together, these assets had a total valuation of $48.8 million in 2016, of which bridges & culverts comprised 44%, followed by roads at 20%.

Investments, primarily in transportation infrastructure, remained consistent until the 1990s when they had a large increase as the municipality updated or grew its asset portfolio. Expenditures have fluctuated since 2000. In the period between 2005-2009, the municipality made its largest expenditures, totaling more than $15 million, allocated primarily to environmental infrastructure ($7.2 million) and transportation infrastructure ($7 million). Since 2010, expenditures have totaled $7.4 million.

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.

Based on 2016 replacement cost, and a blend of age-based and assessed condition data, 63% of the municipality's assets are in good to very good condition as of 2015. However, 18%, with a valuation of $8.7 million are in poor to very poor condition. 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 approximation and help guide replacement needs and facilitate strategic budgeting. More than 70% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 6%, with a valuation of $2.8 million, remain in operation beyond their established useful life. An additional 17%, with a valuation of $8.3 million, will reach the end of their useful life within the next five years.

In order for an AMP to be effectively put into action, 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.

We've developed recommendations and strategies to produce full funding for both tax and rate based asset categories. The average annual investment requirement for tax funded categories is $1,648,000. Annual revenue currently allocated to these assets for capital purposes is $1,002,000, leaving an annual deficit of $646,000. To put it another way, these infrastructure categories are currently funded at 61% of their long-term requirements. In 2016, the municipality has annual tax revenues of $3,670,000. We recommend a 15 year option to phase-in full funding. This involves:

1. when realized, reallocating the debt cost reductions of $42,000 to the infrastructure deficit.
2. increasing tax revenues by 1.1% each year for the next 15 years solely for the purpose of phasing in full funding to the tax funded asset categories covered in this AMP.

3. allocating the current gas tax and OCIF revenue to the infrastructure deficit.
4. increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

The average annual investment requirement for water services is $140,000. Annual revenue currently allocated to these assets for capital purposes is $34,000, leaving an annual deficit of $106,000. To put it another way, these infrastructure categories are currently funded at 24% of their long-term requirements. In 2016, Mulmur has annual water revenues of $159,000. We recommend the following to achieve full funding within 15 years:

1. when realized, reallocating the debt cost reductions of $29,000 for water services to the applicable infrastructure deficit.
2. increasing rate revenues by 3.2% for water services each year for the next 15 years solely for the purpose of phasing in full funding to water services
3. increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

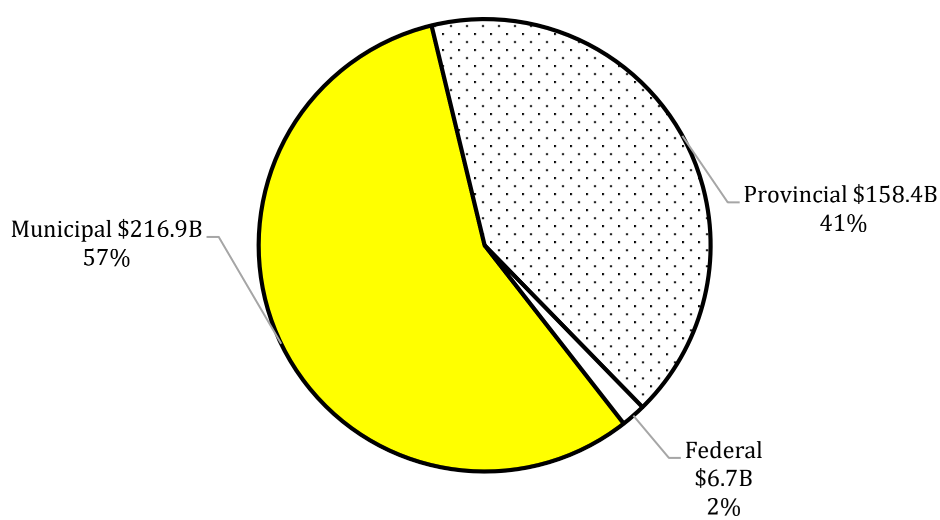
Although our financial strategies allow the municipalities to meet its long-term funding requirements and reach fiscal sustainability, injection of additional revenues will be required to mitigate existing infrastructure backlogs. The municipality has a combined infrastructure backlog of $2.4 million, with machinery & equipment comprising 46%.

A critical aspect of this asset management plan 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 very high degree of confidence in the accuracy, validity and completeness of the asset data for all categories analyzed in this asset management plan.

I. Introduction & Context

Across Canada, 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 province's infrastructure assets than both the provincial and federal government. The asset portfolios managed by Ontario's municipalities are also highly diverse. The total replacement cost of capital assets analyzed in this document is $48.8 million. 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 asset management plan, (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

Inventory	Capture all asset types, inventories and historical data.
Current Valuation	Calculate current condition ratings and replacement values.
Life Cycle Analysis	Identify Maintenance and Renewal Strategies & Life Cycle Costs.
Service Level Targets	Define measurable Levels of Service Targets
Risk & Prioritization	Integrates all asset categories through risk and prioritization strategies.
Sustainable Financing	Identify sustainable Financing Strategies for all asset categories.
Continuous Processes	Provide continuous processes to ensure asset information is kept current and accurate.
Decision Making & Transparency	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 – THE INSTITUTE OF ASSET MANAGEMENT (IAM)

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 life cycles, 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 the Township of Mulmur's 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, useful life etc., summarizes the physical health of the capital assets, assess 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.

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 stipulating the inclusion of all eligible asset categories. Previously, only core infrastructure categories were analyzed. The following asset categories are analysed in this document: road network; bridges & culverts; buildings; storm; water; machinery & equipment; vehicles; and land improvements.

This AMP includes a detailed discussion of the state of local infrastructure and assets for each category; outlines industry standards levels of service and key performance indicators (KPIs); outlines asset management renewal strategy for major infrastructure; and provides financial strategy to mitigate funding shortfalls.

IV. Data and Methodology

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

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; therefore, while deficiencies may be present at the individual level, imprecisions are minimized at the asset-class level as the data is aggregated.

As available, actual field condition data was used to make recommendations more precise. The value of condition data cannot be overstated as they provide a more accurate representation of the state of infrastructure. 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, aggregated, and an average for the previous three years is calculated, 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.

Only predictable sources of funding are used, e.g., tax and rate revenues, user fees, and other streams of income the municipality can rely on with a high degree of certainty. Government grants and other ad-hoc injections of capital are not enumerated in this asset management plan given their unpredictability. As senior governments make greater, more predictable and permanent commitments to funding municipal infrastructure programs, e.g., the federal Gas Tax Fund, future iterations of this asset management plan will account for such funding sources.

3. Infrastructure Report Card

The asset management plan is a complex document, but one with direct implications on the public, a group with varying degrees of technical knowledge. To facilitate communications, we've developed an Infrastructure Report Card that summarizes our findings in accessible 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.

TABLE 3 INFRASTRUCTURE REPORT CARD DESCRIPTION

Financial Capacity	A municipality's financial capacity is determined by how well it's meeting the average annual investment requirements (0-100%) for each infrastructure class.
Asset Health	Using either field inspection data as available or age-based data, the asset health provide a grade for each infrastructure class based on the portion of assets in poor to excellent condition (0-100%). We use replacement cost to determine the weight of each condition group within the asset class.

Letter Grade	Rating	Description
A	Very Good	The asset is functioning and performing well; only normal preventative 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.

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

2. 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.

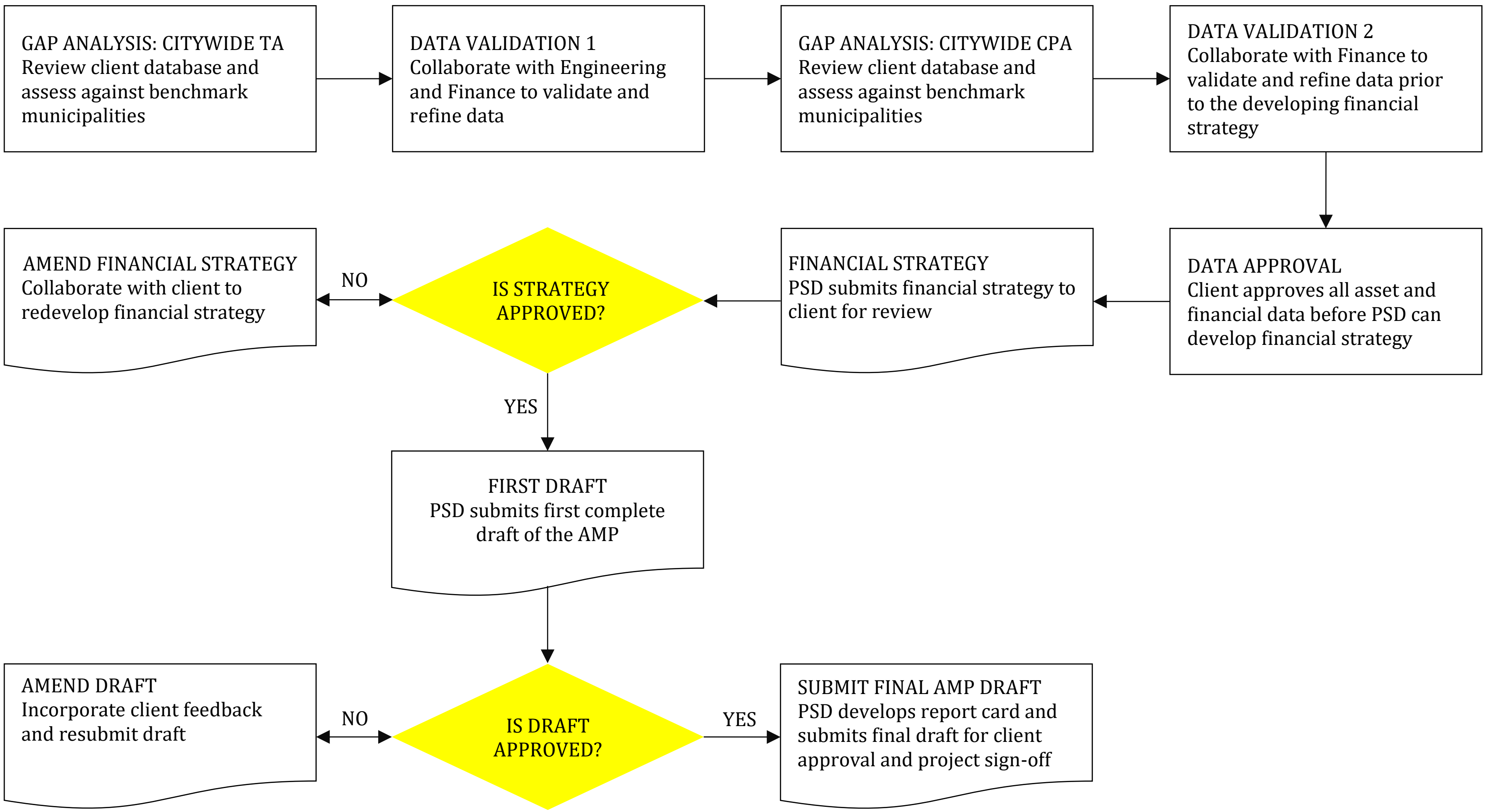
3. Our calculations and recommendations will reflect the best available data at the time this AMP was developed.

4. The focus of this plan is restricted to capital expenditures and does not capture O&M 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. Aggregate Indicators

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 asset management plan for the municipality had a total 2016 valuation of $48.8 million, of which bridges & culverts comprised 44%, followed by roads at 20%. The ownership per household (Figure 4) totaled $74,000 based on 1,721 households for all service areas except for water and storm services which serve 152 households.

FIGURE 3 ASSET VALUATION BY CLASS

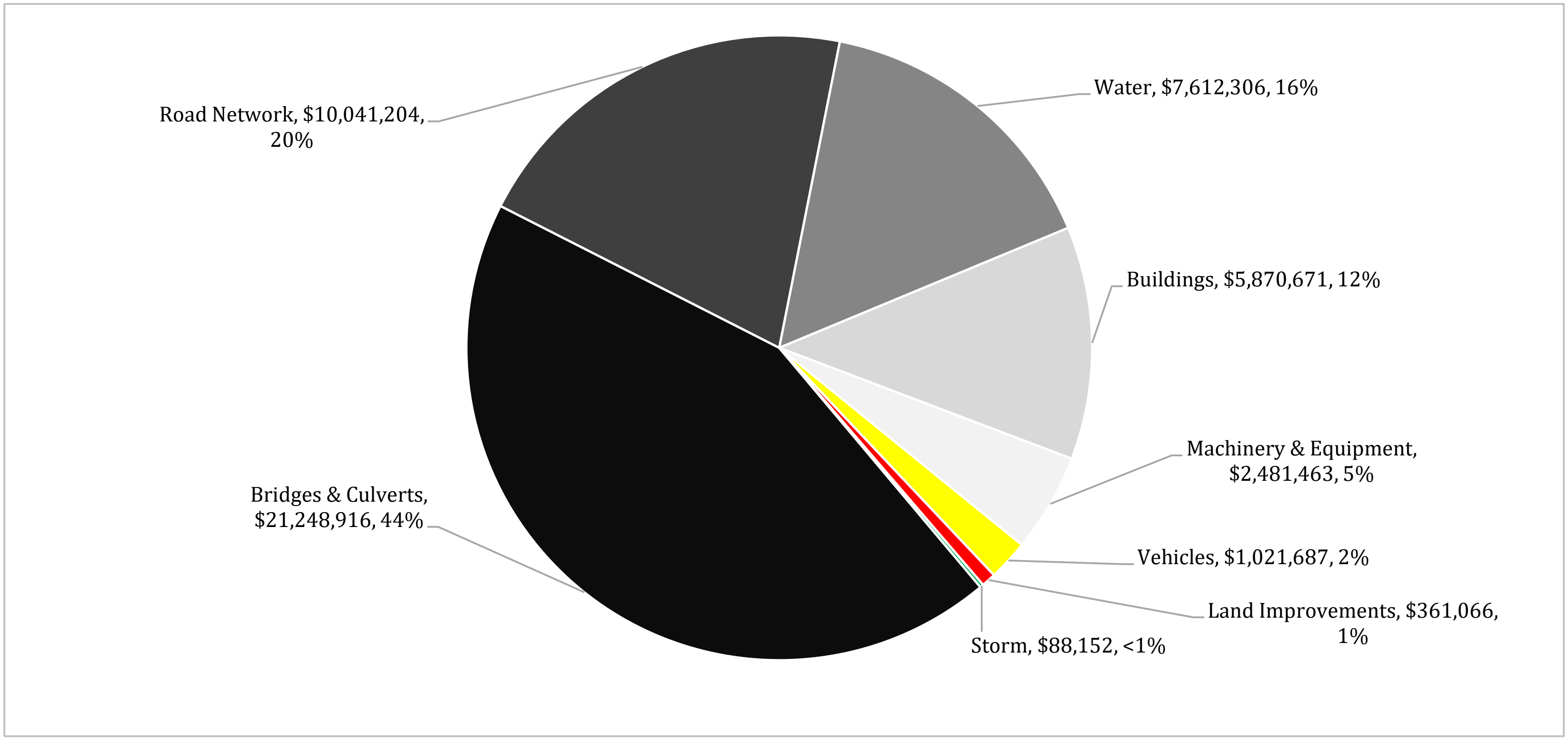
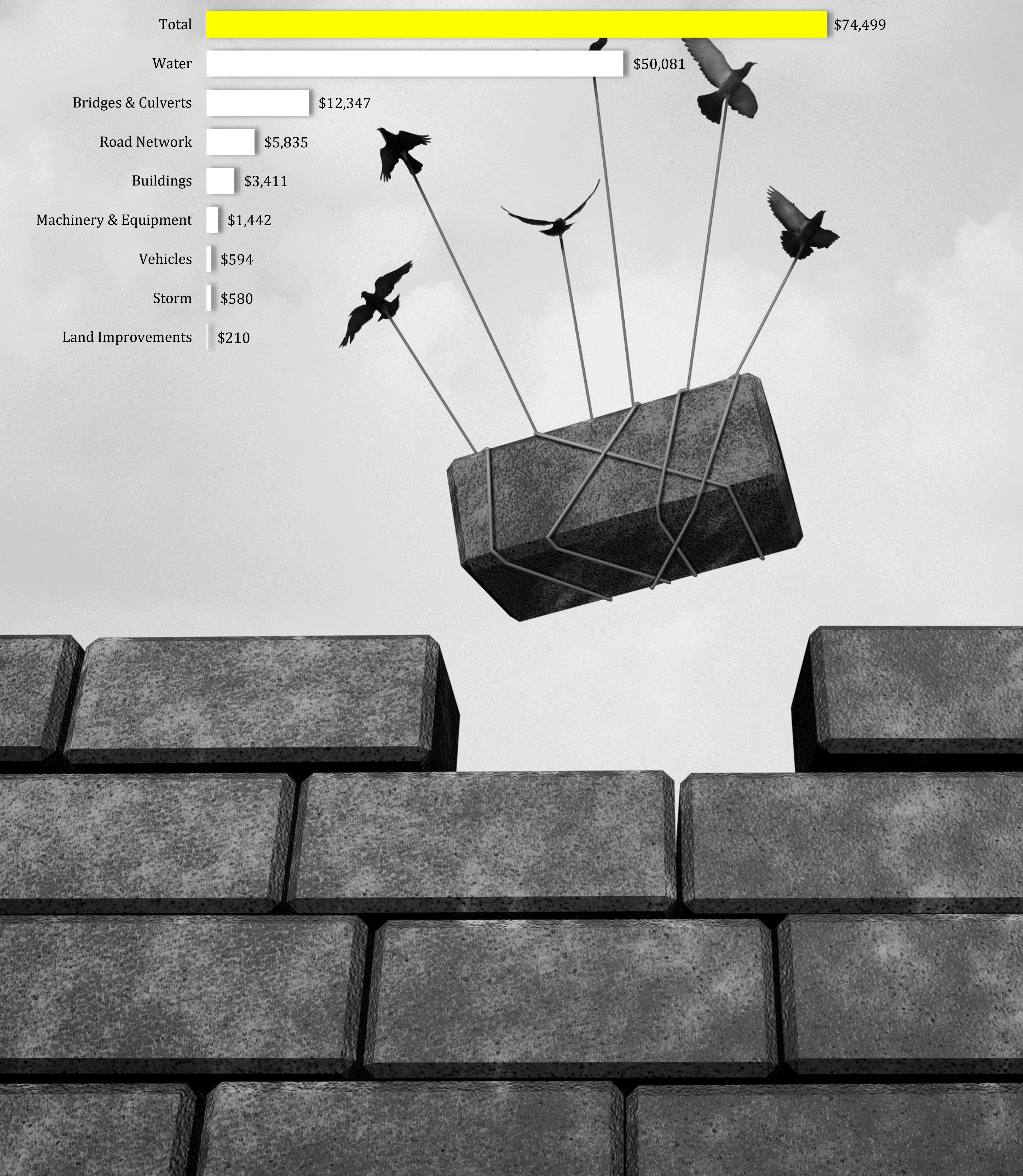


FIGURE 4 2016 OWNERSHIP PER HOUSEHOLD



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, 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 asset classes in this AMP.

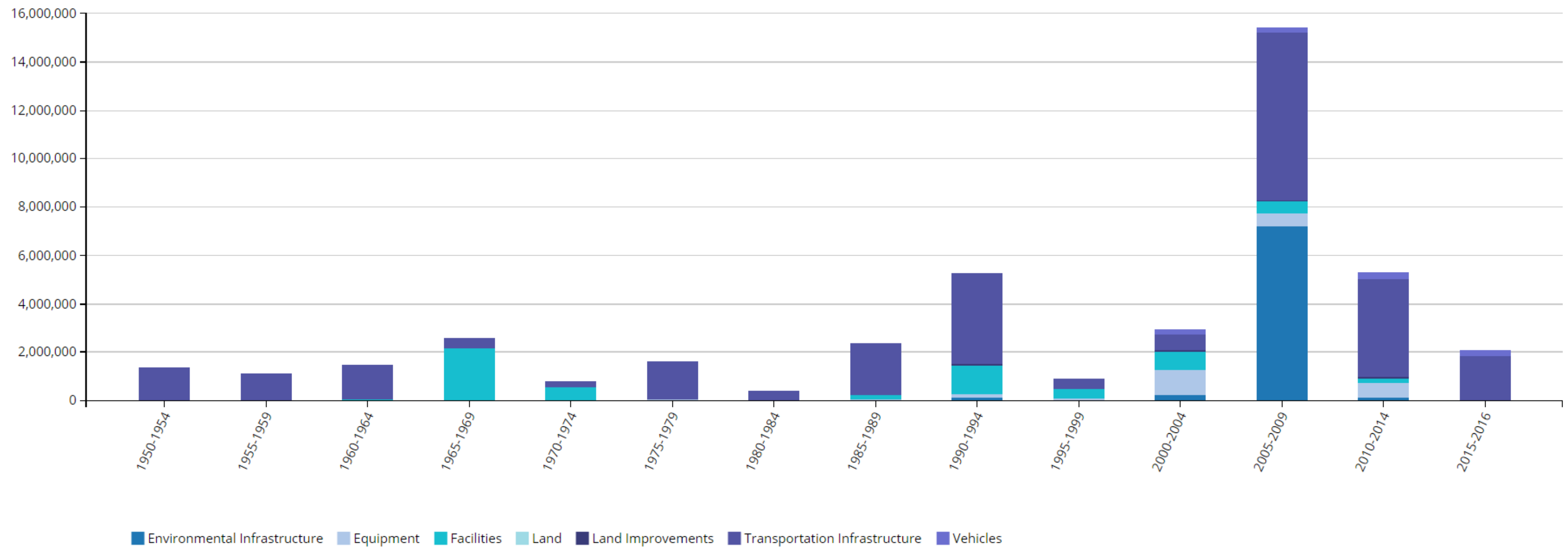
TABLE 4 SOURCE OF CONDITION DATA BY ASSET CLASS

Asset Category	Component	Source of Condition Data
Roads Network	Road Base	Age-based (68%), Assessed (32%)
	Road Surface - Asphalt	Age-based (5%), Assessed (95%)
	Road Surface - Surface Treatment	Age-based
	Road Surface - Gravel	Age-based
	Barriers	Age-based
	Signs	Age-based
	Streetlights	Age-based
Bridges & Culverts	Bridge Decks	Assessed
	Bridges	Assessed
	Box Culverts	Assessed
	Culverts	Age-based
Water System	All	Age-based
Storm Water System	All	Age-based
Facilities	All	Age-based
Land Improvements	All	Age-based
Equipment	All	Age-based
Rolling Stock	All	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. The installation year profile in Figure 5 illustrates the historical invesments in infrastructure across the asset classes analyzed in this AMP since 1950 using 2016 replacement costs. Often, investment in critical infrastructure parallels population growth or other significant shifts in demographics.

FIGURE 5 HISTORICAL INVESTMENT IN INFRASTRUCTURE - ALL ASSET CLASSES

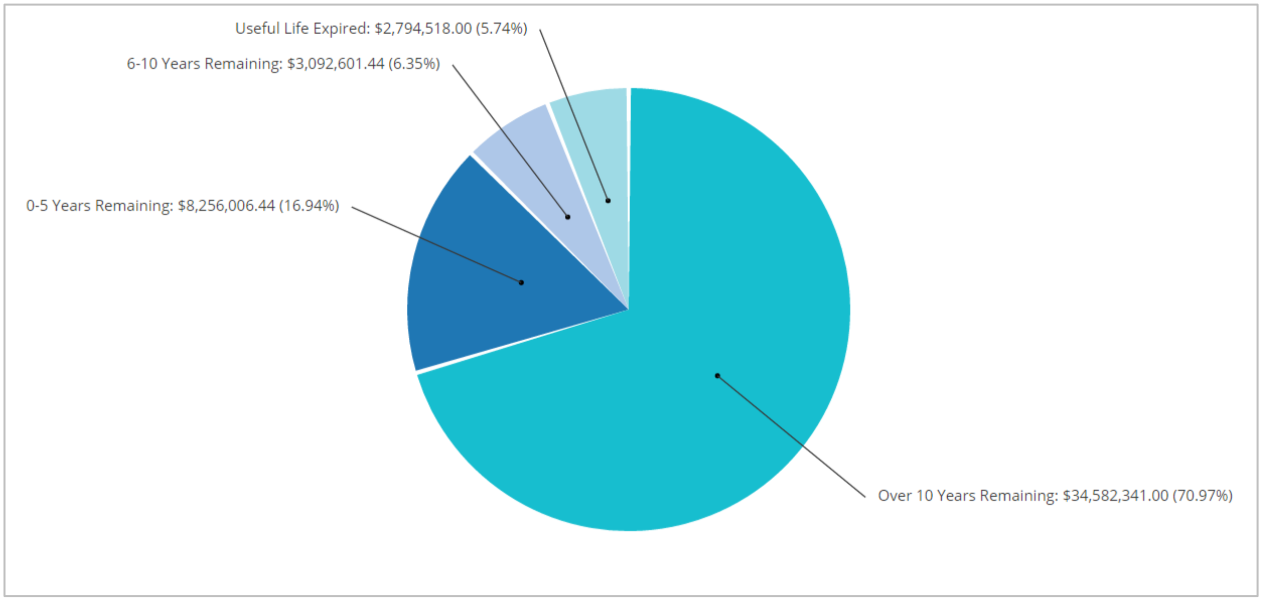


Investments, primarily in transportation infrastructure, remained consistent until the 1990s when they had a large increase as the municipality updated or grew its asset portfolio. Expenditures have fluctuated since 2000. In the period between 2005-2009, the municipality made its largest expenditures, totaling more than $15 million, allocated primarily to environmental infrastructure ($7.2 million) and transportation infrastructure ($7 million). Since 2010, expenditures have totaled $7.4 million.

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

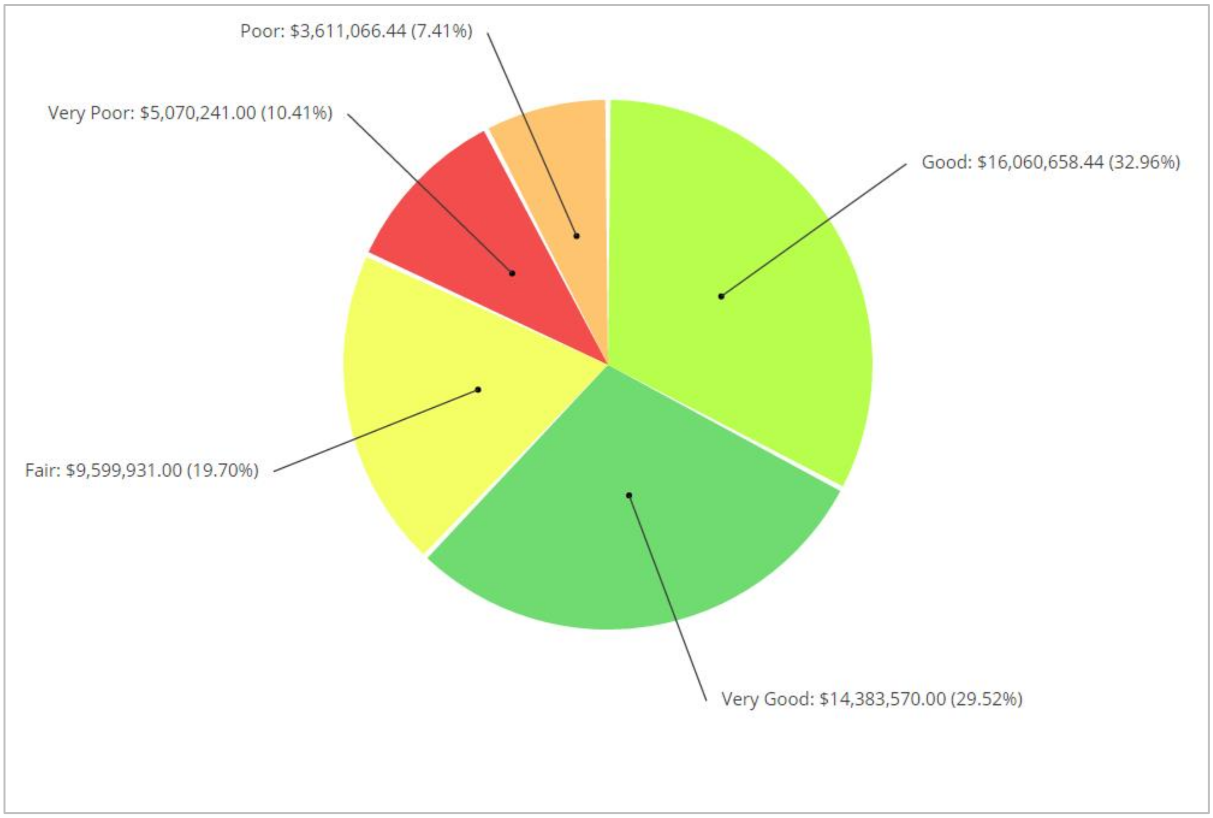


More than 70% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 6%, with a valuation of $2.8 million, remain in operation beyond their established useful life. An additional 17%, with a valuation of $8.3 million, will reach the end of their useful life within the next five years.

5. Overall Condition – All Asset Classes

Based on 2016 replacement cost, and a blend of age-based and assessed condition data, 63% of the municipality's assets are in good to very good condition as of 2015. However, 18%, with a valuation of $8.7 million are in poor to very poor condition.

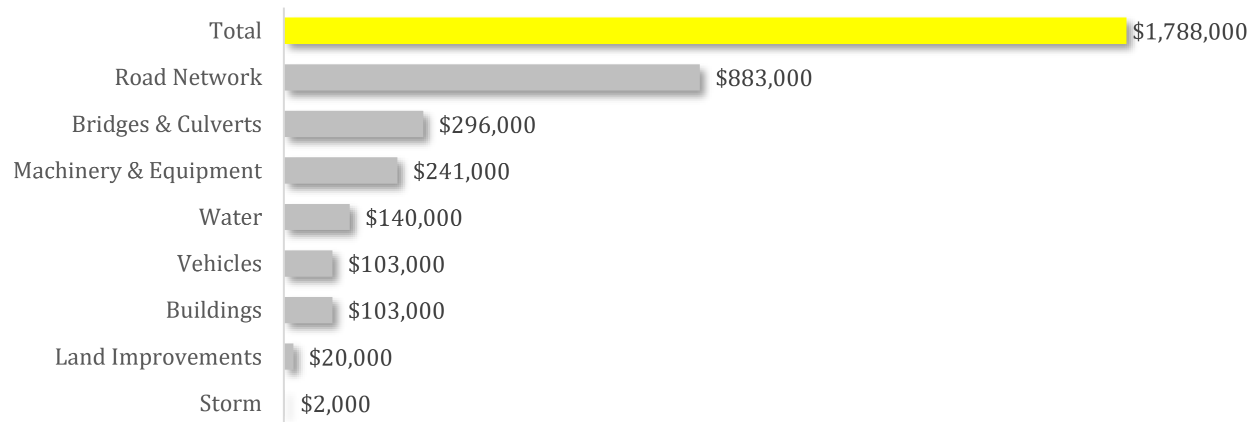
FIGURE 7 ASSET CONDITION DISTRIBUTION BY REPLACEMENT COST AS OF 2015 - ALL CLASSES



6. Financial Profile

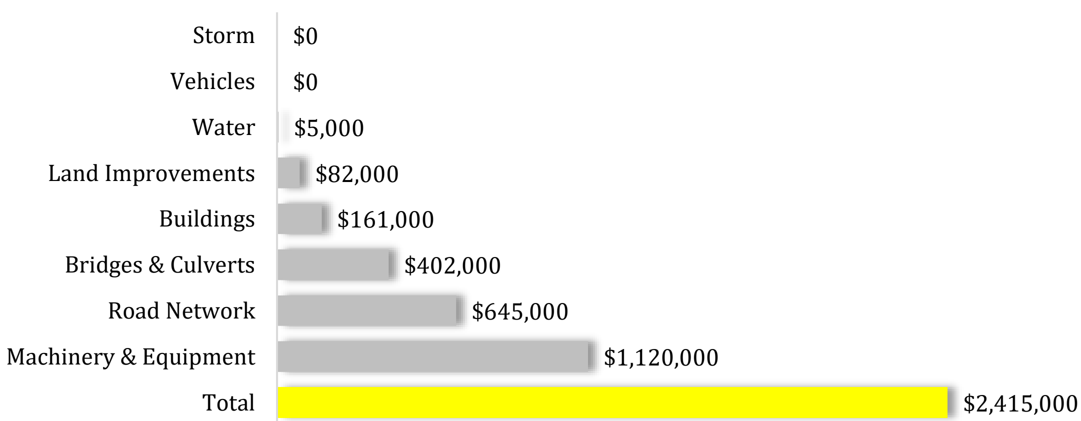
This section details key financial indicators related to the municipality's asset classes as analyzed in this asset management plan.

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 need as they arise, prevent infrastructure backlogs and achieve long-term sustainability. In total, the municipality must allocate $1.8 million annually for the assets covered in this AMP.

FIGURE 9 INFRASTRUCTURE BACKLOG - ALL ASSET CLASSES

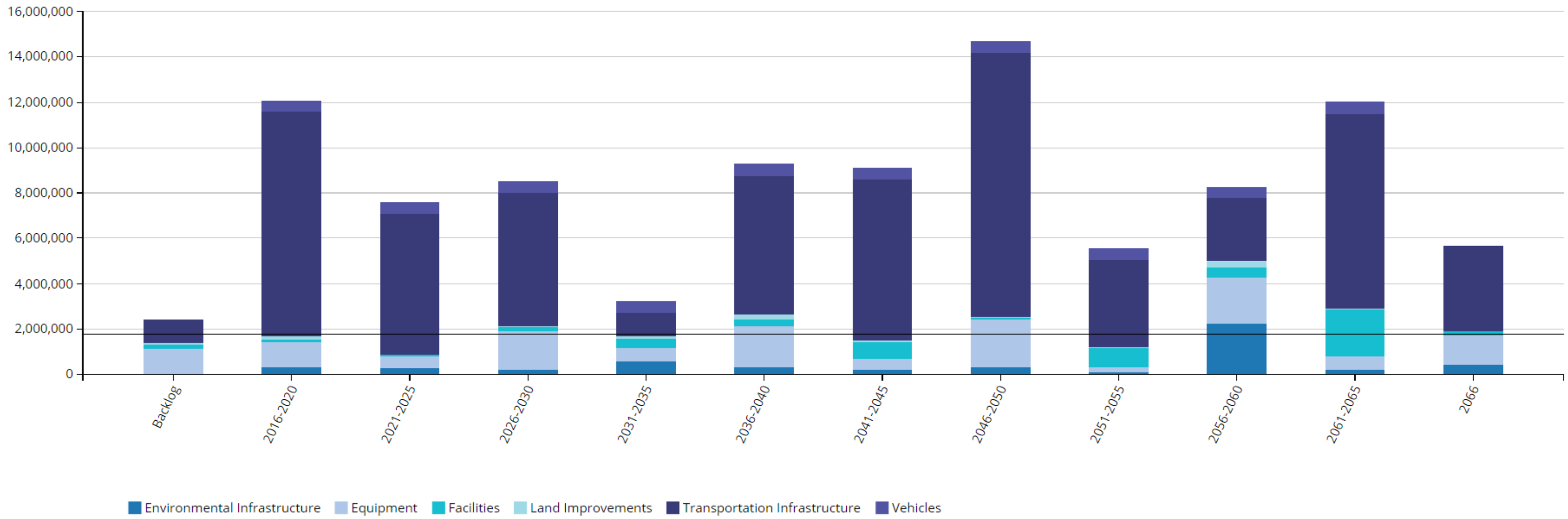


The municipality has a combined infrastructure backlog of $2.4 million, with machinery & equipment comprising 46%. The backlog represents the investment needed today to meet previously deferred replacement needs. In the absence of assessed data, the backlog represents the value of assets still in operation 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 categories as analyzed in this AMP. 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 10 REPLACEMENT PROFILE - ALL ASSET CLASSES



Based primarily on age data, the municipality has a combined backlog of more than $2.4 million, of which equipment assets comprise $1.1 million, followed by transportation infrastructure at $1 million. Aggregate replacement needs will total more than $12 million over the next five years; transportation infrastructure will comprise $10 million of these requirements. The municipality's aggregate annual requirements (indicated by the black line) total $1.8 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 categories as they arise without the need for deferring projects and accruing annual infrastructure deficits. Currently, the municipality is funding 61% of its annual requirements for tax-funded assets and 24% for its rate-funded assets. See the 'Financial Strategy' chapter for achieving a sustainable funding level. 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 very high degree of confidence in the data used to develop this AMP, receiving a weighted confidence rating of 90%. 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 is from an authoritative source.	The data is error free.	The data is verified by an authoritative source.	Average Confidence Rating	Weighted Average Data Confidence Rating
Road Network	90%	90%	90%	80%	100%	90%	19%
Bridges & Culverts	90%	90%	90%	80%	100%	90%	39%
Water	90%	90%	90%	80%	100%	90%	14%
Storm	90%	90%	90%	80%	100%	90%	<1%
Facilities	90%	90%	90%	80%	100%	90%	11%
Land Improvements	90%	90%	90%	80%	100%	90%	1%
Rolling Stock	90%	90%	90%	80%	100%	90%	2%
Machinery & Equipment	90%	90%	90%	80%	100%	90%	5%
Overall Weighted Average Data Confidence Rating							90%

VI. State of Local Infrastructure

In this section, we detail key indicators for each class discussed in this asset management plan. 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

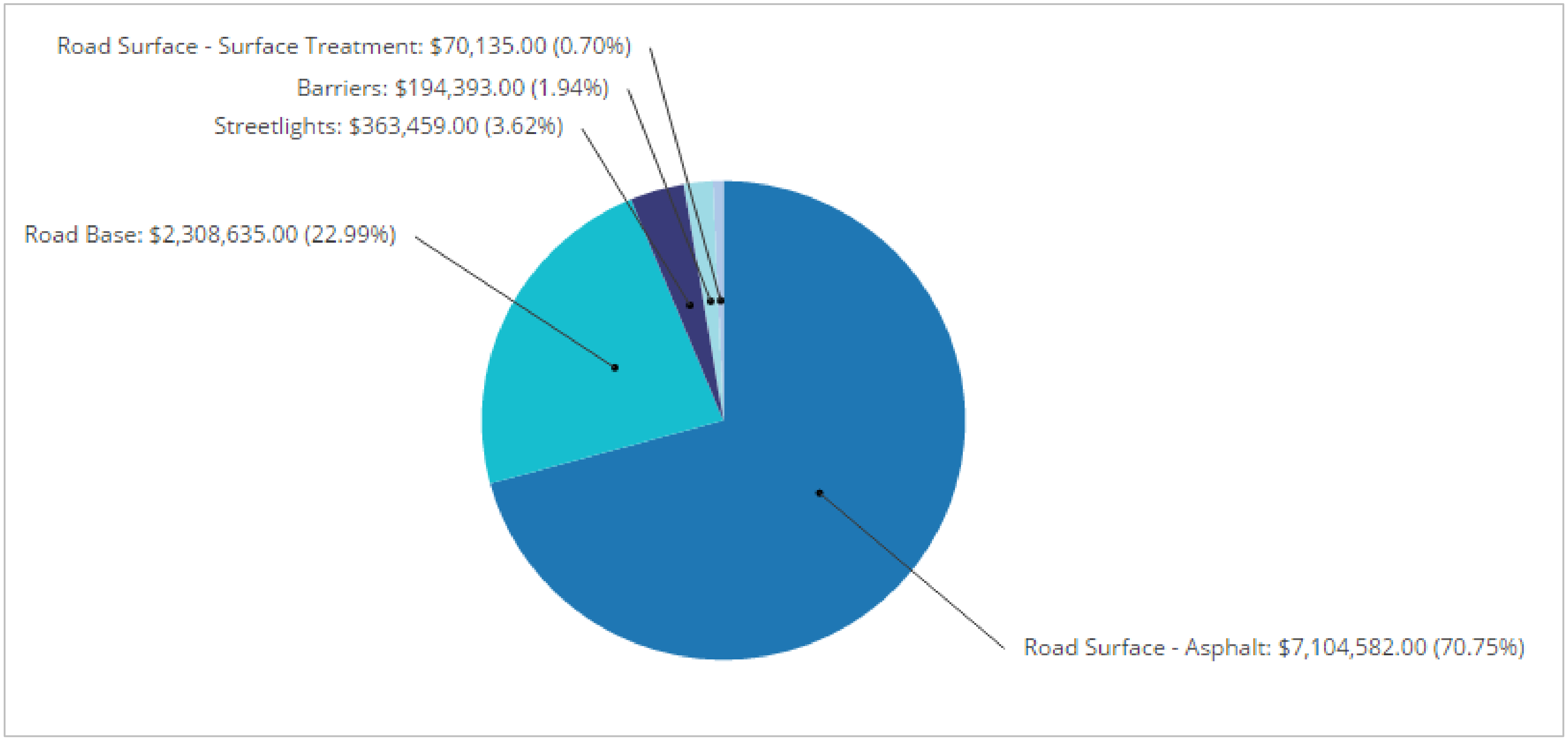
Table 6 illustrates key asset attributes for the municipality's road network, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement cost were derived. In total, the municipality's roads assets are valued at $10 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

TABLE 6 KEY ASSET ATTRIBUTES – ROAD NETWORK

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Road Network	Road Base	278,381m	40	CPI Tables	$2,308,635
	Road Surface - Asphalt	60,704m	15	User Defined Cost	$7,104,582
	Road Surface - Surface Treatment	2,163m	4	CPI Tables	$70,135
	Road Surface - Gravel	26,810m	4	CPI Tables	Not planned for replacement
	Barriers	2,337m	25	CPI Tables	$194,393
	Signs	625	10	CPI Tables	Not planned for replacement
	Streetlights	93	25	CPI Tables	$363,459
				Total	$10,041,204

Note that the municipality is planning to pave the road surface – surface treated asset in 2017. This project has an estimated cost of $300,000.

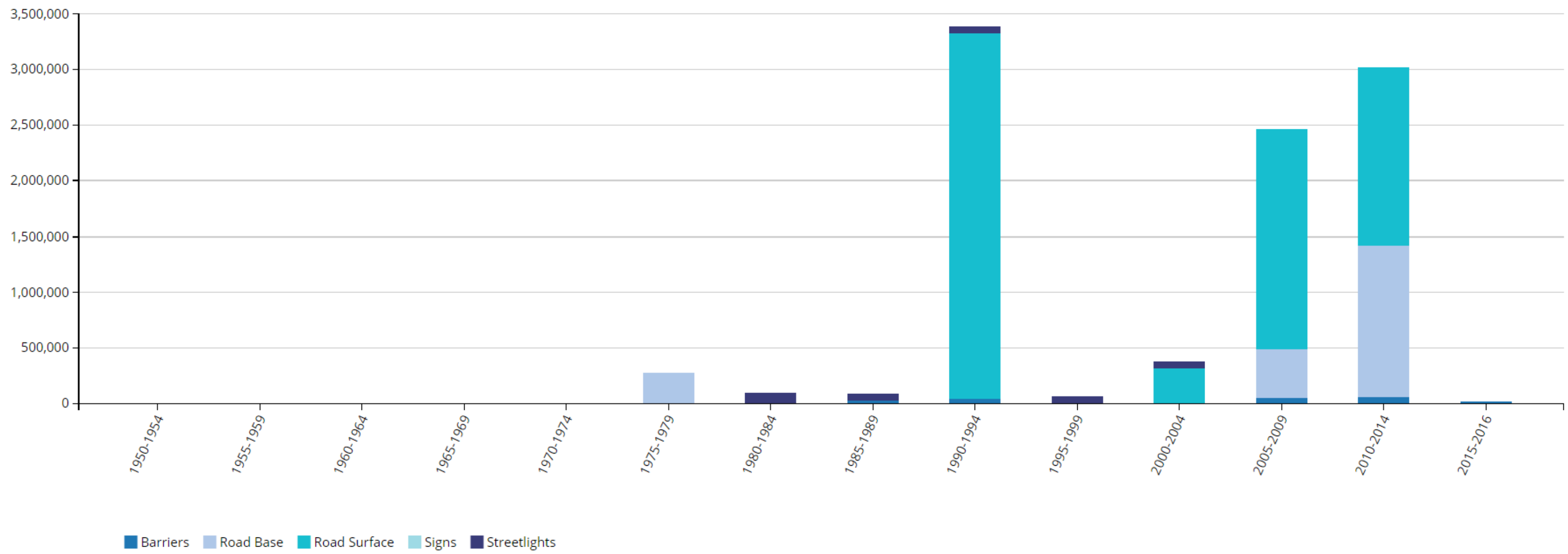
FIGURE 11 ASSET VALUATION – ROAD NETWORK



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 short-, medium- and long-term replacement needs.

FIGURE 12 HISTORICAL INVESTMENT – ROAD NETWORK

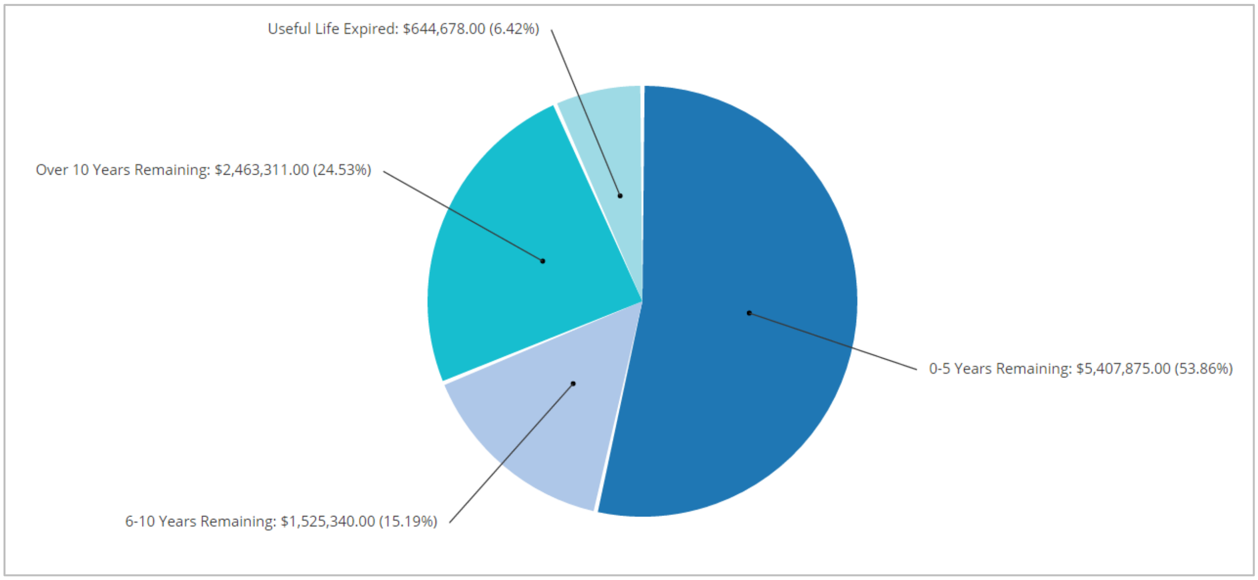


Major investments in the municipality's road network took place in the early 1990s, with expenditures totaling $3.4 million, allocated primarily to road surfaces. Expenditures have risen again since 2000, totaling $6 million, with investments in road base totaling $1.7 million.

1.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 13 illustrates the useful life consumption levels as of 2015 for the municipality's road network.

FIGURE 13 USEFUL LIFE CONSUMPTION - ROAD NETWORK

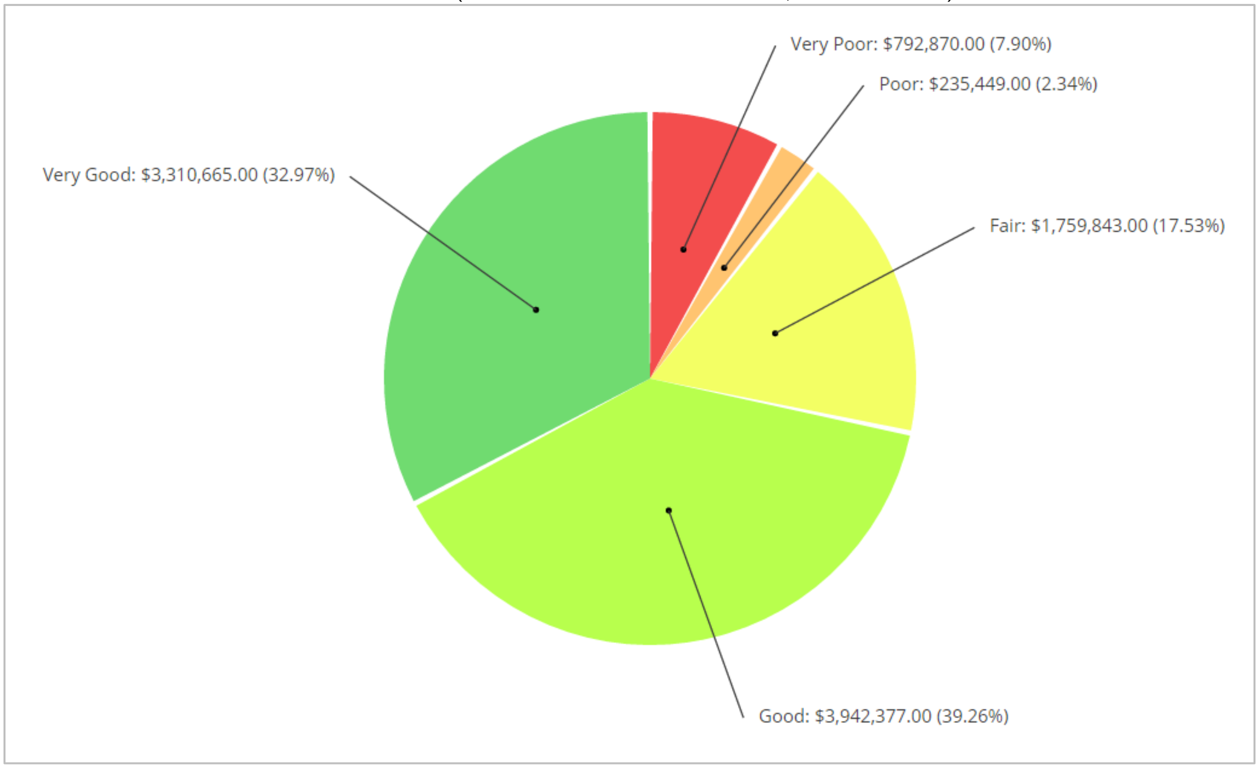


More than 50% of the municipality's road network assets, with a valuation of $5.4 million, have less than five years of useful life remaining. An additional 6% remain in operation beyond their useful life.

1.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's road network 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. Based on information provided by the municipality, 95% of paved surfaces and 32% of the roads base have condition data available, respectively; remaining assets rely on age-based approximations.

FIGURE 14 ASSET CONDITION - ROAD NETWORK (ASSESSED: 95% PAVED SURFACES; 32% ROAD BASE)

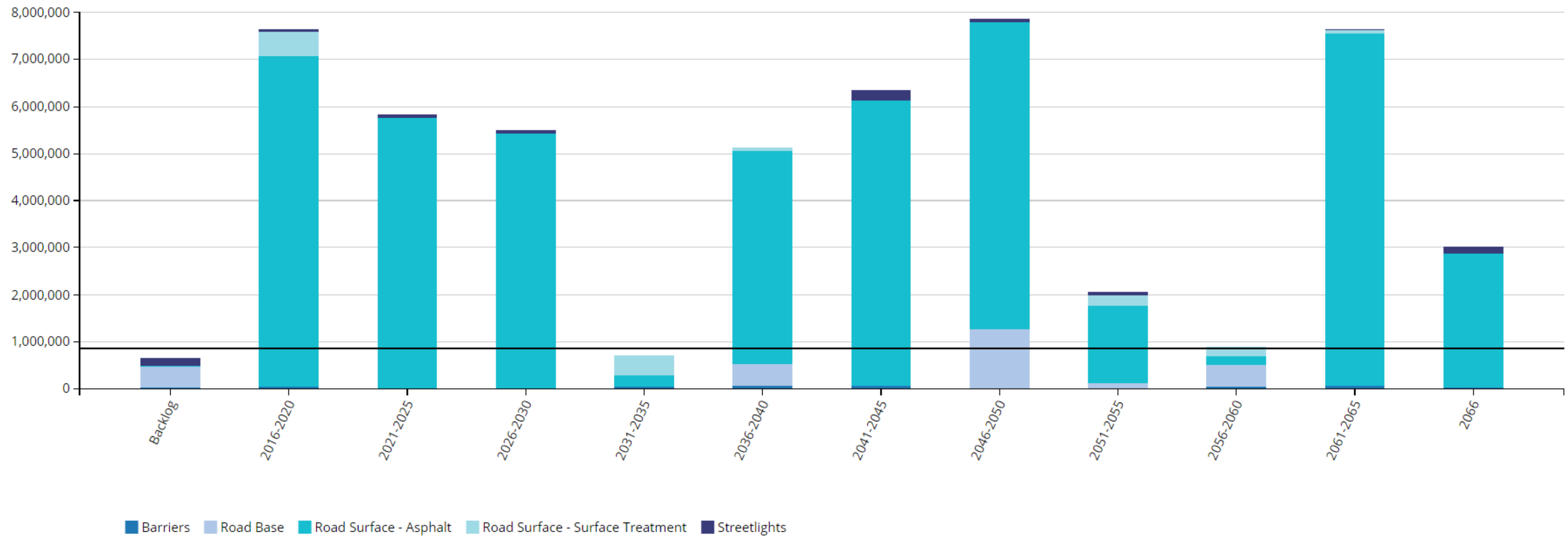


While more than 70% of the road network is in good to very good condition, 10%, with a valuation of more than $1 million, is in poor to very poor condition.

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 $645,000, replacement needs are forecasted to be $7.7 million over the next five years; an additional $5.8 million will be required between 2021 and 2025. The municipality's annual requirements (indicated by the black line) for its road network total $883,000. 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. However, the municipality is currently allocating $160,000, leaving an annual deficit of $723,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

1.6 Recommendations – Road Network

- The municipality should continue its condition assessments of road surfaces and base, and expand the program to incorporate additional asset components.

- A blend of age and observed data indicates a backlog of $645,000 and near-term replacement needs of more than $13 million. 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 life cycle activity framework should also be developed to promote standard life cycle 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'

- The municipality is funding only 18 % of its long-term replacement needs. See the 'Financial Strategy' section on how to achieve more sustainable funding levels.

2. Bridges & Culverts

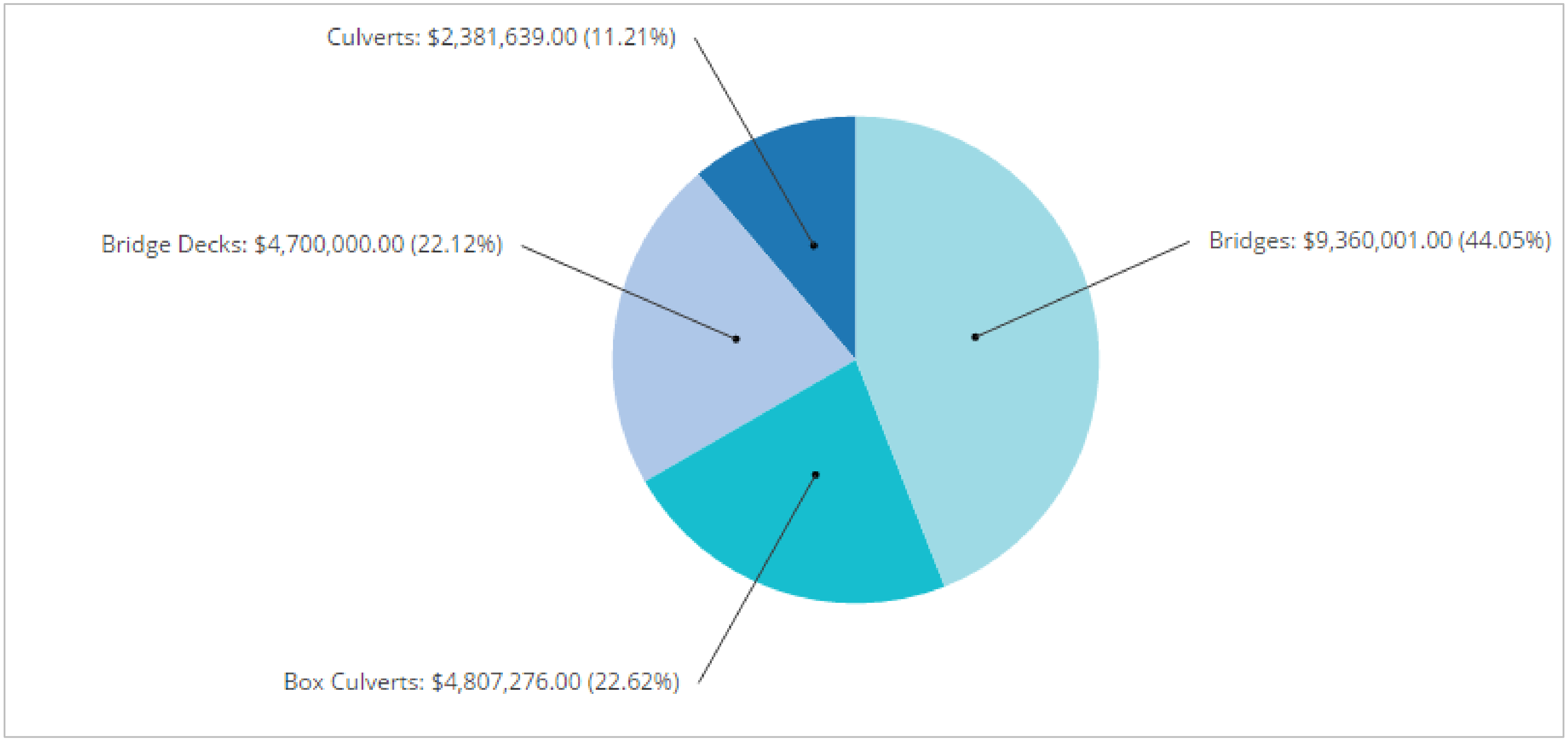
2.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

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 $21 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality.

TABLE 7 KEY ASSET ATTRIBUTES – BRIDGES & CULVERTS

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Bridges & Culverts	Bridge Decks	20	50	User Defined Cost	$4,700,000
	Bridges	21	75	CPI Table	$9,360,001
	Box Culverts	14	50 to 75	CPI Table	$4,807,276
	Culverts	45	40	CPI Table	$2,381,639
				Total	$21,248,916

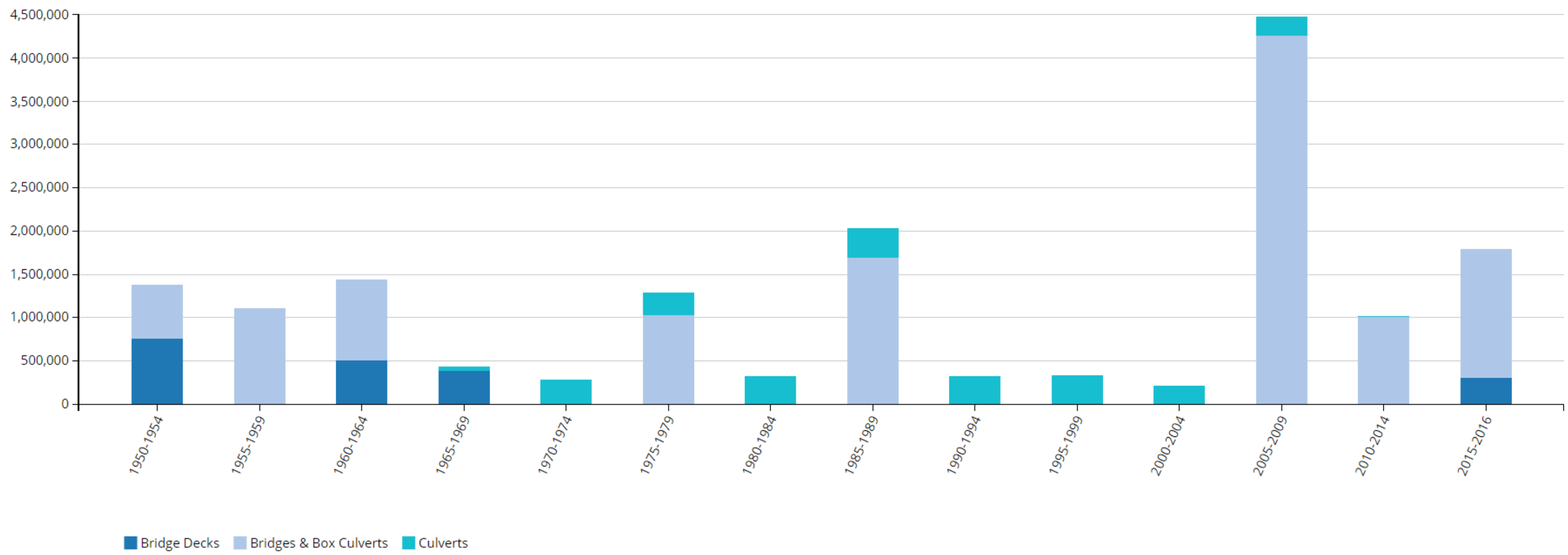
FIGURE 16 ASSET VALUATION – BRIDGES & CULVERTS



2.2 Historical Investment in Infrastructure

Figure 17 shows the municipality's historical investments in its bridges & culverts since 1950 based on 2016 replacement costs. 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 short-, medium- and long-term replacement needs.

FIGURE 17 HISTORICAL INVESTMENT - BRIDGES & CULVERTS

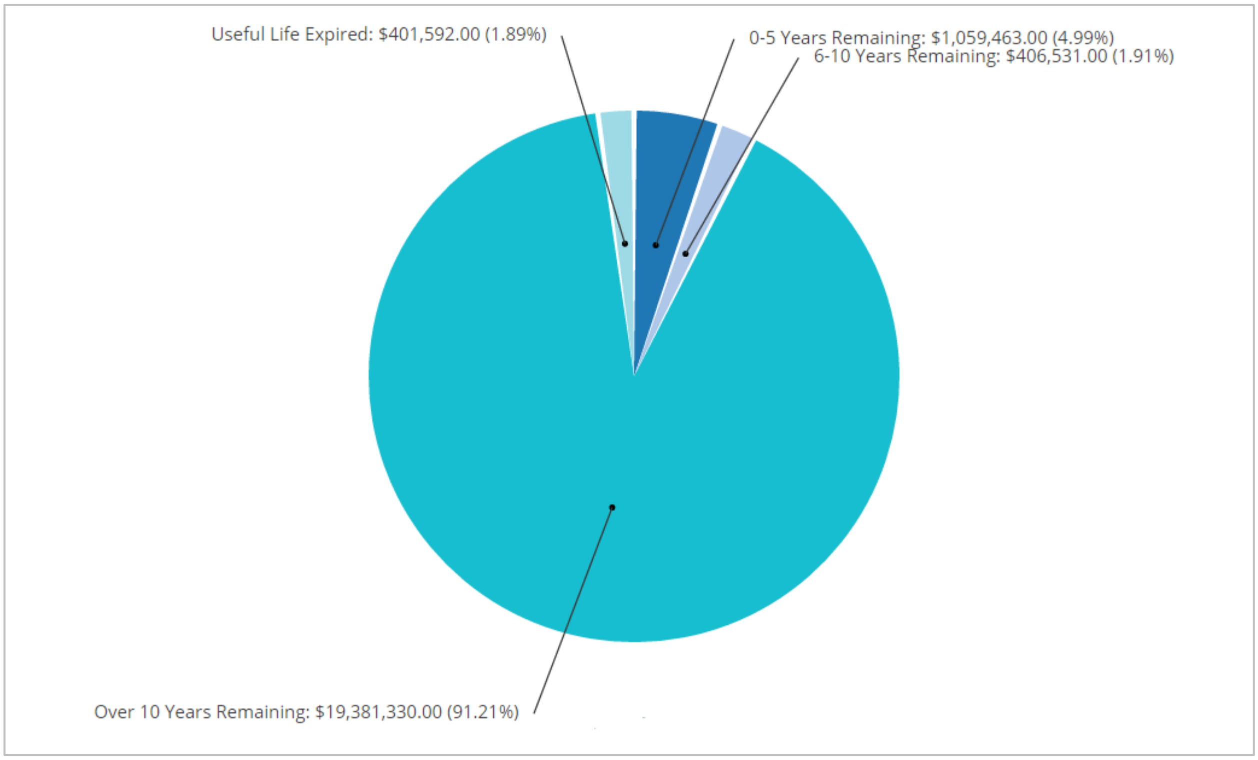


While the municipality has invested consistently in its bridges & culverts over the last six decades, major investments occurred in the late 1970s and 1980s. Between 2005-2009, the municipality incurred the largest expenditures, totaling $4.5 million, primarily in bridges and & box culverts. Since 2010, investments have totaled $2.8 million.

2.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 18 illustrates the useful life consumption levels as of 2015 for the municipality's bridges & culverts.

FIGURE 18 USEFUL LIFE CONSUMPTION – BRIDGES & CULVERTS

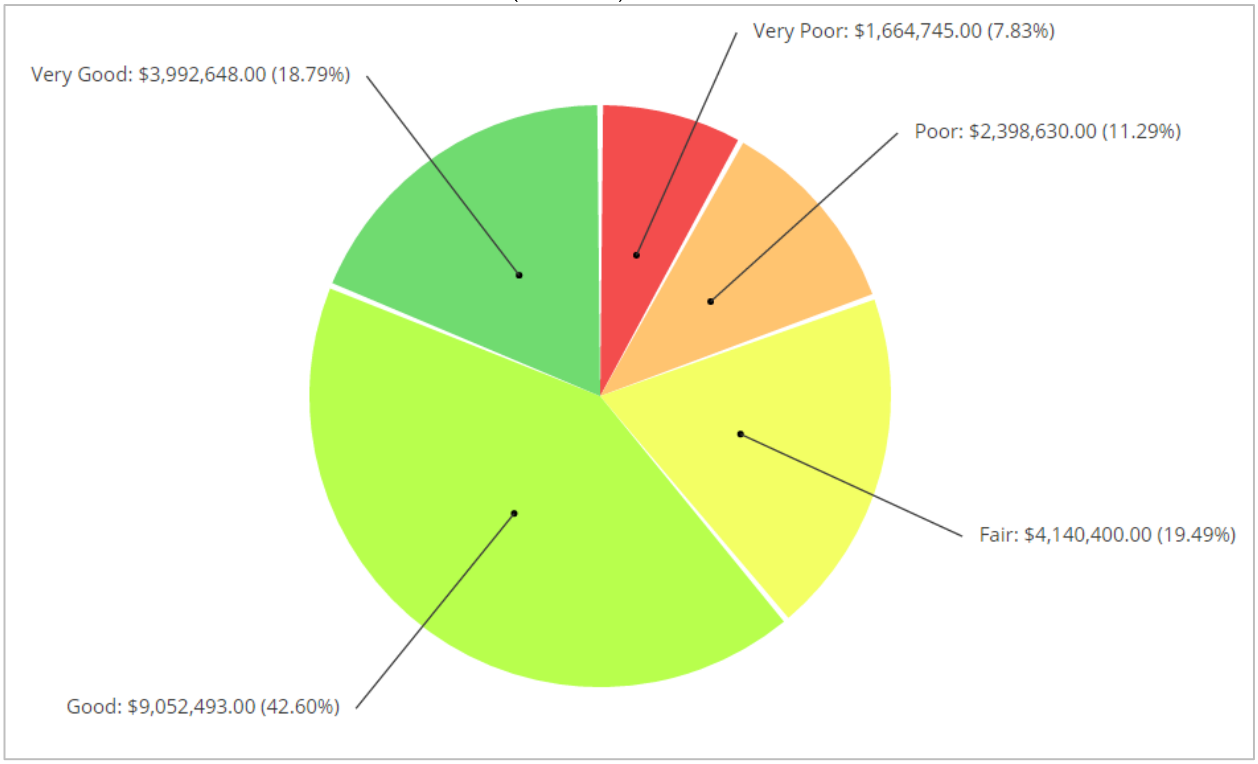


More than 90 % of the municipality's bridges & culverts have at least 10 years of useful life remaining; 2%, with a valuation of $402,000 remain in operation beyond their useful life. An additional 5% will reach the end of their useful life in the next five years.

2.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's bridges & culverts as of 2015. 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. The municipality has provided its OSIM inspection data for the purpose of this AMP.

FIGURE 19 ASSET CONDITION – BRIDGES & CULVERTS (ASSESSED)

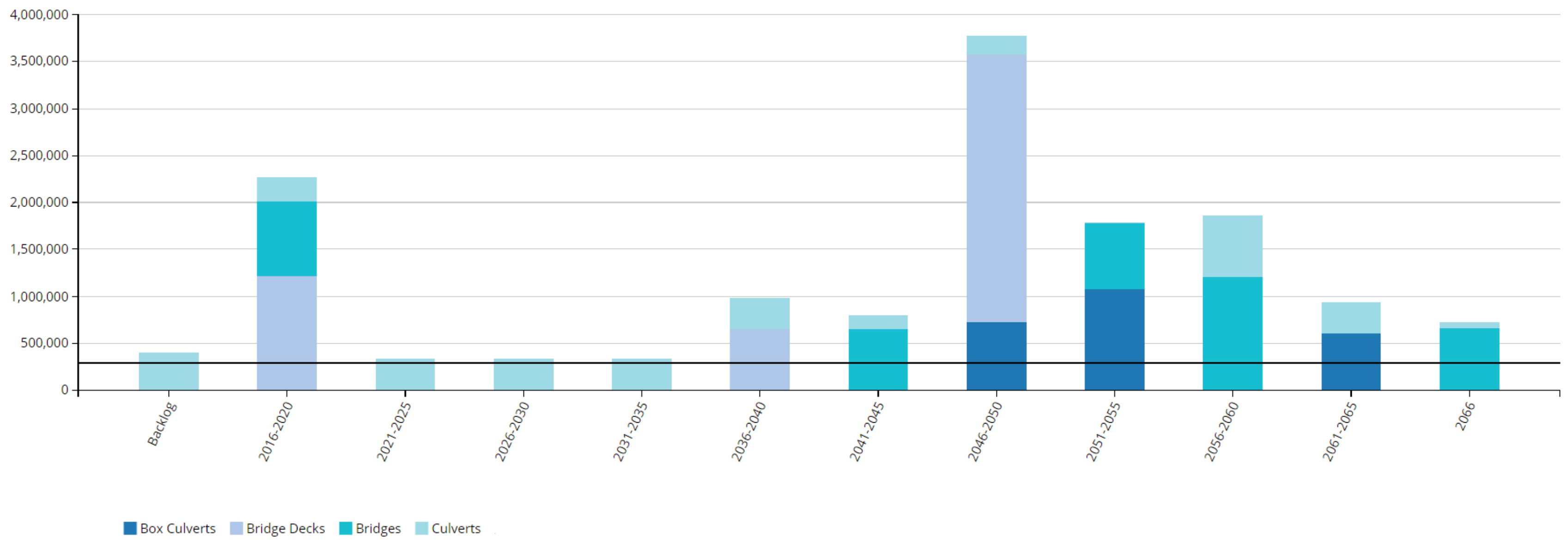


While 62% of the municipality's bridges & culverts are in good to very good condition, 20%, with a valuation of $4.1 million, are in poor to very poor condition.

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 $402,000, replacement needs for bridges & culverts are forecasted to be $2.3 million in the next five years; an additional $338,000 will be required between 2021 and 2030. The municipality's annual requirements (indicated by the black line) for its bridges & culverts total $296,000. 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. However, the municipality is currently allocating $200,000, leaving an annual deficit of $96,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

2.6 Recommendations – Bridges & Culverts

- The results and recommendations from the OSIM inspections should be 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’.

- The municipality is funding 68% of its long-term replacement needs. See the ‘Financial Strategy’ section on how to achieve more sustainable funding levels.

3. Water

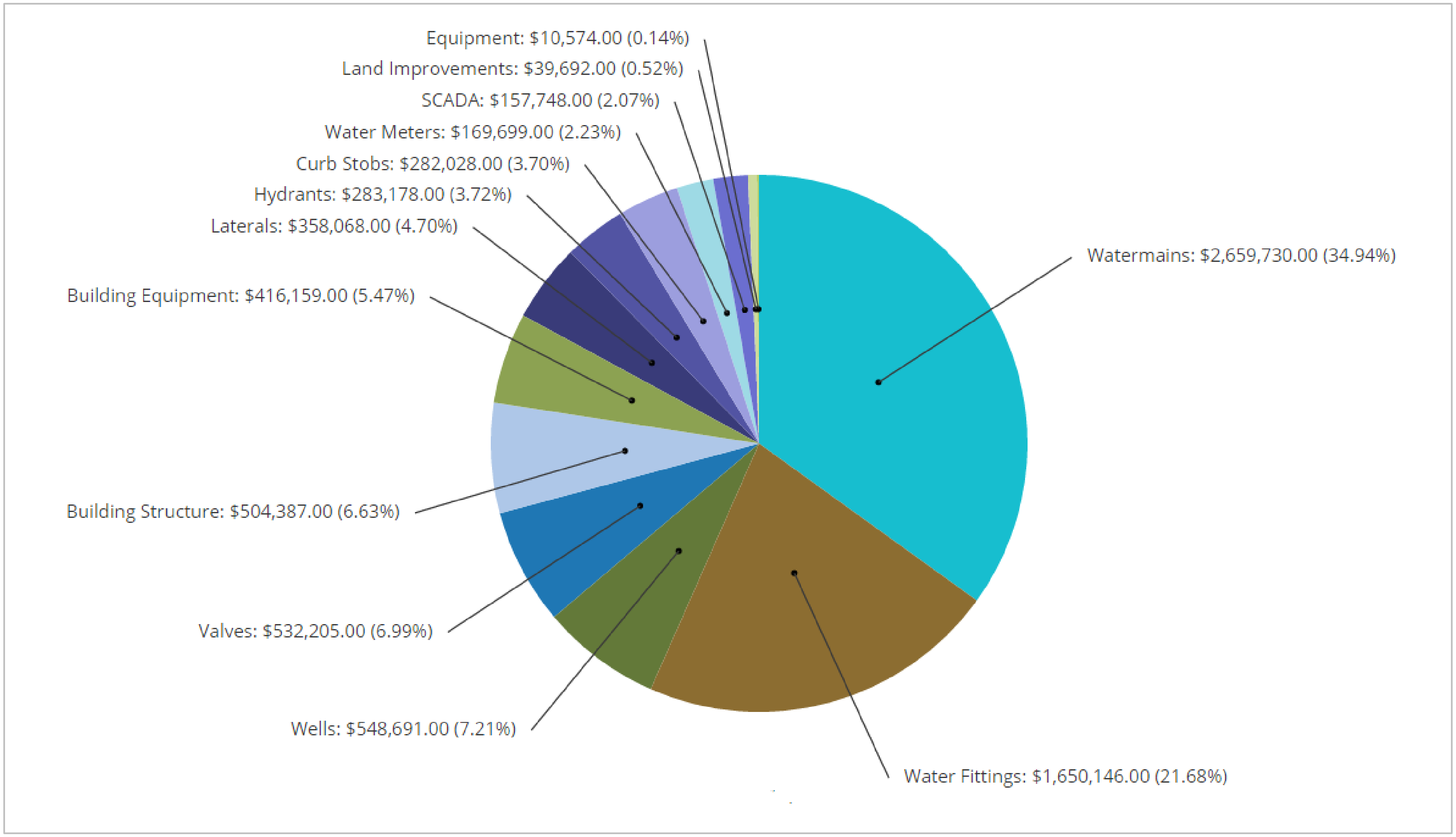
3.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the municipality's water system assets, 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 $7.6 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

TABLE 8 KEY ASSET ATTRIBUTES – WATER

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Water Services	Domestic Lateral 19 to 25 mm	1550	100	CPI Tables	$337,049
	Hydrant Lateral 150mm	69	100	CPI Tables	$21,019
	Watermains 150mm PVC	7,068	100	CPI Tables	$2,659,731
	Water Valves	53	25	CPI Tables	$532,205
	Water Fittings - Copper Tap 19 to 25mm	138	100	CPI Tables	$1,271,144
	Water Fittings - Tee 19 to 150mm PVC	35	100	CPI Tables	$333,344
	Water Fittings - Cross 150mm PVC	1	100	CPI Tables	$9,436
	Water Fittings - Cap 150mm PVC	4	100	CPI Tables	$36,222
	Water Meters	154	50	CPI Tables	$169,699
	Wells	9	15 to 50	CPI Tables	$548,691
	SCADA	1	10	CPI Tables	$157,748
	Hydrants	21	50	CPI Tables	$283,178
	Curb Stops - 19mm	153	50	CPI Tables	$282,028
	Water Equipment	7	10 to 100	CPI Tables	$426,733
	Water Facility	2	50	CPI Tables	$504,387
	Water Land Improvements	2	20 to 30	CPI Tables	$39,692
				Total	$7,612,306

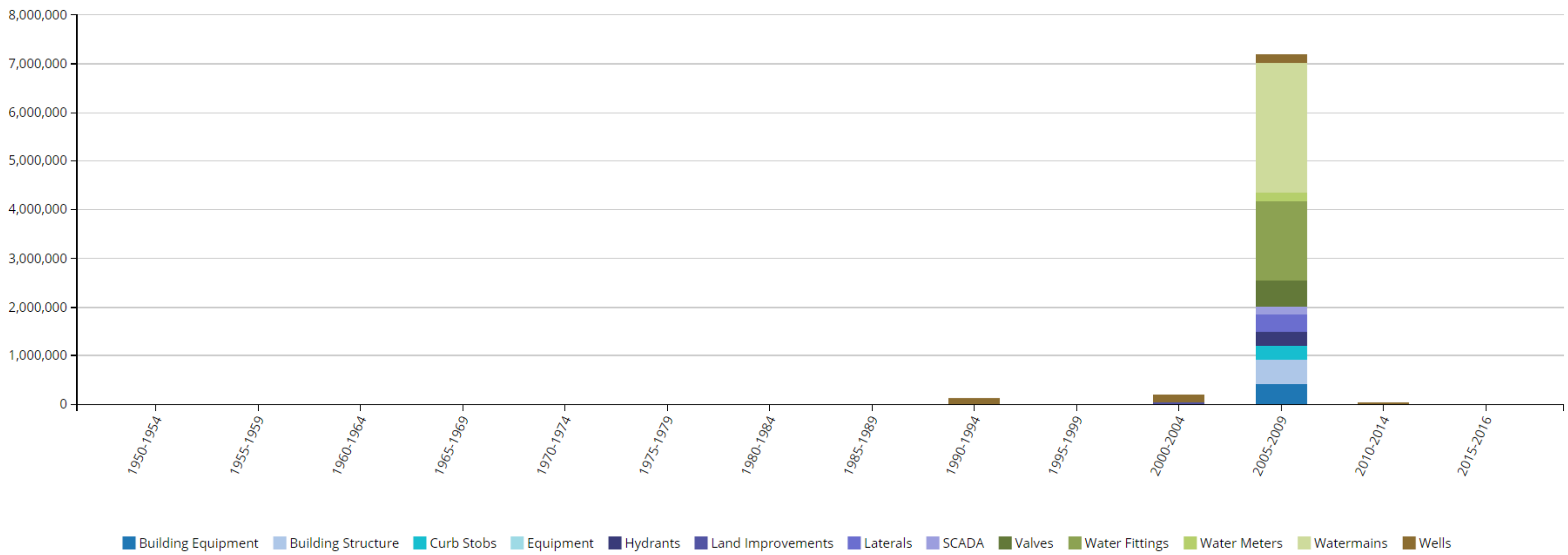
FIGURE 21 ASSET VALUATION – WATER SYSTEM



3.2 Historical Investment in Infrastructure

Figure 22 shows the municipality's historical investments in its water system since 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 3.3) can inform the forecasting and planning of short-, medium- and long-term replacement needs.

FIGURE 22 HISTORICAL INVESTMENT – WATER SYSTEM

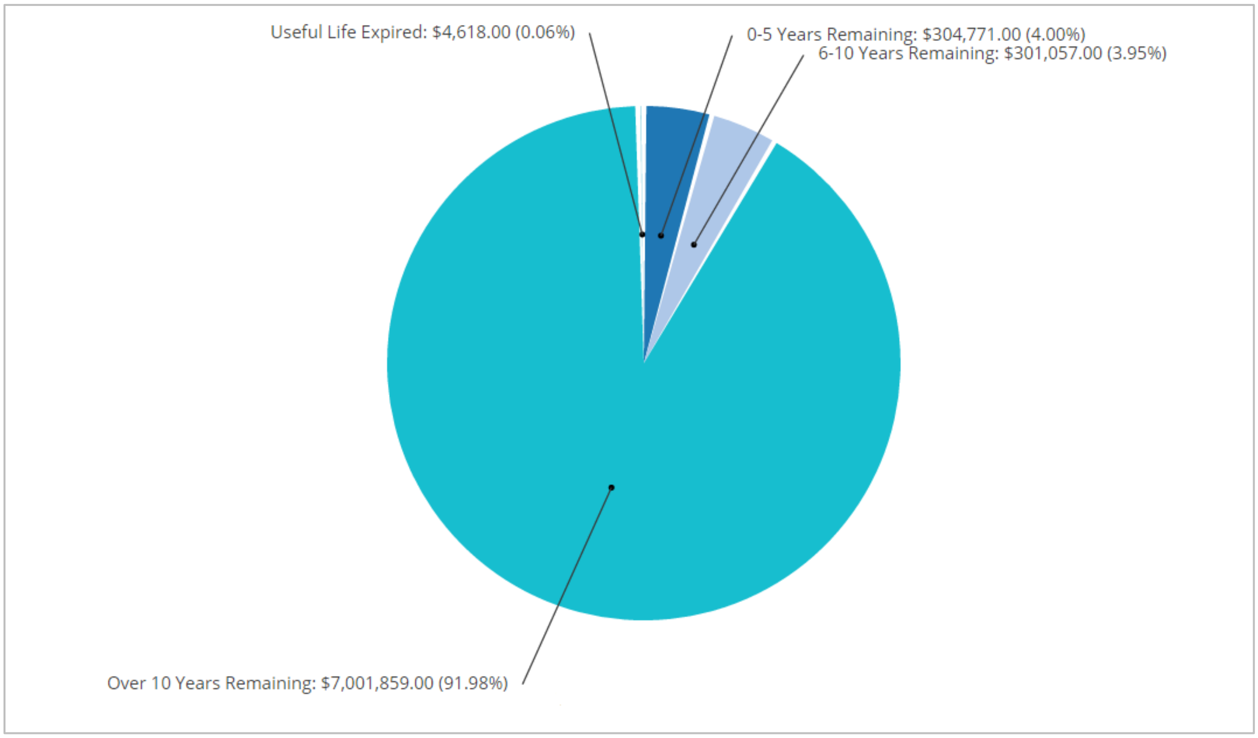


The vast majority of investment in the municipality's water system occurred between 2005-2009, with expenditures totaling $7.2 million, primarily in water mains and fittings.

3.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 23 illustrates the useful life consumption levels as of 2015 for the municipality's water system.

FIGURE 23 USEFUL LIFE CONSUMPTION – WATER SYSTEM

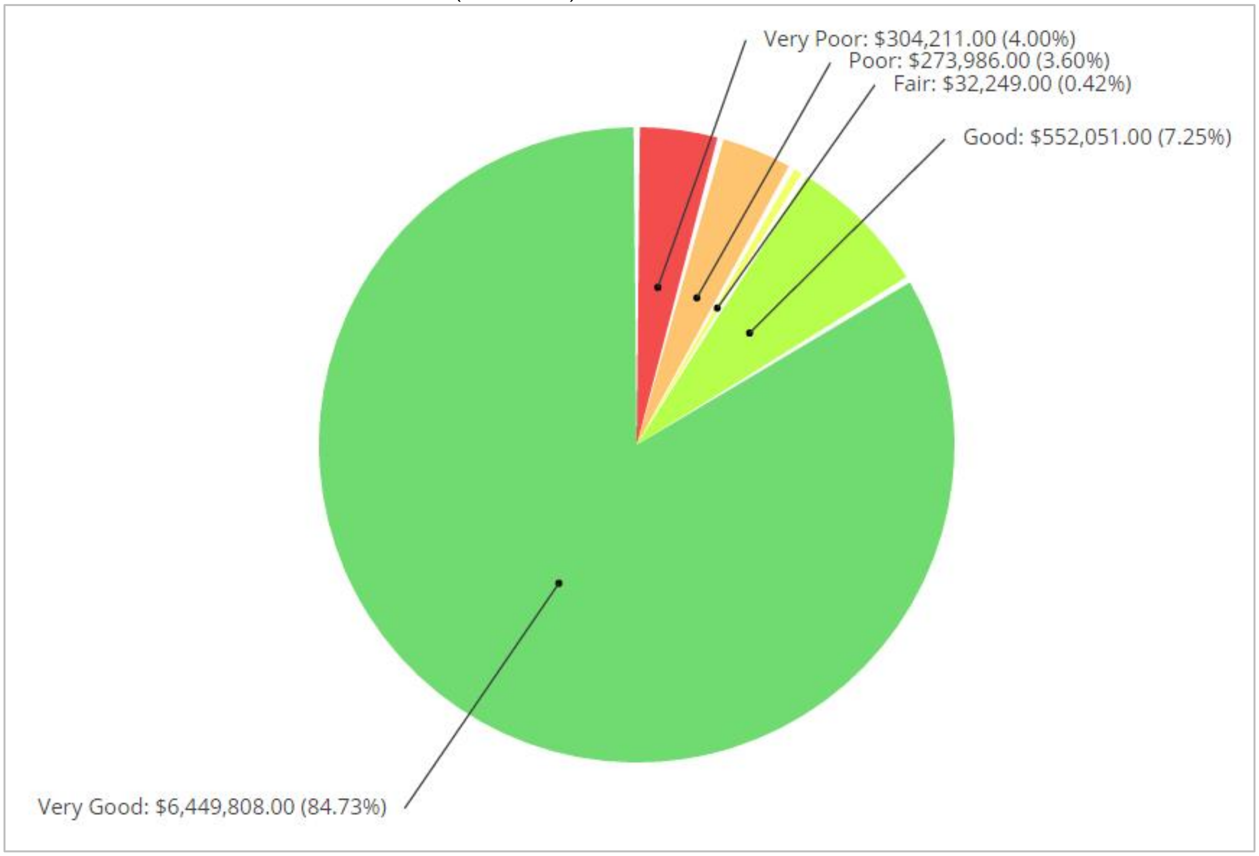


More than 90% of the municipality's water system assets have at least 10 years of useful life remaining; 4%, with a valuation of $305,000 will reach the end of their useful life in the next five years.

3.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's water services 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 not provided condition data for its water system.

FIGURE 24 ASSET CONDITION – WATER SYSTEM (AGE-BASED)

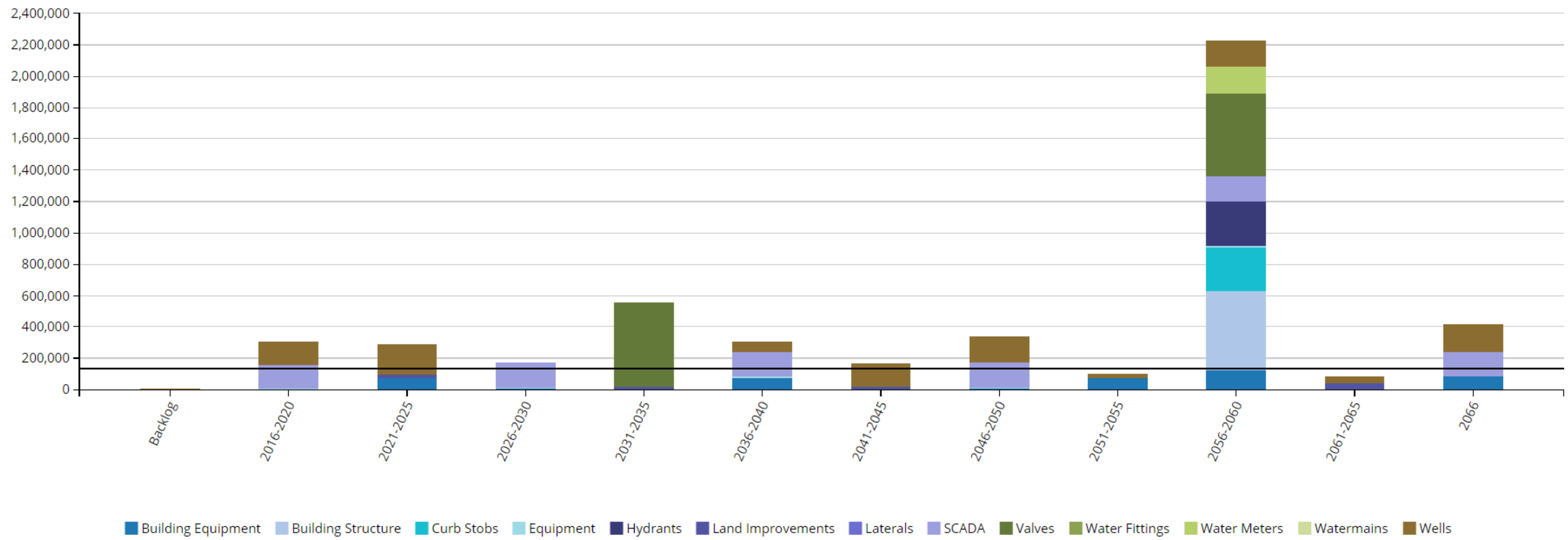


Based on age data, more than 90% of the municipality's water system assets are in good to very good condition. However, 8%, with a valuation of $578,000 are in poor to very poor condition.

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



Age-based data shows a minimal backlog of $5,000. The municipality's replacement needs will total $305,000 over the next five years, and $294,000 in the next 10 years. The municipality's annual requirements (indicated by the black line) for its water system total $140,000. 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. However, the municipality is currently allocating $34,000, leaving an annual deficit of $106,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

3.6 Recommendations – Water System

- Similar to bridges & culverts, water services are uniquely consequential to a community's wellbeing. While age-based data shows the majority of assets to be in good to very good condition, the municipality should establish a condition assessment program. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

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

- The municipality is funding 24% of its long-term replacement needs. See the 'Financial Strategy' section on how to achieve more sustainable funding levels.

4. Storm

4.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 9 illustrates key asset attributes for the municipality's storm assets, 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 stormwater assets are valued at $88,152 based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality.

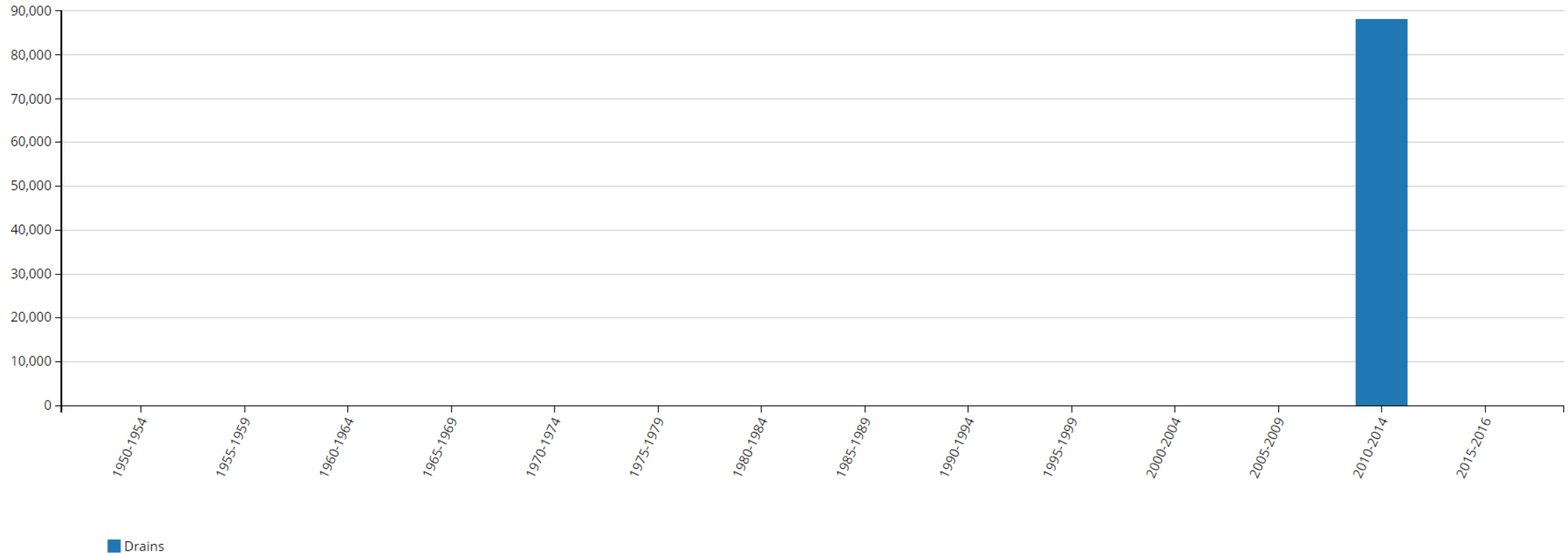
TABLE 9 ASSET INVENTORY - STORM

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Stormwater Services	Municipal Drain	1	50	CPI Table	$88,152
				Total	$88,152

4.2 Historical Investment in Infrastructure

Figure 26 shows the municipality's historical investments in its storm 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 short-, medium- and long-term replacement needs.

FIGURE 26 HISTORICAL INVESTMENT - STORM

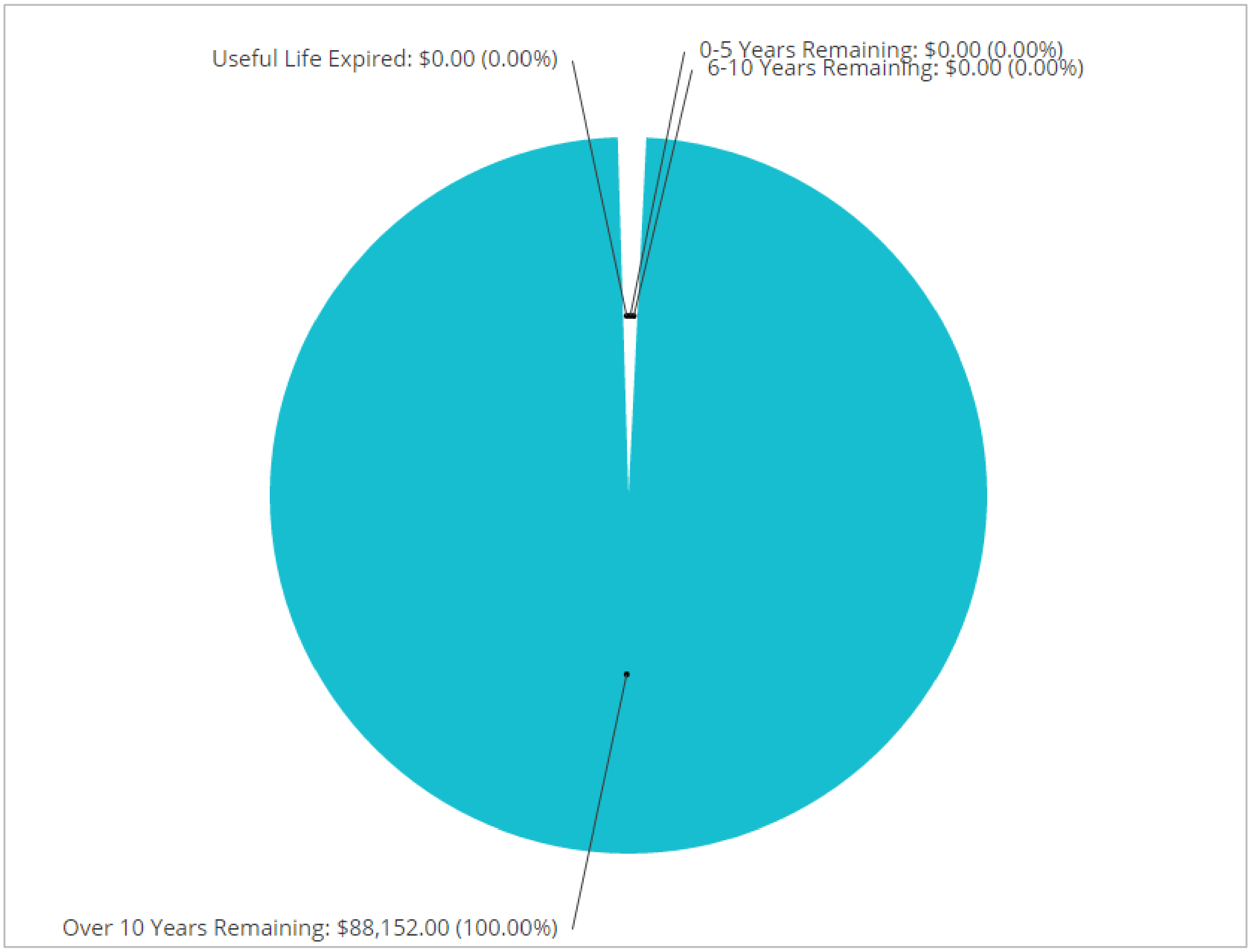


Inventory data shows the municipality installed all of its storm drains between 2010-2014, totaling $88,152.

4.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 27 illustrates the useful life consumption levels as of 2015 for the municipality's storm assets.

FIGURE 27 USEFUL LIFE CONSUMPTION – STORM

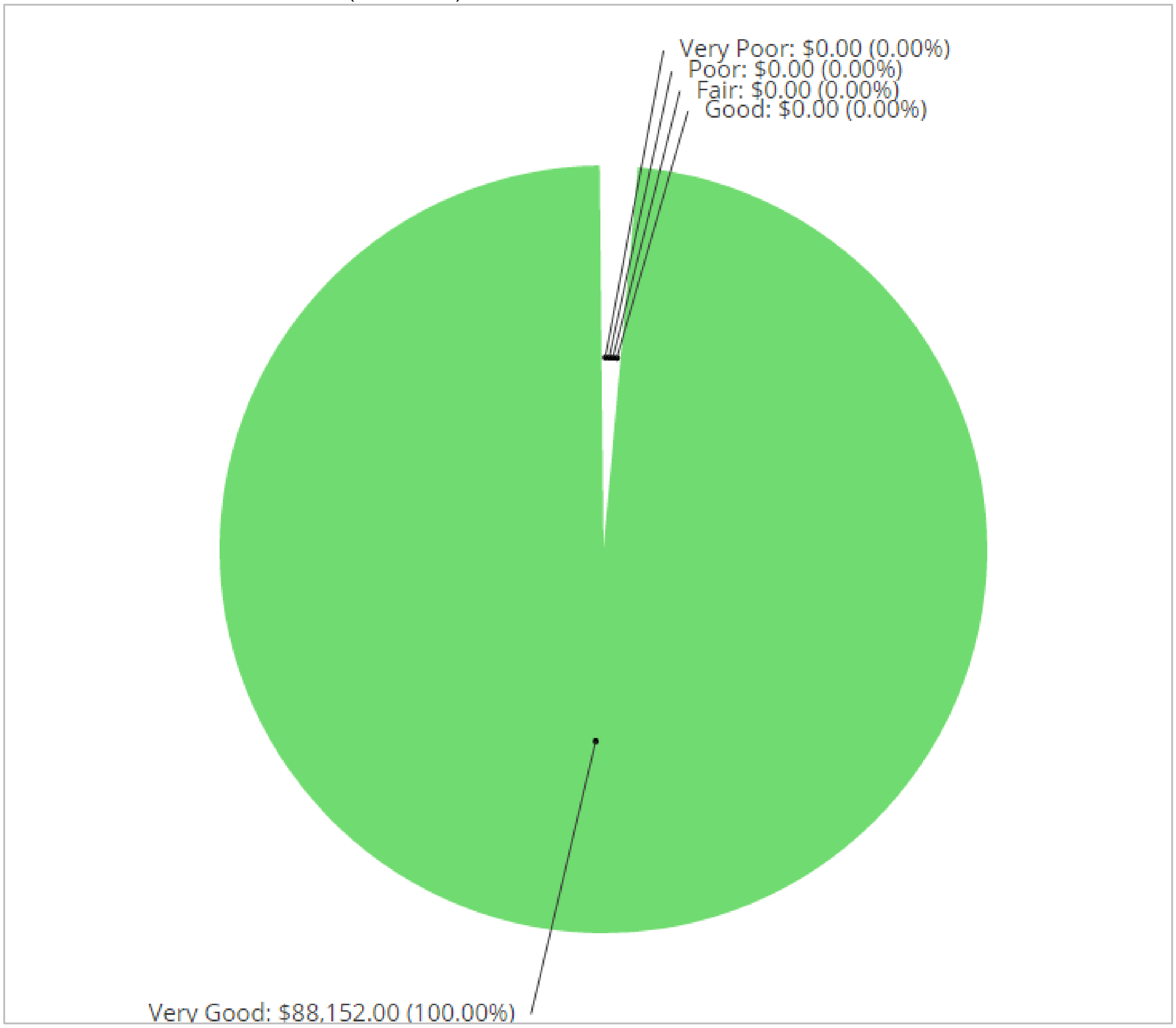


Given their relatively recent in-service dates, all assets have at least 10 years of useful life remaining.

4.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's storm services 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 not provided condition data.

FIGURE 28 ASSET CONDITION – STORM (AGE-BASED)

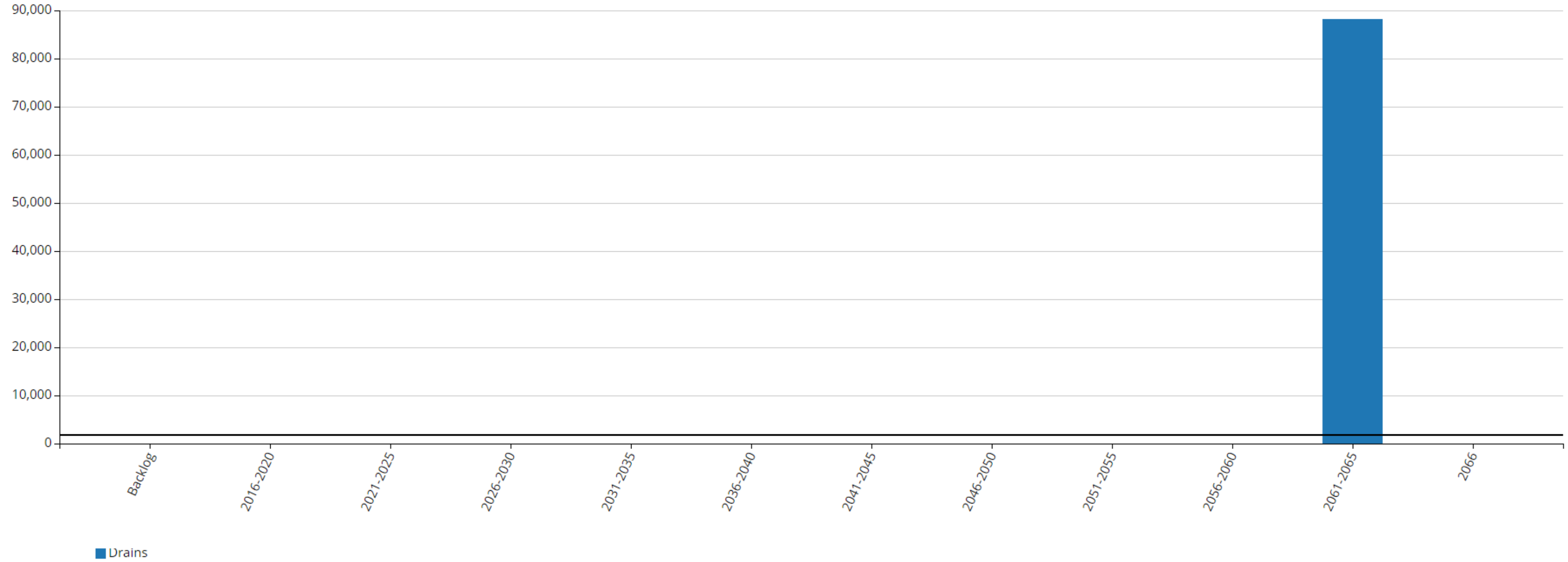


Reflecting its useful life consumption levels, all storm assets are in very good condition.

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 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 29 FORECASTING REPLACEMENT NEEDS – STORM



Age-based data shows no infrastructure backlog nor any upcoming short- or medium-term needs. The municipality's storm assets will require replacement between 2061-2065. The municipality's annual requirements (indicated by the black line) for storm assets total $2,000. 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. However, the municipality is currently allocating $0, leaving an annual deficit of $2,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

4.6 Recommendations – Storm

- In time, municipality should implement a comprehensive condition assessment program that covers all storm sewer assets 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.

- The municipality is not funding any portion of its long-term replacement needs. See the 'Financial Strategy' section on how to achieve more sustainable funding levels.

5. Buildings

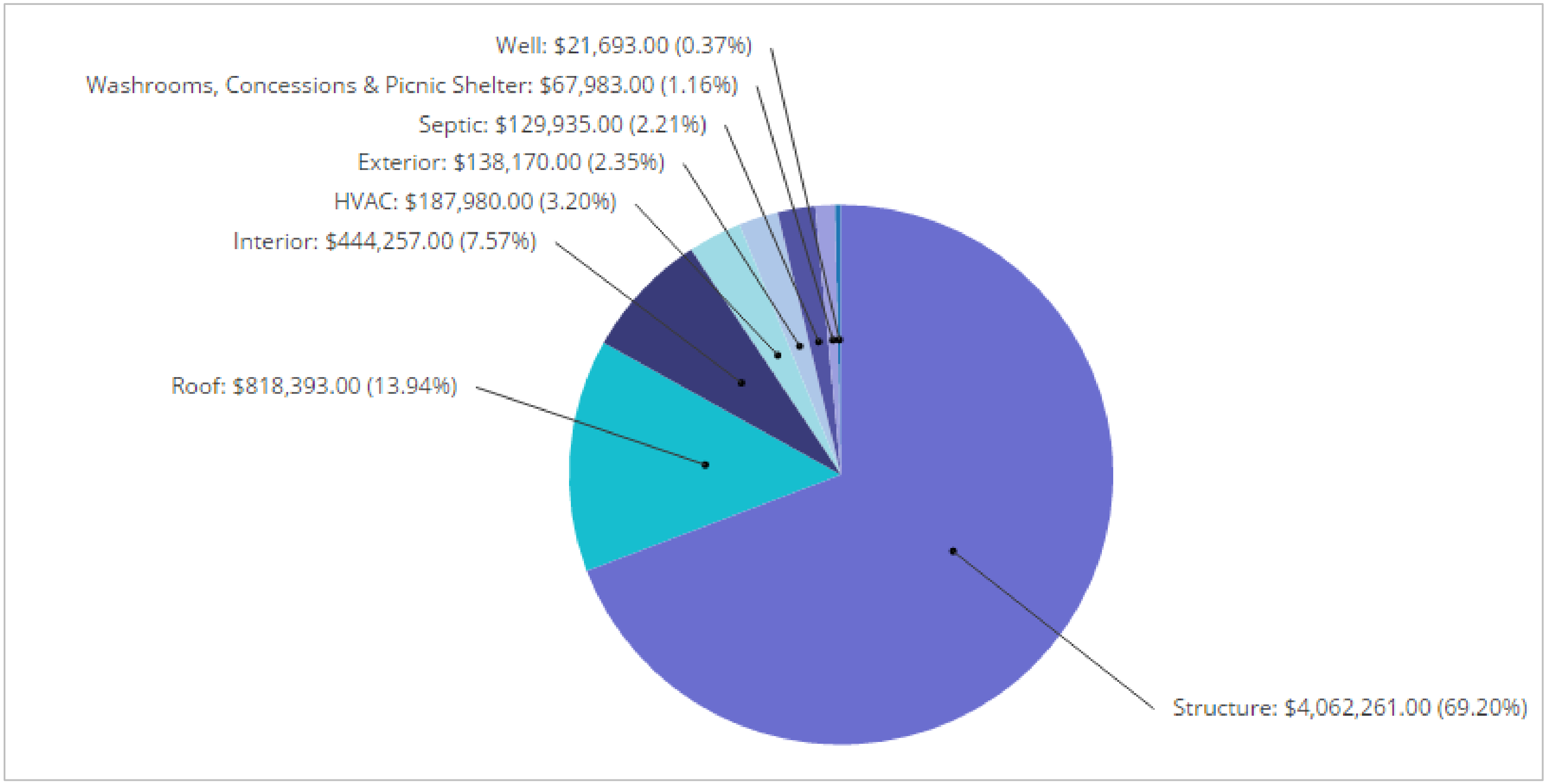
5.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 10 illustrates key asset attributes for the municipality's buildings assets, 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 $5.9 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality.

TABLE 10 KEY ASSET ATTRIBUTES - BUILDINGS

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2016 Replacement Cost
Buildings	Exterior	3	15 to 50	CPI Table	$138,169
	HVAC	3	25	CPI Table	$187,980
	Interior	13	10 to 40	CPI Table	$444,256
	Roof	11	20 to 100	CPI Table	$818,393
	Septic	5	25	CPI Table	$129,935
	Structure	8	50 to 100	CPI Table	$4,062,262
	Washroom, Concession & Picnic Shelters	1	50	CPI Table	$67,983
	Well	2	30	CPI Table	$21,693
				Total	$5,870,671

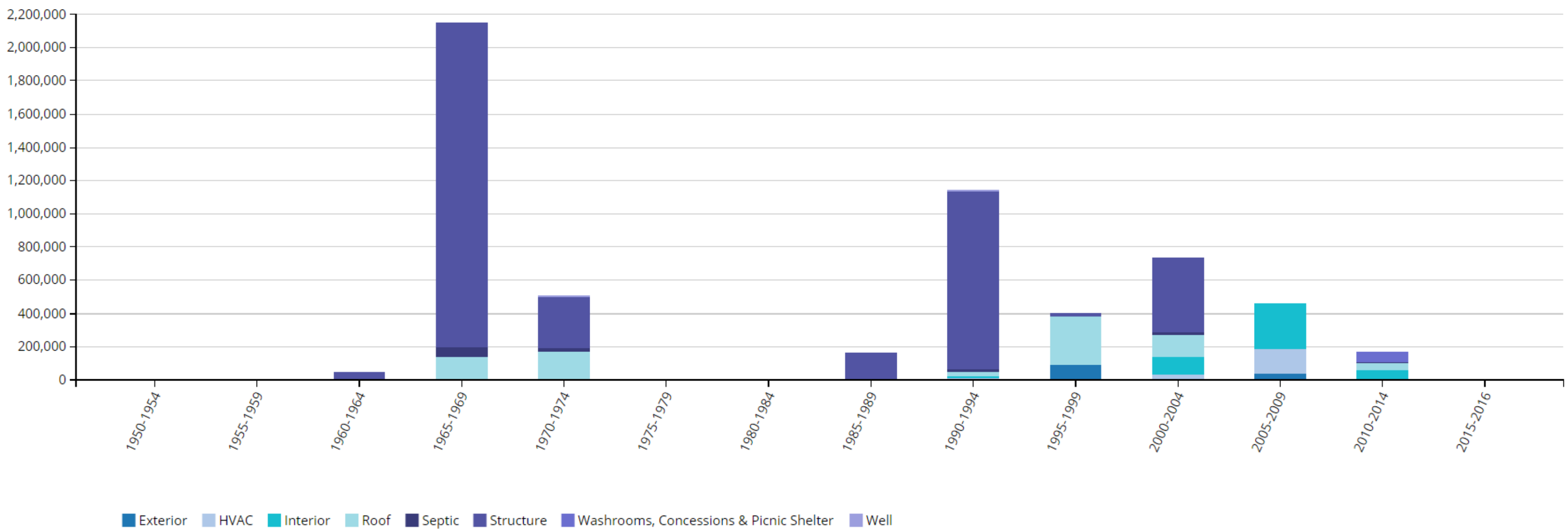
FIGURE 30 ASSET VALUATION – BUILDINGS



5.2 Historical Investment in Infrastructure

Figure 31 shows the municipality's historical investments in its buildings 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 5.3) can inform the forecasting and planning of short-, medium- and long-term replacement needs.

FIGURE 31 HISTORICAL INVESTMENT - BUILDINGS

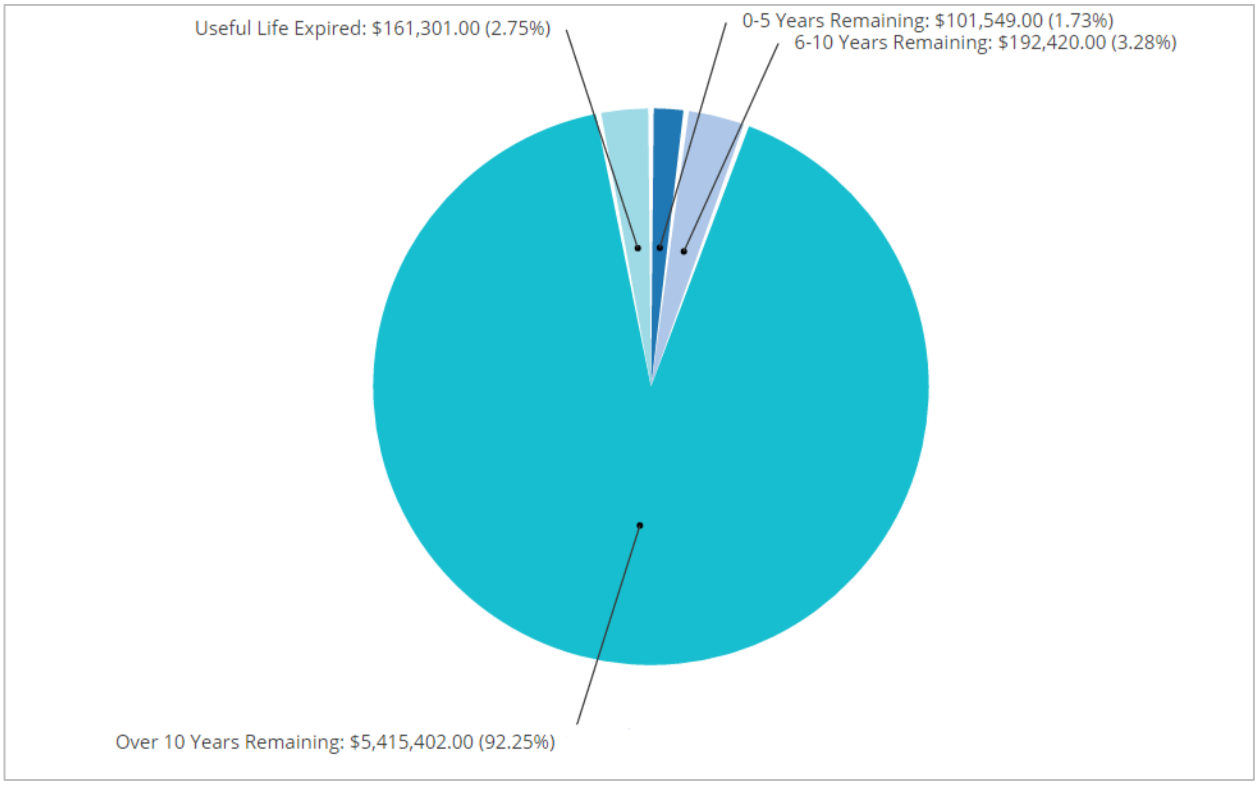


The largest investment in the municipality's buildings and facilities assets occurred in the mid- to late-1960s, with expenditures totaling $2.1 million, primarily in structures. An additional $1 million was invested in structures between 1990-1994. Since 2000, expenditures have totaled $1.4 million.

5.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 32 illustrates the useful life consumption levels as of 2015 for the municipality's buildings assets.

FIGURE 32 USEFUL LIFE CONSUMPTION – BUILDINGS

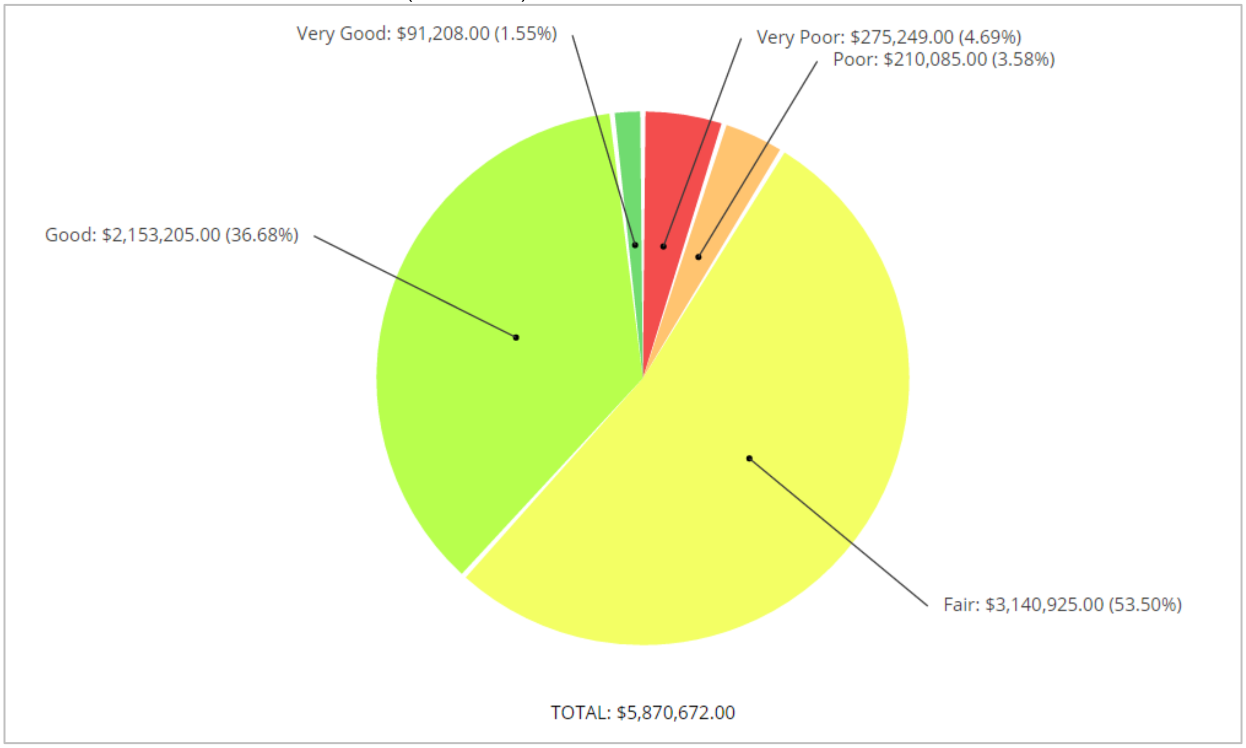


More than 90% of the municipality's buildings assets have at least 10 years of useful life remaining; 3%, with a valuation of $161,000, remain in operation beyond their useful life.

5.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's buildings 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 not provided condition data.

FIGURE 33 ASSET CONDITION – BUILDINGS (AGE-BASED)

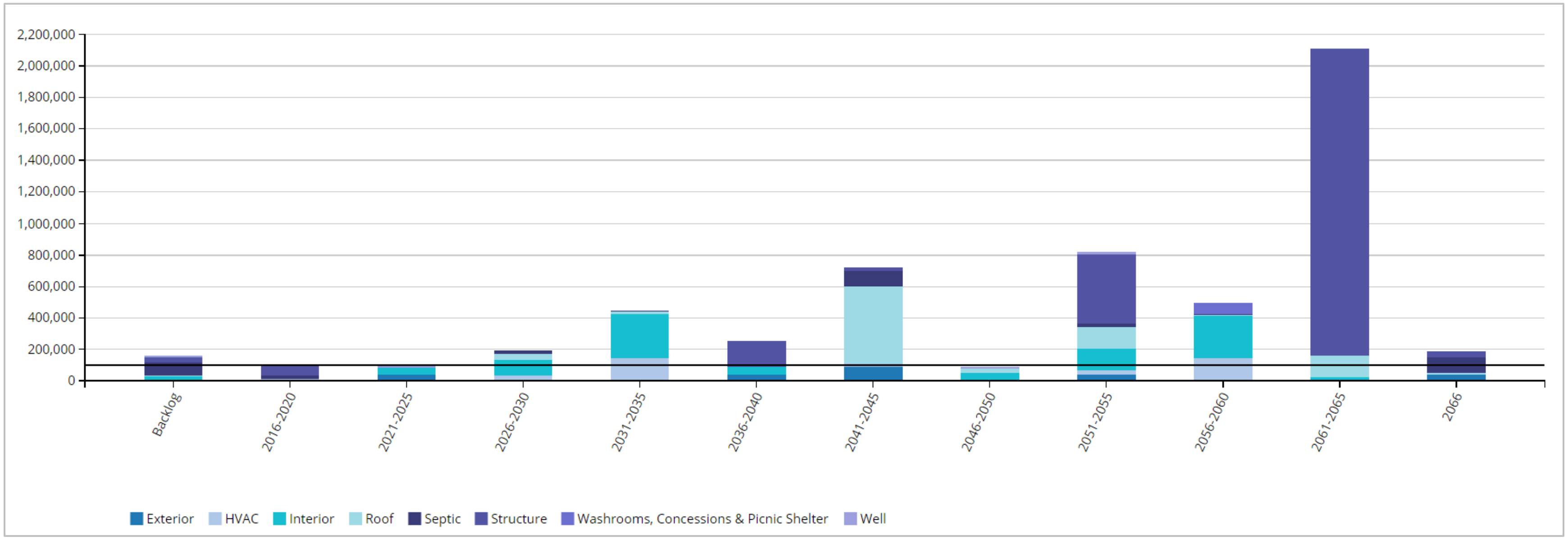


Age-based data indicates that approximately 40% of the buildings assets, with a valuation of $2.2 million, are in good to very good condition; 8% are in poor to very poor condition.

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 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 34 FORECASTING REPLACEMENT NEEDS – BUILDINGS



In addition to an age-based backlog of $161,000, the municipality's replacement needs are forecasted to be $102,000 in the next five years; an additional $198,000 is forecasted between 2021-2025. The municipality's annual requirements (indicated by the black line) for its buildings total $103,000. 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. However, the municipality is currently allocating $0, leaving an annual deficit of $103,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

5.6 Recommendations – Buildings

- The municipality should implement a component based condition inspection program for its facilities. 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.

- 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’.

- The municipality is not funding any portion of its annual requirements needed for future replacement needs. See the ‘Financial Strategy’ section on how to achieve more optimal funding levels.

6. Machinery & Equipment

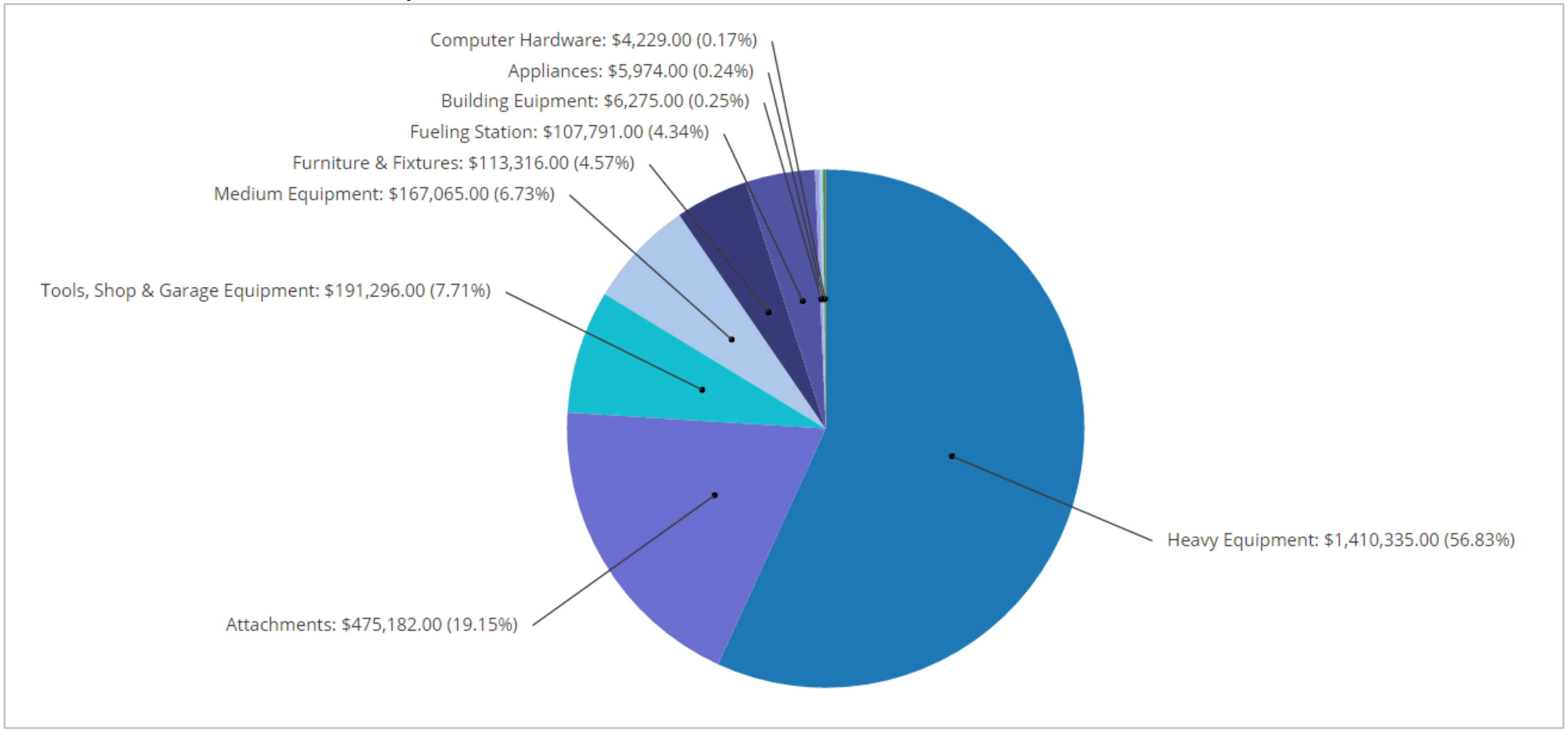
6.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 11 illustrates key asset attributes for the municipality's machinery & equipment assets, 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 $2.5 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality and obtained from the municipality's accounting data as maintained in the CityWide® Tangible Asset module.

TABLE 11 ASSET INVENTORY – MACHINERY & EQUIPMENT

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Machinery & Equipment	Appliances	2	15	CPI Monthly (ON)	$5,974
	Attachments	21	10 to 25	CPI Monthly (ON)	$475,182
	Building Equipment	1	10	CPI Monthly (ON)	$6,275
	Computer Hardware - 2014 Dell Server	24	5	CPI Monthly (ON)	$4,229
	Fueling Station Equipment	4	25	CPI Monthly (ON)	$107,792
	Furniture and Fixture	46	5 to 20	CPI Monthly (ON)	$113,315
	Heavy Equipment	5	8 to 10	CPI Monthly (ON)	$1,410,335
	Medium Equipment	4	10 to 15	CPI Monthly (ON)	$167,065
	Tools, Shop and Garage Equipment	34	5 to 25	CPI Monthly (ON)	$191,296
				Total	$2,481,463

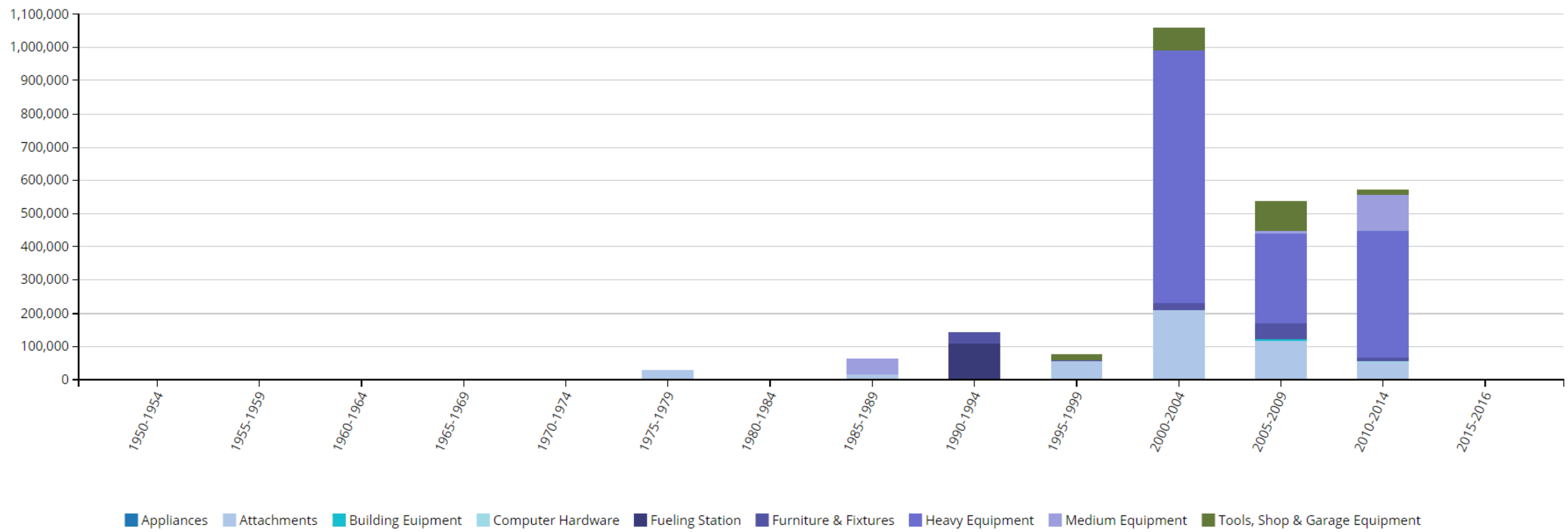
FIGURE 35 ASSET VALUATION – MACHINERY & EQUIPMENT



6.2 Historical Investment in Infrastructure

Figure 36 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 6.3) can inform the forecasting and planning of short-, medium- and long-term replacement needs.

FIGURE 36 HISTORICAL INVESTMENT – MACHINERY & EQUIPMENT

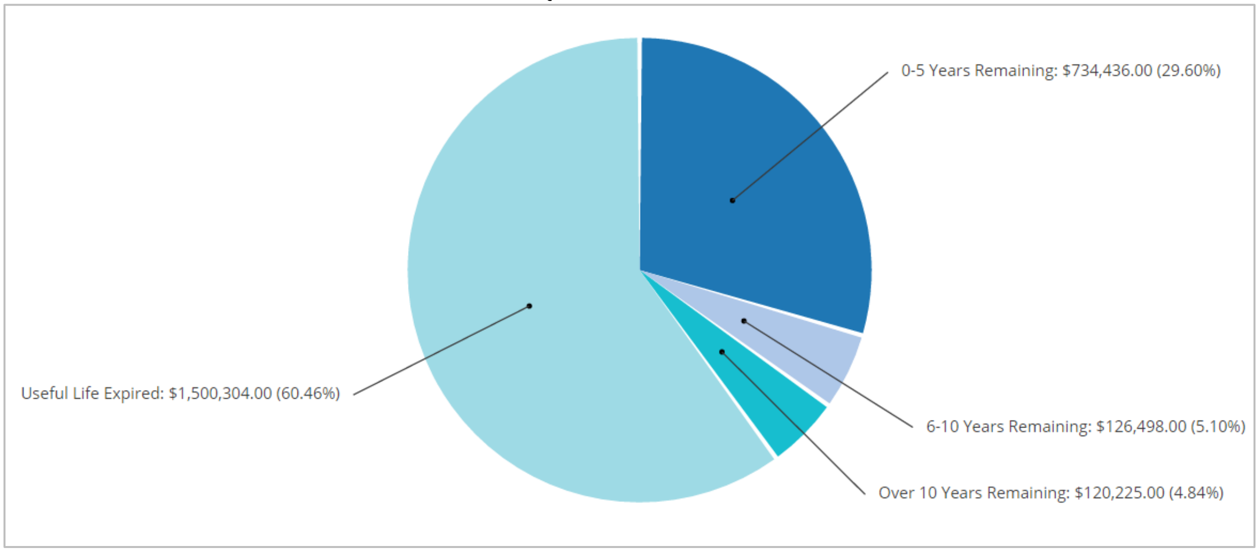


The majority of investment in machinery & equipment occurred between 2000-2014, with expenditures totaling $2.1 million, allocated primarily to heavy equipment.

6.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 37 illustrates the useful life consumption levels as of 2015 for the municipality's machinery & equipment assets.

FIGURE 37 USEFUL LIFE CONSUMPTION – MACHINERY & EQUIPMENT

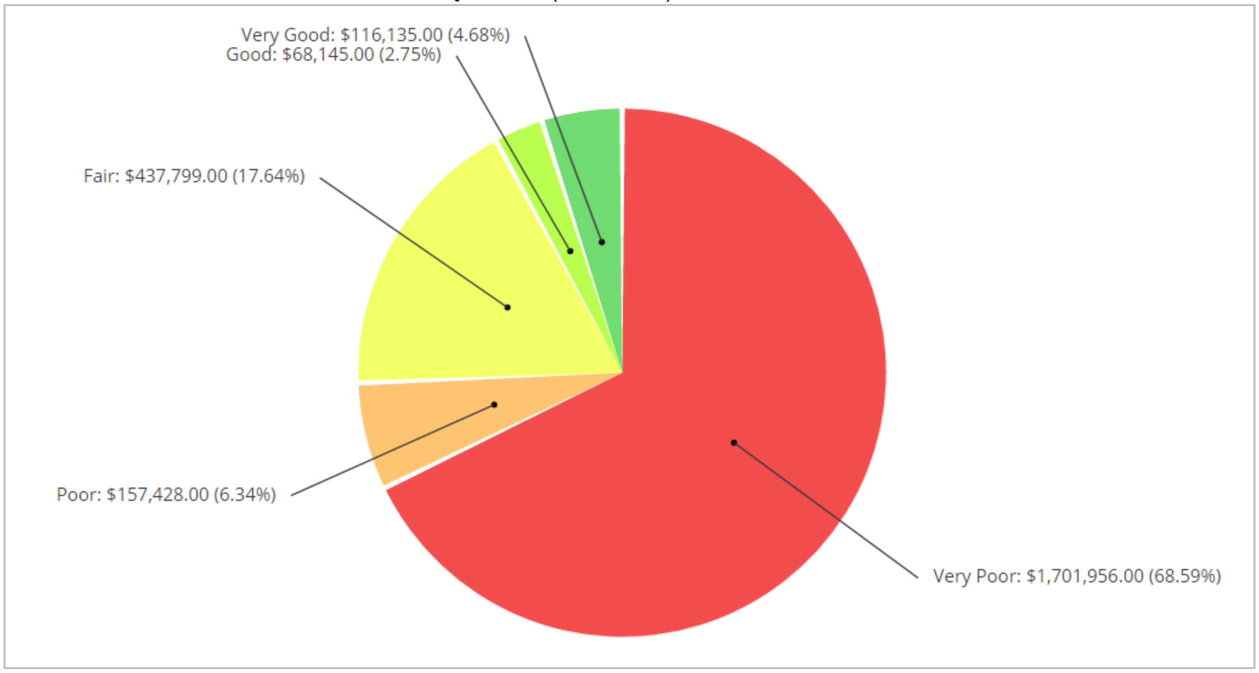


The majority, more than 60%, remain in operation beyond their established useful life. An additional 30%, with a valuation of $734,000, will reach the end of their useful life in the next five years.

6.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's machinery & equipment 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 not provided condition data.

FIGURE 38 ASSET CONDITION – MACHINERY & EQUIPMENT (AGE-BASED)

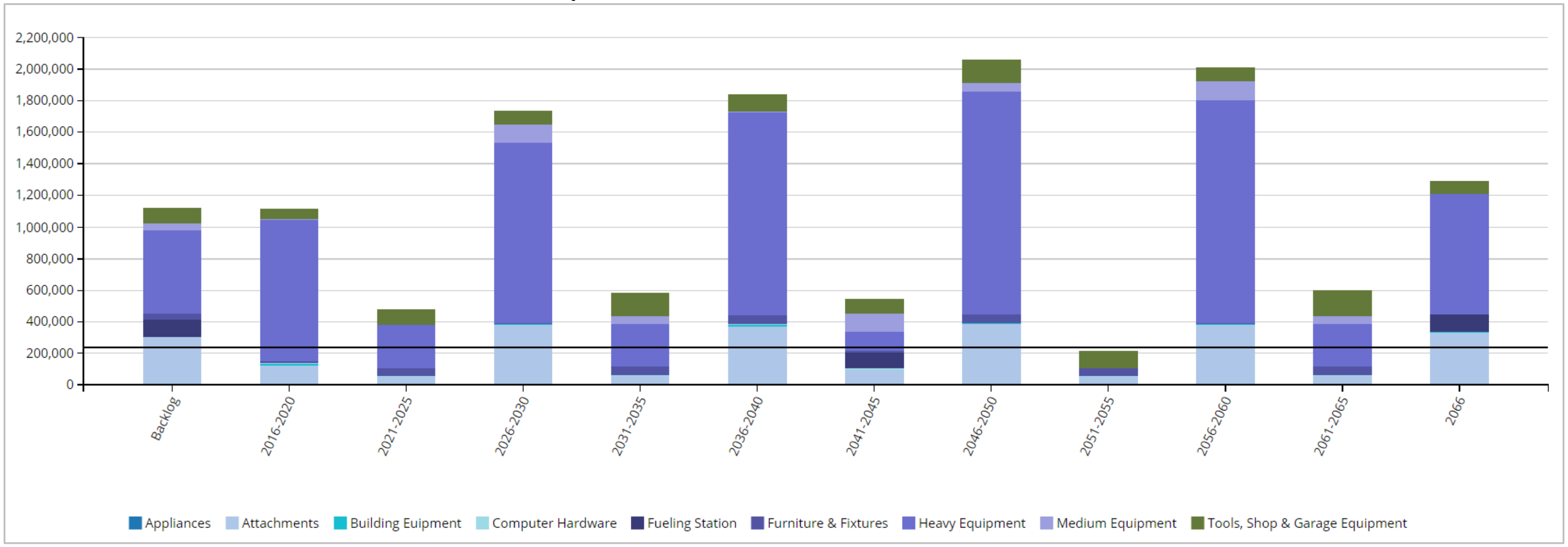


Based on age data, 75% of machinery & equipment assets, are in poor to very poor condition.

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 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 39 FORECASTING REPLACEMENT NEEDS – MACHINERY & EQUIPMENT



In addition to an age-based backlog of $1.1 million, the municipality's replacement needs total approximately $1.1 million in the next five years. An additional $484,000 will be required between 2021-2025. The municipality's annual requirements (indicated by the black line) for its machinery & equipment total $241,000. 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. However, the municipality is currently allocating $197,000, leaving an annual deficit of $44,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

6.6 Recommendations – Machinery & Equipment

- Age-based data indicates a backlog of $1.1 million and replacement needs of more than $1.5 million in the next 10 years. The municipality should implement a component based condition inspection program 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.

- The municipality is funding 82% of its annual requirements for future replacement needs. See the 'Financial Strategy' section on how to achieve more sustainable funding levels.

7. Land Improvements

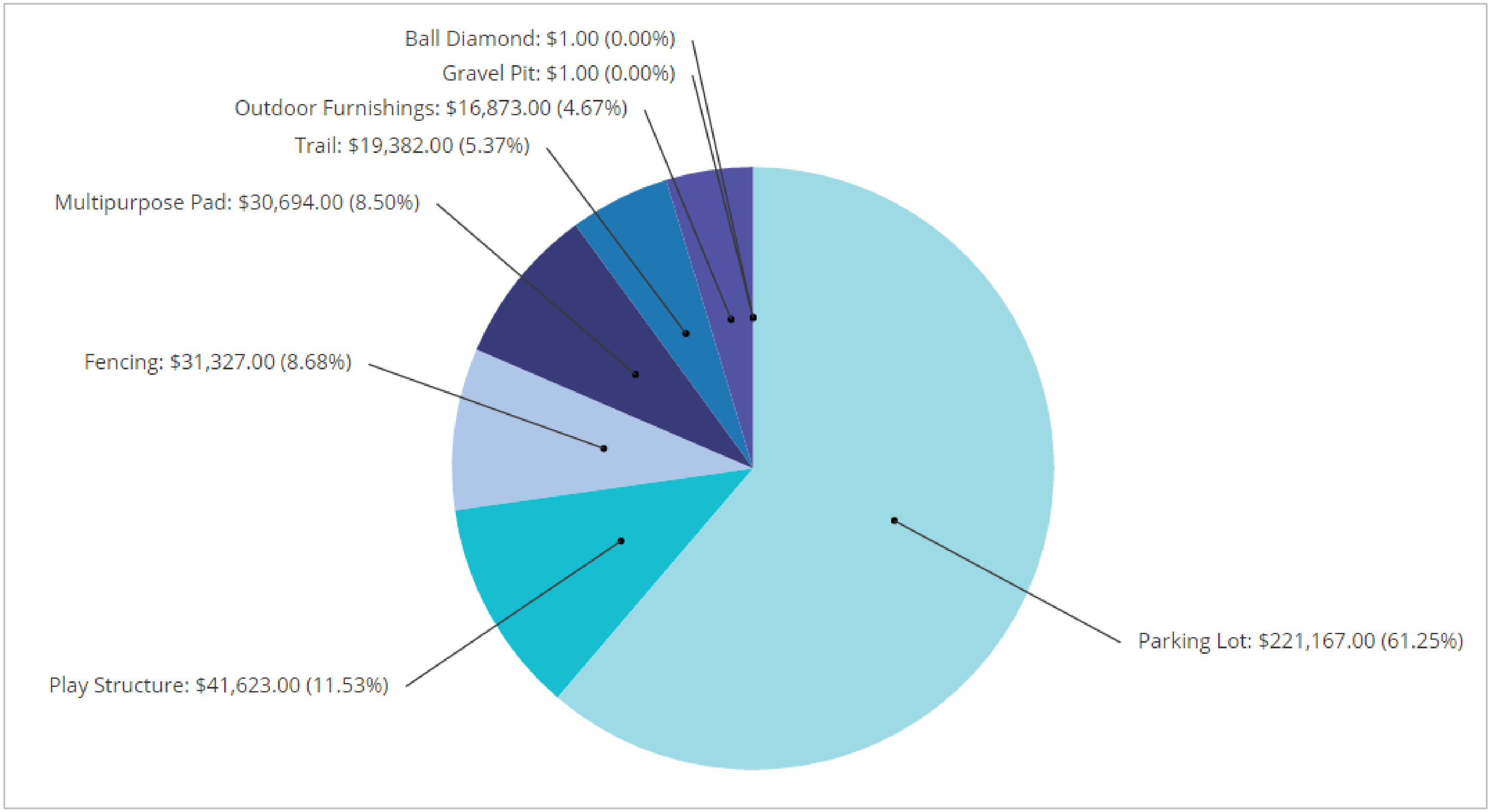
7.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 12 illustrates key asset attributes for the municipality's land improvement assets, 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 $361,000 based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality.

TABLE 12 ASSET INVENTORY - LAND IMPROVEMENTS

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Land Improvements	Ball Diamond	1	1	CPI Table	Not planned for replacement
	Fencing	6	20 to 25	CPI Table	$31,327
	Gravel Pit	1	1	CPI Table	Not planned for replacement
	Multipurpose Pad	1	20	CPI Table	$30,694
	Outdoor Furnishings	3	20	CPI Table	$16,874
	Parking Lot	3	20	CPI Table	$221,166
	Play Structure	4	10	CPI Table	$41,623
	Trail	3	25 to 50	CPI Table	$19,382
				Total	$361,066

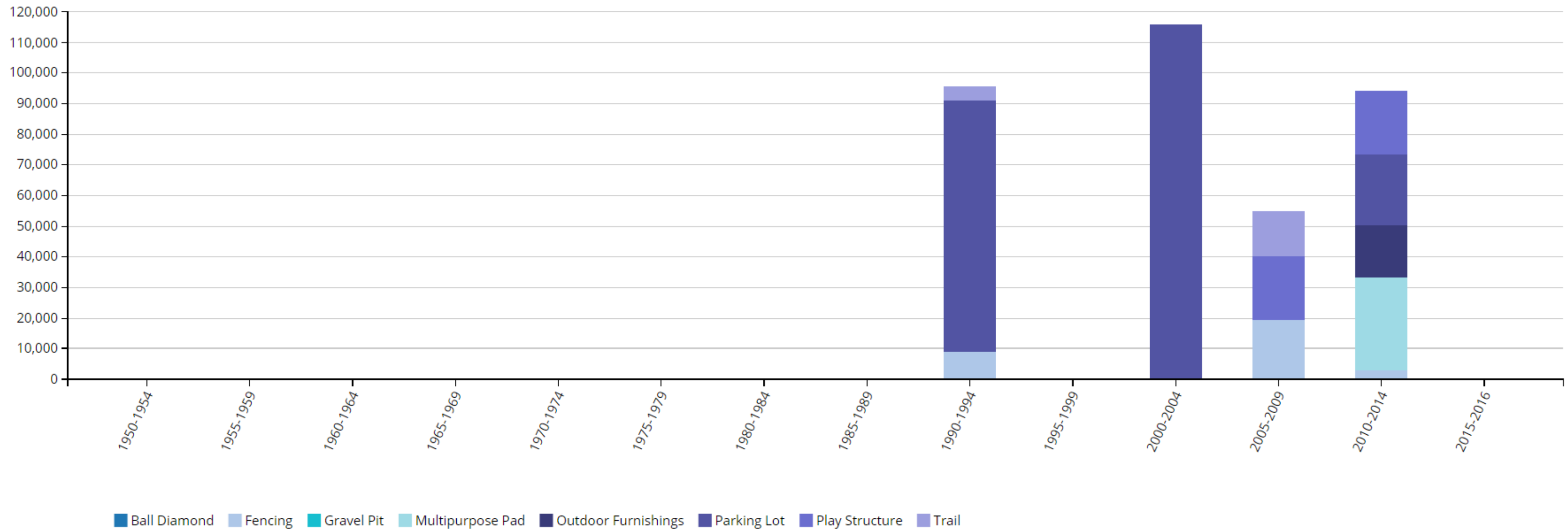
FIGURE 40 ASSET VALUATION – LAND IMPROVEMENTS



7.2 Historical Investment in Infrastructure

Figure 41 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 7.3) can inform the forecasting and planning of short-, medium- and long-term replacement needs.

FIGURE 41 HISTORICAL INVESTMENT - LAND IMPROVEMENTS

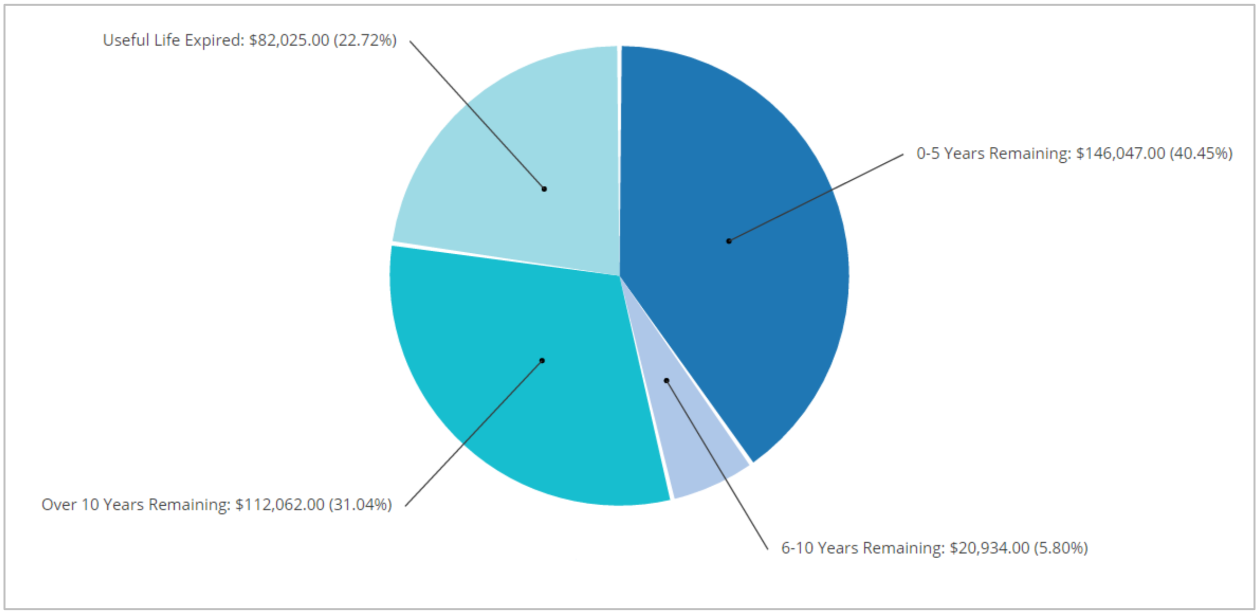


Investments in land improvement occurred in the early 1990s ($96,000) and again between 2000-20004 ($116,000), primarily in parking lots. Since 2005, expenditures have totaled $150,000.

7.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 42 illustrates the useful life consumption levels as of 2015 for the municipality's land improvement assets.

FIGURE 42 USEFUL LIFE CONSUMPTION - LAND IMPROVEMENTS

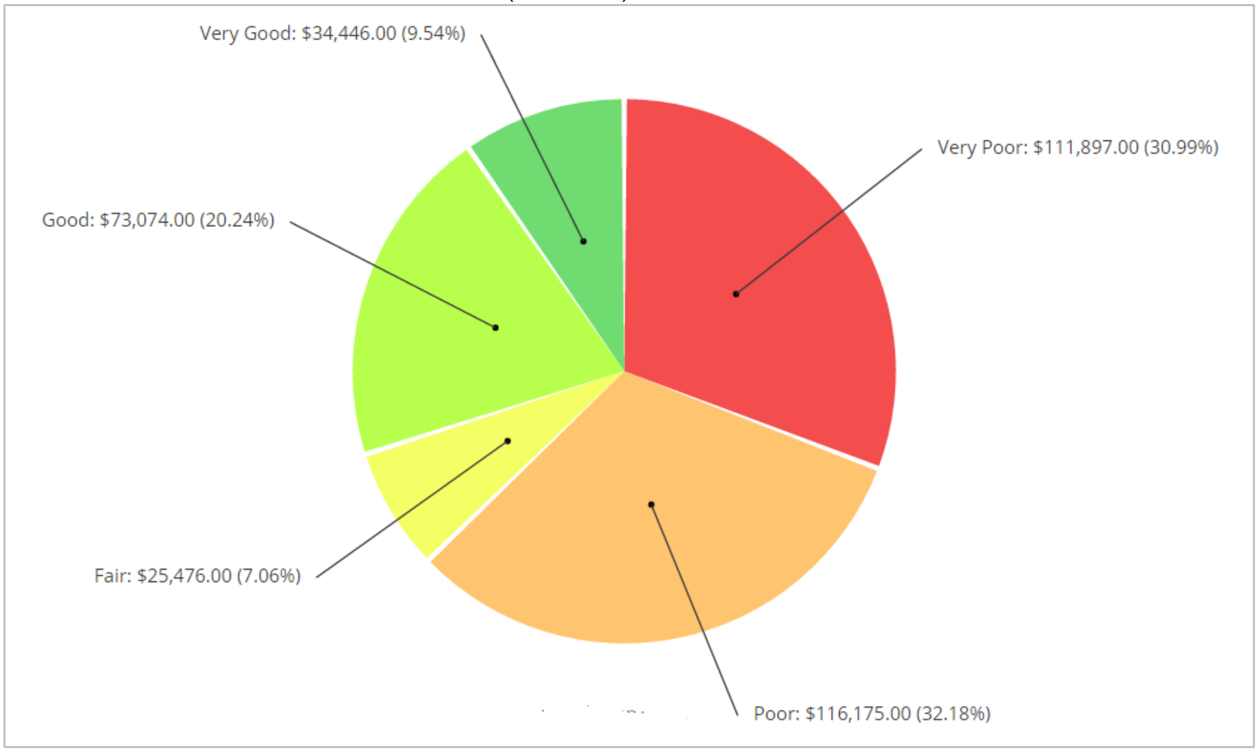


More than 40% of land improvement assets, with a valuation of $146,000 will reach the end of their useful life in the next five years; 23% remain in operation beyond their established useful life.

7.4 Current Asset Condition

Using replacement cost, in this section, we summarize the condition of the municipality's land improvement 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 not provided condition data.

FIGURE 43 ASSET CONDITION - LAND IMPROVEMENTS (AGE-BASED)

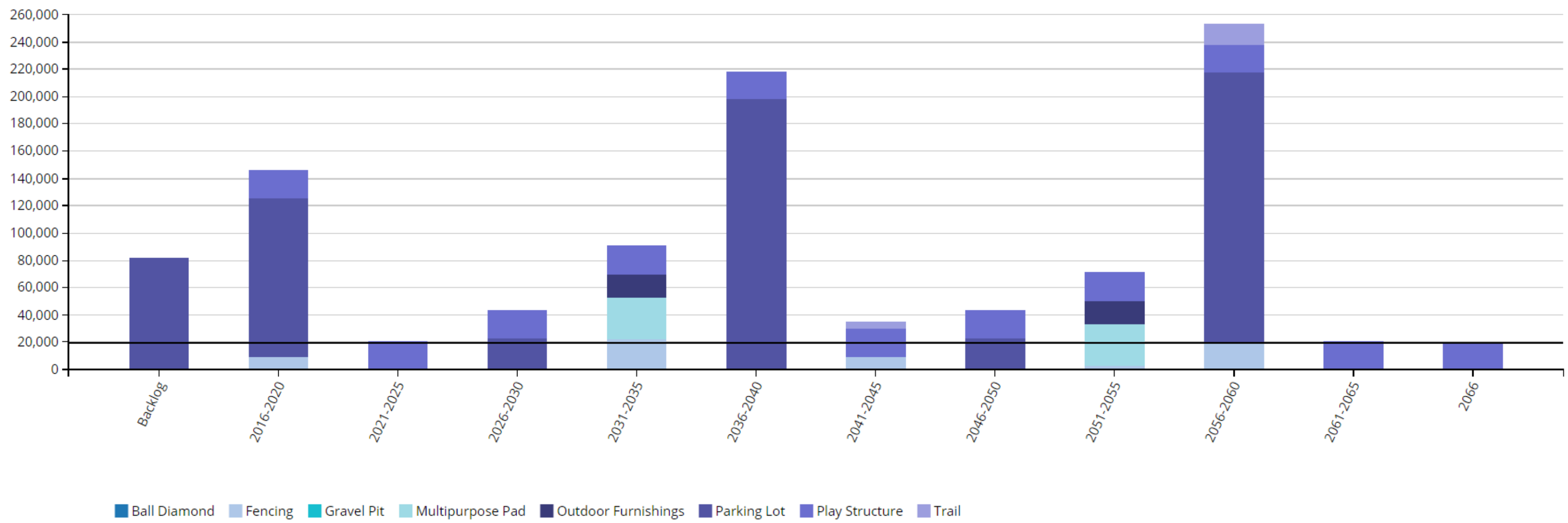


Based on age data, more than 60% of the municipality's land improvement assets, with a valuation of $128,0000, are in poor to very poor condition; 30% are in good to very good condition.

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 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 44 FORECASTING REPLACEMENT NEEDS - LAND IMPROVEMENTS



In addition to an age-based backlog of $82,000 the municipality's replacement needs will total $146,000 over the next five years; an additional $21,000 will be required between 2021-2025. The municipality's annual requirements (indicated by the black line) for its land improvements total $20,000. 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. However, the municipality is currently allocating $253,000, leaving an annual surplus of $233,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

7.6 Recommendations – Land Improvements

- Age-based data shows that the majority of assets are in poor to very poor condition. The municipality should implement a condition assessment program for its land improvement assets to better estimate actual condition levels. 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.

- The municipality is over-funding (1265%) of its long-term replacement needs. See the 'Financial Strategy' section on how to achieve more sustainable funding levels.

8. Vehicles

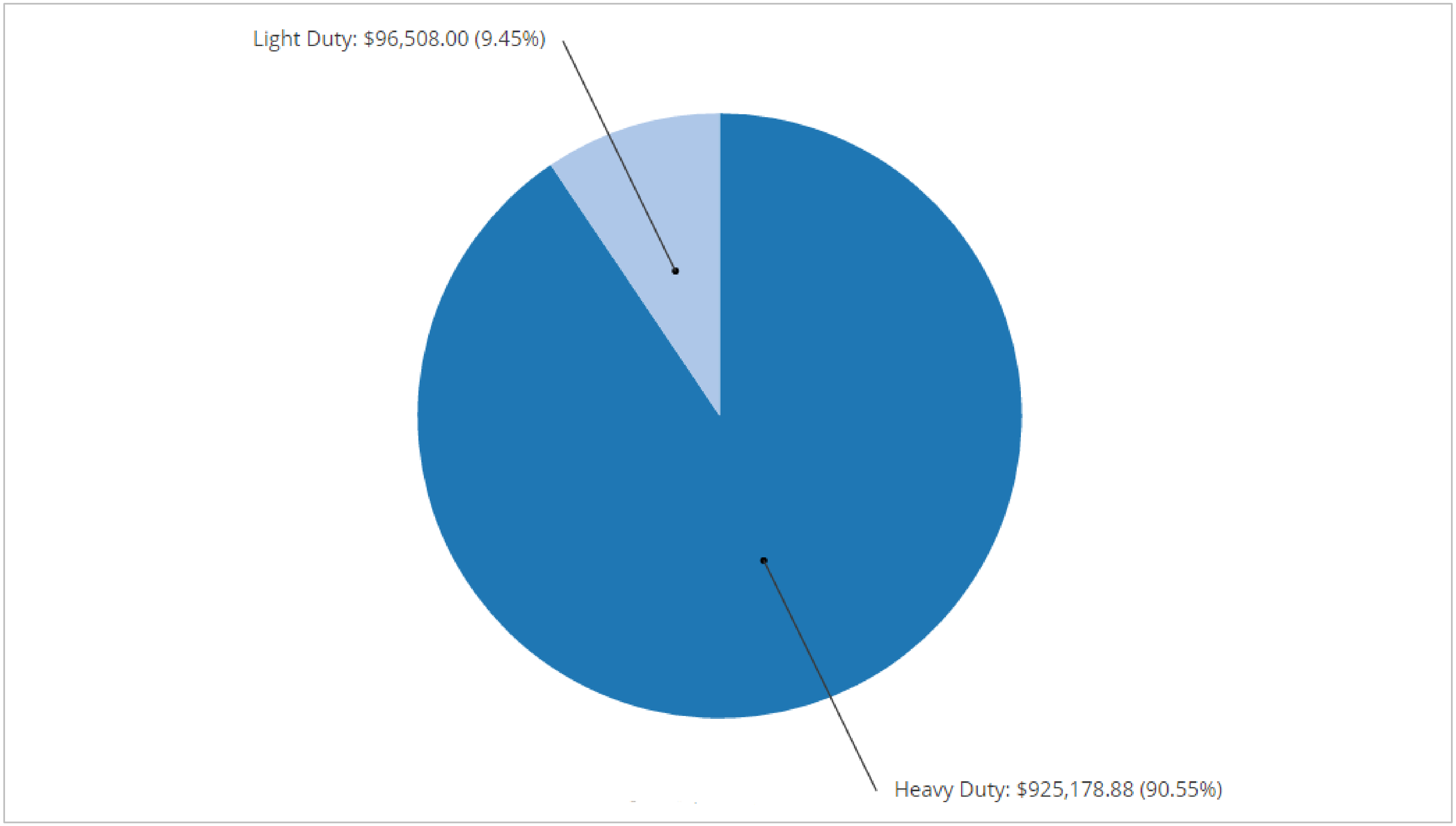
8.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 13 illustrates key asset attributes for the municipality's vehicles assets, 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 $1 million based on 2016 replacement costs. The useful life indicated for the asset types below was assigned by the municipality.

TABLE 13 ASSET INVENTORY - VEHICLES

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2016 Overall Replacement Cost
Vehicles	Heavy Duty (plow and dump trucks)	5	10	CPI Tables	$925,179
	Light Duty (Chevy Silverado, GMC Sierra)	3	8 to 10	CPI Tables	$96,508
				Total	$1,021,687

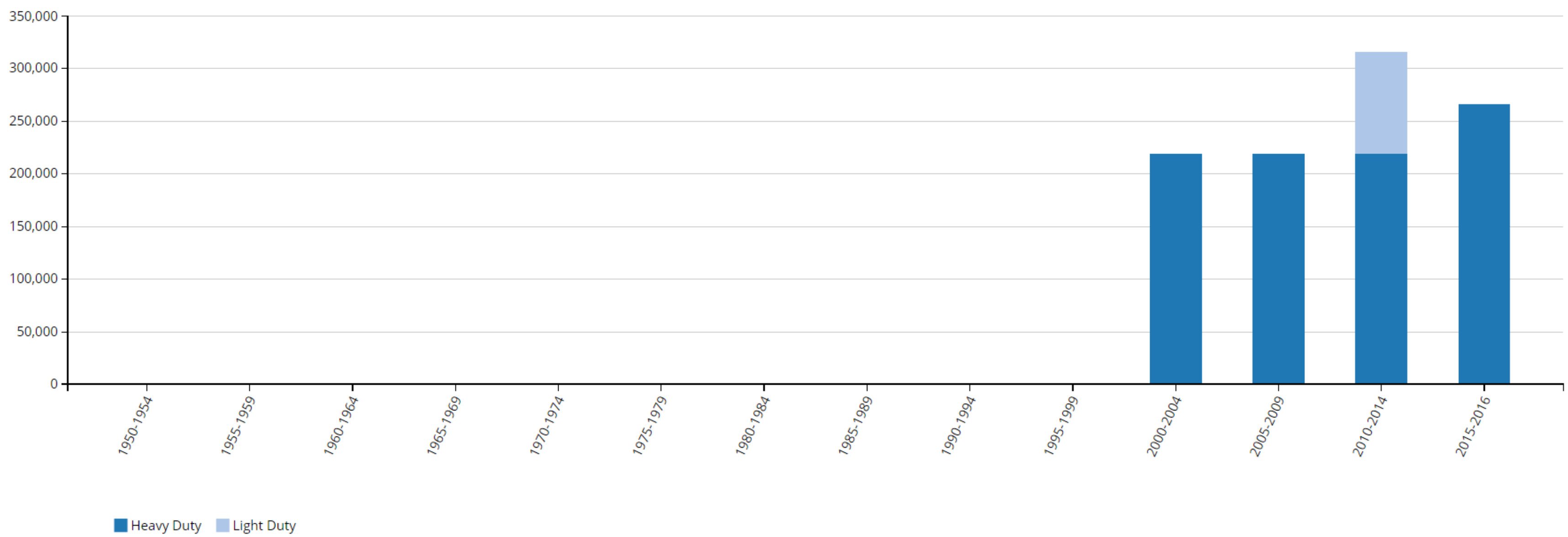
FIGURE 45 ASSET VALUATION – VEHICLES



8.2 Historical Investment in Infrastructure

Figure 46 shows the municipality's historical investments in its vehicles 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 short-, medium- and long-term replacement needs.

FIGURE 46 HISTORICAL INVESTMENT – VEHICLES

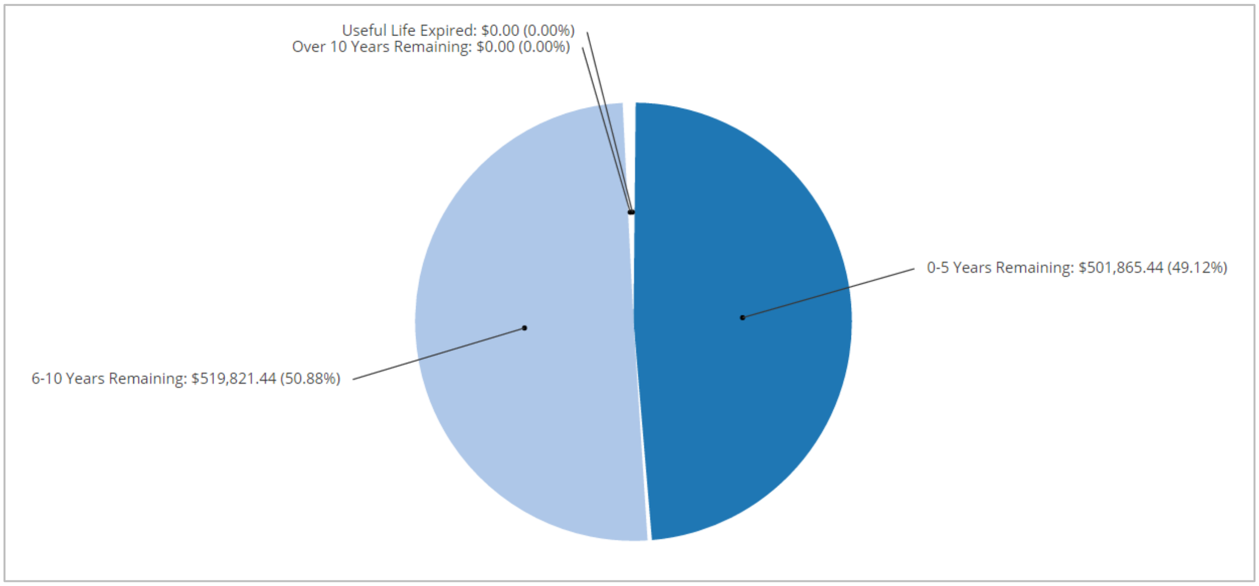


Based on in-service dates, the municipality's vehicles portfolio was established over the past 15 years.

8.3 Useful Life Consumption

In this section, we detail the extent to which assets have consumed their useful life based on the above, established useful life standards. In conjunction historical spending patterns, observed condition data, understanding the consumption rate of assets based on industry established useful life measures provides a more complete profile of the state of a community's infrastructure. Figure 47 illustrates the useful life consumption levels as of 2015 for the municipality's vehicles.

FIGURE 47 USEFUL LIFE CONSUMPTION – VEHICLES

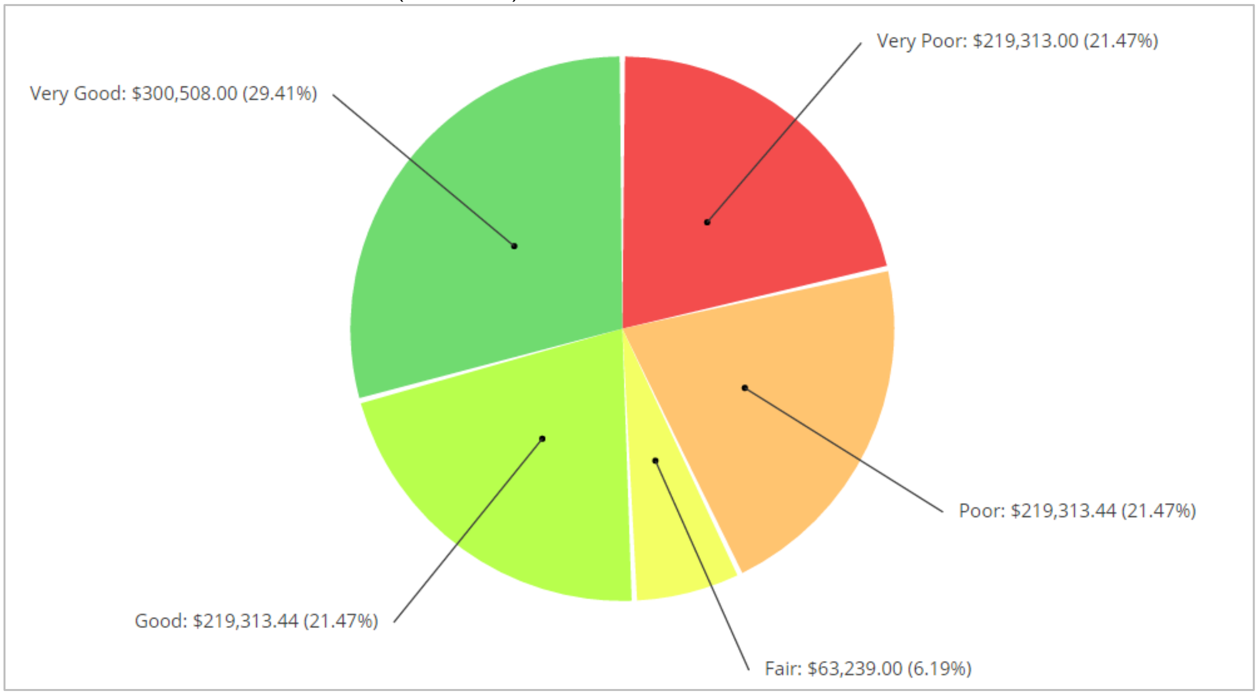


While 50% of the vehicles assets have between 6-10 years remaining, the remaining 50% will reach the end of their useful life in the next five years.

8.4 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 not provided condition data.

FIGURE 48 ASSET CONDITION – VEHICLES (AGE-BASED)

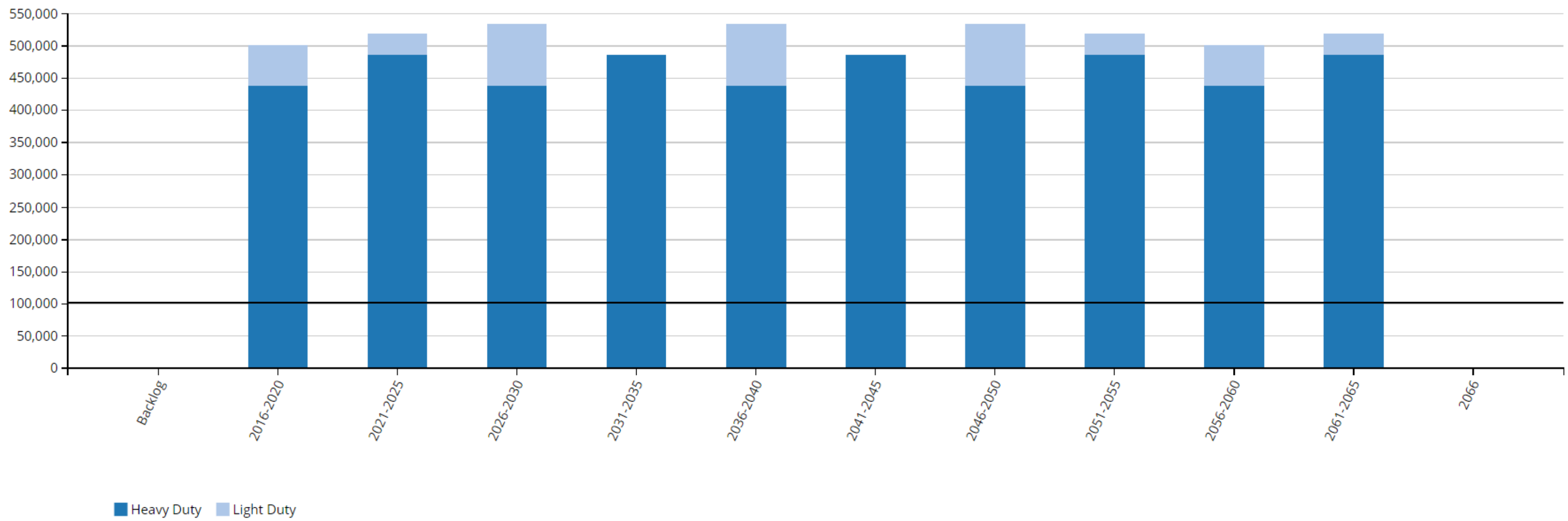


Age-based data shows that while 51% of the municipality's vehicles assets, with a valuation of $520,000, are in good to very good condition, 43% are in poor to very poor condition.

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 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 49 FORECASTING REPLACEMENT NEEDS - VEHICLES



Age-based data shows no backlog associated with vehicles assets. However, replacement needs will reach $502,000 in the next five years. an additional $520,000 will be required between 2021-2025. The municipality's annual requirements (indicated by the black line) for its vehicles total $103,000. 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. However, the municipality is currently allocating $192,000, leaving an annual surplus of $89,000. See the 'Financial Strategy' section for achieving a sustainable funding level. 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.

8.6 Recommendations – Vehicles

- A preventative maintenance and life cycle assessment program should be established for the fleet class 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.

- The municipality is over-funding (186%) of its long-term replacement needs. See the 'Financial Strategy' section on how to achieve more sustainable funding levels.

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; underpromise and overdeliver; or promise only that which can be delivered efficiently without placing 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 levels of service 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*.

- **Available**: 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
- **Reliable**: Services are predictable and continuous
- **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.

While the above categories provide broad strategic direction to council and staff, specific and measurable KPIs related to each LOS category are needed to ensure the municipality remains steadfast in its pursuit of delivering the highest value for money to various internal and external stakeholders.

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 AMPs. The municipality should develop appropriate and achievable targets that reflect evolving demand on infrastructure, its fiscal capacity and the overall corporate objectives.

TABLE 14 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 right-of-way)
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 km 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 • Percentage of signage that pass reflectivity test. The remaining should be replaced
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 km • Operating costs for bridge and large culverts per square metre • Percentage of customer requests with a 24-hour response rate

TABLE 15 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 buildings and 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 • Overall facility condition index as a percentage of desired condition index • Annual adjustment in condition indexes • Annual percentage of new facilities (square metre) • Percent of facilities rated poor or critical • Percentage of facilities replacement value spent on operations and maintenance Increase facility utilization rate by [x] percent by 2020. • $Utilization\ Rate = \frac{Occupied\ Space}{Facility\ Usable\ Area}$
Operational Indicators	• [x] sq.ft. of facilities per full-time employee (or equivalent), i.e., maintenance staff • Percentage of facilities inspected within the last five years • Number/type of service requests • Percentage of customer requests responded to within 24 hours

TABLE 16 KEY PERFORMANCE INDICATORS – FLEET AND VEHICLES

Level	KPI (Reported Annually)
Strategic	• Percentage of total reinvestment compared to asset replacement value • Completion of strategic plan objectives
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	• Percentage of all vehicles replaced • Average age of fleet vehicles • Percent of vehicles rated poor or critical • Percentage of fleet replacement value spent on operations and maintenance
Operational Indicators	• Average downtime per fleet category • Average utilization per fleet category and/or each vehicle • Ratio of preventative maintenance repairs vs. reactive repairs • Percent of vehicles that received preventative maintenance • Number/type of service requests • Percentage of customer requests responded to within 24 hours

TABLE 17 KEY PERFORMANCE INDICATORS – WATER

Level	KPI (Reported Annually)
Strategic	• Percentage of total reinvestment compared to asset replacement value • Completion of strategic plan objectives (water)
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 • Lost revenue from system outages
Tactical	• Percentage of water network rehabilitated / reconstructed • Overall water network condition index as a percentage of desired condition index • Annual adjustment in condition indexes • Annual percentage of growth in water network • Percentage of mains where the condition is rated poor or critical for each network • Percentage of water network replacement value spent on operations and maintenance
Operational Indicators	• Percentage of water network inspected • 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 • Percentage of customer requests responded to within 24 hours

3. Future Performance

In addition to the financial capacity, and legislative requirements, e.g., *Safe Drinking Water Act*, the Minimum Maintenance Standards for municipal highways, building codes and the *Accessibility for Ontarians with Disability Act*, many factors, internal and external, can influence the establishment of LOS and their associated KPIs, both target and actual, including the municipality's overarching mission as an organization, the current state of its infrastructure, and the municipality's financial capacity.

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 levels of service.

State of the Infrastructure
The current state of capital assets will determine the quality of service the municipality can deliver to its residents. As such, levels of service 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 opinions and insights regarding the levels of service a particular asset 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 facilitate any planned growth in infrastructure services.

Demographic Changes
The type of residents that dominate a municipality can also serve as infrastructure demand drivers, 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 wellbeing 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 will develop an implementation process that can be applied to the needs identification and prioritization of renewal, rehabilitation, and maintenance activities. This will assist in the production of a 10-year 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 life cycle interventions required; and prioritization techniques, including risk, to determine which priority projects should move forward into the budget first.

1. Non-Infrastructure Solutions and 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 a portion of the capital budget should be dedicated for these items in each programs budget.

It is recommended, under this category of solutions, that the municipality should 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 clearer path of what is required to achieve sustainable infrastructure programs.

2. Condition Assessment Programs

The foundation of good asset management practice is based on having comprehensive and reliable information on the current condition of the infrastructure. Municipalities need to have a clear understanding regarding 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 about an asset may lead to its premature 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 very detailed or very cursory approach.

When establishing the condition assessment of an entire asset class, the cursory approach (metrics such as good, fair, poor, very poor) is used. This will be a less expensive approach when applied to thousands of assets, yet 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 later.

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. The CityWide Works software has a road patrol component built in that could capture this type of inspection data during road patrols in the field, enabling later analysis of rehabilitation and replacement needs for budget development.

It is recommended that the municipality continue to 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 would be to have the structural engineer who performs the inspections to develop a maintenance requirements report, and rehabilitation and replacement requirements report as part of the overall assignment. In addition to refining 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 will be developed for the municipality's bridges.

2.3 Facilities & Buildings

The most popular and practical type of buildings and facility 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, mathematical modeling, or a combination of both. But the most accurate way of determining the condition requires a walk-through to collect baseline data.

The following five asset classifications are typically inspected:

- Site Components – property around the facility and includes the 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 type of 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 establish a facilities condition assessment program for its water facilities, and establish supplementary condition assessment protocols for other buildings and facilities. It is also recommended that a portion of capital funding is dedicated to this.

2.4 Fleet

The typical approach to optimizing the maintenance expenditures of a corporate fleet of vehicles is through routine vehicle inspections, routine vehicle servicing, and an established routine preventative maintenance program. Most, if not all, makes and models of vehicles 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 good vehicle maintenance is to avoid or mitigate the consequence of failure of equipment or parts. An established preventative maintenance program serves to ensure this, as it will consist of scheduled inspections and follow up repairs of vehicles and equipment in order to decrease breakdowns and excessive downtimes.

A good preventative 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 preventative maintenance program would move further and further away from reactive repairs and instead towards the prevention of all equipment failure before it occurs.

It is recommended that a preventative maintenance routine is defined and established for all fleet vehicles and that a software application is utilized for the overall management of the program.

2.5 Water

Unlike sewer mains, it is very difficult to inspect water mains from the inside due to the high pressure flow of water constantly underway within the water system. Physical inspections require a disruption of service to residents, can be an expensive exercise, and are time consuming to set up. It is recommended practice that physical inspection of water mains typically only occurs 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 are:

- Remote eddy field current (RFEC)
- Ultrasonic and acoustic techniques
- Impact echo (IE)
- 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 could be used, along with weighting factors, to determine an overall condition score are listed below.

- Age
- Material Type
- Breaks
- Hydrant Flow Inspections
- Soil Condition

It is recommended that the municipality establish a condition assessment program for its watermais, and that funds are budgeted for this initiative.

2.6 Parks and open spaces

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 park inspection will involve qualified groups of trained industry professionals (operational staff or landscape architects) performing an analysis of the condition of a group of Parks 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 establish a parks condition assessment program and that a portion of capital funding is dedicated to this.

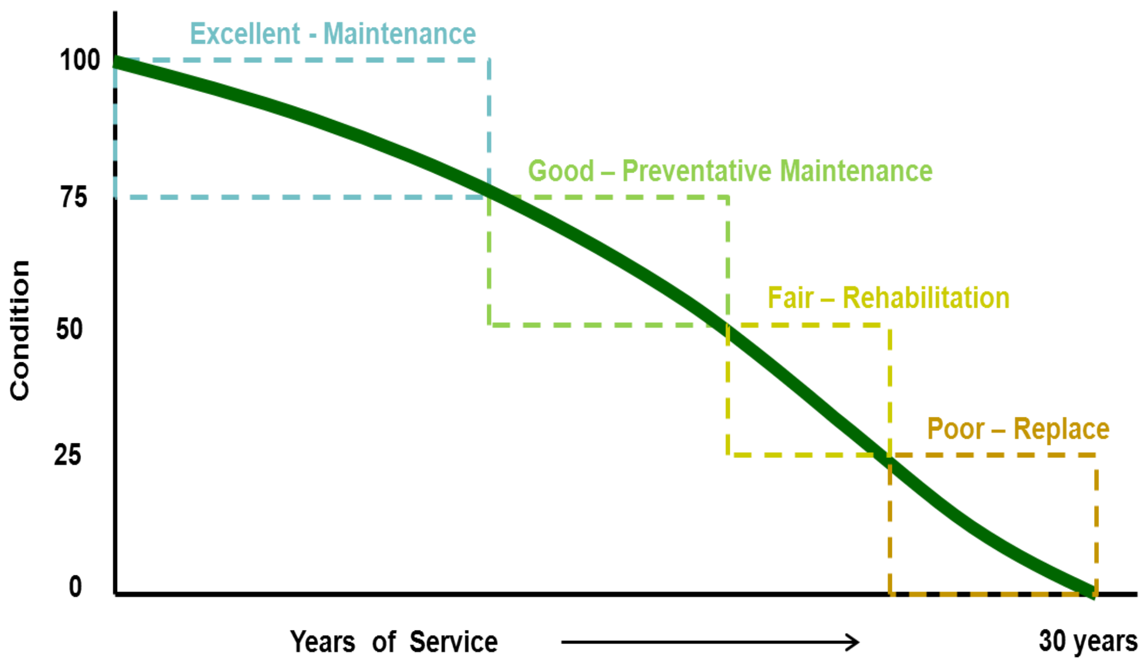
3. Life Cycle Analysis Framework

An industry review was conducted to determine which life cycle 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 could 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 municipality activities used for roads and the associated local costs for those work activities. All of 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 road with a 30-year life.

FIGURE 50 PAVED ROAD GENERAL DETERIORATION PROFILE



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

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

TABLE 18 ASSET CONDITION AND RELATED WORK ACTIVITY - PAVED ROADS

Condition	Condition Range	Work Activity
Excellent condition (Maintenance only phase)	100-76	• maintenance only
Good Condition (Preventative maintenance phase)	75 - 51	• crack sealing • emulsions
Fair Condition (Rehabilitation phase)	50 -26	• resurface - mill & pave • resurface - asphalt overlay • single & double surface treatment (for rural roads)
Poor Condition (Reconstruction phase)	25 - 1	• reconstruct - pulverize and pave • reconstruct - full surface and base reconstruction
Critical Condition (Reconstruction phase)	0	• 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 threshold and condition ranges can be easily updated and a revised financial analysis can be calculated. 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.

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

3.2 Bridges & Culverts

The best approach to develop a 10 year needs list for the municipality's bridge structure portfolio would be to have 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 Facilities & Buildings

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. Of course, if the inspection data is housed or uploaded into the CityWide software, then these reports can be produced automatically from the system.

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 / legislative requirements, energy conservation programs and upgrades, customer complaints and health and safety concerns, and also 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 Fleet and Vehicles

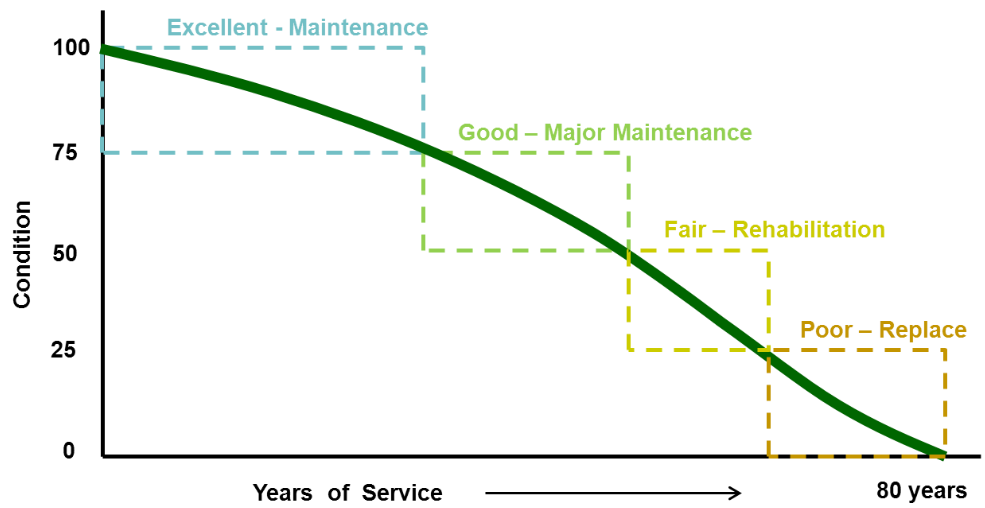
The best approach to develop a 10-year needs list for the municipality's fleet and vehicle portfolio would first be through a defined preventative maintenance program, and secondly, through an optimized life cycle vehicle replacement schedule. The preventative maintenance program would serve to determine budget requirements for operating and minor capital expenditures for part renewal and major refurbishments and rehabilitations. An optimized vehicle replacement program will ensure a vehicle 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 fleet industry in regards to vehicle life cycles 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 fleet management that should also be examined in further detail as part of the long-term management plan, such as fleet utilization and incorporating green fleet, etc. It is recommended that the municipality establish a prioritization framework for the fleet asset class that incorporates the key components outlined above.

3.5 Water

As with roads and sewers above, the following analysis has been conducted at a fairly 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 51 WATER MAIN GENERAL DETERIORATION



As shown above, during the water main's life cycle 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 19 ASSET CONDITION AND RELATED WORK ACTIVITY FOR WATER MAINS

Condition	Condition Range	Work Activity
excellent condition (Maintenance only phase)	100-76	• maintenance only (cleaning & flushing etc.)
good Condition (Preventative maintenance phase)	75 - 51	• water main break repairs • small pipe section repairs
fair Condition (Rehabilitation phase)	50 -26	• structural water main relining
poor Condition (Reconstruction phase)	25 - 1	• pipe replacement
critical Condition (Reconstruction phase)	0	• 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. While Mulmur's population has increased each census period since 1991, 30% of its residents are over 55. Shifts in demographics can cause disproportionate demand on infrastructure services.

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 piece 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.

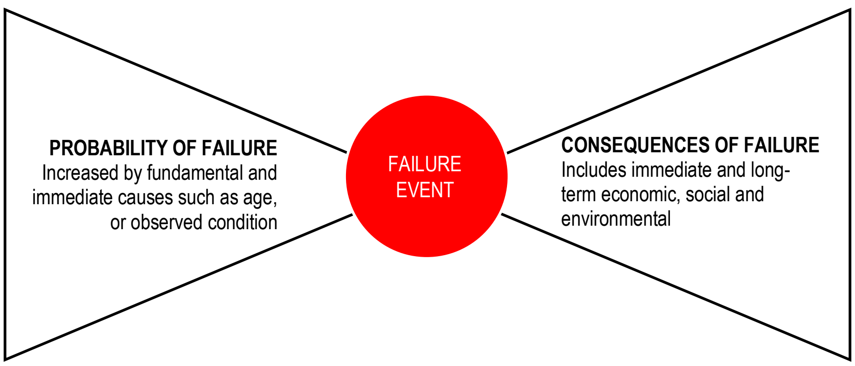
Risk mitigation is traditionally thought of in terms of safety and liability factors. In asset management, the definition of risk should heavily emphasize these factors but should be expanded to consider the risks to the municipality's ability to deliver targeted levels of service

- 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 below. 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. The following diagram (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 52 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 20 PROBABILITIY 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 their material types, classifications (or other attributes). Asset classes for which replacement cost is used include: bridges & culverts, buildings, 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 higher risk scoring.

Assets for which other attributes are used include: water, and roads. For linear infrastructure, pipe diameter is used to estimate a suitable consequence of failure score. Pipe diameter information was not available for the municipalities assets therefore a risk score could not be generated. Scoring for roads and rate-based facilities is based on classification or asset type.

TABLE 21 CONSEQUENCE OF FAILURE – BRIDGES & CULVERTS

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

TABLE 22 CONSEQUENCE OF FAILURE - BUILDINGS

Replacement Value	Consequence of failure
Up to $20k	Score of 1
$21k to $50k	Score of 2
$51k to $100k	Score of 3
$101k to $1 million	Score of 4
Over $1 million	Score of 5

TABLE 23 CONSEQUENCE OF FAILURE – LAND IMPROVEMENTS

Replacement Value	Consequence of failure
Up to $5k	Score of 1
$6k to $10k	Score of 2
$11k to $40k	Score of 3
$41k to $80k	Score of 4
Over $80k	Score of 5

TABLE 24 CONSEQUENCE OF FAILURE – ROLLING STOCK

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 $200k	Score of 4
Over $200k	Score of 5

TABLE 25 CONSEQUENCE OF FAILURE - EQUIPMENT

Replacement Value	Consequence of failure
Up to $10k	Score of 1
$11k to $15k	Score of 2
$16k to $30k	Score of 3
$31k to $100k	Score of 4
Over $100k	Score of 5

TABLE 26 CONSEQUENCE OF FAILURE - ROADS

Road Classification	Consequence of failure
Gravel	Score of 1
Surface Treatment	Score of 3
Asphalt	Score of 5

The risk matrix in Figure 53 that follow segment assets within each asset class according to the probability and likelihood of failure scores as discussed above.

FIGURE 53 DISTRIBUTION OF ASSETS BASED ON RISK – ALL ASSET CLASSES

Consequence \ Probability	1	2	3	4	5
5	13 Assets 15,487.35 m, unit(s) $4,465,139.00	37 Assets 31,221.02 unit(s), m $4,759,624.44	27 Assets 13,802.83 unit(s), m $3,917,796.00	5 Assets 1,438.91 unit(s), m $1,710,628.44	8 Assets 230.93 unit(s), m $1,347,973.00
4	3 Assets 3.00 unit(s) $1,100,863.00	5 Assets 5.00 unit(s) $1,867,248.00	4 Assets 4.00 unit(s) $908,702.00	2 Assets 2.00 unit(s) $221,757.00	5 Assets 5.00 unit(s) $181,747.00
3	5 Assets 5.00 unit(s) $1,684,344.00	14 Assets 14.00 unit(s) $6,533,126.00	8 Assets 2,170.00 m, unit(s) $2,816,401.00	4 Assets 4.00 unit(s) $726,093.00	14 Assets 14.00 unit(s) $1,188,874.00
2	15 Assets 5,428.08 m, unit(s) $2,161,946.00	11 Assets 2,631.60 m, unit(s) $1,670,636.00	7 Assets 7.00 unit(s) $1,050,090.00	1 Assets 1.00 unit(s) $38,756.00	9 Assets 9.00 unit(s) $285,938.00
1	751 Assets 15,080.98 m, unit(s) $4,971,278.00	128 Assets 29,668.70 unit(s), m $1,230,024.00	88 Assets 13,863.32 m, unit(s) $906,942.00	40 Assets 3,636.15 unit(s), m $913,832.00	306 Assets 218,483.24 unit(s), m $2,065,709.00

FIGURE 54 DISTRIBUTION OF ASSETS BASED ON RISK – ROAD NETWORK

Consequence \ Probability	1	2	3	4	5
5	11 Assets 15,485.35 m $2,995,716.00	35 Assets 31,219.02 m $3,470,119.00	25 Assets 13,800.83 m $1,588,035.00	2 Assets 1,435.91 m $165,140.00	2 Assets 224.93 m $16,302.00
4	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
3	0 Assets - $0.00	0 Assets - $0.00	1 Assets 2,163.00 m $70,135.00	0 Assets - $0.00	0 Assets - $0.00
2	1 Assets 3,051.12 m $146,785.00	2 Assets 2,622.60 m $270,522.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
1	11 Assets 8,239.25 m, unit(s) $168,164.00	48 Assets 29,589.70 m $201,736.00	43 Assets 13,818.82 m, unit(s) $101,673.00	21 Assets 3,617.15 m, unit(s) $70,309.00	232 Assets 218,409.24 m, unit(s) $776,568.00

FIGURE 55 DISTRIBUTION OF ASSETS BASED ON RISK – BRIDGES & CULVERTS

Consequence \ Probability	1	2	3	4	5
5	1 Assets 1.00 unit(s) $1,250,000.00	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $1,210,000.00	0 Assets - $0.00
4	1 Assets 1.00 unit(s) $990,000.00	1 Assets 1.00 unit(s) $1,000,000.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
3	2 Assets 2.00 unit(s) $1,270,000.00	11 Assets 11.00 unit(s) $6,380,000.00	4 Assets 4.00 unit(s) $2,550,000.00	1 Assets 1.00 unit(s) $650,000.00	1 Assets 1.00 unit(s) $800,000.00
2	1 Assets 1.00 unit(s) $350,000.00	4 Assets 4.00 unit(s) $1,290,000.00	3 Assets 3.00 unit(s) $930,000.00	0 Assets - $0.00	0 Assets - $0.00
1	6 Assets 6.00 unit(s) $132,648.00	9 Assets 9.00 unit(s) $382,493.00	9 Assets 9.00 unit(s) $660,400.00	9 Assets 9.00 unit(s) $538,630.00	15 Assets 15.00 unit(s) $864,745.00

FIGURE 56 DISTRIBUTION OF ASSETS BASED ON RISK – WATER

Consequence \ Probability	1	2	3	4	5
5	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
4	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
3	1 Assets 1.00 unit(s) $331,521.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
2	9 Assets 2,371.96 m, unit(s) $1,570,285.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $157,748.00
1	726 Assets 6,827.73 m, unit(s) $4,548,002.00	54 Assets 54.00 unit(s) $552,051.00	3 Assets 3.00 unit(s) $32,249.00	4 Assets 4.00 unit(s) $273,986.00	3 Assets 3.00 unit(s) $146,463.00

FIGURE 57 DISTRIBUTION OF ASSETS BASED ON RISK – STORM

Consequence	1	2	3	4	5
5	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
4	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
3	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
2	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
1	1 Assets 1.00 unit(s) $88,152.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00

Probability

FIGURE 58 DISTRIBUTION OF ASSETS BASED ON RISK – BUILDINGS

Consequence	1	2	3	4	5
5	0 Assets - $0.00	1 Assets 1.00 unit(s) $1,070,192.00	1 Assets 1.00 unit(s) $1,949,761.00	0 Assets - $0.00	0 Assets - $0.00
4	0 Assets - $0.00	3 Assets 3.00 unit(s) $820,832.00	4 Assets 4.00 unit(s) $908,702.00	1 Assets 1.00 unit(s) $171,329.00	0 Assets - $0.00
3	1 Assets 1.00 unit(s) $67,983.00	1 Assets 1.00 unit(s) $99,463.00	2 Assets 2.00 unit(s) $179,368.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $127,343.00
2	0 Assets - $0.00	3 Assets 3.00 unit(s) $90,703.00	2 Assets 2.00 unit(s) $56,851.00	1 Assets 1.00 unit(s) $38,756.00	1 Assets 1.00 unit(s) $37,652.00
1	3 Assets 3.00 unit(s) $23,225.00	10 Assets 9.00 m, unit(s) $72,015.00	3 Assets 2.50 unit(s) $46,243.00	0 Assets - $0.00	8 Assets 8.00 unit(s) $110,254.00

Probability

FIGURE 59 DISTRIBUTION OF ASSETS BASED ON RISK – MACHINERY & EQUIPMENT

Consequence	1	2	3	4	5
5	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $380,000.00	0 Assets - $0.00	4 Assets 4.00 unit(s) $1,030,335.00
4	2 Assets 2.00 unit(s) $110,863.00	1 Assets 1.00 unit(s) $46,416.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $50,428.00	5 Assets 5.00 unit(s) $181,747.00
3	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	3 Assets 3.00 unit(s) $76,093.00	11 Assets 11.00 unit(s) $261,531.00
2	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	5 Assets 5.00 unit(s) $69,849.00
1	2 Assets 2.00 unit(s) $5,272.00	7 Assets 7.00 unit(s) $21,729.00	27 Assets 27.00 unit(s) $57,799.00	6 Assets 6.00 unit(s) $30,907.00	43 Assets 43.00 unit(s) $158,494.00

Probability

FIGURE 60 DISTRIBUTION OF ASSETS BASED ON RISK – LAND IMPROVEMENTS

Consequence	1	2	3	4	5
5	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	1 Assets 1.00 unit(s) $116,175.00	1 Assets 1.00 unit(s) $82,023.00
4	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
3	1 Assets 1.00 unit(s) $14,840.00	2 Assets 2.00 unit(s) $53,663.00	1 Assets 1.00 unit(s) $16,898.00	0 Assets - $0.00	0 Assets - $0.00
2	2 Assets 2.00 unit(s) $13,791.00	2 Assets 2.00 unit(s) $19,411.00	0 Assets - $0.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $20,689.00
1	2 Assets 2.00 unit(s) $5,815.00	0 Assets - $0.00	3 Assets 3.00 unit(s) $8,578.00	0 Assets - $0.00	5 Assets 5.00 unit(s) $9,185.00

Probability

FIGURE 61 DISTRIBUTION OF ASSETS BASED ON RISK – VEHICLES

Consequence	1	2	3	4	5
5	1 Assets 1.00 unit(s) $219,423.00	1 Assets 1.00 unit(s) $219,313.44	0 Assets - $0.00	1 Assets 1.00 unit(s) $219,313.44	1 Assets 1.00 unit(s) $219,313.00
4	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
3	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00
2	2 Assets 2.00 unit(s) $81,085.00	0 Assets - $0.00	2 Assets 2.00 unit(s) $63,239.00	0 Assets - $0.00	0 Assets - $0.00
1	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00	0 Assets - $0.00

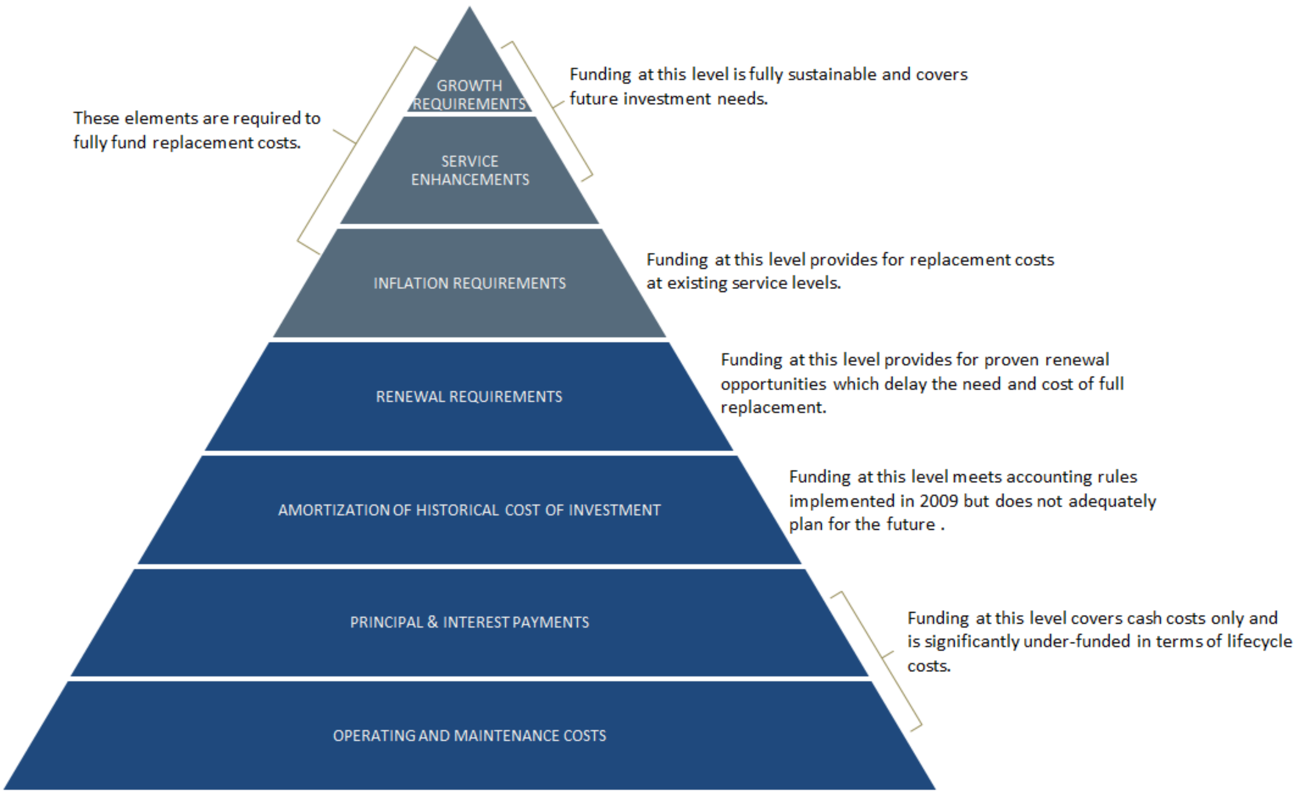
Probability

IX. Financial Strategy

1. General Overview

In order for an AMP to be effectively put into action, 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 following pyramid depicts the various cost elements and resulting funding levels that should be incorporated into AMPs that are based on best practices.

FIGURE 62 COST ELEMENTS



This report develops such a financial plan by presenting several scenarios for consideration and culminating with final recommendations. As outlined below, the scenarios presented model different combinations of the following components:

1. the financial requirements (as documented in the SOTI section of this report) for:
    - existing assets
    - existing service levels
    - requirements of contemplated changes in service levels (none identified for this plan)
    - requirements of anticipated growth (none identified for this plan)

2. use of traditional sources of municipal funds:
    - tax levies
    - user fees
    - reserves
    - debt
    - development charges

3. use of non-traditional sources of municipal funds:
    - reallocated budgets
    - partnerships
    - procurement methods

4. use of senior government funds:
    - gas tax
    - grants (not included in this plan due to Provincial requirements for firm commitments)

If the financial plan component of an AMP results in a funding shortfall, the Province requires the inclusion of a specific plan as to how the impact of the shortfall will be managed. In determining the legitimacy of a funding shortfall, the Province may evaluate a municipality's approach to the following:

1. in order to reduce financial requirements, consideration has been given to revising service levels downward
2. all asset management and financial strategies have been considered. For example:
    - if a zero debt policy is in place, is it warranted? If not, the use of debt should be considered.
    - do user fees reflect the cost of the applicable service? If not, increased user fees should be considered.

This AMP includes recommendations that avoid long-term funding deficits.

2. Financial Profile: Tax Funded Assets

2.1 Funding objective

We have developed scenarios that would enable the municipality to achieve full funding within five to 20 years for the following assets: roads; bridges & culverts; storm sewers; buildings; machinery & equipment; vehicles; and yard improvement. For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees, reserves and debt.

2.2 Current funding position

Table 27 and Table 28 outline, by asset category, the municipality's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by taxes.

TABLE 27 SUMMARY OF INFRASTRUCTURE REQUIREMENTS AND CURRENT FUNDING AVAILABLE: TAX FUNDED ASSETS

		2016 Funding Available					
Asset Category	Average Annual Investment Required	Taxes	Gas Tax	OCIF	Taxes to Reserves	Total Funding Available	Annual Deficit
Road Network	883,000	0	110,000	50,000	0	160,000	723,000
Bridges & Culverts	296,000	0	0	0	200,000	200,000	96,000
Storm Sewer	2,000	0	0	0	0	0	2,000
Equipment	241,000	192,000	0	0	5,000	197,000	44,000
Facilities	103,000	0	0	0	0	0	103,000
Land Improvements	20,000	253,000	0	0	0	253,000	-233,000
Vehicles	103,000	192,000	0	0	0	192,000	-89,000
Total	1,648,000	637,000	110,000	6,000	205,000	1,002,000	646,000

2.3 Recommendations for full funding

The average annual investment requirement for tax funded categories is $1,648,000. Annual revenue currently allocated to these assets for capital purposes is $1,002,000, leaving an annual deficit of $646,000. To put it another way, these infrastructure categories are currently funded at 61% of their long-term requirements. In 2016, the municipality has annual tax revenues of $3,670,000. As illustrated in Table 28, without consideration of any other sources of revenue, full funding would require the following tax change over time:

TABLE 28 TAX CHANGE REQUIRED FOR FULL FUNDING

Asset Category	Tax Increase Required for Full Funding
Road Network	19.7%
Bridges & Culverts	2.6%
Storm Sewer Network	0.1%
Facilities	2.8%
Machinery & Equipment	1.2%
Vehicles	-2.4%
Land Improvements	-6.3%
Total	17.7%

As illustrated in Table 35, Mulmur Township's debt payments for these asset categories will be decreasing by $10,000 over the next 5 years and by $36,000 over the next 10 years. Although not shown in the table, debt payment decreases will be $42,000 and $74,000 over the next 15 and 20 years respectively. Our recommendations include capturing those decreases in cost and allocating them to the infrastructure deficit outlined above. Table 29 outlines this concept and presents a number of options.

TABLE 29 EFFECT OF REALLOCATING DECREASES IN DEBT COST

	Without reallocation of decreasing debt costs				With reallocation of decreasing debt costs			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit (Surplus)	646,000	646,000	646,000	646,000	646,000	646,000	646,000	646,000
Change in Debt Costs	N/A	N/A	N/A	N/A	-10,000	-36,000	-42,000	-74,000
Resulting Infrastructure Deficit (Surplus)	646,000	646,000	646,000	646,000	636,000	610,000	604,000	572,000
Resulting Rate Increase Required:								
Total Over Time	17.6%	17.6%	17.6%	17.6%	17.3%	16.6%	16.5%	15.6%
Annually	3.5%	1.8%	1.2%	0.9%	3.5%	1.7%	1.1%	0.8%

Considering all of the above information, we recommend the 15-year option in Table 29. This involves full funding being achieved over 15 years by:

1. when realized, reallocating the debt cost reductions of $42,000 to the infrastructure deficit as outlined above.
2. increasing tax revenues by 1.1% each year for the next 15 years solely for the purpose of phasing in full funding to the tax funded asset categories covered in this AMP.
3. allocating the current gas tax and OCIF revenue as outlined in Table 27
4. increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this periodic funding cannot be incorporated into an AMP unless there are firm commitments in place. We have included OCIF formula based funding, if applicable, since this funding is a multi-year commitment.
2. We realize that raising tax revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.

Although this option achieves full funding on an annual basis in 15 years and provides financial sustainability over the period modeled, the recommendations do require prioritizing capital projects to fit the resulting annual funding available. Current data shows a pent up investment demand of $645,000 for paved roads, $402,000 for bridges & culverts, $1,120,000 for machinery & equipment, $161,000 for facilities, $82,000 for land improvements, $0 for storm and $0 for vehicles. Prioritizing future projects will require the current data to be replaced by condition based data. Although our recommendations include no further use of debt, the results of the condition based analysis may require otherwise.

3. Financial Profile: Rate Funded Assets

3.1 Funding objective

We have developed scenarios that would enable the municipality to achieve full funding within five to 20 years for water assets. For each scenario developed we have included strategies, where applicable, regarding the use of tax revenues, user fees, reserves and debt.

3.2 Current funding position

Table 30 and Table 31 outline, by asset category, the municipality's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by rates.

TABLE 30 SUMMARY OF INFRASTRUCTURE REQUIREMENTS AND CURRENT FUNDING AVAILABLE

Asset Category	Average Annual Investment Required	2014 Annual Funding Available				Annual Deficit
		Rates	To Operations	To Perpetual Care	Total	
Water System	140,000	159,000	-125,000	0	34,000	106,000
Total	140,000	159,000	-125,000	0	34,000	106,000

3.3 Recommendations for full funding

The average annual investment requirement for water services is $140,000. Annual revenue currently allocated to these assets for capital purposes is $34,000, leaving an annual deficit of $106,000. To put it another way, these infrastructure categories are currently funded at 24% of their long-term requirements. In 2016, Mulmur has annual water revenues of $159,000. As illustrated in the table below, without consideration of any other sources of revenue, full funding would require the following increases over time:

TABLE 31 RATE CHANGE REQUIRED FOR FULL FUNDING

Asset Category	Rate Increase Required for Full Funding
Water	66.7%

As illustrated in Table 35, Mulmur Township's debt payments for water services will be decreasing by $29,000 over the next 5, 10 and 15 years. Our recommendations include capturing those decreases in cost and allocating them to the applicable infrastructure deficit. Table 32 outlines the above concept and present a number of options:

TABLE 32 WITH AND WITHOUT CHANGE IN DEBT COSTS

	Without change			With change		
	5 Years	10 Years	15 Years	5 Years	10 Years	15 Years
Infrastructure Deficit (Surplus)	106,000	106,000	106,000	106,000	106,000	106,000
Change in Debt Costs	N/A	N/A	N/A	-29,000	-29,000	-29,000
Resulting Infrastructure Deficit (Surplus)	106,000	106,000	106,000	77,000	77,000	77,000
Resulting Rate Increase Required:						
Total Over Time	66.7%	66.7%	66.7%	48.4%	48.4%	48.4%
Annually	13.3%	6.7%	4.4%	9.7%	4.8%	3.2%

Considering all of the above information, we recommend the following to achieve full funding within 15 years:

1. when realized, reallocating the debt cost reductions of $29,000 for water services to the applicable infrastructure deficit.
2. increasing rate revenues by 3.2% for water services each year for the next 15 years solely for the purpose of phasing in full funding to water services
3. increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:

1. As in the past, periodic senior government infrastructure funding will most likely be available during the phase-in period. By Provincial AMP rules, this periodic funding cannot be incorporated into an AMP unless there are firm commitments in place. We have included OCIF formula based funding, if applicable, since this funding is a multi-year commitment.
2. We realize that raising rate revenues by the amounts recommended above for infrastructure purposes will be very difficult to do. However, considering a longer phase-in window may have even greater consequences in terms of infrastructure failure.
3. Any increase in rates required for operations would be in addition to the above recommendations.

Although this option achieves full funding on an annual basis in 15 years and provides financial sustainability over the period modeled, the recommendations do require prioritizing capital projects to fit the resulting annual funding available. Current data shows a pent up investment demand of $5,000 for water services. Prioritizing future projects will require the current data to be replaced by condition based data. Although our recommendations include no further use of debt, the results of the condition based analysis may require otherwise.

4. Use of debt

For reference purposes, Table 33 outlines the premium paid on a project if financed by debt. For example, a $1M project financed at 3.0%[3] over 15 years would result in a 26% premium or $260,000 of increased costs due to interest payments. For simplicity, the table does not take into account the time value of money or the effect of inflation on delayed projects.

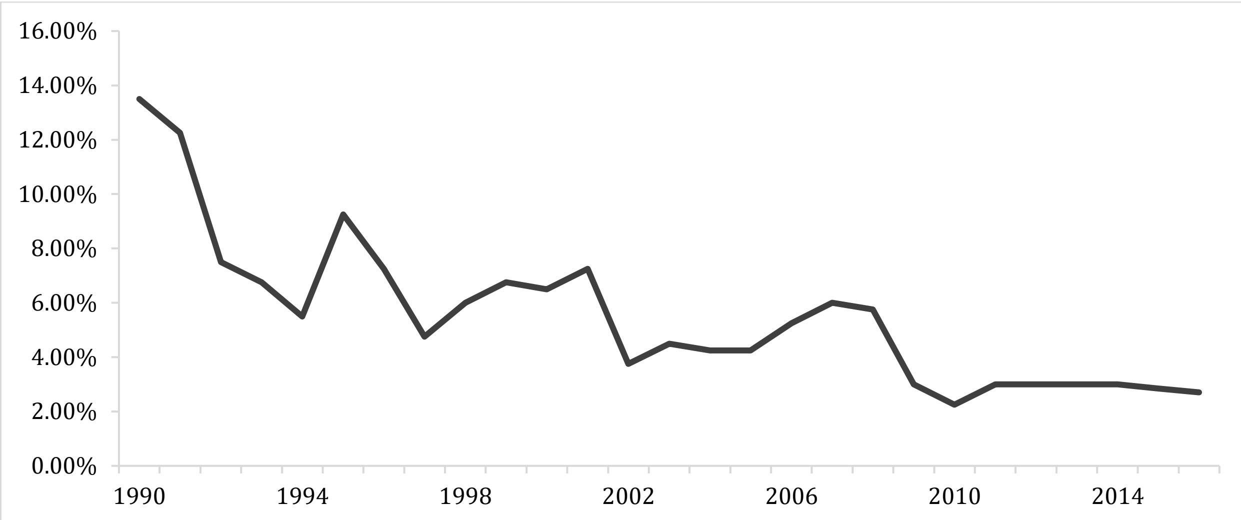
TABLE 33 TOTAL INTEREST PAID AS A % OF PROJECT COSTS

	Number of Years Financed					
Interest Rate	5	10	15	20	25	30
7.0%	22%	42%	65%	89%	115%	142%
6.5%	20%	39%	60%	82%	105%	130%
6.0%	19%	36%	54%	74%	96%	118%
5.5%	17%	33%	49%	67%	86%	106%
5.0%	15%	30%	45%	60%	77%	95%
4.5%	14%	26%	40%	54%	69%	84%
4.0%	12%	23%	35%	47%	60%	73%
3.5%	11%	20%	30%	41%	52%	63%
3.0%	9%	17%	26%	34%	44%	53%
2.5%	8%	14%	21%	28%	36%	43%
2.0%	6%	11%	17%	22%	28%	34%
1.5%	5%	8%	12%	16%	21%	25%
1.0%	3%	6%	8%	11%	14%	16%
0.5%	2%	3%	4%	5%	7%	8%
0.0%	0%	0%	0%	0%	0%	0%

[3] Current municipal Infrastructure Ontario rates for 15 year money is 3.2%.

It should be noted that current interest rates are near all-time lows. Sustainable funding models that include debt need to incorporate the risk of rising interest rates. The following graph shows where historical lending rates have been:

FIGURE 63 HISTORICAL PRIME BUSINESS INTEREST RATES



As illustrated in Table 33, a change in 15 year rates from 3% to 6% would change the premium from 26% to 54%. Such a change would have a significant impact on a financial plan.

Table 34 and Table 35 outline how Mulmur has historically used debt for investing in the asset categories as listed. There is currently $684,000 of debt outstanding for the assets covered by this AMP with corresponding principal and interest payments of $103,000. In terms of overall debt capacity, in 2014 Mulmur Township had $244,000 in total annual principal and interest payment commitments, well within its provincially prescribed maximum of $960,000.

TABLE 34 OVERVIEW OF USE OF DEBT

Asset Category	Debt at December 31st, 2015	Use of Debt in Last Five Years				
		2011	2012	2013	2014	2015
Road Network	0	0	0	0	0	46,000
Bridges & Culverts	506,000	0	0	0	0	533,000
Equipment	0	0	0	0	0	0
Facilities	150,000	0	0	0	0	167,000
Land Improvements	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0
Total Tax Funded	656,000	0	0	0	0	746,000
Water services	28,000	0	0	0	0	0
Total Rate Funded	28,000	0	0	0	0	82,000

TABLE 35 OVERVIEW OF DEBT COSTS

Asset Category	Principal & Interest Payments in Next Ten Years						
	2016	2017	2018	2019	2020	2021	2026
Road Network	0	0	0	0	0	0	0
Bridges & Culverts	51,000	50,000	49,000	47,000	46,000	45,000	38,000
Equipment	0	0	0	0	0	0	0
Facilities	23,000	23,000	22,000	21,000	20,000	19,000	0
Land Improvements	0	0	0	0	0	0	0
Vehicles	0	0	0	0	0	0	0
Total Tax Funded	74,000	73,000	71,000	68,000	66,000	64,000	38,000
Water services	29,000	0	0	0	0	0	0
Total Rate Funded	29,000	0	0	0	0	0	0

The revenue options outlined in this plan allow Mulmur to fully fund its long-term infrastructure requirements without further use of debt. However, project prioritization based on replacing age-based data with observed data for several tax funded and rate funded classes may require otherwise.

5. Use of reserves

5.1 Available reserves

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

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

By infrastructure category, Table 36 outlines the details of the reserves currently available to Mulmur.

TABLE 36 SUMMARY OF RESERVES AVAILABLE

Asset Category	Balance at December 31, 2015
Road Network	131,000
Bridges & Culverts	315,000
Equipment	50,000
Facilities	63,000
Land Improvements	87,000
Vehicles	22,000
Total Tax Funded	668,000
Water system	308,000
Total Rate Funded	308,000

There is considerable debate in the municipal sector as to the appropriate level of reserves that a municipality should have on hand. There is no clear guideline that has gained wide acceptance. Factors that municipalities should take into account when determining their capital reserve requirements include:

- breadth of services provided
- age and condition of infrastructure
- use and level of debt
- economic conditions and outlook
- internal reserve and debt policies.

The reserves in Table 36 are available for use by applicable asset categories during the phase-in period to full funding. This, coupled with Mulmur's judicious use of debt in the past, allows the scenarios to assume that, if required, available reserves and debt capacity can be used for high priority and emergency infrastructure investments in the short to medium-term.

5.2 Recommendation

As Mulmur updates its AMP and expands it to include other asset categories, we recommend that future planning should include determining what its long-term reserve balance requirements are and a plan to achieve such balances.

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 37 2016 INFRASTRUCTURE REPORT CARD

Asset Category	Asset Health Grade	Funding Percentage	Financial Capacity Grade	Average Asset Category Grade	Comments
Roads	C	18%	F	F	Based on 2016 replacement cost, and a blend of age-based and assessed condition data, 63% of the municipality's assets are in good to very good condition as of 2015. However, 18%, with a valuation of $8.7 million are in poor to very poor condition. The municipality is severely underfunding its assets. Average funding is 61% for tax funded categories and 24% for rate funded categories.
Bridges & Culverts	C	68%	C	C	
Water Network	B	24%	F	D	
Storm	A	0%	F	D	
Buildings	C	0%	F	F	
Vehicles	C	186%	A	B	
Land Improvements	D	1265%	A	C	
Machinery & Equipment	F	191%	A	C	
		Average Asset Health Grade	C		
		Average Financial Capacity Grade	F		
		Overall Grade for the Municipality	D		

XI. Appendices: Grading and Conversion Scales

Appendix 1: Grading and Conversion Scales

TABLE 38 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. Preventative maintenance is beneficial at this stage.
C	Fair	Deterioration is evident but asset continues to full its function. Preventative 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 39 FINANCIAL CAPACITY SCALE

How well is the municipality funding its long-term infrastructure requirements?
Short Term: Less than 5 years
Medium Term: 5 to 20 years
Long Term: Greater than 20 years

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 underpreparing 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.