AMP2018

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The 2018 Asset Management Plan for the

City of Corinth

SUBMITTED BY PSD
WWW.PSDRCS.COM
FEBRUARY 2019

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Executive Summary

Infrastructure is inextricably linked to the economic, social and environmental advancement of a community. As analyzed in this asset management plan (AMP), the city of Corinth's infrastructure portfolio comprises the following asset classes: road system, bridges & culverts, buildings, stormwater system, water system, wastewater system, and machinery & equipment. The asset classes analyzed in this asset management plan for the City had a total 2018 valuation of $659 million, of which the water system comprised 36%.

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

In addition to observed field conditions, historical capital expenditures can assist the City in identifying impending infrastructure needs and guide its medium- and long-term capital programs. The City has continuously invested into its infrastructure over the decades. Investments fluctuated during the 1970s and 1980s and then peaked in the late 1990s. During this time, $218 million was invested with $103 million put into the road system. Since 2015, $29.5 million has been invested with a heavier focus on roads, the water system and buildings.

Based on 2018 replacement cost, and primarily age-based data, over 39% of assets, with a valuation of $210 million, are in good to very good condition; 21% are in poor to very poor condition. The City has provided condition information for 6% of assets based on 2018 replacement cost. 86% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 4%, with a valuation of $22 million, remain in operation beyond their established useful life. An additional 3% will reach the end of their useful life within the next five years.

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

The average annual investment requirement for the above categories is $6,319,000. Annual revenue currently allocated to these assets for capital purposes is $0 leaving an annual deficit of $6,319,000. To put it another way, these infrastructure categories are currently funded at 0% of their long-term requirements. In 2018, Corinth has annual tax revenues of $11,400,000. Our strategy includes a 20-year option to become 50% funded by debt and 50% by current revenues by:

- starting in 2024, increasing tax revenues by 0.8% each year for the next 20 years solely for the purpose of phasing in 50% funding to the asset categories covered in this section of the AMP.
- when realized, reallocating the debt cost reductions to the infrastructure deficit as outlined above.
- phasing the debt funded portion of the capital plan from 100% to 50% as outlined above.
- 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 wastewater system, water system and stormwater system are $6,099,000. Annual revenue currently allocated to these assets for capital purposes is $0 leaving an annual deficit of $6,099,000. To put it another way, these infrastructure categories are currently funded at 0% of their long-term requirements. In 2018, Corinth has annual wastewater system revenue of $3,288,000, annual water system revenue of $7,758,000 and annual stormwater system revenue of $712,000.

Our strategy includes a 20 year option to become 50% funded by debt and 50% by current revenues by:

- each year for the next 20 years, solely for the purpose of phasing in 50% funding to the asset categories covered in this section of the AMP, increase revenues as follows: wastewater system 0.4%; water system 1.0%; stormwater system 3.8%.
- when realized, reallocating the debt cost reductions to the infrastructure deficit as outlined above.
- phasing the debt funded portion of the capital plan from 100% to 50% as outlined above.
- 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.

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

Asset Management Policy & City Council Resolution

RESOLUTION NO. 18-12-6-17

A RESOLUTION REVIEWING AND APPROVING THE STRATEGIC ASSET MANGEMENT POLICY FOR THE CITY OF CORINTH; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the City Council has reviewed and approved the Strategic Asset Management Policy attached hereto as Exhibit A, and

NOW, THEREFORE, THE COUNCIL OF THE CITY OF CORINTH HEREBY RESOLVES:

SECTION 1. That the City Council has reviewed the attached Strategic Asset Management Policy, which contain the strategies and policies of implementing and developing a comprehensive asset management system that provides optimized lifecycle asset management across and the city, and hereby approves the Strategic Asset Management Policy.

SECTION 2. That the Public Works Director is the chair of the Asset Management Team and is responsible for the overall design, maintenance, documentation, review and improvement of the City's Asset Management System.

SECTION 3. That all resolutions or parts of resolutions in force when the provisions of this resolution became effective which are inconsistent or in conflict with the terms or provisions contained in this resolution are hereby repealed to the extent of any such conflict only.

SECTION 4. That this resolution shall take effect immediately upon its passage and approval.

PASSED AND APPROVED this the 6th day of December 2018.

Bill Heidemann, Mayor

CITY OF CORINTH TEXAS

ATTEST:

Kim Pence, City Secretary

APPROVED AS TO FORM:

Wm. Andrew Messer, City Attorney

CITY OF CORINTH

POLICY/ADMINISTRATIVE PROCEDURE/ADMINISTRATIVE DIRECTIVE

SUBJECT: STRATEGIC ASSET MANAGEMENT POLICY	INITIAL APPROVAL DATE: 12-06-2018
NEXT POLICY REVIEW: March 1, 2021	LAST REVISION DATE: 12-06-2018

1. PURPOSE

The purpose of this policy is to provide leadership in and commitment to the development and implementation of the City's asset management program. It is intended to guide the consistent use of asset management across the organization, to facilitate logical and evidence-based decision-making for the management of municipal infrastructure assets and to support the delivery of sustainable community services now and in the future.

By using sound asset management practices, the City will work to ensure that all municipal infrastructure assets meet expected performance levels and continue to provide desired service levels in the most efficient, reasonable and effective manner. Linking service outcomes to infrastructure investment decisions will assist the Municipality in focusing on service, rather than budget driven asset management approaches.

This policy demonstrates an organization-wide commitment to the good stewardship of municipal infrastructure assets, and to improved accountability and transparency to the community through the adoption of best practices regarding asset management planning.

2. POLICY STATEMENT

This policy introduces an integrated Asset Management System (AMS) across all asset classes. The AMS adopted for each asset class will be consistent with international standards and commensurate with the size and importance of those asset classes.

The City of Corinth has a strategic role in providing an accessible street system, a dependable water system, a safe wastewater system, an adequate stormwater system, quality buildings, and dependable machinery, equipment, and vehicles that contribute to our economic development and enhances the quality of life for all Corinth residents. Long-term sustainable asset management is essential to fulfilling this role and delivering cost-effective infrastructure and services.

The approval of this policy is an important step towards integrating the Municipality's strategic goals with its asset management program, and ensuring that critical municipal infrastructure assets and vital services are maintained and provided to the community in a consistent, reliable and sustainable manner.

2.1 Policy Principles

The Following principles collectively guide the current management and future development of Corinth's infrastructure assets:

- Implement international best practice benchmarks for asset management.
  The ISO 55000 suite of standards will be the international benchmark used by Corinth.

- Deliver a 'fix it first' approach.
  Use the full potential of existing assets by proactively repairing or rehabilitating assets rather than replacing them to ensure their sustainability.

- Ensure life-cycle costs are factored into infrastructure investment decision-making.
  Capital expansion programs and projects will be accompanied by a clear position on the ongoing funding required to maintain and operate the new assets and services.

- Provide 'fit for purpose' solutions.
  Maintain existing assets to a 'fit for purpose' condition that is sustainable.

  Corinth will define appropriate, affordable levels of service which balance performance, costs and risks over the asset's life to ensure the full range of assets are sustainable.

3. SCOPE

This policy covers the physical assets that comprise the city's infrastructure network and the integrated asset management system including data, processes, information system, governance, knowledge and capability.

The department's transport infrastructure asset classes covered by this policy include:

- Roads
- Bridges and culverts
- Water systems
- Wastewater systems
- Stormwater systems
- Buildings and facilities
- Machinery and equipment
- Vehicles

Although human factors such as leadership, motivation and culture are not directly addressed within the scope of this policy, they are critical to successfully achieving optimized and sustainable asset management and require due consideration. This is applicable to all the department's managers, employees, contractors and suppliers.

4. ROLES AND RESPONSIBILITIES

The development and continuous support of the Municipality's asset management program requires a wide range of duties and responsibilities. The following passages outline the persons responsible for these tasks:

A. Council

1. Approve the AM policy
2. Maintain adequate organizational capacity to support the core practices of the AM program
3. Prioritize effective stewardship of assets in adoption and ongoing review of policy and budgets
4. Monitor levels of service

B. City Manager

1. Development of recommended policy and policy updates
2. Provide organization-wide leadership in AM practices and concepts
3. Provide departmental staff coordination
4. Establish and monitor levels of service
5. Coordinate and track AM program implementation and progress

C. Asset Management Team (AMT)

1. Development of recommended policy and policy updates
2. Provide corporate oversight to goals and directions and ensure the AM program aligns with the Municipality's strategic plan
3. Ensure that adequate resources are available to implement and maintain core AM practices
4. Provide departmental staff coordination
5. Establish and monitor levels of service
6. Track, analyze and report on AM program progress and results
7. External resources will contribute to development of condition ratings, lifecycle calculations, risk analysis and management, and cost estimates. External resources will also be responsible for providing legal advice.

D. Departmental Staff

1. Utilize the new business processes and technology tools developed as part of the AM program
2. Participate in implementation task teams to carry-out AM activities
3. Establish and monitor levels of service
4. Provide support and direction for AM practices within their department
5. Track, analyze and report on AM program progress and results

5. POLICY IMPLEMENTATION

Corinth will convene a senior management team, the Asset Management team (AMT), to oversee the development, implementation and continuous improvement of all components of the Asset Management System.

Corinth will measure and report on the Asset Sustainability Ratio as a key performance indicator on an annual basis. The city will also benchmark its progress against ISO 55000 requirements on a regular basis.

The Public Works Director is the chair of the Asset Management Team and is responsible for the overall design, maintenance, documentation, review and improvement of the City's Asset Management System.

The components of the Asset Management System will include:

- Asset management policy
- Asset management strategies and objectives
- Asset management plans
- High level action plans for improvement of asset management practice across Corinth in the Capital Improvement Plan (CIP), and
- Performance monitoring, reporting and review processes.

5.1 International Asset Management Standard

International asset management specifications highlight the importance of city-wide asset management policies as part of an integrated suite within an Asset Management System. The contents of this policy confirm to the direction and intent of the ISO 55000 suite of international asset management standards. ISO 55001 specifies that an organization shall establish, implement, maintain and continually improve an asset management system, including the processes needed and their interactions. In addition, the city shall develop a Strategic Asset Management Plan which includes documentation of the role of the asset management system in a supporting achievement of asset management objectives.

6. OBJECTIVES

The objective of this policy is to set the direction and framework required for infrastructure asset sustainability, and to include:

- Ensuring that the City's infrastructure assets are managed in a sustainable manner, with appropriate levels of service that balance the needs of residents and the environment within available funding and consistent with the city's risk framework.
- Safeguarding the City's infrastructure assets and employees by implementing effective asset management strategies and providing the necessary financial resources for those assets.
- Ensuring resources required and operational capabilities are identified and responsibility for asset management is allocated.

- Assigning clear responsibilities and accountabilities for the ownership and control of the City's infrastructure assets and the associated reporting responsibilities.
- Maximizing value-for-money, taking into account the full costs of providing, holding, using, maintaining and disposing of assets throughout their lifecycles.
- Optimizing the infrastructure solutions through improved management and economies of scale.
- Demonstrating transparent and responsible asset management processes that align with established best practices.

7. BENEFITS

The benefits to the City of implementing this policy include development a comprehensive asset management system that provides optimized lifecycle asset management across the city.

8. RISK MANAGEMENT

All components of the Asset Management System shall be developed in line with the principles of the City's Risk Management Framework.

9. PERFORMANCE ASSESSMENT AND IMPROVEMENT

Corinth is committed to continual improvement in asset management practices and asset management performance.

Corinth will define, through a Capital Improvement Plan (CIP), mechanisms for performance assessment and continual improvement of asset management system and practices that will include a reporting and review framework managed through the Asset Management Team including:

- Performance and condition monitoring
- Investigation of asset-related failures, incidents and non-conformities
- Evaluation of compliance
- Audit
- Improvement actions
- Records

Corinth will develop Asset Management Plans for each of its asset classes that will:

- Define performance measures for the asset based on city objectives, Council priorities, asset management objectives and recognized best practices.
- Review available resources
- Identify performance gaps, if any
- Define options to close the gaps based on sustainability principles and risk
- Outline improvements to the asset required to achieve sustainability.

10. REFERENCES

References include, but are not limited to:

- International Organization for Standardization (ISO), ISO 55000, 55001, and 55002
- IPWEA International Infrastructure Management Manual

11. POLICY REVIEW

This policy shall be reviewed on a biennial basis. The next review of this policy is due on March 1, 2021.

City of Corinth Asset Management Team

The City of Corinth's Asset Management team, listed below, were PSD's key contacts on this project and will continue to work on asset management initiatives going forward.

Table 1 Asset Management Team

Name	Title
Cody Collier	Director of Public Works
Melissa Dolan	Special Programs and Recreation Manager
George Marshall	City Engineer
Ben Rodriguez	Planning Manager
Garrett Skrehart	GIS Manager
Lee Ann Bunselmeyer	Director of Finance
Becky Buck	Comptroller
Julia Sykes	HR Generalist

I. Introduction & Context

The state of Texas has some of the largest infrastructure in the US and is leading the way in wind power energy production and population growth, necessitating continued and improved maintenance on their assets.

Texas is geographically the largest state in the continental US, with a large-scale infrastructure portfolio that is increasingly in need of maintenance. The asset portfolios managed by Texas municipalities are highly diverse. The City of Corinth's capital assets portfolio, as analyzed in this asset management plan (AMP) is valued at $659 million using 2018 replacement costs and event costs. The City 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 City manage these assets optimally in order to produce the highest total value for taxpayers. This asset management plan, (AMP) will assist the City in the pursuit of judicious asset management for its capital assets.

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 2 Objectives of Asset Management

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

1. Overarching Principles

The Institute of Asset Management (IAM) recommends the adoption of seven key principles for a sustainable asset management program. According to IAM, asset management must be:[1]

Table 3 Principles of Asset Management

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

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

III. AMP Objectives and Content

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

This AMP is developed in accordance with international best practices in asset management. The following asset classes are analysed in this document: road system; bridges & culverts; water; wastewater; stormwater; facilities; and machinery & equipment.

IV. Data and Methodology

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

1. Condition Data

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

As available, actual field condition data was used to make recommendations more meaningful and representative of the City's state of infrastructure. 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 and combined to enumerate the total available funding; funding for the previous three years is analyzed as data is available. These figures are then assessed against the average annual requirements, and are used to calculate the annual funding shortfall (surplus) and for forming the financial strategies.

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

Only predictable sources of funding are used, e.g., tax and utility revenues, user fees, and other streams of income the City can rely on with a high degree of certainty. Government grants and other ad-hoc injections of capital are not included in this asset management plan given their unpredictability. As state and federal governments make greater, more predictable and permanent commitments to funding municipal infrastructure programs, 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 make communications more meaningful and the AMP more accessible, we've developed an Infrastructure Report Card that summarizes our findings in common language that municipalities can use for internal and external distribution. The report card is developed using two key, equally weighted factors: Financial Capacity and Asset Health.

Table 4 Infrastructure Report Card Description

	Financial Capacity	A City's financial capacity grade is determined by the level of funding available (0-100%) for each asset class for the purpose of meeting the average annual investment requirements.
	Asset Health	Using either field inspection data as available or age-based data, the asset health component of the report card uses condition (0-100%) to estimate how capable assets are in performing their required functions. We use replacement cost to determine the weight of each condition group within the asset class.
Letter Grade	**Rating**	**Description**
A	Very Good	The asset is functioning and performing well; only normal preventative maintenance is required. The City is fully prepared for its long-term replacement needs based on its existing infrastructure portfolio.
B	Good	The City 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 City 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 City 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 City 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 City may have to divest some of its assets (e.g., bridge closures, park closures) and levels of service will be reduced significantly.

4. Limitations and Assumptions

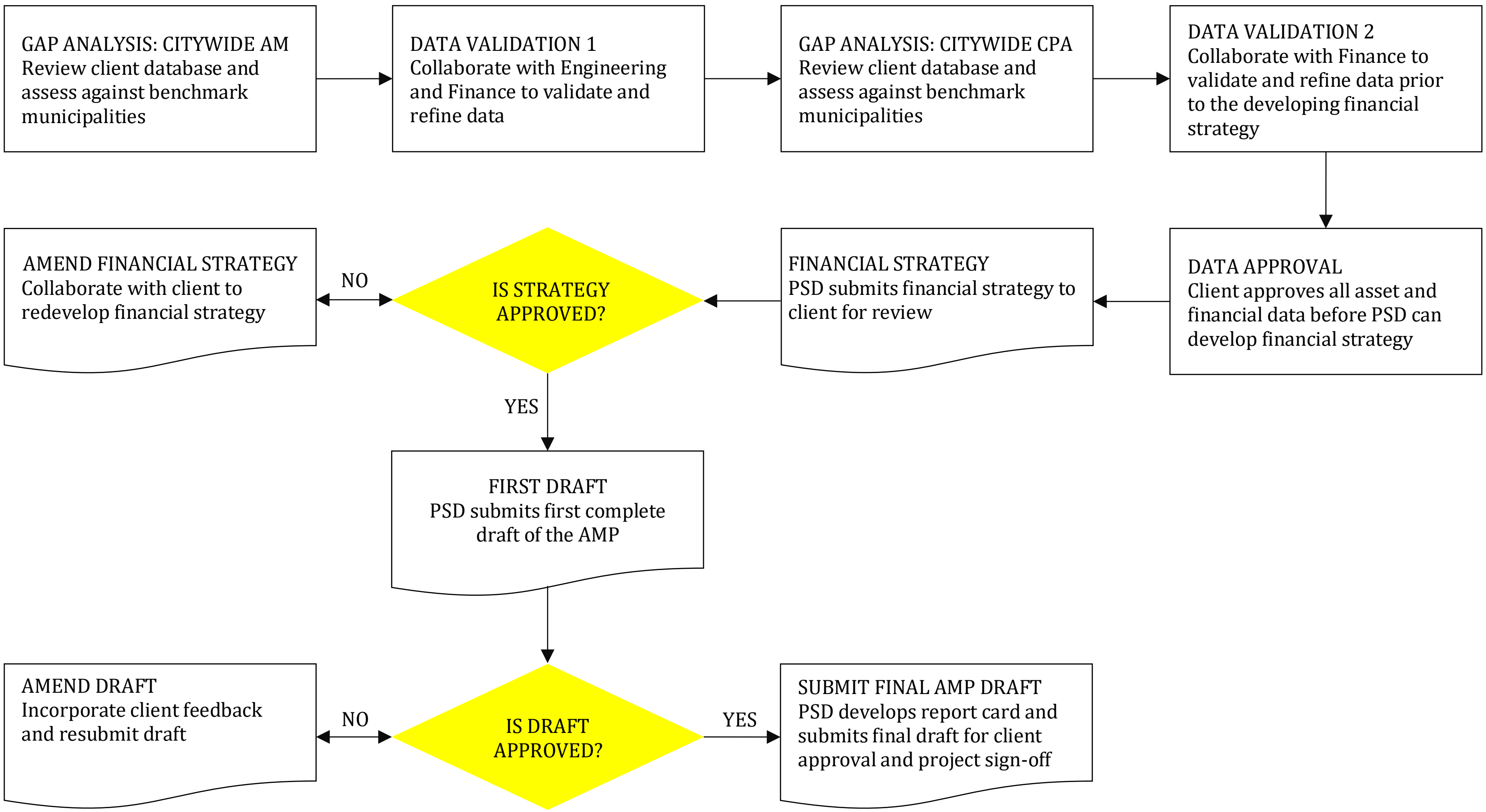
Several limitations continue to persist as municipalities advance their asset management practices.

- As available, we use field condition assessment data to illustrate the state of infrastructure and develop the requisite financial strategies. However, in the absence of observed data, we rely on the age of assets to estimate their physical condition.
- A second limitation is the use of inflation measures, for example using CPI/NRBCPI to inflate historical costs in the absence of actual replacement costs. While a reasonable approximation, the use of such multipliers may not be reflective of market prices and may over- or understate the value of a City's infrastructure portfolio and the resulting capital requirements.
- Our calculations and recommendations will reflect the best available data at the time this AMP was developed.
- The focus of this plan is restricted to capital expenditures and does not capture O&M 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 1 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 City 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 a best practice approach in asset management. 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 City'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 City's self-assessed score in each factor is then used to calculate data confidence in each asset class using Equation 1 below.

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

V. Summary Statistics

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

1. Asset Valuation

The asset classes analyzed in this asset management plan for the City had a total 2018 valuation with event costs of $659 million, of which the water system comprised 36%, followed by the road system at 32%. The ownership per household (Figure 3) totaled $90,339 based on 7,300 households for all asset categories except for the wastewater system with 7275 households.

Figure 2 Asset Valuation by Class

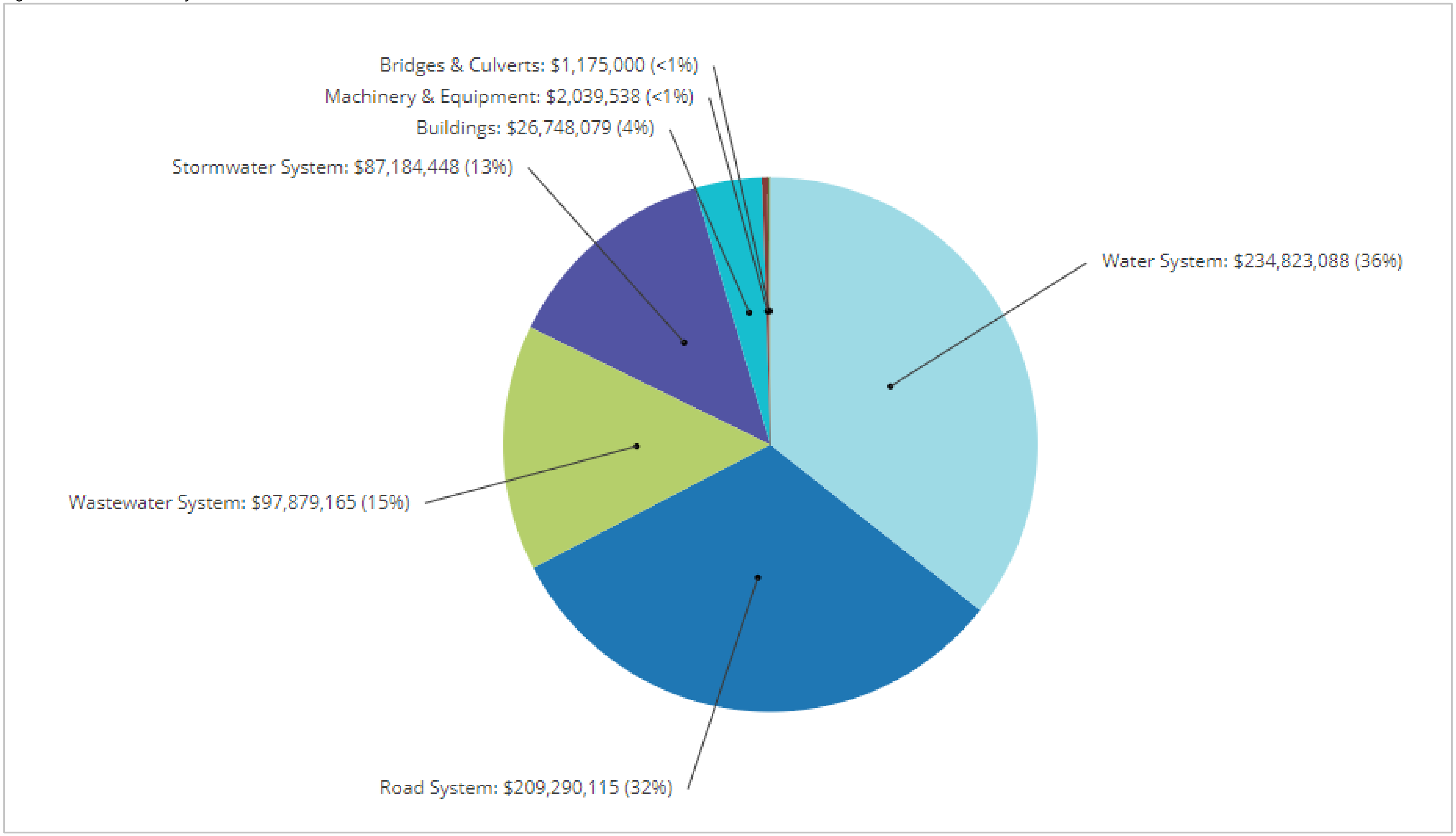


Figure 3 2017 Ownership Per Household

2. Source of Condition Data by Asset Class

Observed data will provide the most precise indication of an asset's physical health. In the absence of such information, the age of capital assets can be used as a meaningful approximation of the asset's condition. Table 5 indicates the source of condition data used for the various asset classes in this AMP. The City has condition data for 6% of all assets based on 2018 replacement cost.

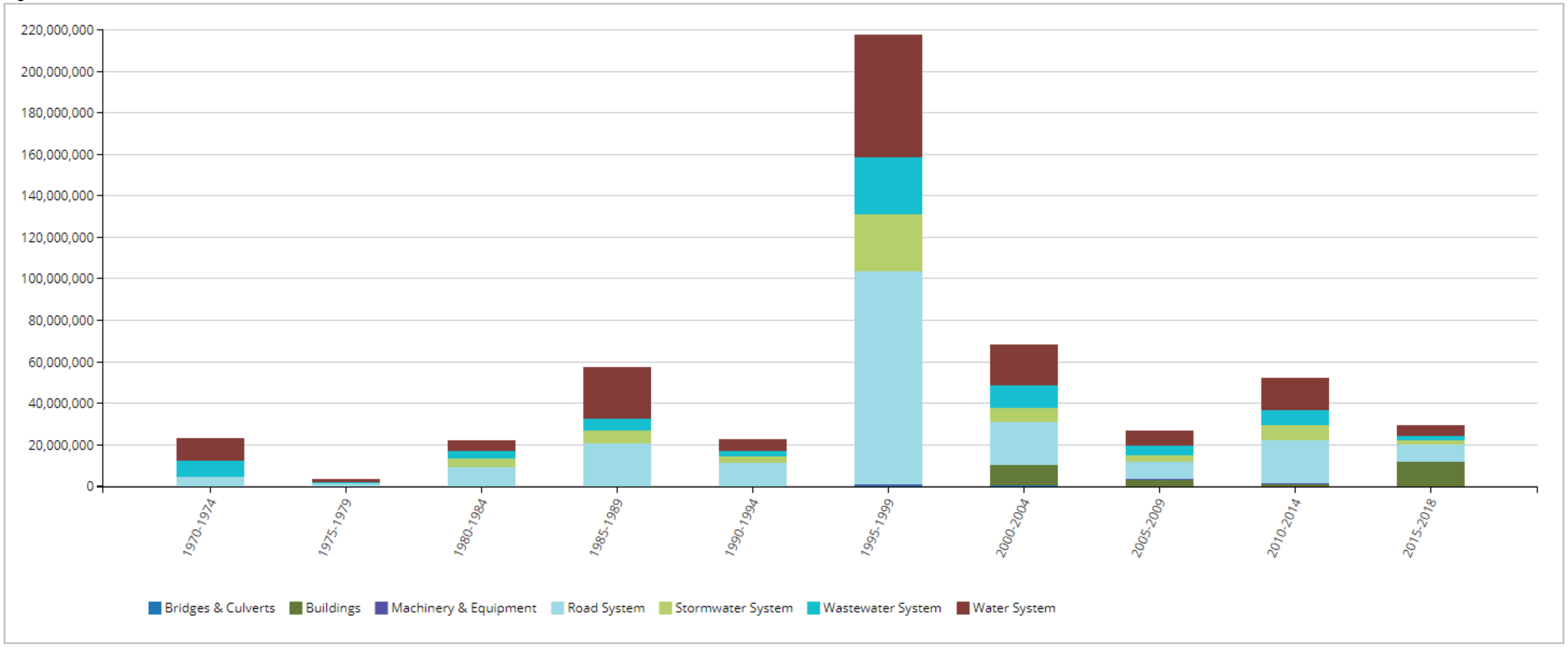
Table 5 Source of Condition Data by Asset Class

Asset class	Component	Source of Condition Data
Roads System	Street Signs	100% Assessed - 2018
	Remaining Segments	Age-based
Bridges & Culverts	All	100% Assessed - 2018
Water System	Pumping	100% Assessed – 2017
	Storage	100% Assessed – 2017
	Remaining Segments	Age-based
Wastewater System	Lift Station	100% Assessed – 2018
	Meter Station	100% Assessed – 2018
	Remaining Segments	Age-based
Stormwater System	All	Age-based
Buildings	All	Age-based
Machinery & Equipment	Rolling Stock	12% Assessed - 2019
	Remaining Segments	Age-based

3. Historical Investment in Infrastructure – All Asset Classes

In conjunction with condition data, two other measurements can augment staff understanding of the state of infrastructure and impending and long-term infrastucture needs: installation year profile, and useful life remaining. Using 2018 replacement costs, Figure 4 illustrates the historical invesments made in the asset classes analyzed in this AMP since 1970. Often, investment in critical infrastructure parallels population growth or other significant shifts in demographics; they can also fluctuate with provincial and federal stimulus programs. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 4 Historical Investment in Infrastructure – All Asset Classes

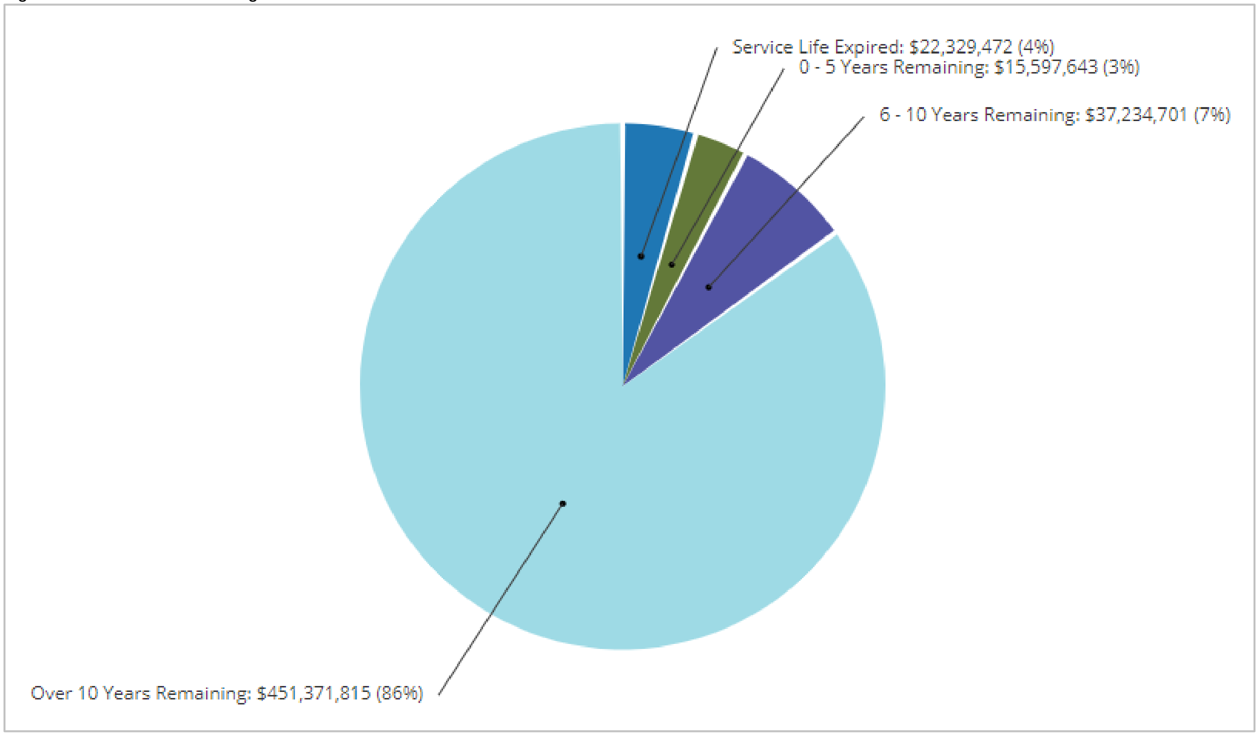


The City has continuously invested into its infrastructure over the decades. Investments fluctuated during the 1970s and 1980s and then peaked in the late 1990s. During this time, $218 million was invested with $103 million put into the road system. Since 2015, $29.5 million has been invested with a heavier focus on roads, the water system and buildings.

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 5 shows the distibution of assets based on the percentage of useful life already consumed.

Figure 5 Useful Life Remaining as of 2017 – All Asset Classes

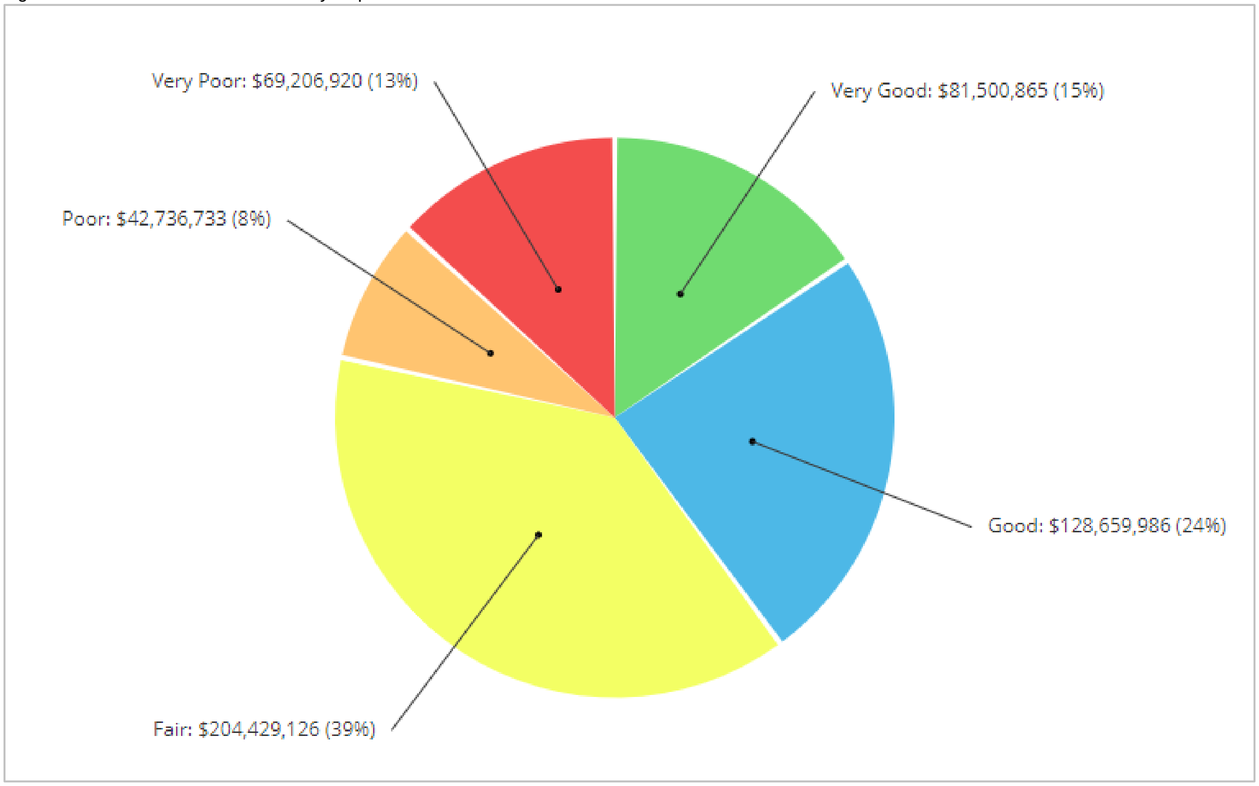


86% of the assets analyzed in this AMP have at least 10 years of useful life remaining. However, 4%, with a valuation of $22 million, remain in operation beyond their established useful life. An additional 3% will reach the end of their useful life within the next five years.

5. Overall Condition – All Asset Classes

Based on 2018 replacement cost, and primarily age-based data, over 39% of assets, with a valuation of $210 million, are in good to very good condition; 21% are in poor to very poor condition.

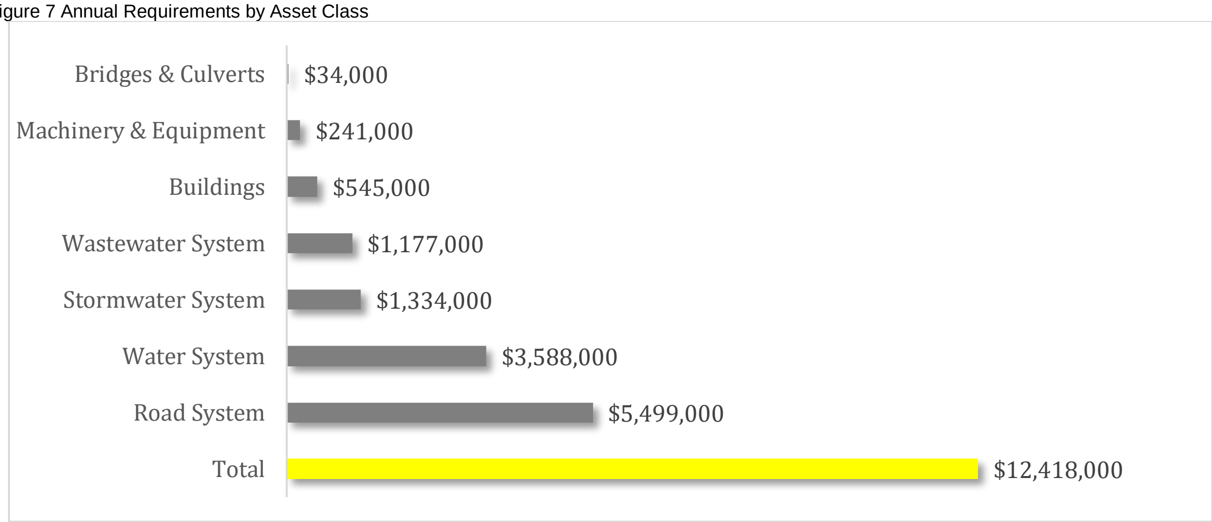
Figure 6 Asset Condition Distribution by Replacement Cost as of 2017 – All Asset Classes



6. Financial Profile

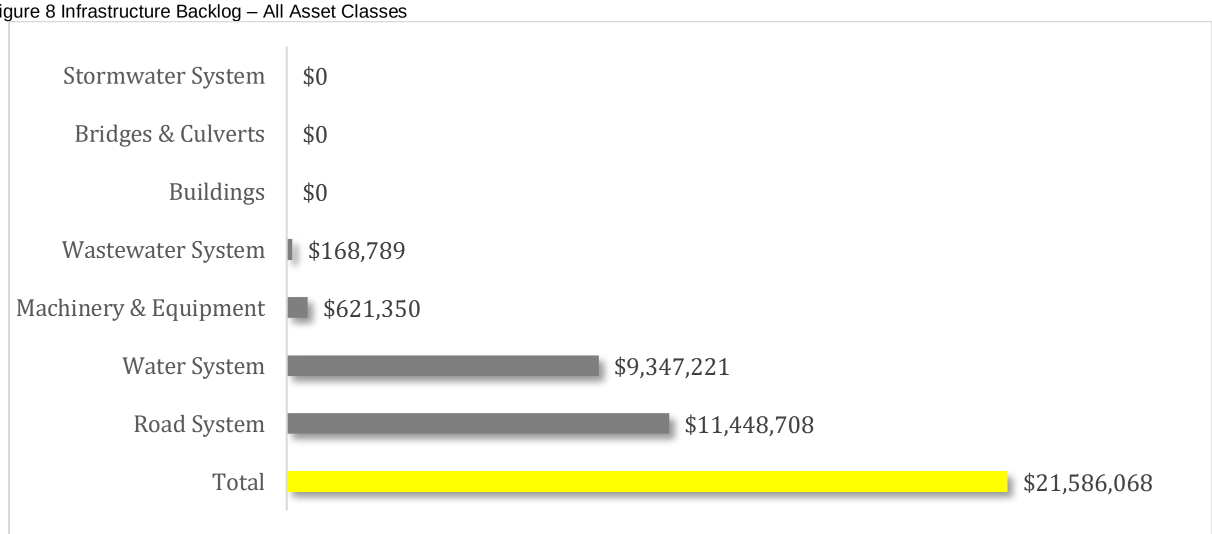
This section details key high-level financial indicators for the City's asset classes.

Figure 7 Annual Requirements by Asset Class



The annual requirements represent the amount the City should allocate annually to each of its asset classes to meet replacement needs as they arise, prevent infrastructure backlogs and achieve long-term sustainability. In total, the City must allocate $12.4 million annually for the assets covered in this AMP.

Figure 8 Infrastructure Backlog – All Asset Classes

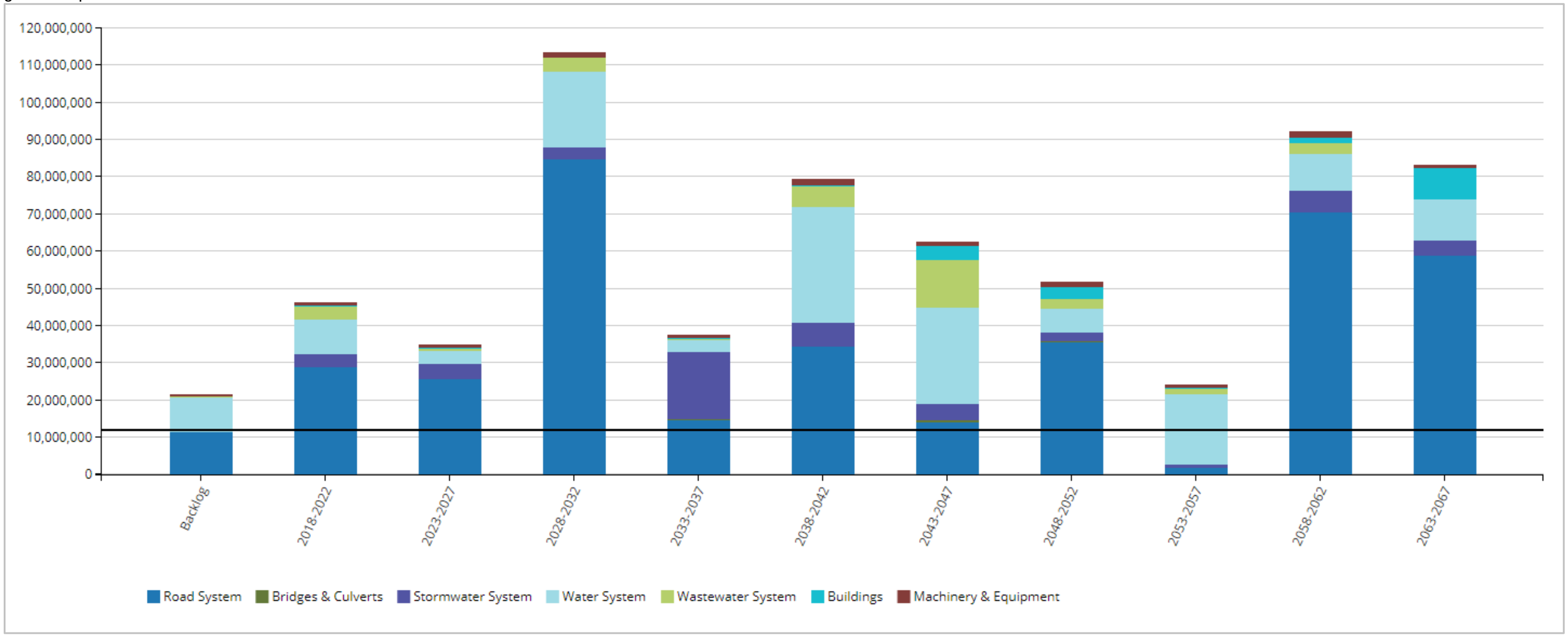


The City has a combined infrastructure backlog of $21.5 million, with the road system comprising 53%. The backlog represents the investment needed today to meet previously deferred replacement needs. In the absence of assessed data, the backlog represents the value of assets still in operation beyond 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 City's asset classes. The backlog is the total investment in infrastructure that was deferred over previous years or decades. In the absence of observed data, the backlog represents the value of assets that remain in operation beyond their useful life.

Figure 9 Replacement Profile – All Asset Classes



Based primarily on age-based data, the City has a combined backlog of $21.5 million, of which the road system comprises $11.4 million. Aggregate replacement needs will total $46 million over the next five years. An additional $35 million will be required between 2023 and 2027. The City's aggregate annual requirements (indicated by the black line) total $12.4 million. At this funding level, the City would be allocating sufficient funds on an annual basis to meet the replacement needs for its various asset classes as they arise without the need for deferring projects and accruing annual infrastructure deficits. Currently, the City is funding 0% of the annual requirements for tax-funded assets and 0% for rate-funded assets. See the 'Financial Strategy' chapter for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the City to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

8. Data Confidence

The City has a high degree of confidence in the data used to develop this AMP, receiving a weighted confidence rating of 98%. This is indicative of significant effort in collecting and refining its data set.

Table 6 Data Confidence Ratings

Asset Class	The data is up-to-date.	The data is complete and uniform.	The data comes from an authoritative source.	The data is error free.	The data is verified by an authoritative source.	Average Confidence Rating	Weighted Confidence Rating
Road System	100%	100%	100%	90%	100%	98%	47%
Bridges & Culverts	100%	100%	100%	90%	100%	98%	0.2%
Water System	100%	100%	100%	90%	100%	98%	54%
Wastewater System	100%	100%	100%	90%	100%	98%	24%
Stormwater System	100%	100%	100%	90%	100%	98%	6%
Buildings & Facilities	100%	100%	100%	90%	100%	98%	6%
Machinery & Equipment	90%	100%	100%	90%	100%	96%	0.3%
					Overall Average Data Confidence Rating		98%

VI. State of Local Infrastructure

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

1. Road System

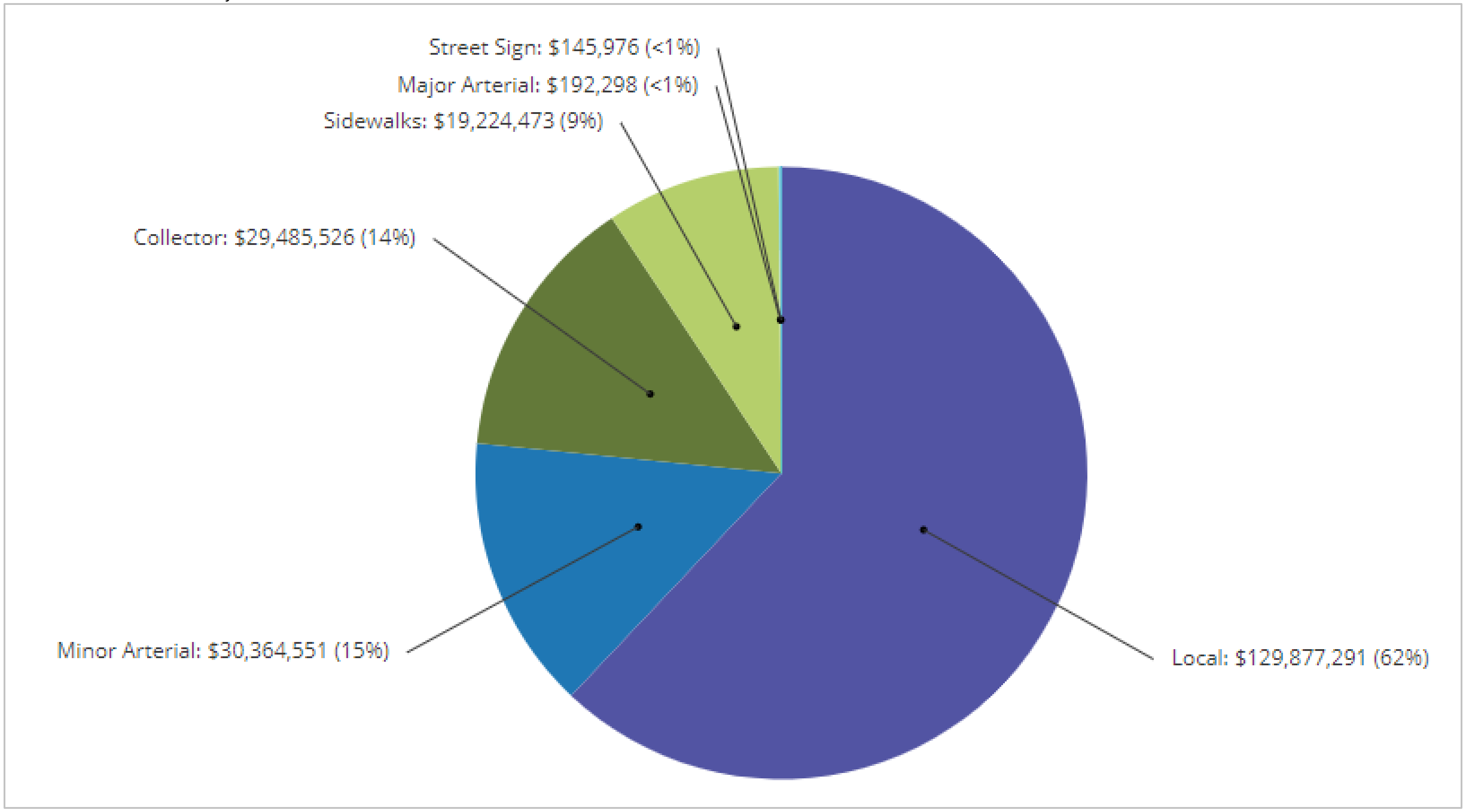
1.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 7 illustrates key asset attributes for the City's road system, 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 City's roads assets are valued at $209 million based on 2018 replacement and life cycle event costs. The useful life indicated for each asset type below was assigned by the City.

Table 7 Key Asset Attributes – Road System

Asset Type	Asset Component	Quantity	Useful Life (Years)	2017 Unit Replacement Cost	2017 Overall Replacement Cost
Road System	Collector	248,083 yd^2	20-40	User-Defined/ Cost/Unit, Event Costs	$29,485,526
	Local	1,012,067 yd^2	20-40	User-Defined/ Cost/Unit, Event Costs	$129,877,291
	Major Arterial	1424 yd^2	40	Cost/Unit	$192,298
	Minor Arterial	228,455 yd^2	20-40	Cost/Unit, Event Costs	$30,364,552
	Sidewalks	2,746,353 ft^2	40	User-Defined	$19,224,473
	Street Signs	1,604	10	User-Defined	$145,976
				Total	**$209,290,116**

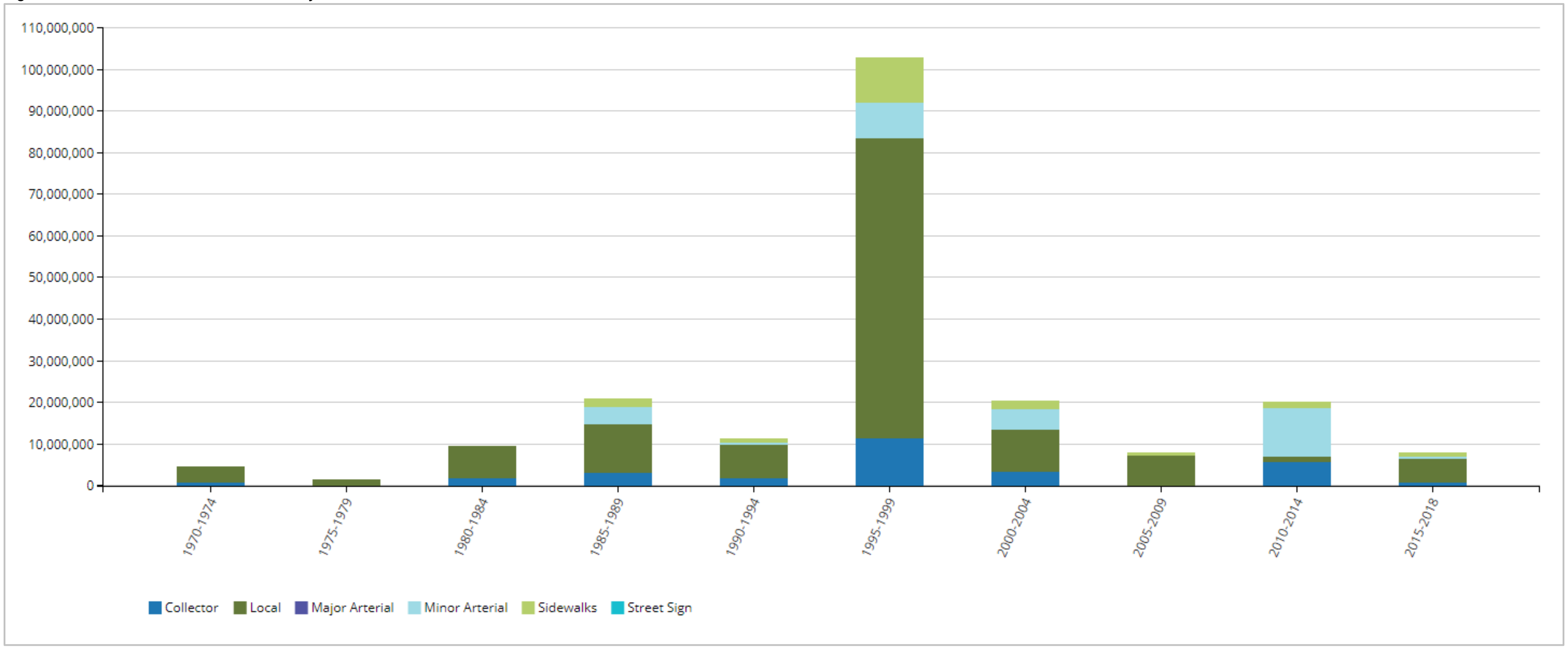
Figure 10 Asset Valuation – Road System



1.2 Historical Investment in Infrastructure

Figure 11 shows the City's historical investments in its road system since 1970. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 1.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 11 Historical Investment – Road System

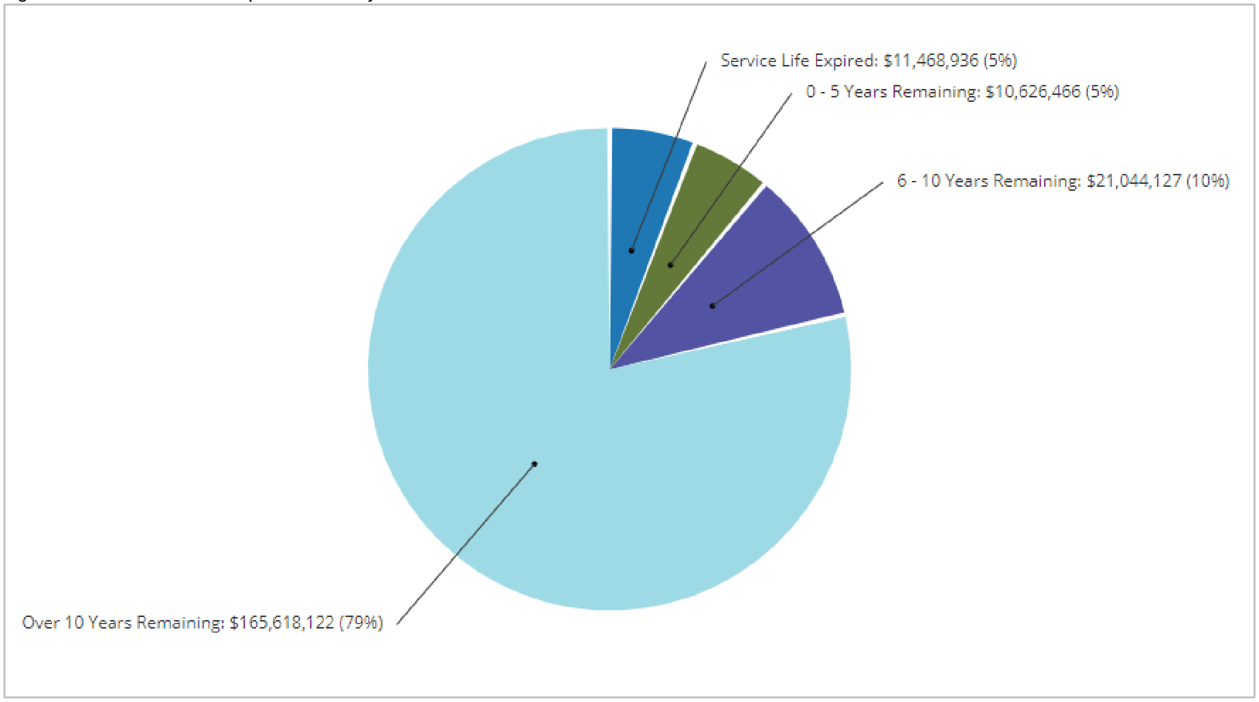


Investments in the City's road system have fluctuated since 1970. In the late 1990s, the period of largest investment, $103 million was invested with over $72 million put into local roads.

1.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 12 illustrates the useful life consumption levels as of 2018 for the City's road system.

Figure 12 Useful Life Consumption - Road System

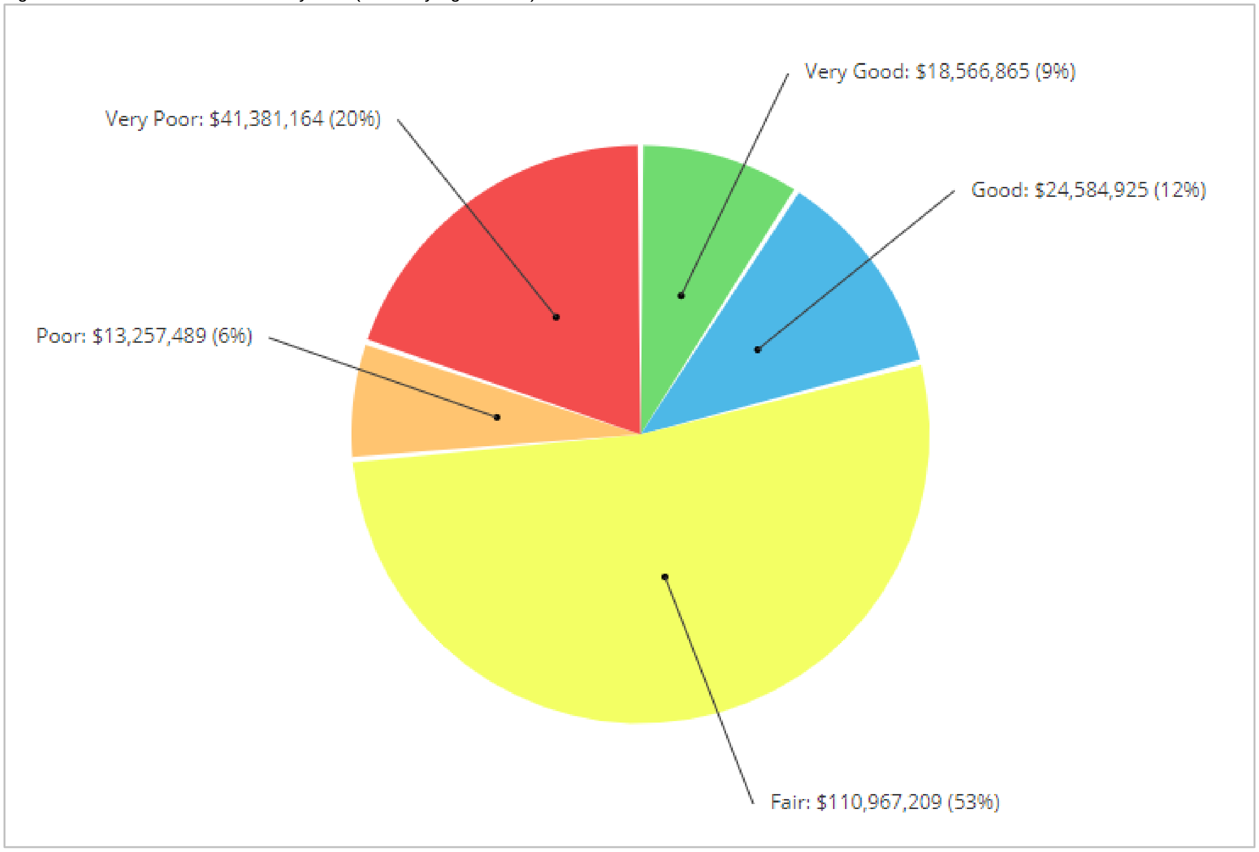


While 79% of the City's road system has at least 10 years of useful life remaining, 5%, with a valuation of $11 million, remain in operation beyond their useful life. An additional 5% will reach the end of their useful life within the next five years.

1.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the City's road system as of 2018. By default, we rely on observed field data as provided by the City. In the absence of such information, age-based data is used as a proxy. The City has only provided condition data for its street signs, the rest of the road system assets are age-based.

Figure 13 Asset Condition – Road System (Primarily Age-Based)

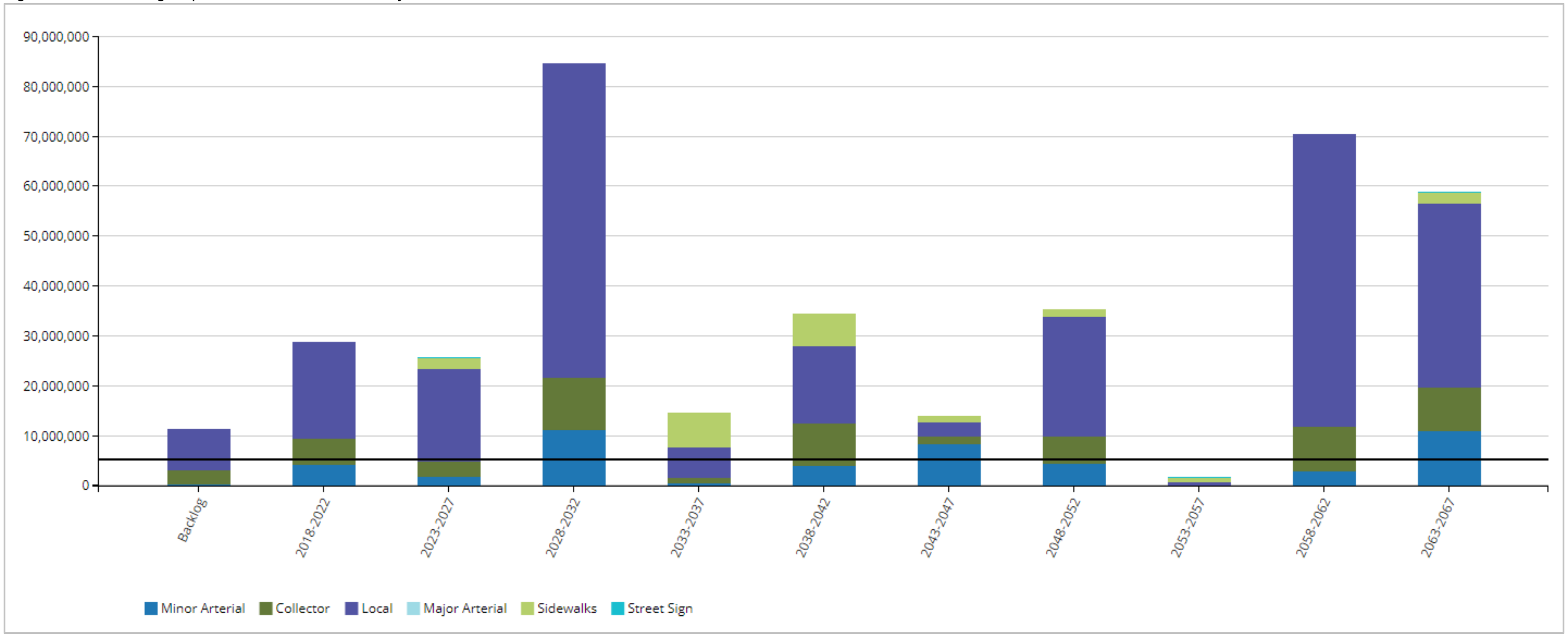


Based primarily on age-based condition data, 21% of assets, with a valuation of $43 million are in good to very good condition; 26% are in poor to very poor condition.

1.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the City's road 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 14 Forecasting Replacement Needs – Road System



In addition to a backlog of $11 million, replacement needs are forecasted to be $29 million in the next five years; an additional $25.7 million is forecasted in replacement needs between 2023-2027. The City's annual requirements (indicated by the black line) for its road system total $5.5 million. At this funding level, the City 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 City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the City to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

1.6 Recommendations – Road System

- Age-based condition data indicates a backlog of $11 million and significant 10-year replacement needs of $54.7 million. The City should conduct condition assessments of its road surfaces and expand the program to incorporate all assets in order to more precisely estimate its actual financial requirements and field needs. See Section 2, ‘Condition Assessment Programs’ in the ‘Asset Management Strategies’ chapter.

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

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

- Road system 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 City is currently not allocating any funding towards this asset category. See the ‘Financial Strategy’ section on how to achieve more sustainable funding levels.

2. Bridges & Culverts

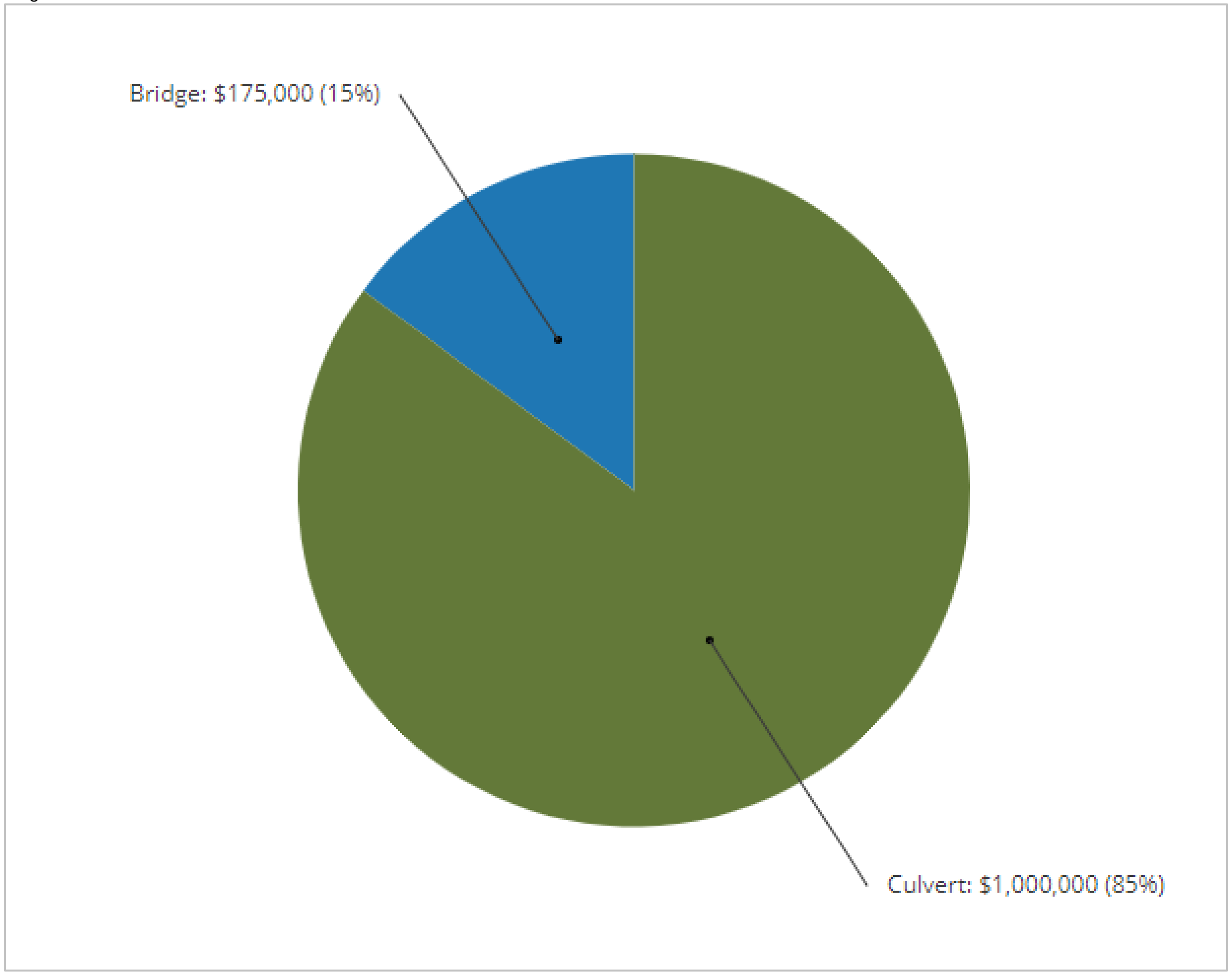
2.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the City'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 City's bridges & culverts assets are valued at $1,175,000 based on 2018 replacement costs. The useful life indicated for each asset type below was assigned by the City.

Table 8 Key Asset Attributes – Bridges & Culverts

Asset Type	Asset Component	Quantity	Useful Life (Years)	2018 Unit Replacement Cost	2018 Overall Replacement Cost
Bridges & Culverts	Bridges	1	20	User-Defined	$175,000
	Culverts	2	40	User-Defined	$1,000,000
				Total	**$1,175,000**

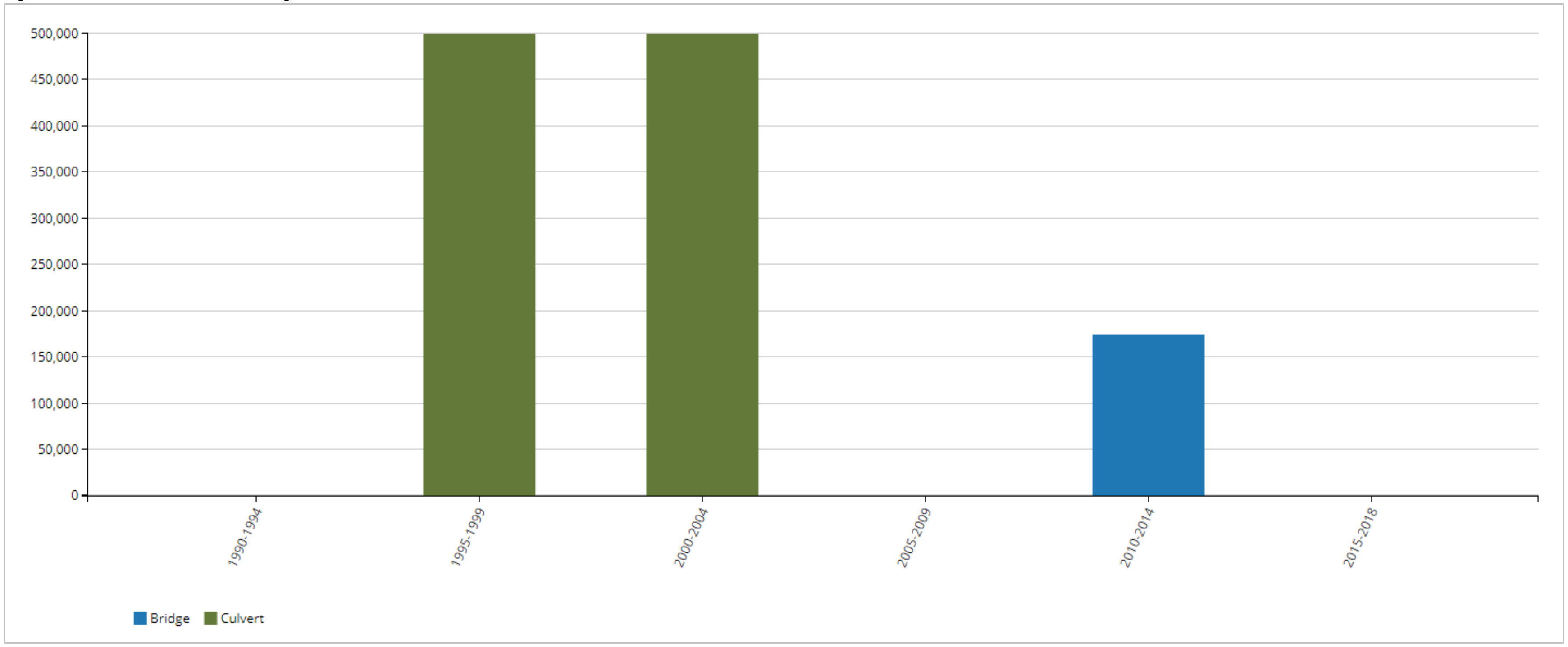
Figure 15 Asset Valuation – Bridges & Culverts



2.2 Historical Investment in Infrastructure

Figure 16 shows the City's historical investments in its bridges & culverts since 1990. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 2.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 16 Historical Investment – Bridges & Culverts

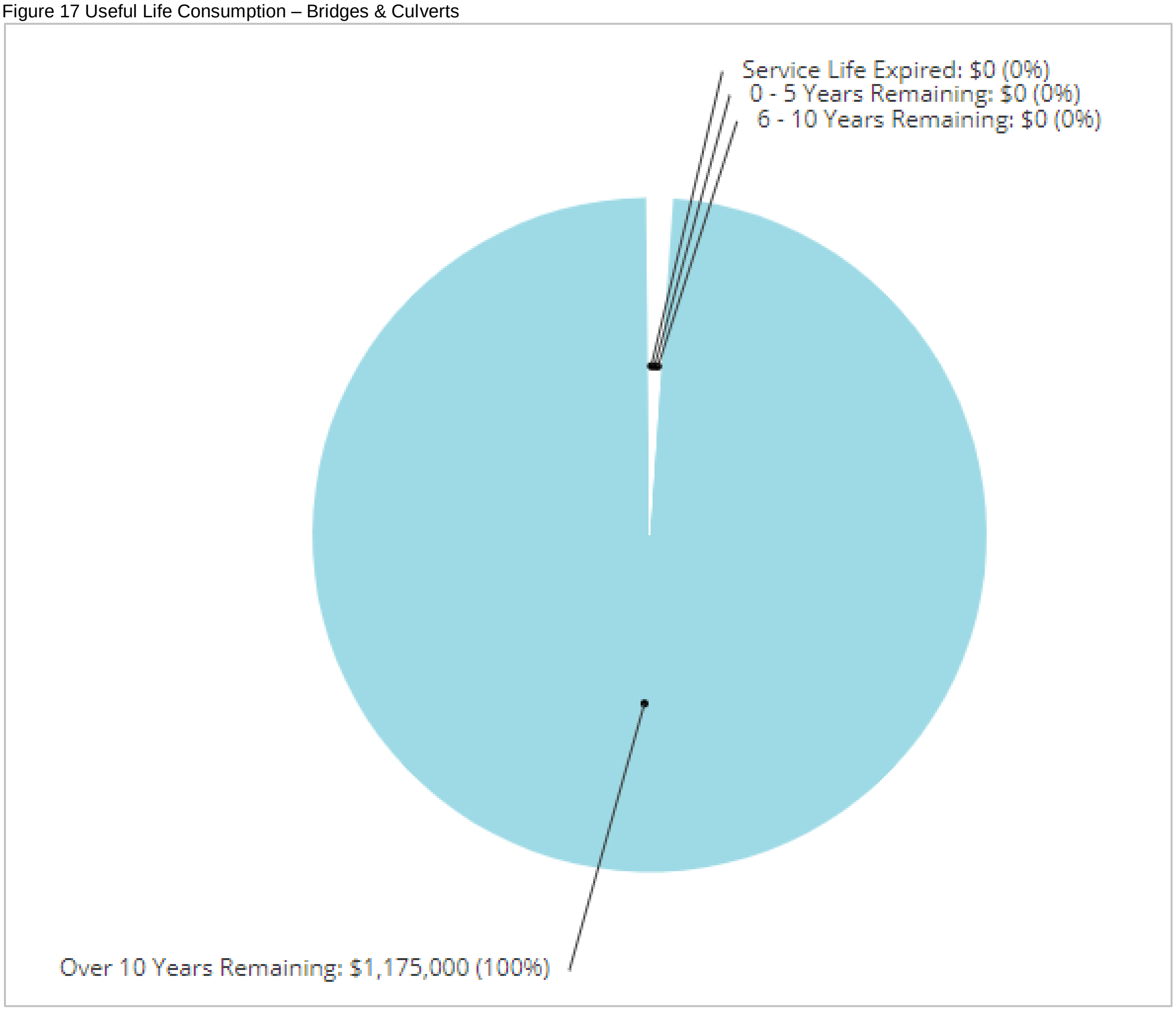


The City has invested lightly in its bridges and culverts since 1990. In the late 1990s and early 2000s, the period of the largest investments $1 million was invested into culverts.

2.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 17 illustrates the useful life consumption levels as of 2018 for the City's bridges & culverts.

Figure 17 Useful Life Consumption – Bridges & Culverts

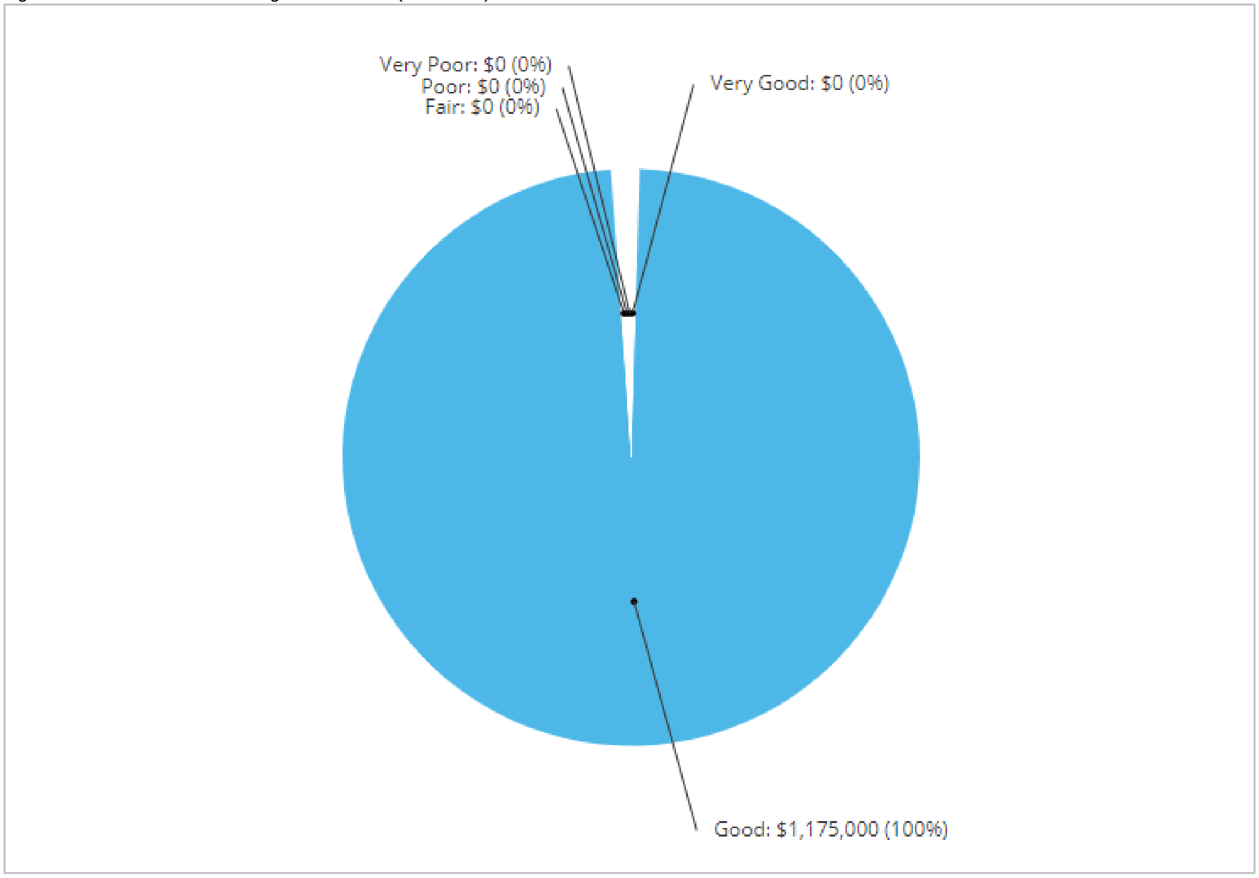


100% of the assets have at least 10 years of useful life remaining.

2.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the City's bridges & culverts as of 2017. By default, we rely on observed field data adapted from OSIM inspections as provided by the City. In the absence of such information, age-based data is used as a proxy. All assets are based on assessed condition data.

Figure 18 Asset Condition – Bridges & Culverts (Assessed)

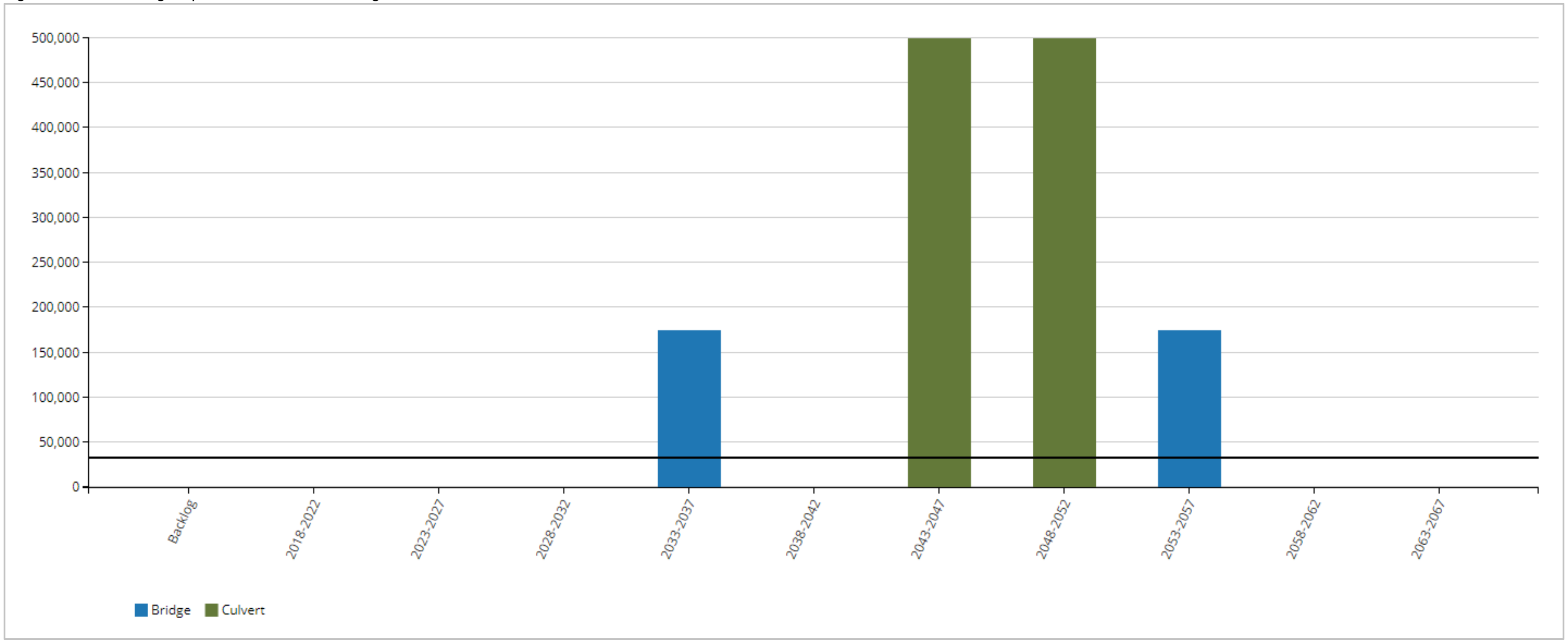


Assessed condition data indicates that 100% of the cities bridges & culverts are in good condition.

2.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the City'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 19 Forecasting Replacement Needs – Bridges & Culverts



Assessed data indicates no backlog and no replacement need in the next 10 years. The City's annual requirements (indicated by the black line) for its bridges & culverts total $34,000. At this funding level, the City 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 City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for achieving a more optimal and sustainable funding level.

2.6 Recommendations – Bridges & Culverts

- Assessed condition data indicates no backlog and no replacement need in the next 10 years. The results and recommendations from the bridge inspections should be incorporated into the AMP analysis and used to generate the short-and long-term capital and maintenance budgets for the bridge and large culvert structures. See Section VIII, 'Asset Management Strategies'.

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

- the City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section on how to achieve more sustainable and optimal funding levels.

3. Water System

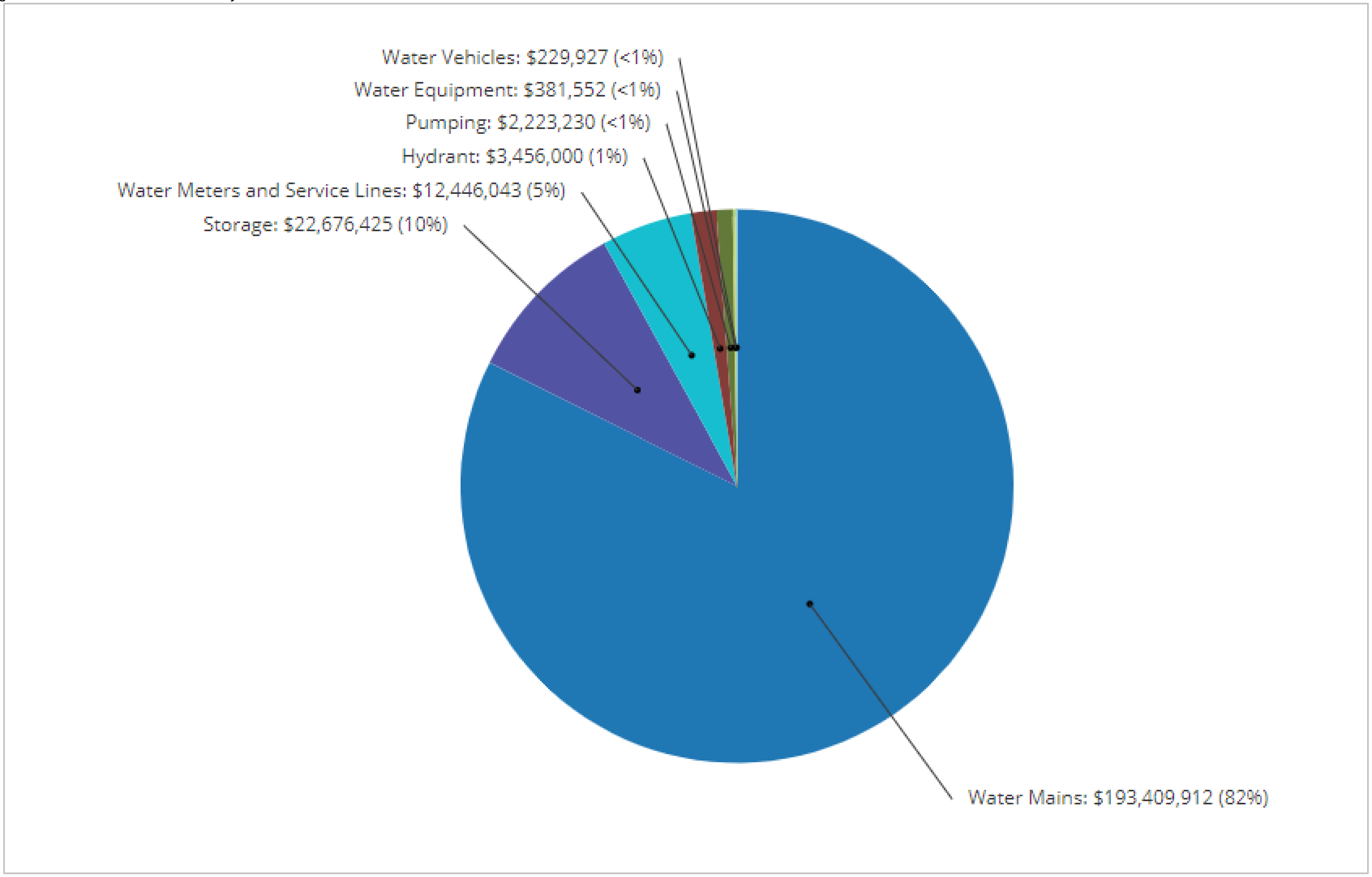
3.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 8 illustrates key asset attributes for the City's water system, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the City's water system assets are valued at $235 million based on 2018 replacement and life cycle event costs. The useful life indicated for each asset type below was assigned by the City.

Table 9 Key Asset Attributes – Water

Asset Type	Asset Component	Quantity	Useful Life (Years)	2018 Unit Replacement Cost	2018 Overall Replacement Cost
Water System	Hydrants	864	50	User-Defined	$3,456,000
	Pumping	3	30	Flat-Rate Inflation	$2,223,230
	Storage	6	75	Flat-Rate Inflation	$22,676,425
	Water Meters and Service Lines	7219	12	User-Defined	$12,446,043
	Water mains (2-6 In)	123,776 ft	50	Cost/Unit, Event Costs	$34,038,425
	Water mains (8 In)	350,787 ft	50	Cost/Unit, Event Costs	$105,236,085
	Water mains (10 In)	4276 ft	50	Cost/Unit, Event Costs	$1,304,220
	Water mains (12 In)	107,672 ft	50	Cost/Unit, Event Costs	$39,838,777
	Water mains (14 In)	2304 ft	50	Cost/Unit, Event Costs	$437,806
	Water mains (16 In)	7645 ft	50	Cost/Unit, Event Costs	$3,364,016
	Water mains (18 In)	27 ft	50	Cost/Unit, Event Costs	$13,780
	Water mains (20 In)	4489 ft	50	Cost/Unit, Event Costs	$2,513,728
	Water mains (24 In)	9399 ft	50	Cost/Unit, Event Costs	$6,391,218
	Water mains (30 In)	328 ft	50	Cost/Unit, Event Costs	$271,858
	Water Vehicles	13	5-10	User-Defined/ Flat-Rate Inflation	$229,927
	Water Equipment	8	10-20	User-Defined	$381,552
				Total	**$234,823,090**

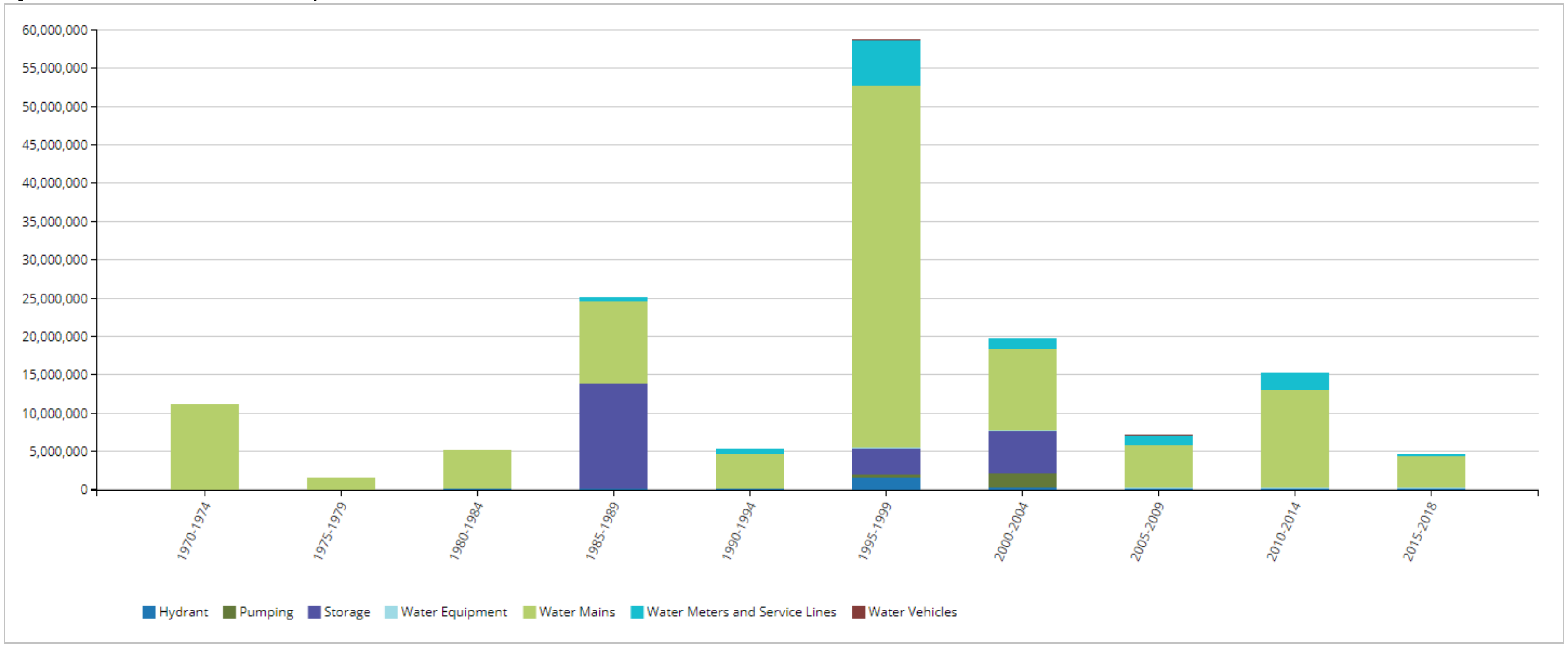
Figure 20 Asset Valuation – Water System



3.2 Historical Investment in Infrastructure

Figure 21 shows the City's historical investments in its water system since 1970. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 3.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 21 Historical Investment – Water System

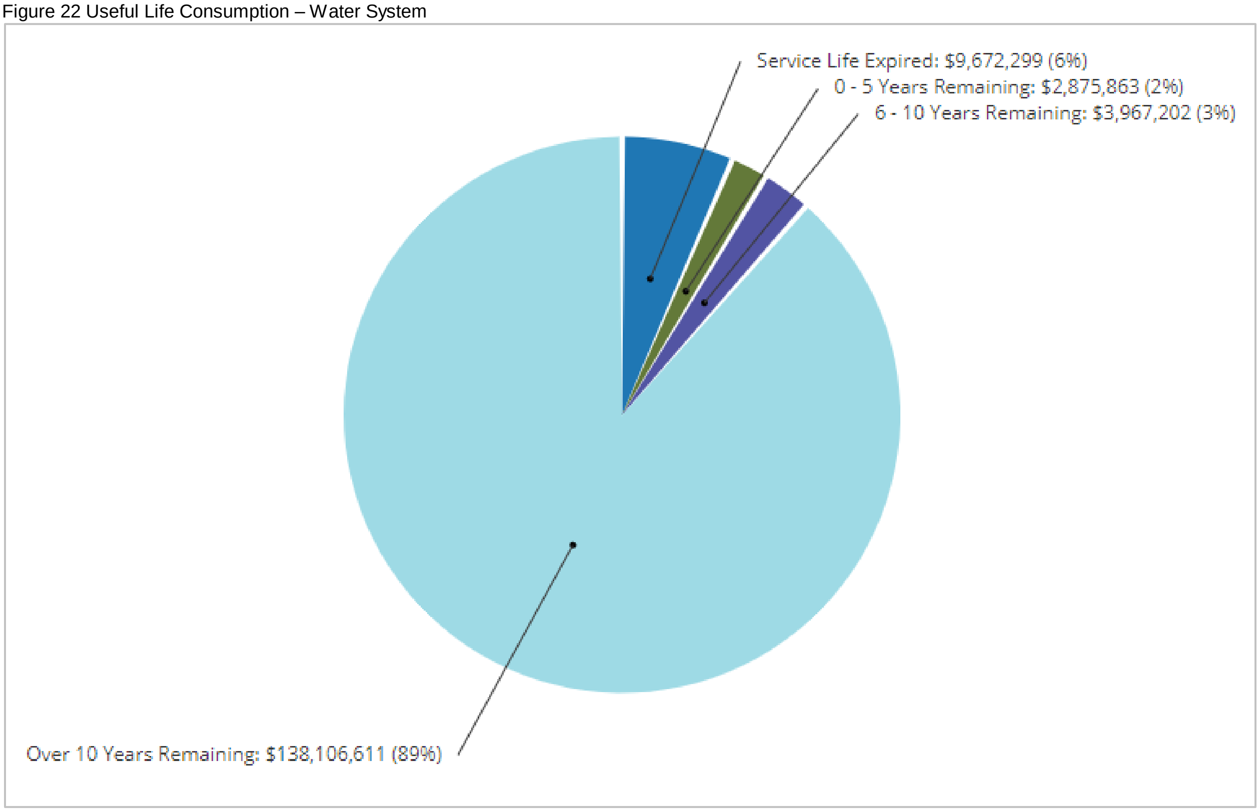


Investments in the water system have fluctuated since the 1970s. In the late 1990s, the period of largest investment, $58.8 million was invested in the water systems with $47 million put into watermains.

3.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 22 illustrates the useful life consumption levels as of 2018 for the City's water system.

Figure 22 Useful Life Consumption – Water System

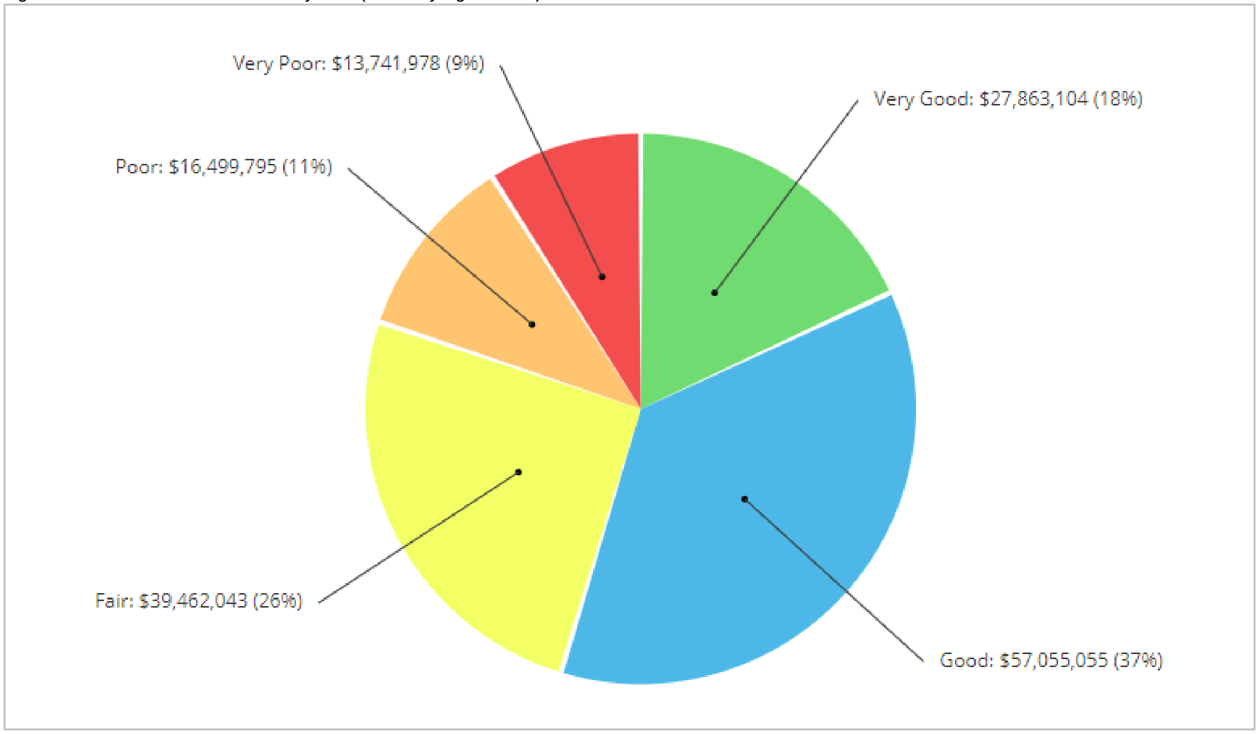


While 89% of the City's water system has at least 10 years of useful life remaining, 6%, with a valuation of $9.6 million, remain in operation beyond their useful life. An additional 2% will reach the end of their useful life within the next five years.

3.4 Current Asset Condition

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

Figure 23 Asset Condition – Water System (Primarily Age-Based)

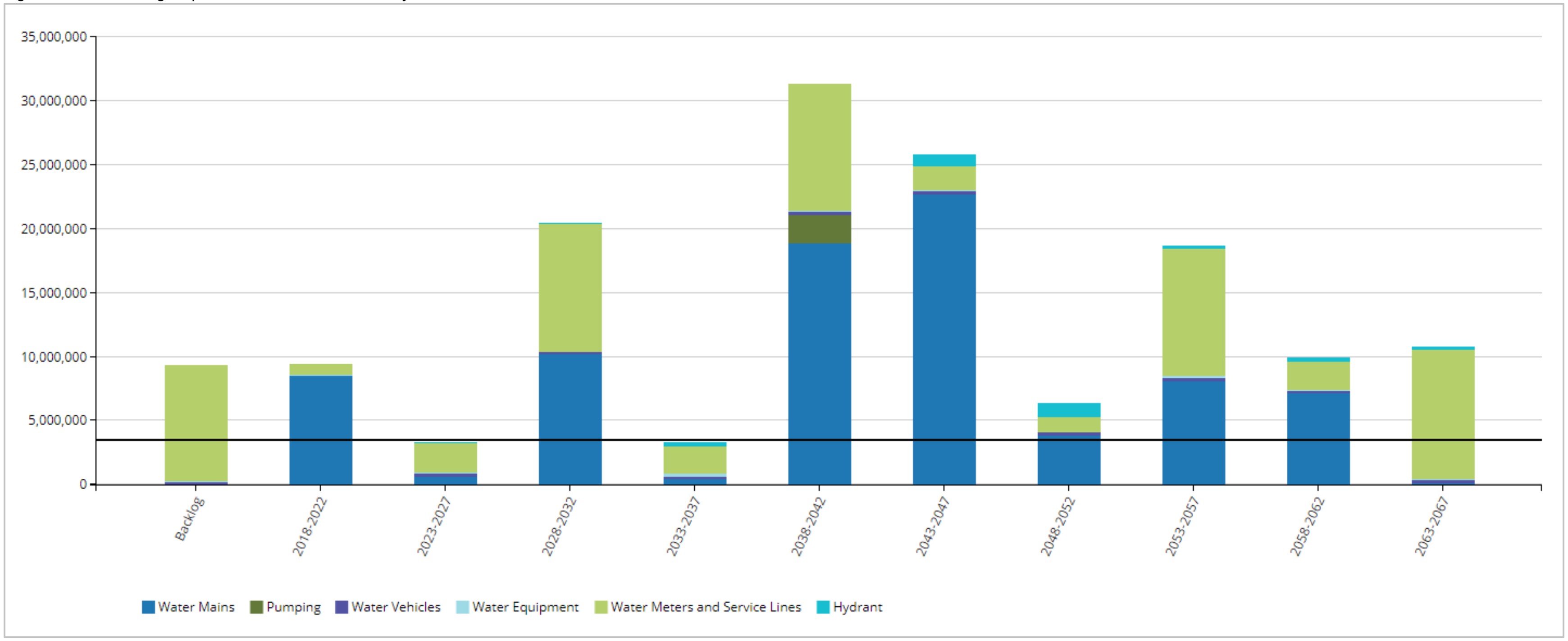


Based on primarily age-based condition data, 55% of assets are in good to very good condition while 20%, with a valuation of $30 million, are in poor to very poor condition.

3.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the City'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 24 Forecasting Replacement Needs – Water System



In addition to a backlog of $9.3 million, replacement needs are forecasted to be $9.4 million in the next five years; an additional $3.3 million is forecasted in replacement needs between 2023-2027. The City's annual requirements (indicated by the black line) for its water system total $3.6 million. At this funding level, the City 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 City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the City to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

3.6 Recommendations – Water System

- Primarily age-base data shows a backlog of $9.3 million and 10-year replacement needs of $12.7 million. The City should start a condition assessment program for its water assets to precisely estimate its financial requirements and field needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

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

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

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

- The City 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 City's operations and maintenance standards.

- The City is not funding any portion of its long-term requirements on an annual basis. See the 'Financial Strategy' section on how to achieve more sustainable and optimal funding levels.

4. Wastewater Systems

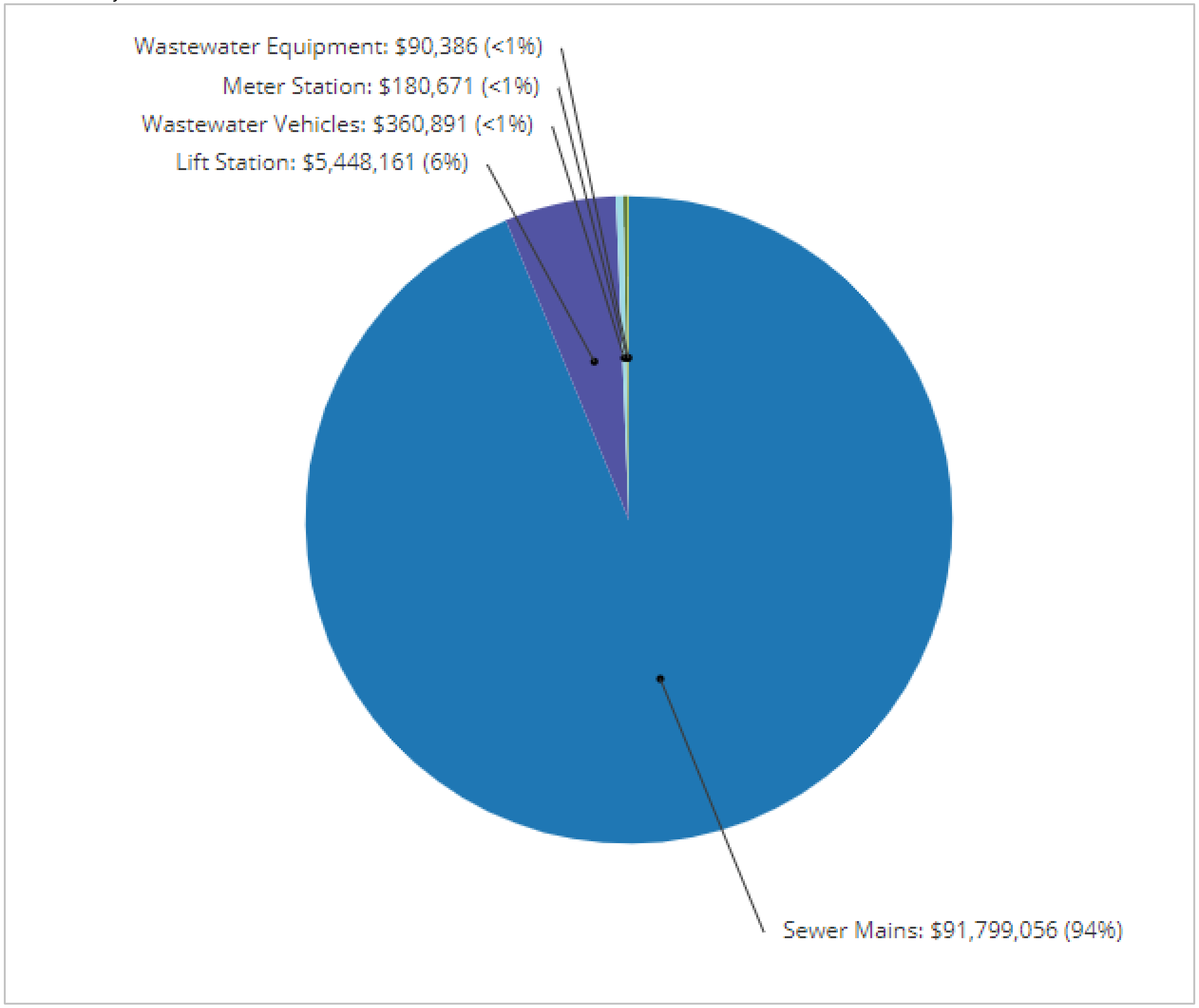
4.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 10 illustrates key asset attributes for the City's wastewater system portfolio, including quantities of various assets, their useful life, replacement costs, and the valuation method by which the replacement costs were derived. In total, the City's wastewater system assets are valued at $98.8 million based on 2017 replacement and life cycle event costs. The useful life indicated for each asset type below was assigned by the City.

Table 10 Asset Inventory – Wastewater Systems

Asset Type	Asset Component	Quantity	Useful Life (Years)	2017 Unit Replacement Cost	2017 Overall Replacement Cost
Wastewater Systems	Lift Station	13	40	Flat-Rate Inflation	$5,448,161
	Meter Station	2	20	Flat-Rate Inflation	$180,671
	Sewer Mains (3-4 In)	2934 ft	50	Cost/Unit, Event Costs	$299,933
	Sewer Mains (6 In)	77,191 ft	50	Cost/Unit, Event Costs	$10,961,132
	Sewer Mains (8 In)	359,063 ft	50	Cost/Unit, Event Costs	$58,240,090
	Sewer Mains (10 In)	20,314 ft	50	Cost/Unit, Event Costs	$3,396,495
	Sewer Mains (12 In)	25,269 ft	50	Cost/Unit, Event Costs	$5,235,774
	Sewer Mains (14-15 In)	16,438 ft	50	Cost/Unit, Event Costs	$4,556,639
	Sewer Mains (18 In)	17,333 ft	50	Cost/Unit, Event Costs	$5,497,930
	Sewer Mains (21-24 In)	4946 ft	50	Cost/Unit, Event Costs	$2,137,506
	Sewer Mains (27 In)	1674 ft	50	Cost/Unit, Event Costs	$840,634
	Sewer Mains (30 In)	1009 ft	50	Cost/Unit, Event Costs	$633,022
	Wastewater Vehicles	5	5-10	Flat-Rate Inflation/ User-Defined	$360,891
	Sewer Equipment	2	5-10	User-Defined	$90,386
				Total	**$98,879,264**

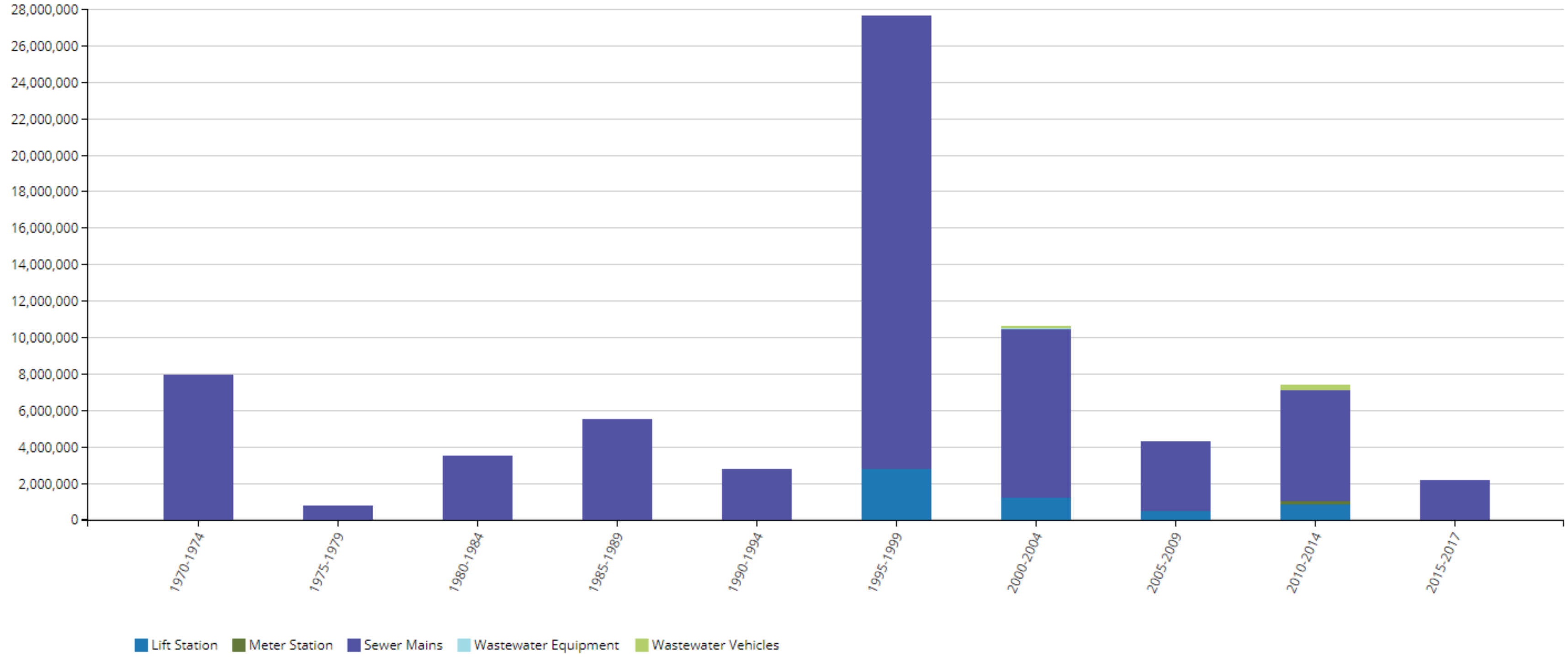
Figure 25 Asset Valuation – Wastewater System



4.2 Historical Investment in Infrastructure

Figure 26 shows the City's historical investments in its wastewater system since 1970. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 4.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2017.

Figure 26 Historical Investment – Wastewater System

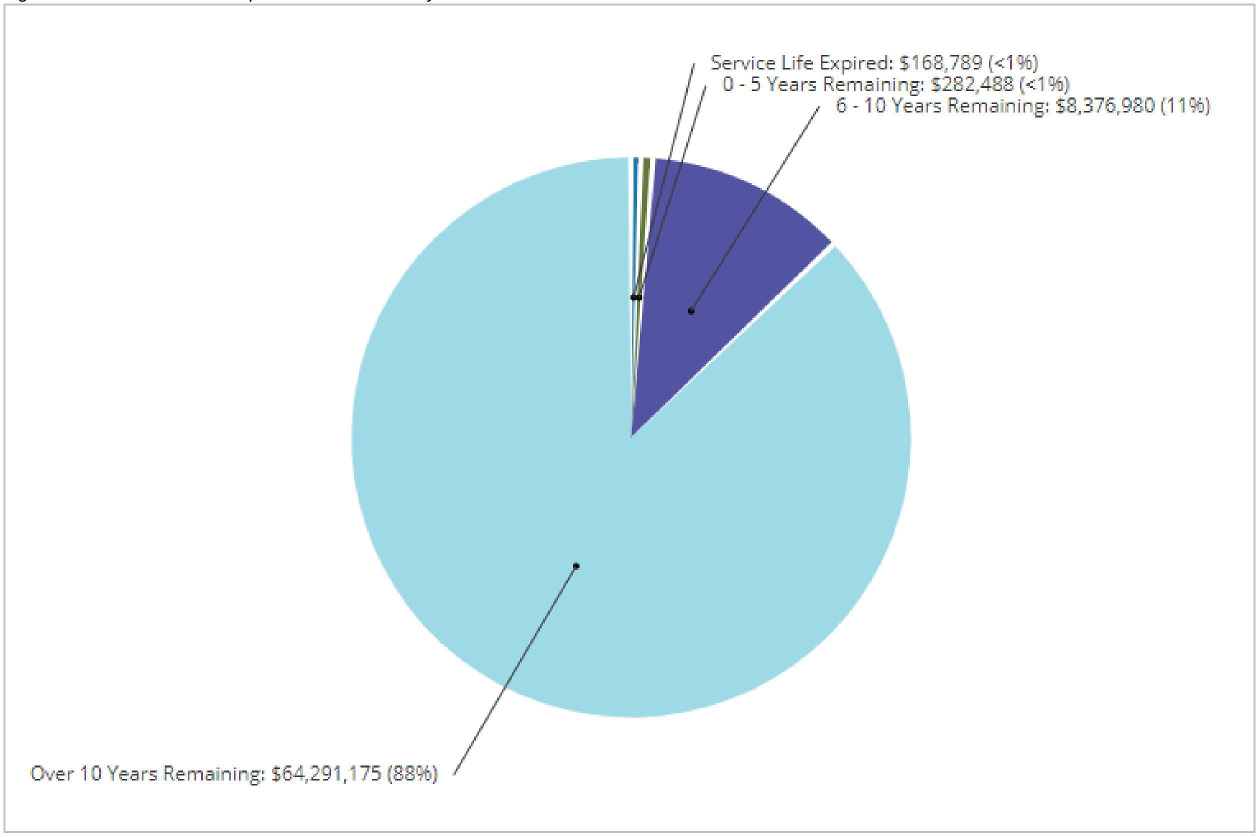


Major investments into the City's wastewater assets began in the early 1970s. Investments then fluctuated and peaked in the late 1990s at $27.7 million. During this time $24.9 million was put into sewer mains.

4.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 27 illustrates the useful life consumption levels as of 2017 for the City's wastewater system.

Figure 27 Useful Life Consumption – Wastewater System

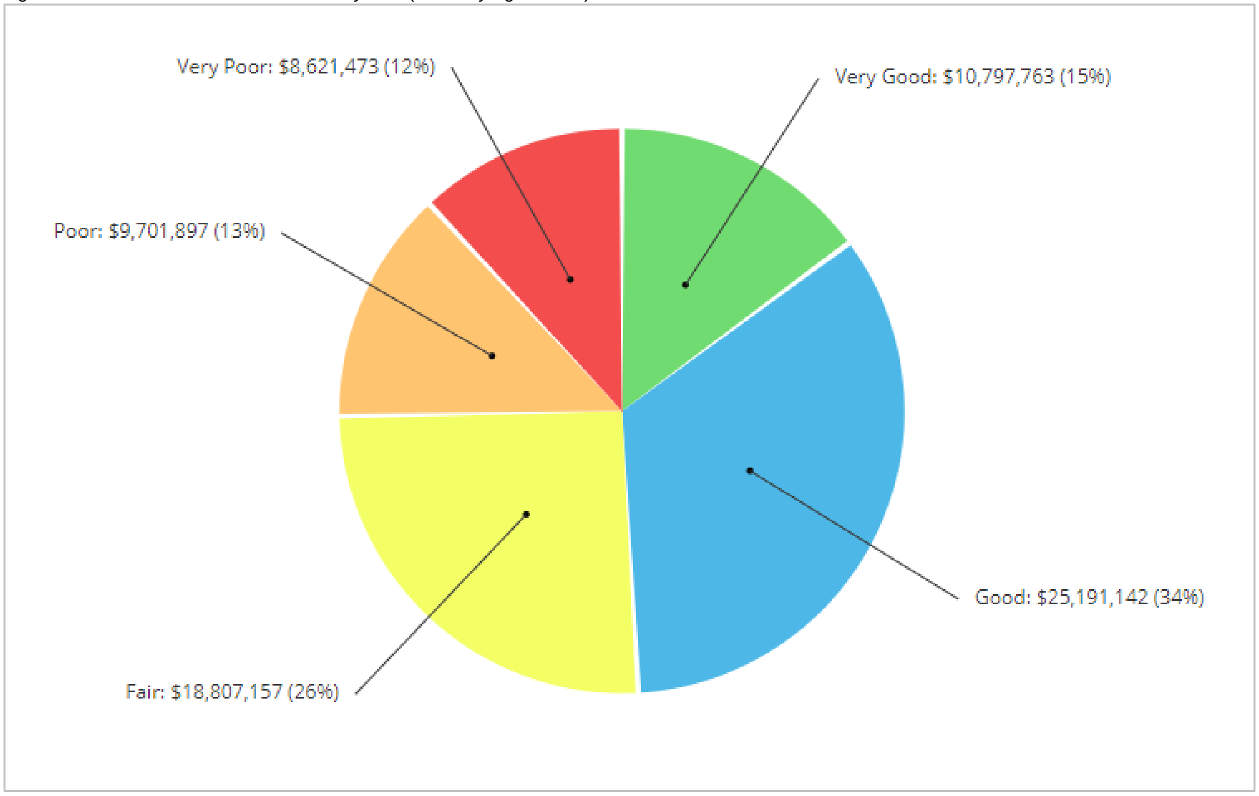


While 88% of the City's wastewater system has at least 10 years of useful life remaining, less than 1%, with a valuation of $169,000, remain in operation beyond their useful life. An additional 1% will reach the end of their useful life within the next five years.

4.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the City's wastewater system as of 2017. By default, we rely on observed field data as provided by the City. In the absence of such information, age-based data is used as a proxy. The City has only provided condition data for its lift and meter stations.

Figure 28 Asset Condition – Wastewater System (Primarily Age-Based)

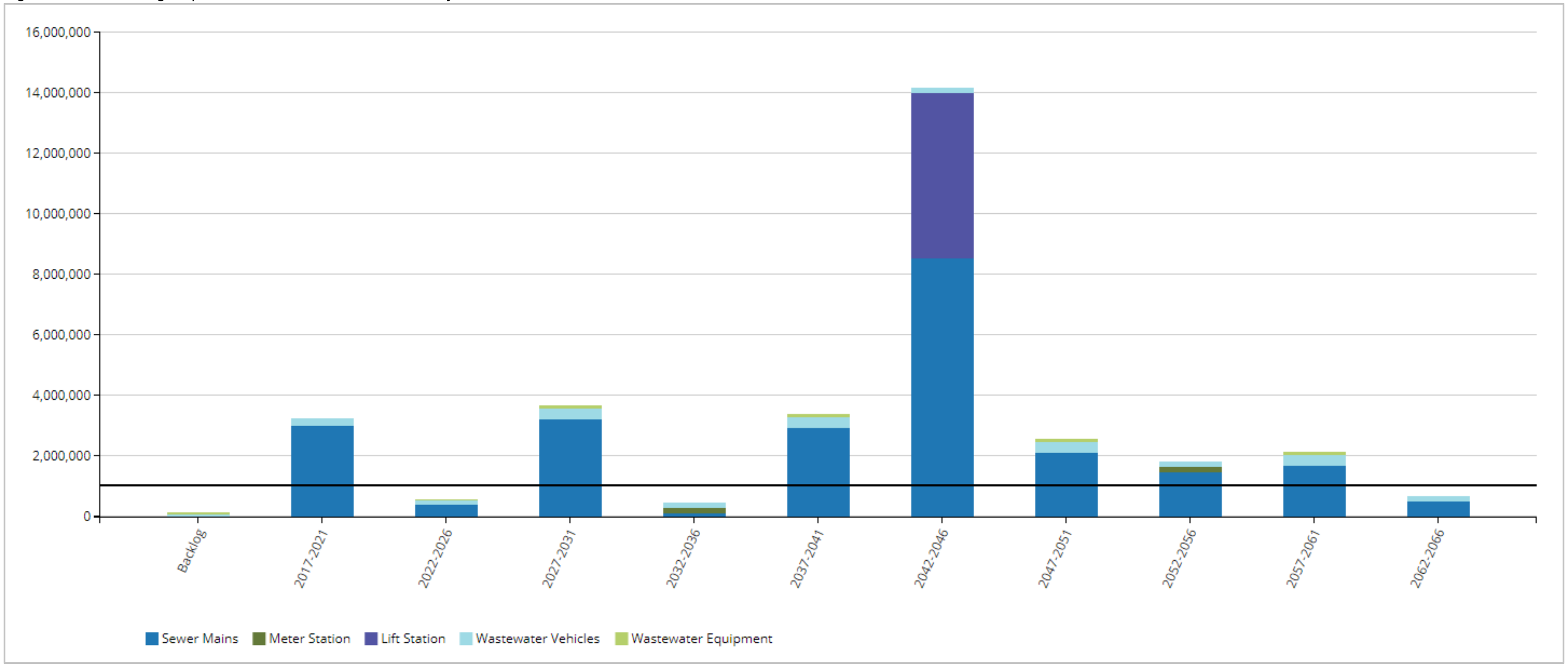


Primarily age-based data indicates that 49% of the assets are in good to very good condition, while 25%, with a valuation of $18 million, are in poor to very poor condition.

4.5 Forecasting Replacement Needs

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

Figure 29 Forecasting Replacement Needs – Wastewater System



Primarily age-based data indicates a minimal backlog and a 5-year replacement need of 3 million. An additional $570,000 will be required between 2022-2026. The City's annual requirements (indicated by the black line) for its wastewater assets total $1.1 million. At this level, funding would be sustainable and replacement needs could be met as they arise without the need for deferring projects. The City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for achieving a more optimal and sustainable funding level. Further, while fulfilling the annual requirements will position the City to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

4.6 Recommendations – Wastewater System

- Primarily age-based data shows a minimal backlog and 10-year replacement needs of $3.5 million. The City should begin a condition assessment program for its wastewater assets to precisely estimate its financial requirements and field needs. See Section 2, 'Condition Assessment Programs' in the 'Asset Management Strategies' chapter.

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

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

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

- The City 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 City's operations and maintenance standards..

- The City is not funding any portion of its long-term requirements on an annual basis. See the 'Financial Strategy' section on how to achieve more sustainable and optimal funding levels.

5. Stormwater System

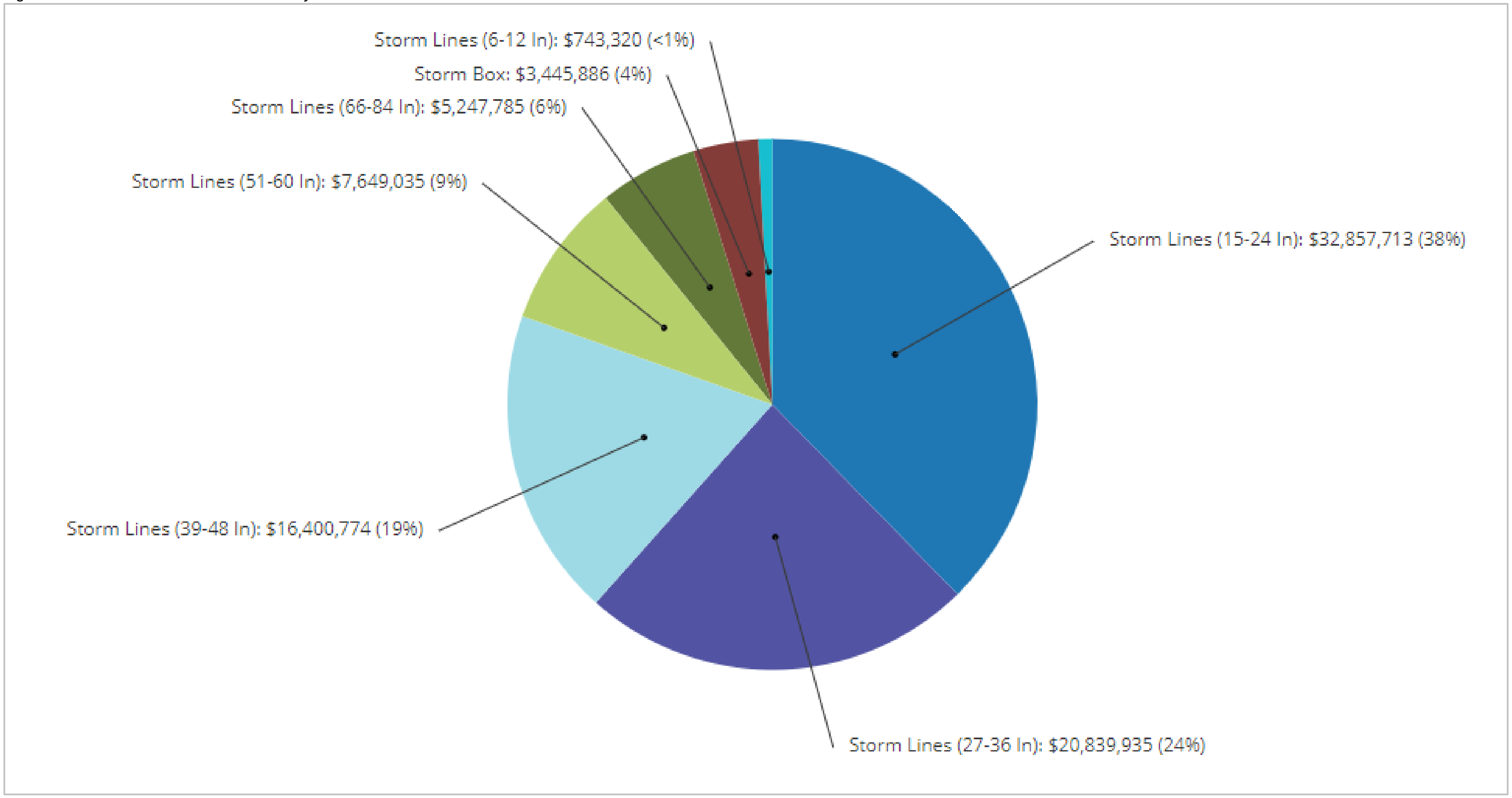
5.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 11 illustrates key asset attributes for the City's stormwater system, 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 City's stormwater system assets are valued at $87 million based on 2018 replacement costs. The useful life indicated for each asset type below was assigned by the City.

Table 11 Asset Inventory – Stormwater System

Asset Type	Asset Component	Quantity	Useful Life in Years	2018 Valuation Method	2018 Replacement Cost
Stormwater System	Storm Box	9918 ft	40	User-Defined	$3,445,886
	Storm Lines (6-12 In)	3072 ft	40	Cost/Unit, Event Costs	$743,319
	Storm Lines (15-24 In)	105,649 ft	40	Cost/Unit, Event Costs	$32,857,713
	Storm Lines (27-36 In)	43,236 ft	40	Cost/Unit, Event Costs	$20,839,935
	Storm Lines (39-48 In)	27,244 ft	40	Cost/Unit, Event Costs	$16,400,774
	Storm Lines (51-60 In)	12,706 ft	40	Cost/Unit, Event Costs	$7,649,035
	Storm Lines (66-84 In)	8717 ft	40	Cost/Unit, Event Costs	$5,247,785
				Total	**$87,184,447**

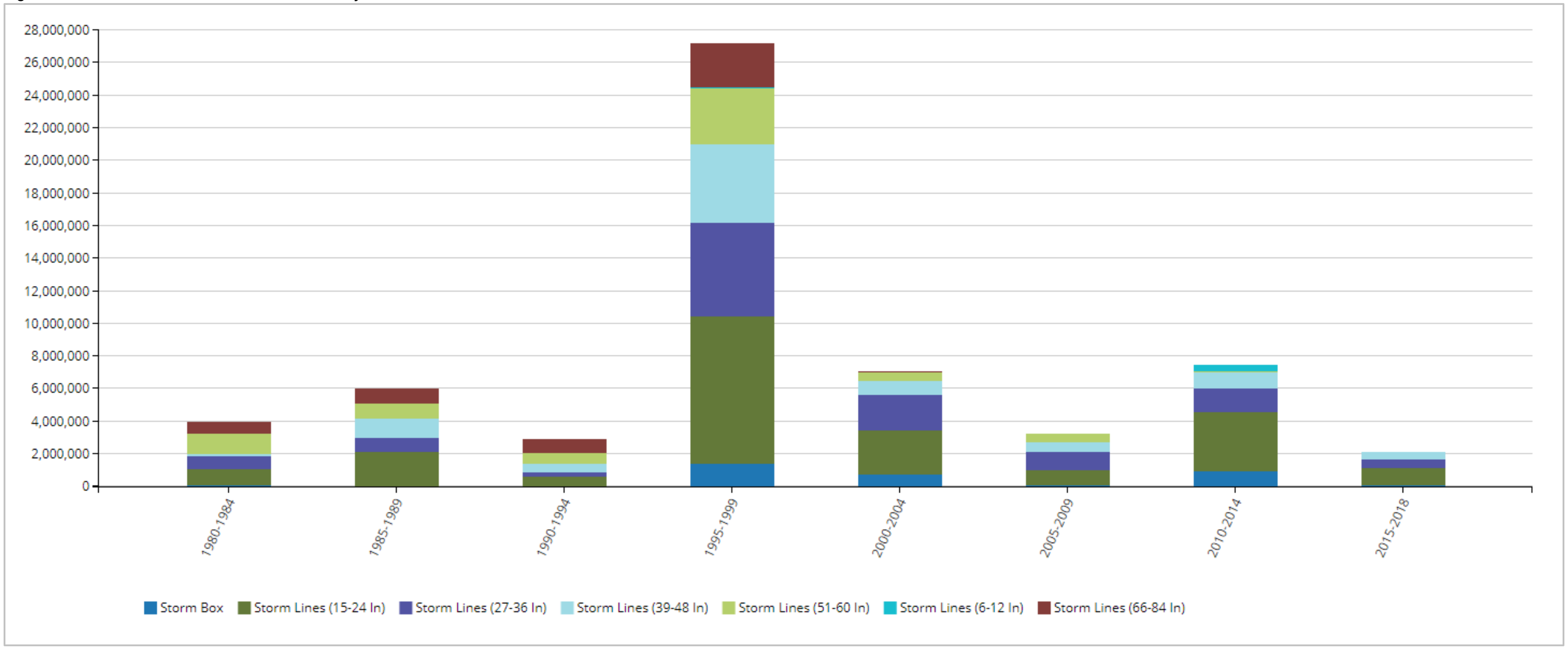
Figure 30 Asset Valuation – Stormwater System



5.2 Historical Investment in Infrastructure

Figure 31 shows the City's historical investments in its stormwater system since 1980. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 5.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 31 Historical Investment – Stormwater System

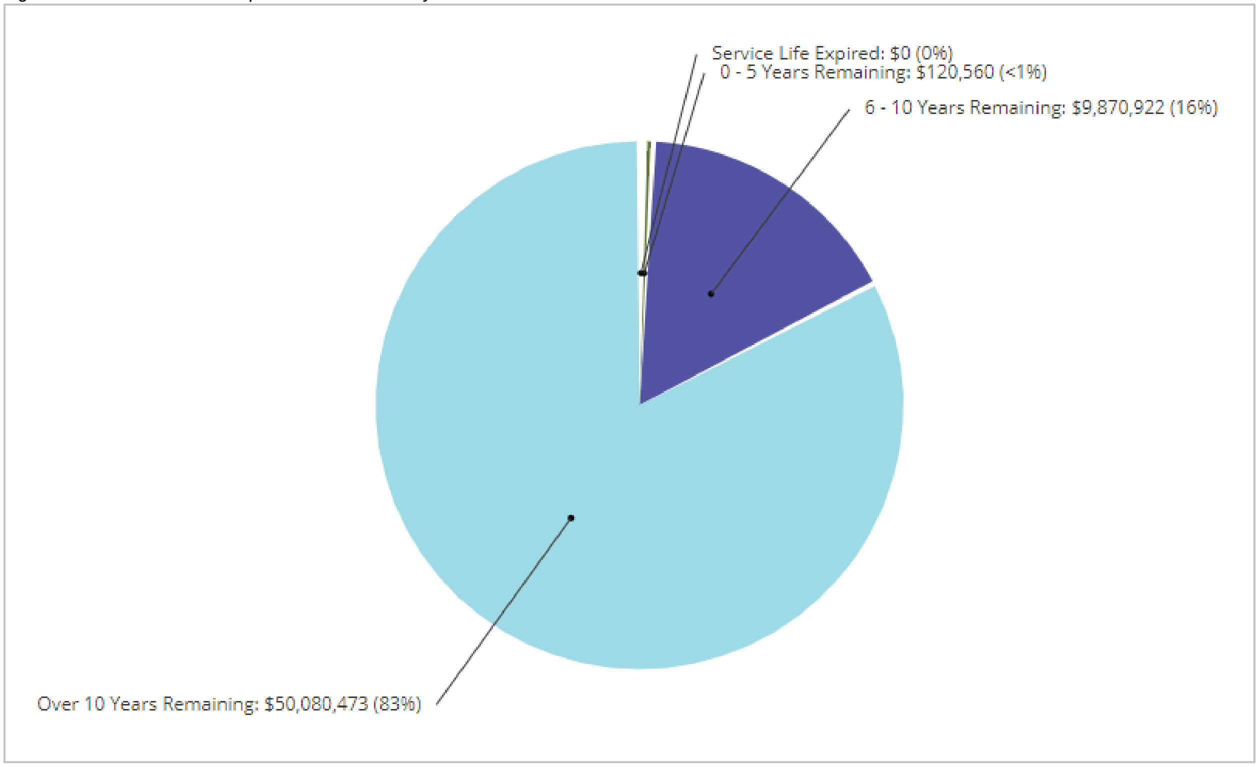


Investments in the stormwater system fluctuated since the 1980s. During the late 1990s, the period of the largest investment, $27 million was invested with a focus on the storm lines.

5.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 32 illustrates the useful life consumption levels as of 2018 for the City's storm assets.

Figure 32 Useful Life Consumption – Stormwater System

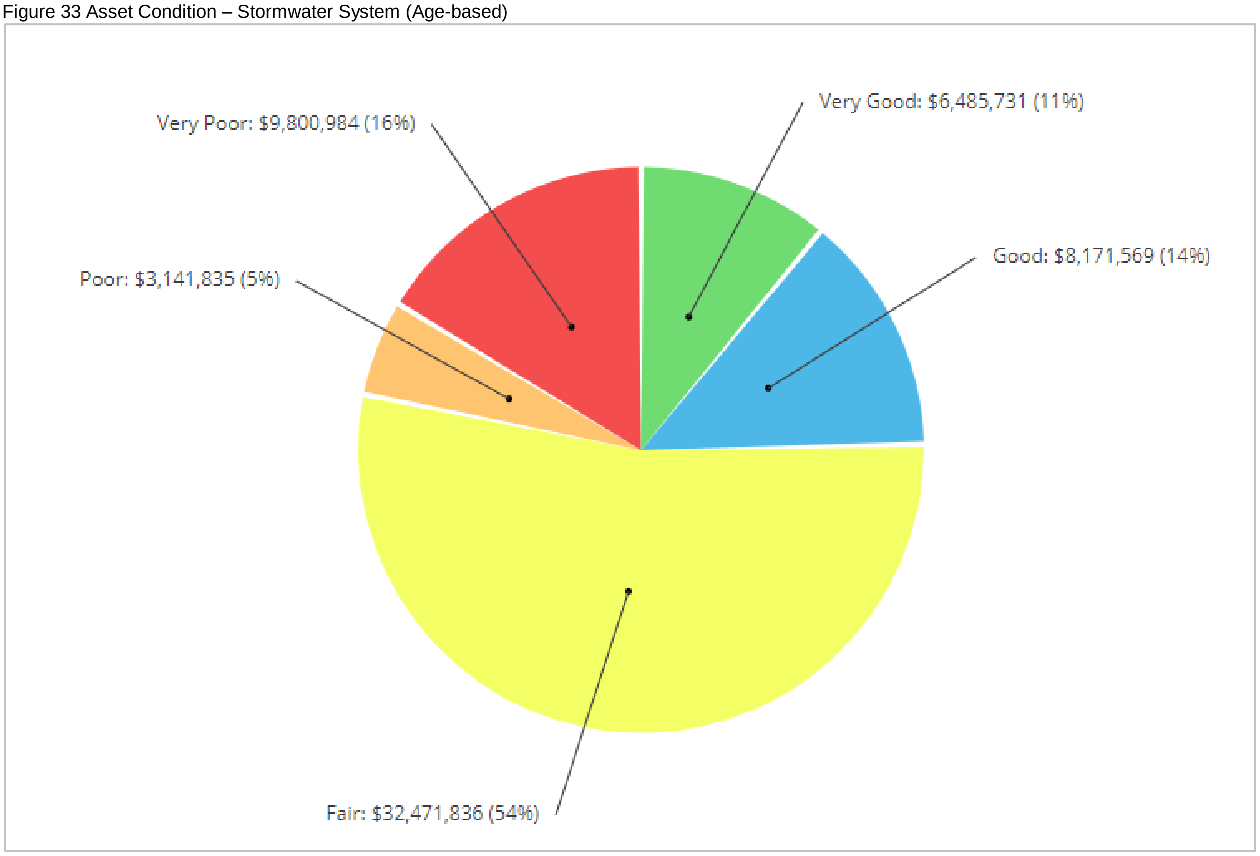


83% of the assets have at least 10 years of useful life remaining while the remaining 17% will reach the end of their useful life within the next ten years.

5.4 Current Asset Condition

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

Figure 33 Asset Condition – Stormwater System (Age-based)

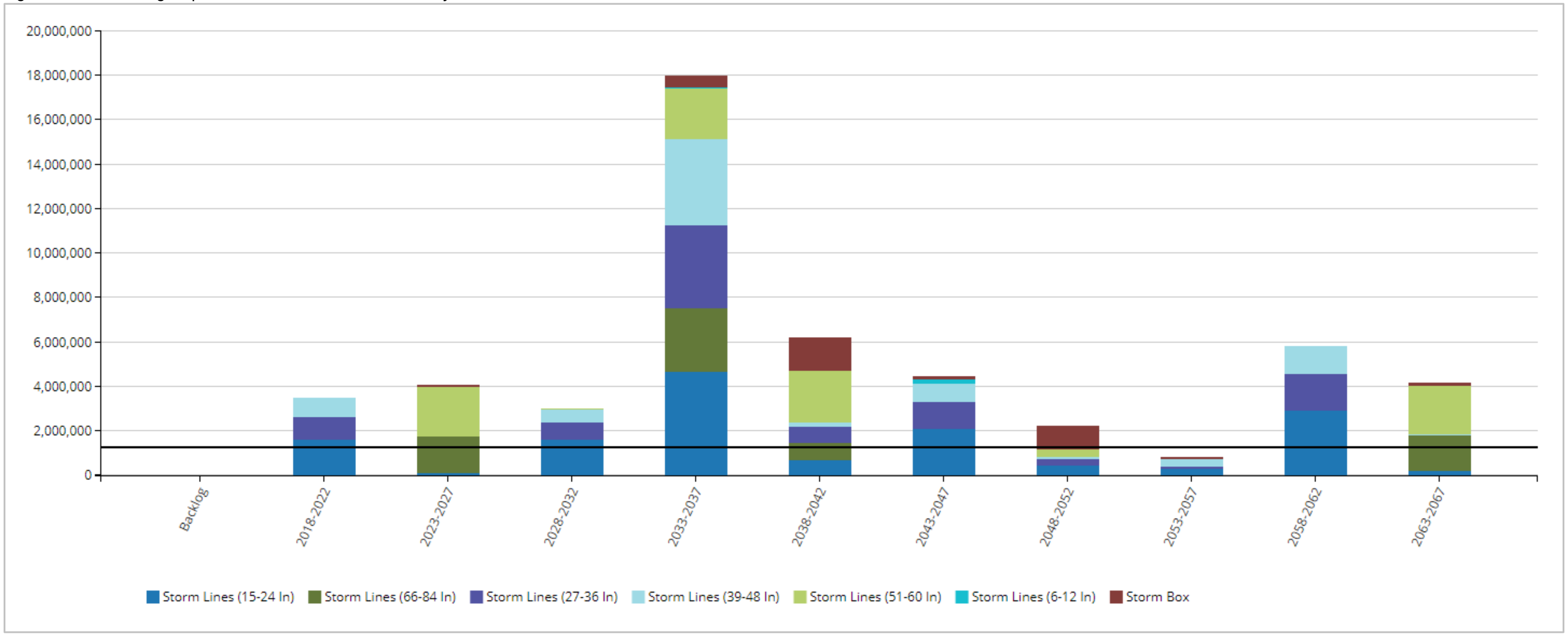


Age-based data indicates that 25% of the assets are in good to very good condition, while 21%, with a valuation of $12.9 million, are in poor to very poor condition.

5.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the City's stormwater 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 34 Forecasting Replacement Needs – Stormwater System



Age-based data shows no backlog and five-year replacement needs of $3.5 million. An additional $4 million will be required between 2023-2027. The City's annual requirements (indicated by the black line) for stormwater assets total $1.3 million. At this funding level, the City 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. The City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for achieving a more optimal and sustainable funding level.

5.6 Recommendations – Stormwater System

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

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

- An appropriate percentage of the replacement value of the assets should then be allocated for the City's operations and maintenance standards.

- Stormwater 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 City is not funding any portion of it's long-term requirements on an annual basis. See the 'Financial Strategy' section on how to achieve more sustainable and optimal funding levels.

6. Buildings & Facilities

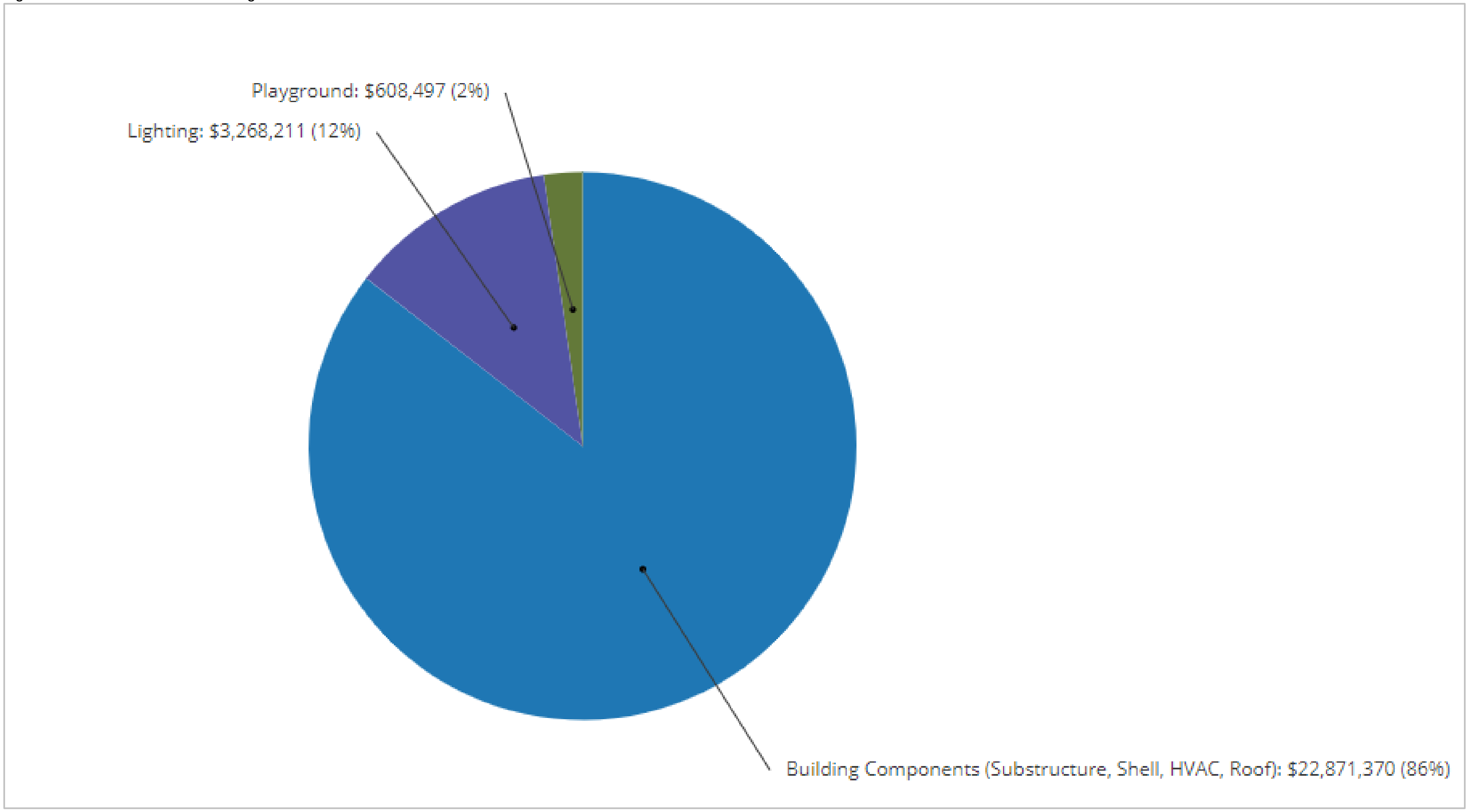
6.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 12 illustrates key asset attributes for the City's buildings & facilities, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the City's buildings assets are valued at $26.7 million based on 2018 replacement costs. The useful life indicated for each asset type below was assigned by the City.

Table 12 Key Asset Attributes – Buildings & Facilities

Asset Type	Asset Component	Quantity	Useful Life in Years	Valuation Method	2018 Replacement Cost
Buildings & Facilities	Building Components (Substructure, Shell, HVAC, Roof)	55	20-75	User-Defined/Flat-Rate Inflation	$22,871,370
	Lighting	86	40	Flat-Rate Inflation	$3,368,211
	Playground	20	20	User-Defined	$608,497
				Total	$26,748,078

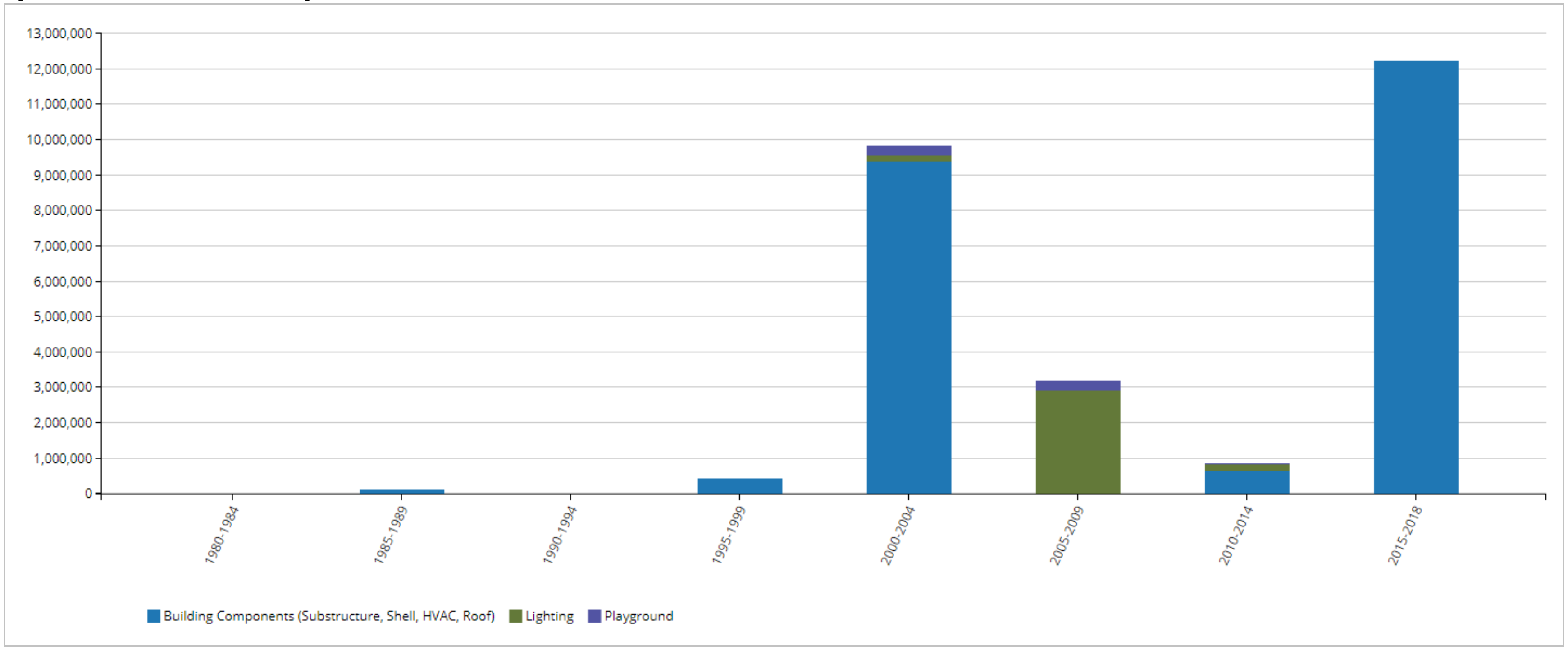
Figure 35 Asset Valuation – Buildings & Facilities



6.2 Historical Investment in Infrastructure

Figure 36 shows the City's historical investments in its buildings & facilities since 1980. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 6.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 36 Historical Investment – Buildings & Facilities

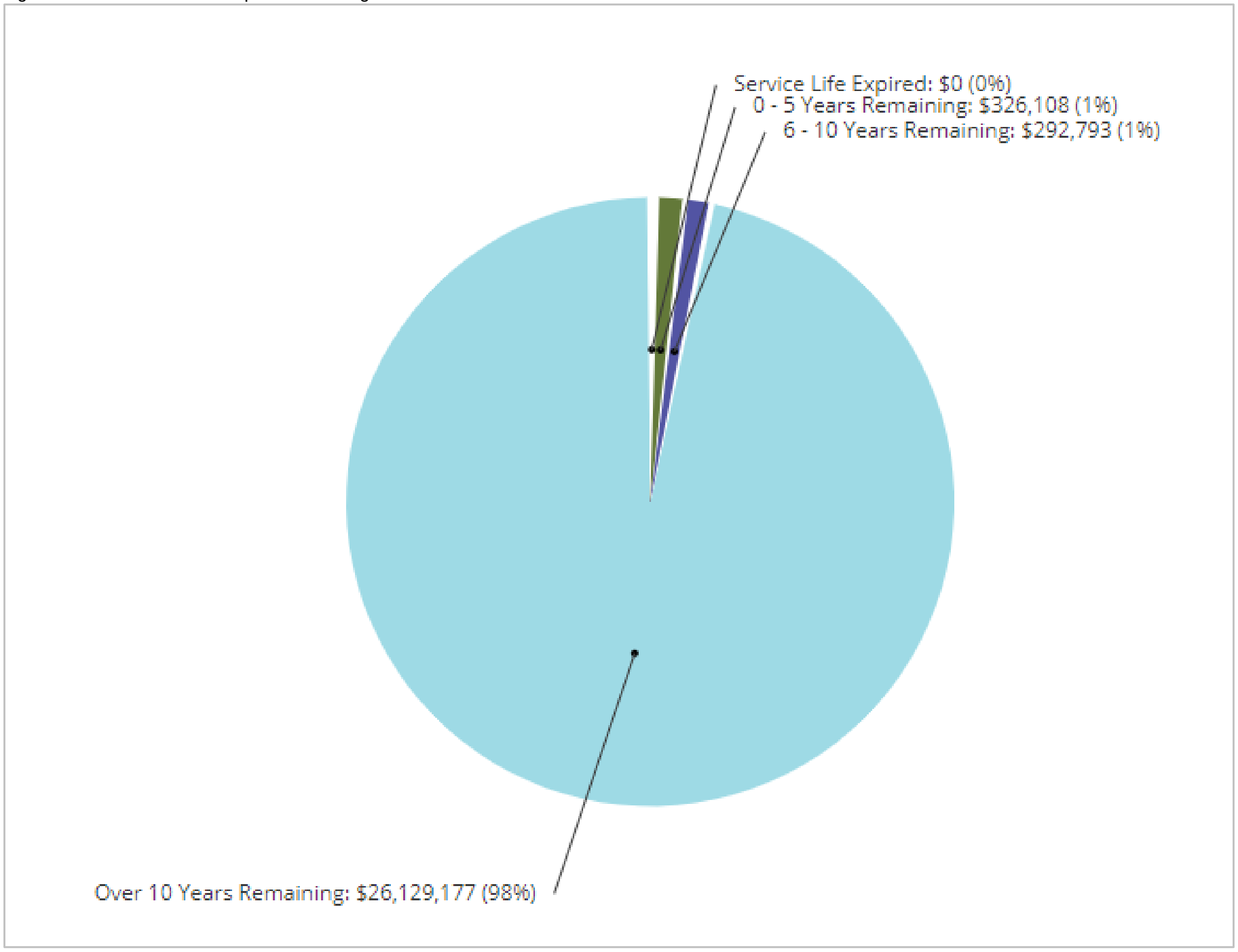


The City's investments into its building assets were minimal starting in late 1980s until the late 1990s. Between 2015 and 2018, the period of largest investment, $12 million was invested into the building assets with a focus on building components.

6.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 37 illustrates the useful life consumption levels as of 2018 for the City's buildings assets.

Figure 37 Useful Life Consumption – Buildings & Facilities

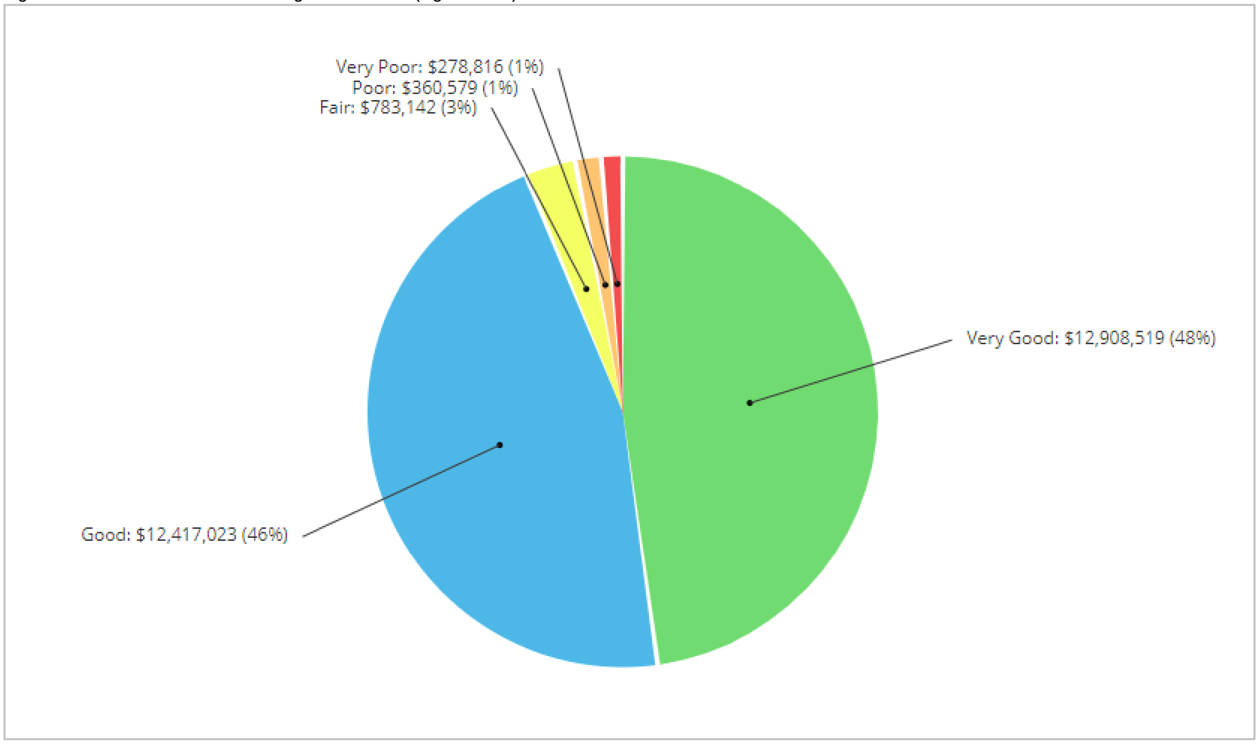


98% of buildings assets have at least 10 years of useful life remaining; 1%, with a valuation of $326,000 will reach the end of their useful life in the next 5 years.

6.4 Current Asset Condition

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

Figure 38 Asset Condition – Buildings & Facilities (Age-Based)

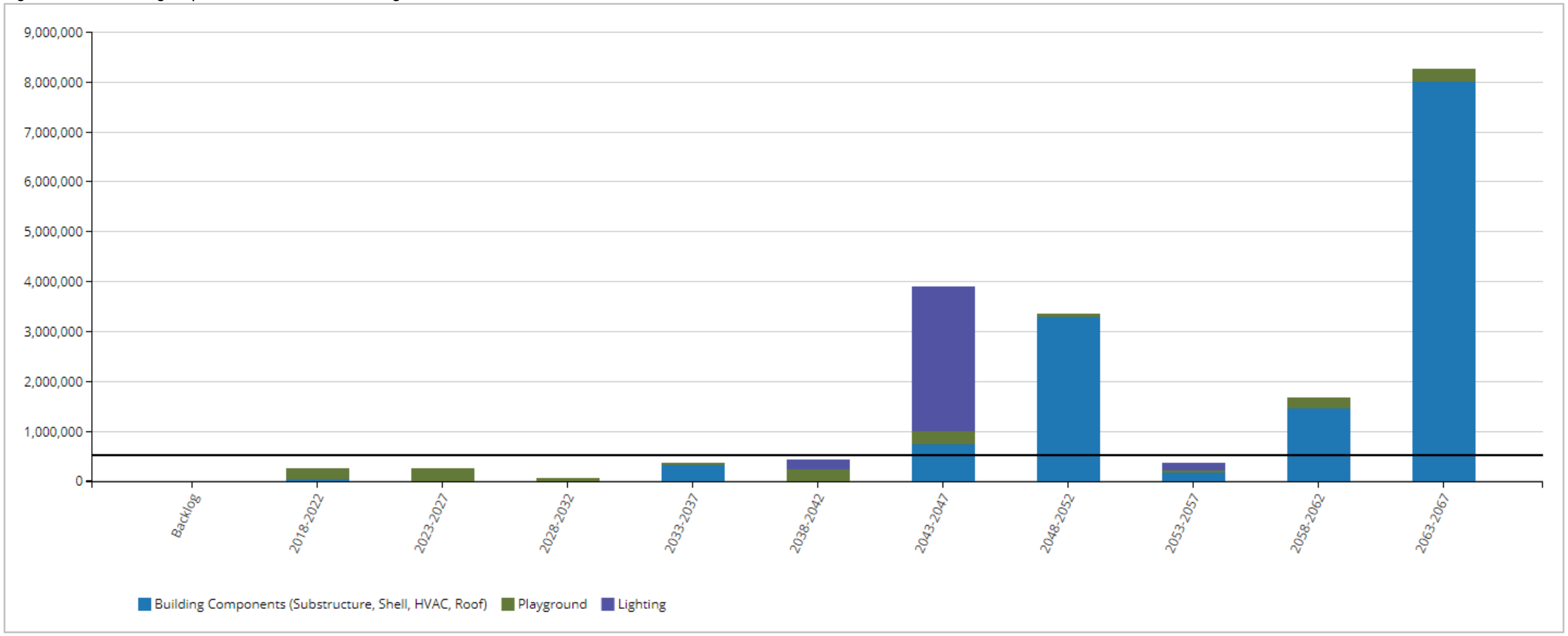


94% of buildings assets, with a valuation of $25 million, are in good to very good condition; 2% are in poor to very poor condition.

6.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the City'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 39 Forecasting Replacement Needs – Buildings & Facilities



Age-based data indicates no backlog and five-year replacement needs of $279,000. An additional $271,000 will be required between 2023-2027. The City's annual requirements (indicated by the black line) for its buildings total $545,000. At this funding level, the City 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. The City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for achieving a more optimal and sustainable funding level.

6.6 Recommendations – Buildings & Facilities

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

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

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

- Using the above information, the City 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 City's operations and maintenance standards..

- 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 City is not funding any portion of it's long-term requirements on an annual basis. See the 'Financial Strategy' section on how to achieve more sustainable and optimal funding levels.

7. Machinery & Equipment

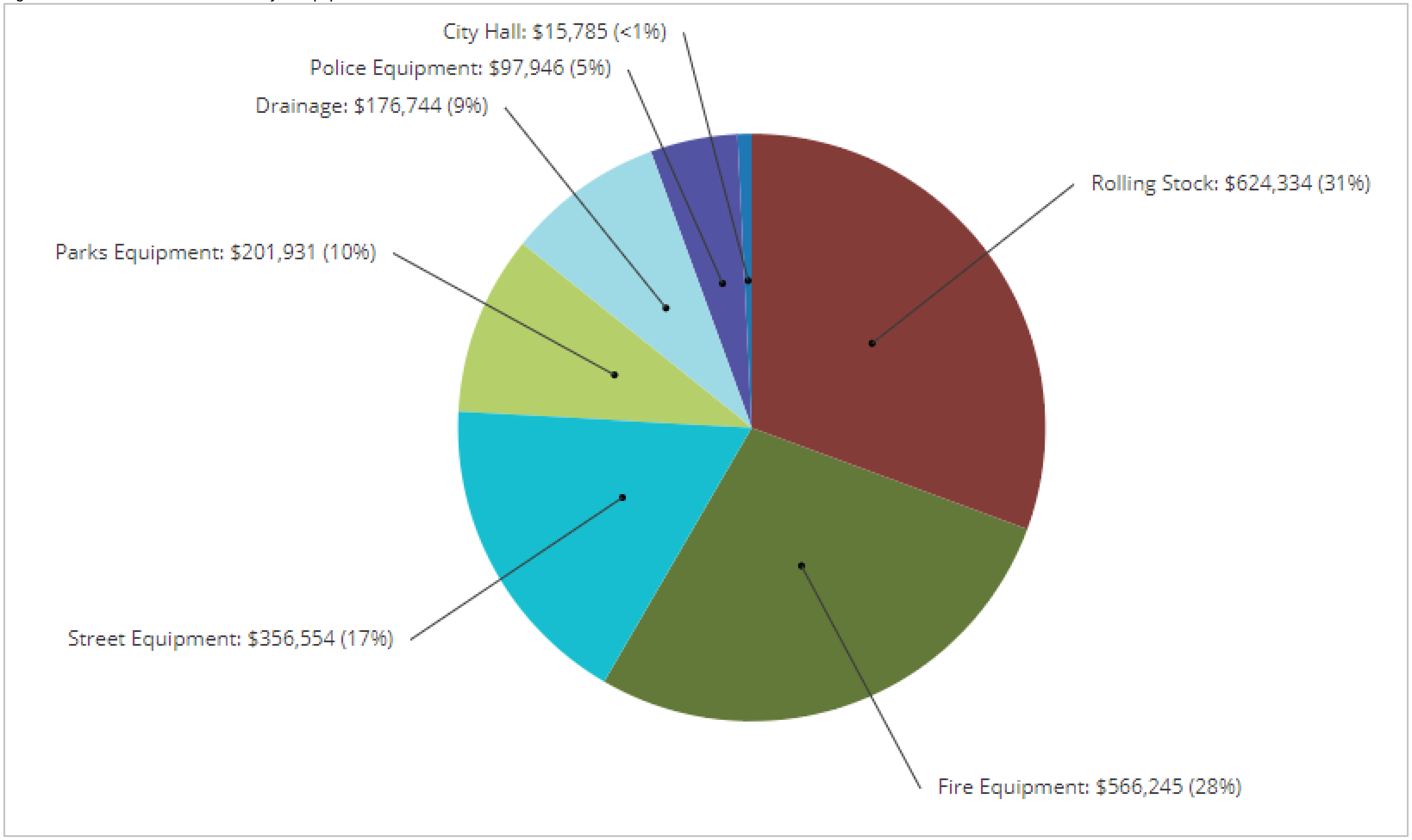
7.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 13 illustrates key asset attributes for the City's machinery & equipment, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. In total, the City's machinery & equipment assets are valued at $2 million based on 2018 replacement costs. The useful life indicated for each asset type below was assigned by the City.

Table 13 Asset Inventory – Machinery & Equipment

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2018 Replacement Cost
Machinery & Equipment	City Hall	2	5	User-Defined	$15,785
	Drainage	4	10-20	User-Defined	$176,744
	Fire Equipment	10	4-10	User-Defined	$566,245
	Parks Equipment	17	7-20	User-Defined	$201,931
	Police Equipment	1	8	User-Defined	$97,946
	Rolling Stock	33	5-15	Flat-Rate Inflation/ User-Defined	$624,334
	Street Equipment	14	5-20	User-Defined	$356,554
				Total	$2,039,539

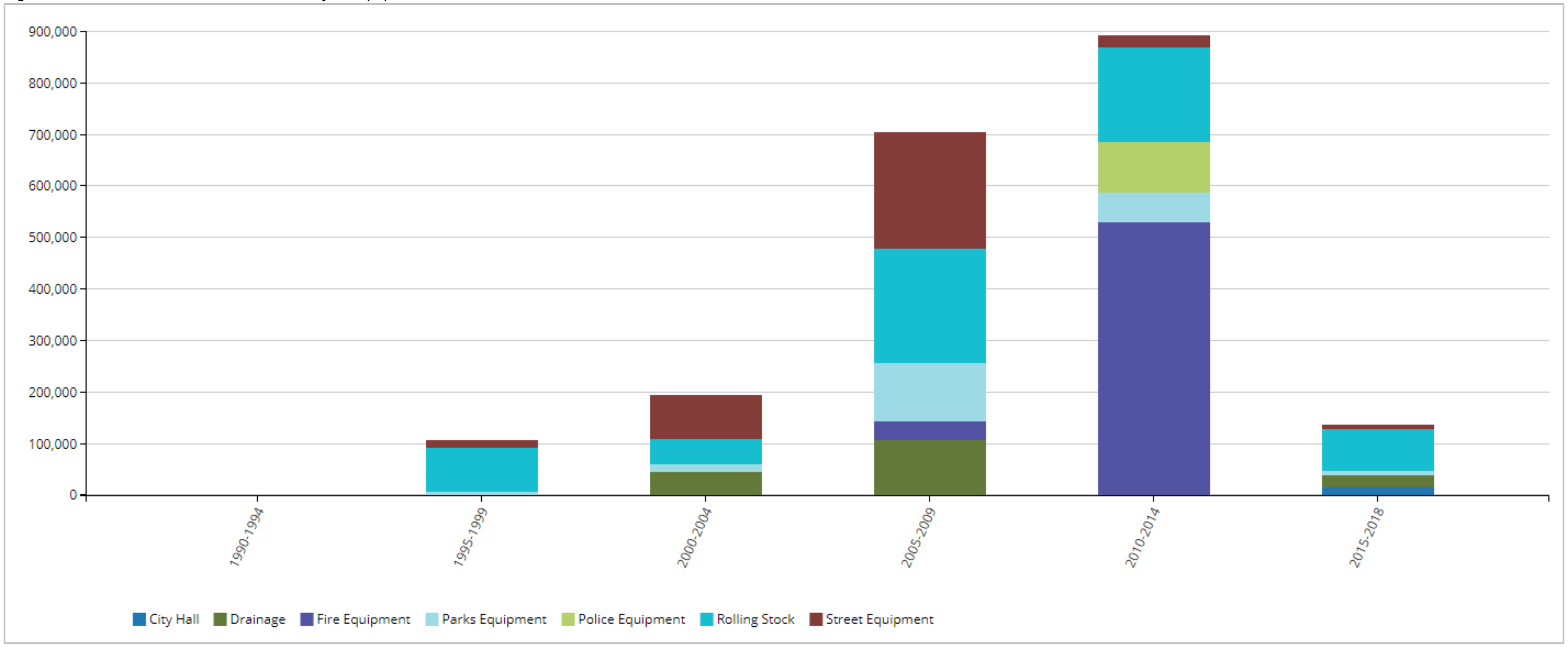
Figure 40 Asset Valuation – Machinery & Equipment



7.2 Historical Investment in Machinery & Equipment

Figure 41 shows the City's historical investments in its machinery & equipment since 1990. While observed condition data will provide superior accuracy in estimating replacement needs and should be incorporated into strategic plans, in the absence of such information, understanding past expenditure patterns and current useful life consumption levels (Section 7.3) can inform the forecasting and planning of infrastructure needs and in the development of a capital program. Note that this graph only includes the active asset inventory as of December 31, 2018.

Figure 41 Historical Investment – Machinery & Equipment

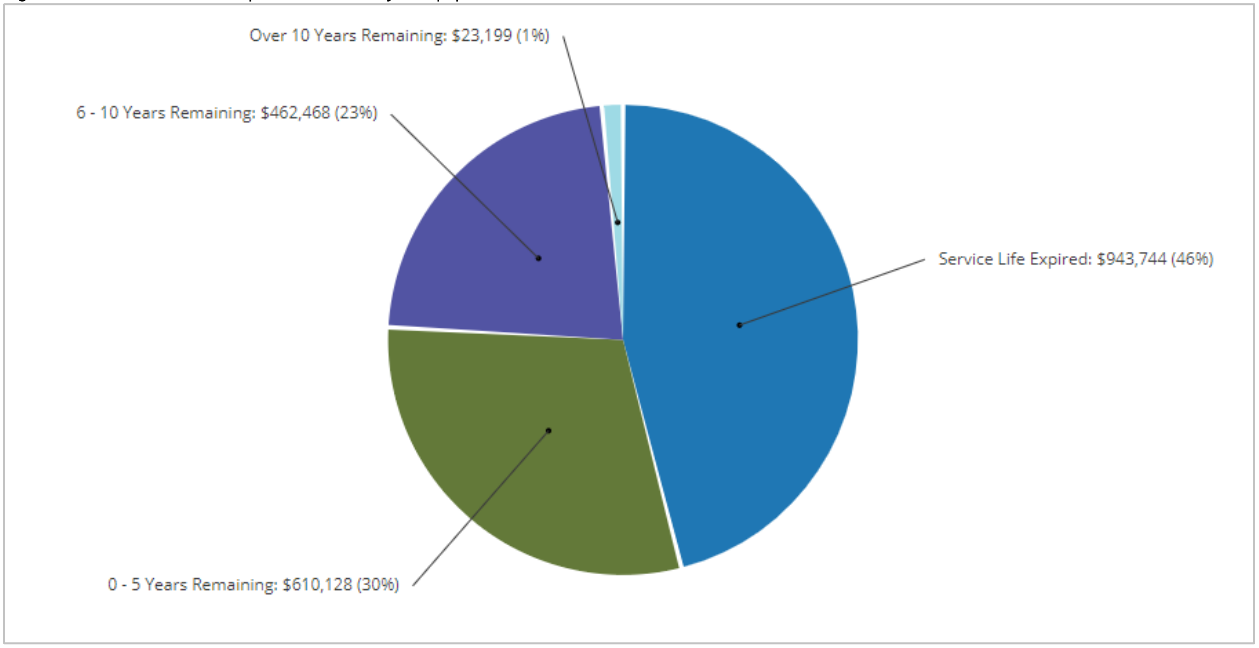


The City rapidly expanded its machinery & equipment portfolio beginning in the late 1990s. Between 2010 and 2014, the period of largest investment, $893,000 was invested in the machinery and equipment category with a heavy focus on fire equipment.

7.3 Useful Life Consumption

In conjunction with historical spending patterns and observed condition data, understanding the consumption rate of assets based on industry established useful life standards provides a more complete profile of the state of a community's infrastructure. Figure 42 illustrates the useful life consumption levels as of 2018 for the City's machinery & equipment assets.

Figure 42 Useful Life Consumption – Machinery & Equipment

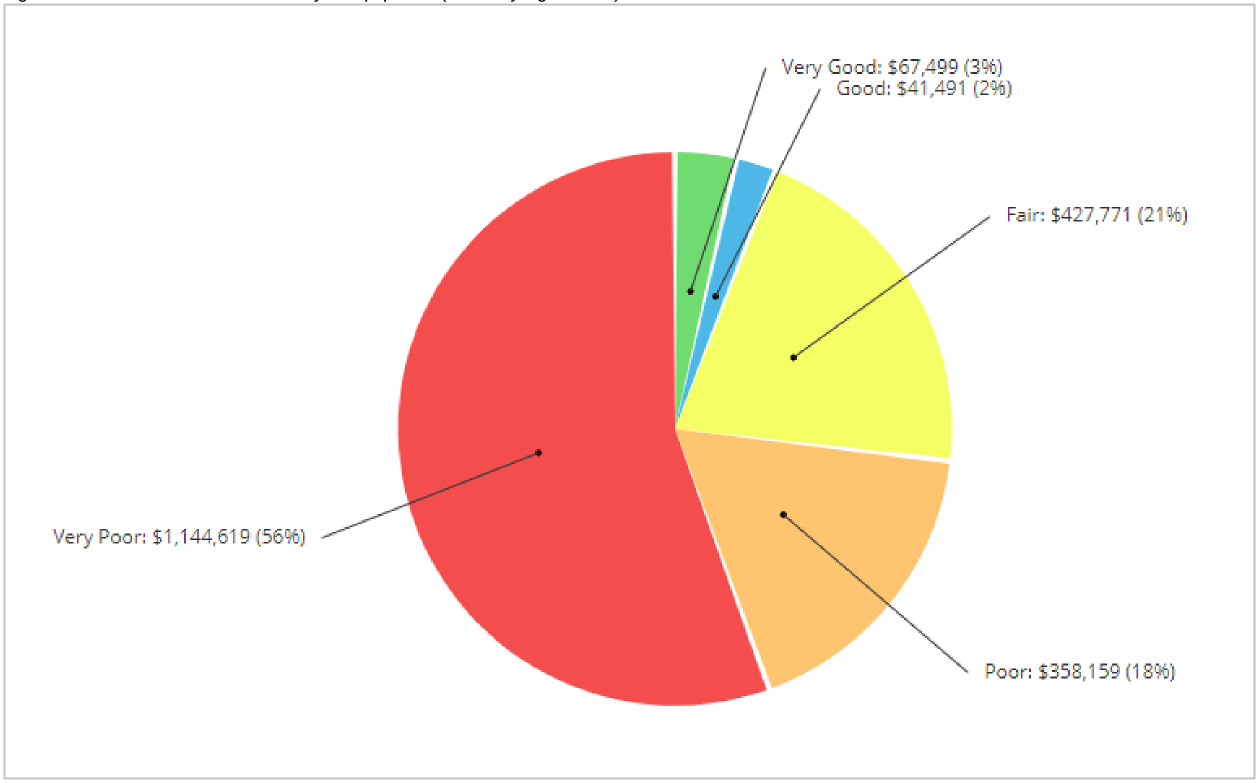


While 1% of assets have at least 10 years of useful life remaining, 46%, with a valuation of $944,000, remain in operation beyond their useful life. An additional 30% will reach the end of their useful life within the next five years.

7.4 Current Asset Condition

Using replacement cost, in this section we summarize the condition of the City's machinery & equipment assets as of 2018. By default, we rely on observed field data as provided by the City. In the absence of such information, age-based data is used as a proxy. The City has provided condition data for some of its rolling stock assets.

Figure 43 Asset Condition – Machinery & Equipment (Primarily Age-based)

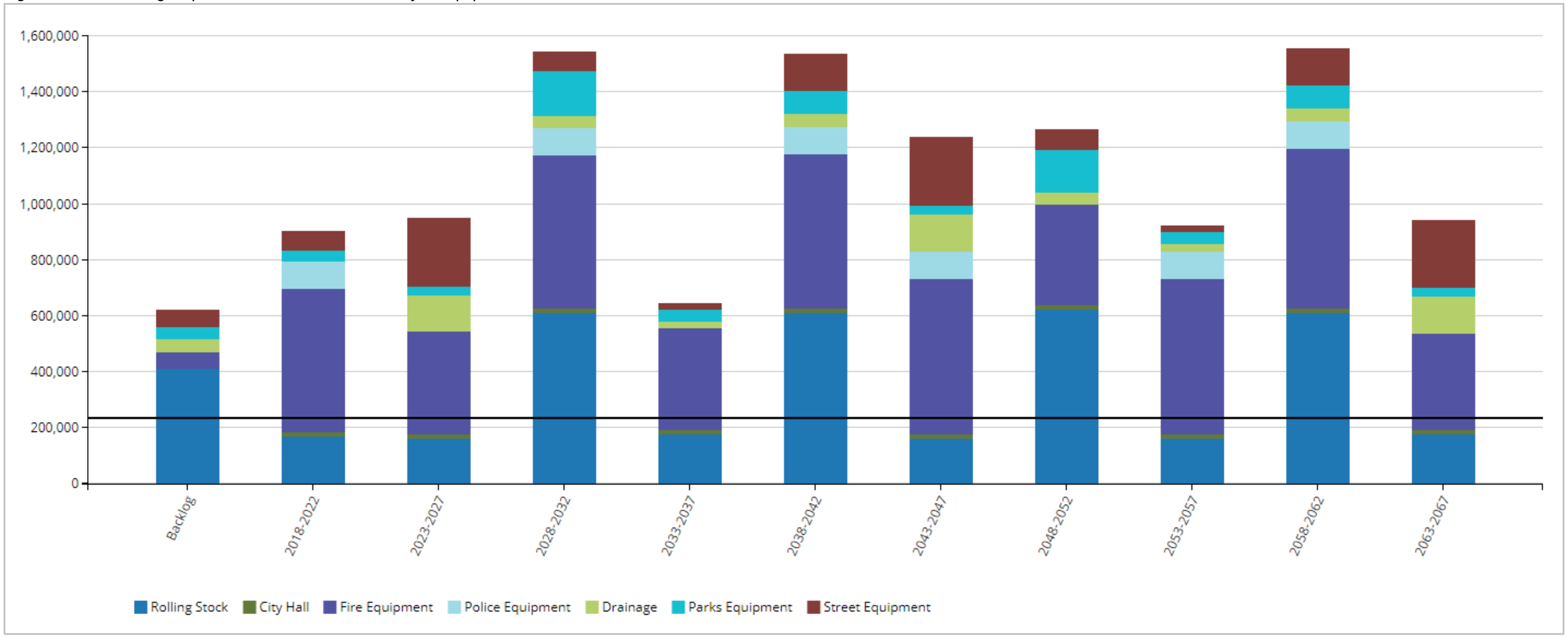


According to primarily age-based data, 74% of assets, with a valuation of $1.5 million, are in poor to very poor condition; 5% are in good to very good condition.

7.5 Forecasting Replacement Needs

In this section, we illustrate the short-, medium- and long-term infrastructure spending requirements (replacement only) for the City'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 44 Forecasting Replacement Needs – Machinery & Equipment



In addition to a backlog of $621,000, the City's replacement needs total $906,000 in the next five years. An additional $951,000 will be required between 2023-2027. The City's annual requirements (indicated by the black line) for its machinery & equipment total $241,000. At this funding level, the City 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 City is currently not allocating any funding towards this asset category. See the 'Financial Strategy' section for maintaining a sustainable funding level. Further, while fulfilling the annual requirements will position the City to meet its future replacement needs, injection of additional revenues will be needed to mitigate existing infrastructure backlogs.

7.6 Recommendations – Machinery & Equipment

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

- Using the above information, the City 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 City’s operations and maintenance standards.

- The City is not funding any portion of it’s long-term requirements on an annual basis. See the ‘Financial Strategy’ section on how to maintain sustainable and optimal funding levels.

8. Vehicles

8.1 Asset Portfolio: Quantity, Useful Life and Replacement Cost

Table 14 illustrates key asset attributes for the City's vehicles portfolio, including quantities of various assets, their useful life, their replacement cost, and the valuation method by which the replacement costs were derived. The City's vehicles are leased through the Enterprise Lease Program, below is a summary of vehicles that have been leased and the vehicles that will be converted to being leased. This program is 100% funded.

Table 14 Asset Inventory – Vehicles

Asset Type	Components	Quantity	Useful Life in Years	Valuation Method	2018 Replacement Cost
Vehicles	Vehicles (Leased)	33		Not Planned for Replacement	$0
	Vehicles (To be converted to leased)	47		Not Planned for Replacement	$0
				Total	$0

VII. Levels of Service

The two primary risks to a City's financial sustainability are the total lifecycle costs of infrastructure, and establishing levels of service (LOS) that exceed its financial capacity. In this regard, municipalities face a choice: overpromise and underdeliver; under promise and overdeliver; or promise only that which can be delivered efficiently without placing 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 City.

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 City. 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 City. The following LOS categories are established as guiding principles for the LOS that each service area in the City should strive to provide internally to the City and to residents/customers. These are derived from best practices in developing Levels of Service frameworks.

Table 15 LOS Categories

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

2. Key Performance Indicators and Targets

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

Table 16 Key Performance Indicators – Road System and Bridges & Culverts

Level	KPI (Reported Annually)
Strategic	– Percentage of total reinvestment compared to asset replacement value – Completion of strategic plan objectives (related to roads, and bridges & culverts)
Financial Indicators	– Annual revenues compared to annual expenditures – Annual replacement value depreciation compared to annual expenditures – Cost per capita for roads, and bridges & culverts – Maintenance cost per square foot – 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 system rehabilitated/reconstructed – Percentage of paved road lane kilometres rated as poor to very poor – Percentage of bridges and large culverts rated as poor to very poor – Percentage of asset class value spent on O&M
Operational Indicators	– Percentage of roads inspected within the last five years – Percentage of bridges and large culverts inspected within the last two years – Operating costs for paved lane per mile – Operating costs for bridge and large culverts per square foot – Percentage of customer requests with a 24-hour response rate

Table 17 Key Performance Indicators – Buildings & Facilities

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

Table 18 Key Performance Indicators – Vehicles

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

Table 19 Key Performance Indicators – Water, Wastewater and Stormwater Systems

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

Table 20 Key Performance Indicators – Machinery & Equipment

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

3. Future Performance

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

Strategic Objectives and Corporate Goals
The City'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 services the City 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 insights regarding the levels of service a particular asset or a network of assets should deliver, e.g., what a road in 'good' condition should look like or the travel time between destinations. The public should be consulted in establishing LOS; however, the discussions should be centered on clearly outlining the lifecycle costs associated with delivering any improvements in LOS.

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

Demographic Changes
The composition of residents in a City can also serve as an infrastructure demand driver, and as a result, can change how a City 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 City 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 City should collect data on its current performance against the KPIs listed and establish targets that reflect the current fiscal capacity of the City, 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 City should be tracked annually.

VIII. Asset Management Strategies

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

1. Non-Infrastructure Solutions & Requirements

The City 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 City 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 City 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 a clearer path of what is required to achieve sustainable infrastructure programs.

2. Condition Assessment Programs

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

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

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

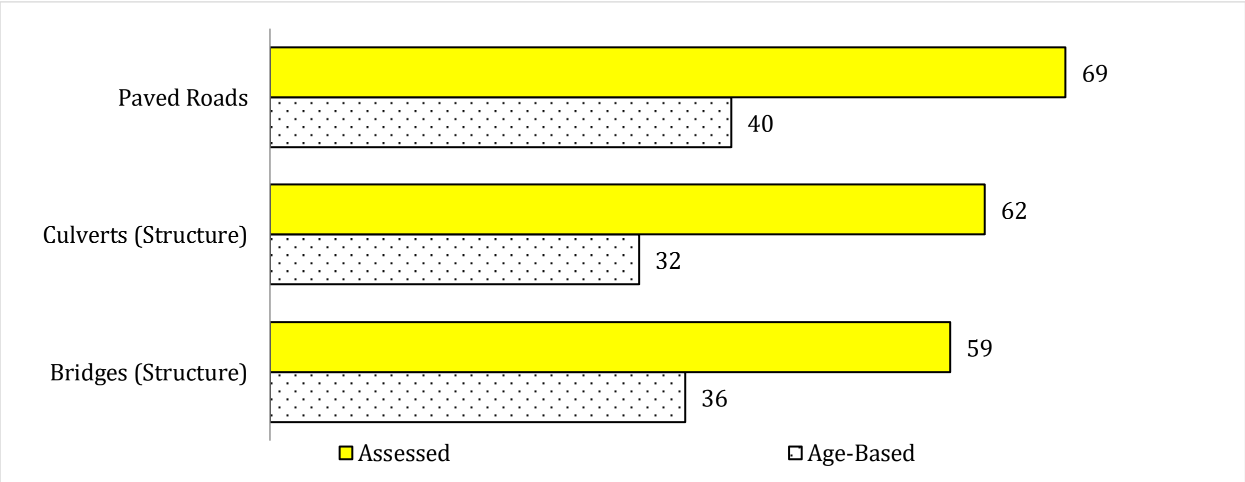
Condition assessment can involve different forms of analysis such as subjective opinion, mathematical models, or variations thereof, and can be completed through a very detailed or very cursory approach. When establishing the condition assessment for an entire asset class, a cursory approach (metrics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

The Impact of Condition Assessments

In 2015, PSD assisted with a published study on the state of roads and bridges that looked at the infrastructure deficits, annual investment gaps, and the physical state of roads, bridges and culverts.

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

Figure 45 Comparing Age-based and Assessed Condition Data



2.1 Pavement Network

Typical industry pavement inspections are performed by consulting firms using specialized assessment vehicles equipped with various electronic sensors and data capture equipment. The vehicles will drive the entire road system 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 system, this can still be seen as a good method and will assist greatly with the overall management of the road system.

It is recommended that the City begin conducting a 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

Municipalities are encouraged to inspect all structures that have a span of 10 feet or more, as a best practice measure.
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 City’s structure portfolio relies on the structural engineer who performs the inspections to also produce a maintenance requirements report, and rehabilitation & replacement requirements report as part of the overall assignment. In addition to defining the overall needs requirements, the structural engineer should identify those structures that will require more detailed investigations and non-destructive testing techniques. Examples of these investigations are:

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

Through detailed investigations, a 10-year needs list can be developed for the City’s bridges.

2.3 Buildings & Facilities

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

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

Once collected, this information can be uploaded into the CityWide®, the City'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 City begin conducting inspections of structures and expand its condition assessment program for other segments. It is also recommended that a portion of capital funding is dedicated to this.

2.4 Vehicles and Machinery & Equipment

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

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

A good 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 progressively 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 vehicles and machinery & equipment assets, and that a software application is utilized for the overall management of the program.

2.5 Water System

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

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

It is recommended that the City conduct a watermain assessment program, and that funds are budgeted for this.

2.6 Sewer System Inspection (Wastewater and Storm)

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

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

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

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

It is recommended that the City begin a wastewater main assessment program and expend it to include stormwater mains. A portion of capital funding should be dedicated to this.

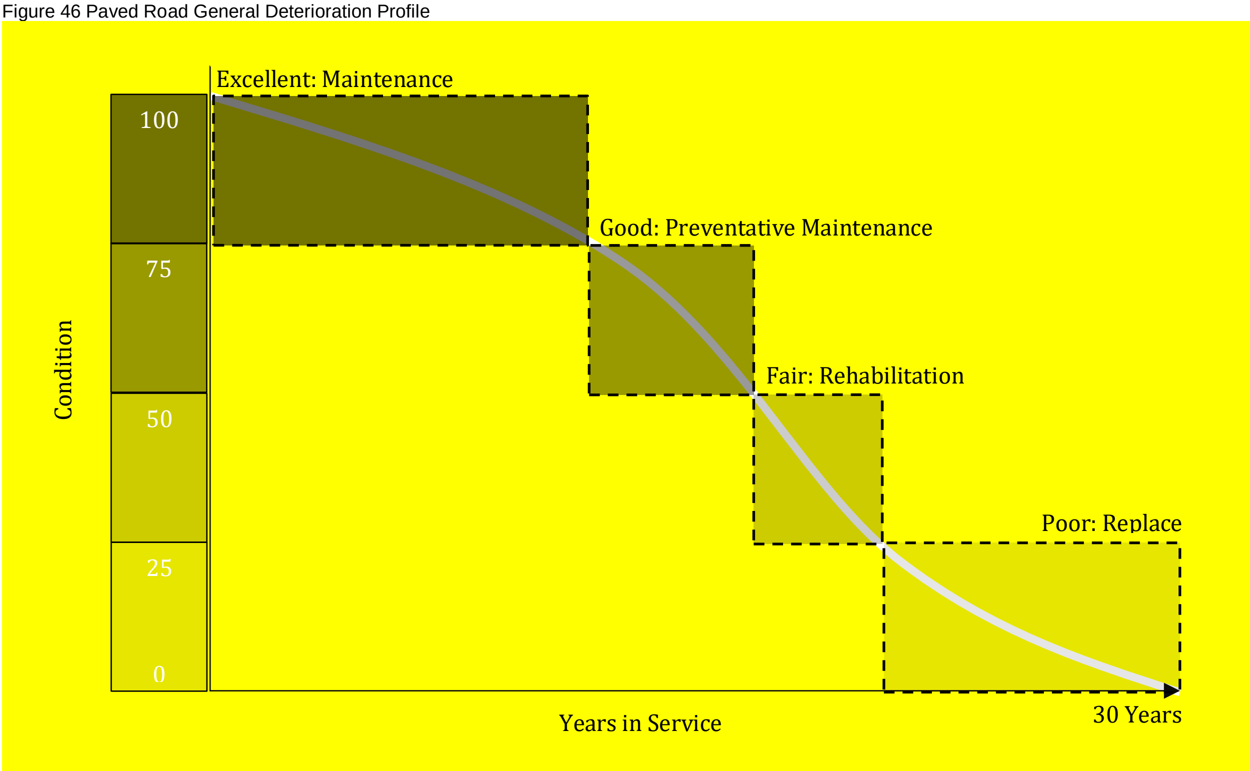
3. Lifecycle Analysis Framework

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

3.1 Paved Roads

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

Figure 46 Paved Road General Deterioration Profile



As shown above, during the road's lifecycle, there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; 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 21 Asset Condition and Related Work Activity for Paved Roads

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

With future updates of this asset management strategy, the City may wish to review the above condition ranges and thresholds for when certain types of work activity occur, and adjust to better suit the City'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 thresholds and condition ranges can be 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 City to present various management options within the financing plan.

It is recommended that the City establish a lifecycle 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 City's bridge structure portfolio relies on the structural engineer who performs the inspections to develop a maintenance requirements report, a rehabilitation and replacement requirements report and identify additional detailed inspections as required.

3.3 Buildings & Facilities

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

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

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

3.4 Vehicles and Machinery & Equipment

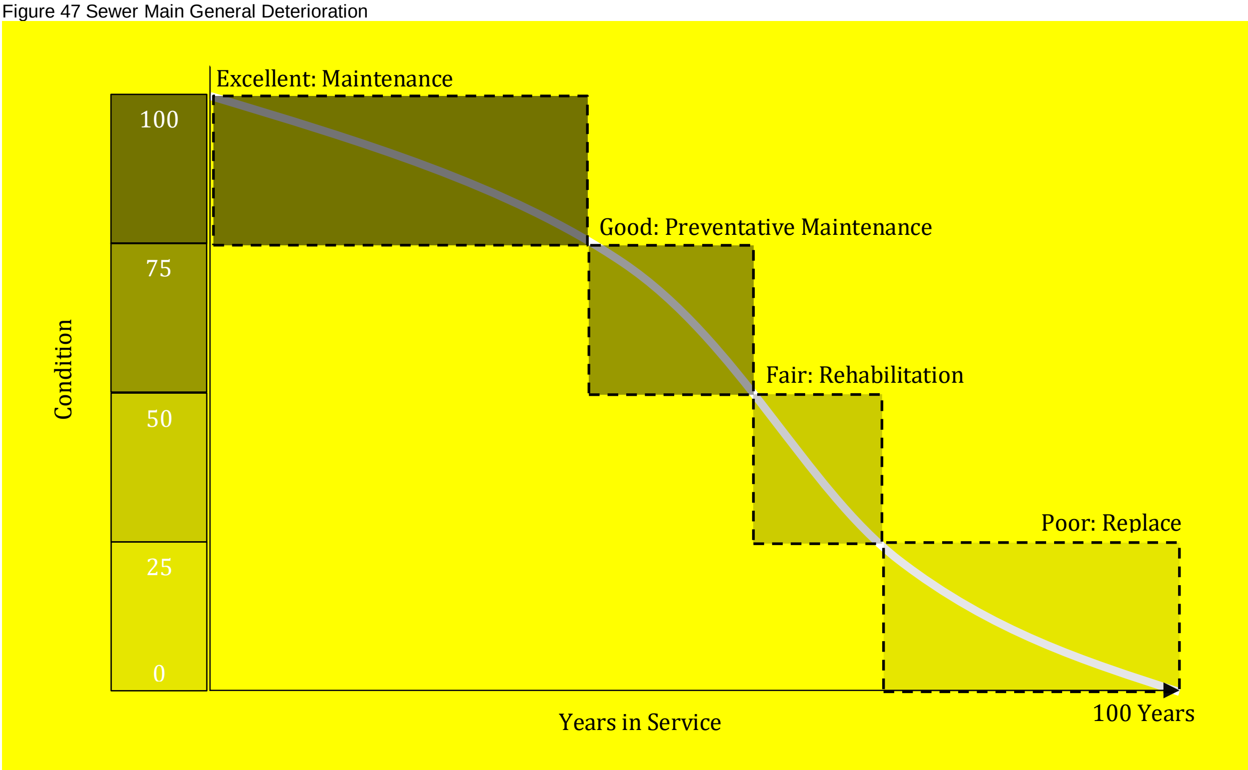
The best approach to develop a 10-year needs list for the City's vehicles and machinery & equipment portfolio would first be through a defined preventative maintenance program, and secondly, through an optimized lifecycle vehicle replacement schedule. The preventative maintenance program would serve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

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

3.5 Wastewater and Stormwater

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

Figure 47 Sewer Main General Deterioration



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

Table 22 Asset Condition and Related Work Activity for Sewer Mains

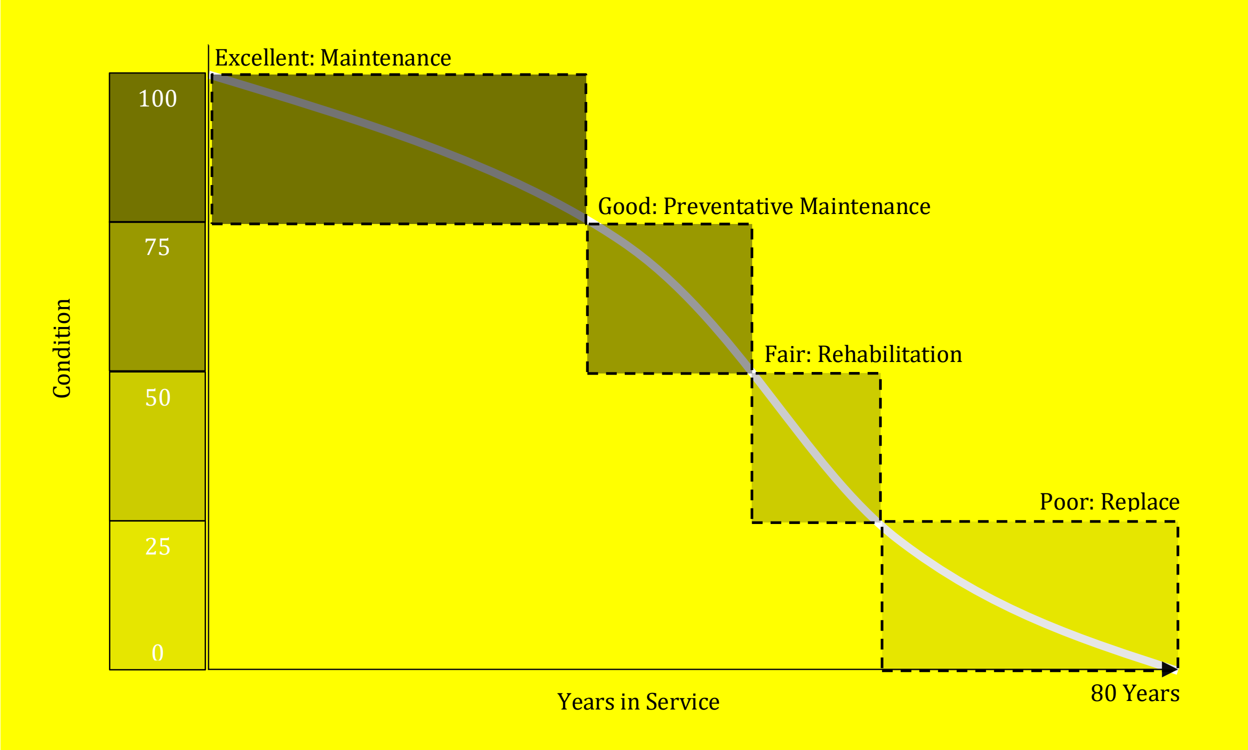
Condition	Condition Range	Work Activity
Very Good (Maintenance only phase)	81-100	– Maintenance only (cleaning & flushing etc.)
Good (Preventative maintenance phase)	61-80	– Mahhole repairs – Small pipe section repairs
Fair (Rehabilitation phase)	41-60	– Structural relining
Poor (Reconstruction phase)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

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

3.6 Water System

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

Figure 48 Water Main General Deterioration



As shown above, during the water main's lifecycle, there are various windows available for work activity that will maintain or extend the life of the asset. These windows are: maintenance; major maintenance; rehabilitation; and replacement or reconstruction. The windows or thresholds for when certain work activities should be applied also coincide approximately with the condition state of the asset as shown in Table 23.

Table 23 Asset Condition and Related Work Activity for Water Mains

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

4. Growth and Demand

Growth is a critical infrastructure demand driver for most infrastructure services. As such, the City must not only account for the lifecycle cost for its existing asset portfolio, but those of any anticipated and forecasted capital projects associated specifically with growth. Based on the 2017 census, the population for Corinth has increased 4.9% since 2011 to reach 21,152. Population changes will require the City to determine the impact to expected levels of service and if any changes to the existing asset inventory may be required.

5. Project Prioritization and Risk Management

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

5.1 Defining Risk Management

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

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

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

- **The exposure of the public and/or staff to injury or loss of life**:
  For example, a single sidewalk asset may demand little consideration and carry minimum importance to the City'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.

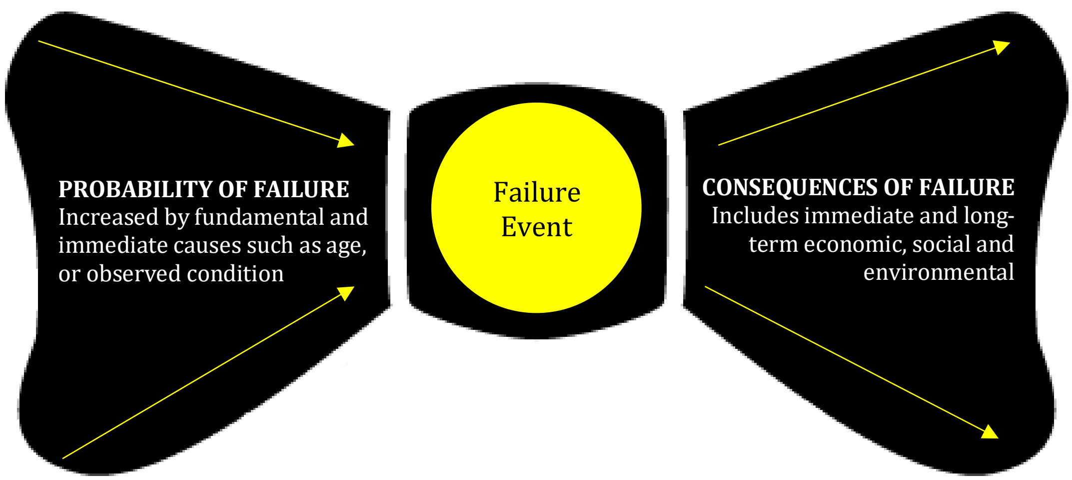
Risk mitigation is traditionally thought of in terms of safety and liability factors. In asset management, the definition of risk should heavily emphasize these factors but should be expanded to consider the risks to the City's ability to deliver targeted levels of service

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

5.2 Risk Matrices

Using the logic above, a risk matrix will illustrate each asset's overall risk, determined by multiplying the probability of failure (PoF) scores with the consequence of failure (CoF) score, as illustrated in the table that follow. This can be completed as a holistic exercise against any data set by determining which factors (or attributes) are available and will contribute to the PoF or CoF of an asset. Figure 49 (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 49 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 24 Probability of Failure – All Assets

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

Consequence of Failure

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

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

Table 25 Consequence of Failure – Roads

Road Classification	Consequence of failure
Local	Score of 1
Collector	Score of 3
Minor Arterial	Score of 4
Major Arterial	Score of 5

Table 26 Consequence of Failure – Bridges & Culverts

Replacement Value	Consequence of failure
Up to $100k	Score of 1
$101 to $150k	Score of 2
$151 to $300k	Score of 3
$301 to $400k	Score of 4
$401 and over	Score of 5

Table 27 Consequence of Failure – Water Mains

Pipe Diameter	Consequence of Failure
Less than 7 In	Score of 1
7-10 In	Score of 2
11-16 In	Score of 3
17-20 In	Score of 4
21 In and over	Score of 5

Table 28 Consequence of Failure – Wastewater Mains

Pipe Diameter	Consequence of failure
Less than 7 In	Score of 1
7-10 In	Score of 2
11-16 In	Score of 3
17-24 In	Score of 4
25 In and over	Score of 5

Table 29 Consequence of Failure – Stormwater Lines

Pipe Diameter	Consequence of Failure
Less than 16 In	Score of 1
16-24 In	Score of 2
25-36 In	Score of 3
37-51 In	Score of 4
52 In and over	Score of 5

Table 30 Consequence of Failure – Buildings & Facilities

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

Table 31 Consequence of Failure – Machinery & Equipment

Replacement Value	Consequence of failure
Up to $15k	Score of 1
$16k to $30k	Score of 2
$31k to $50k	Score of 3
$51k to $100k	Score of 4
Over $100k	Score of 5

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

Figure 50 Distribution of Assets Based on Risk – All Asset Classes

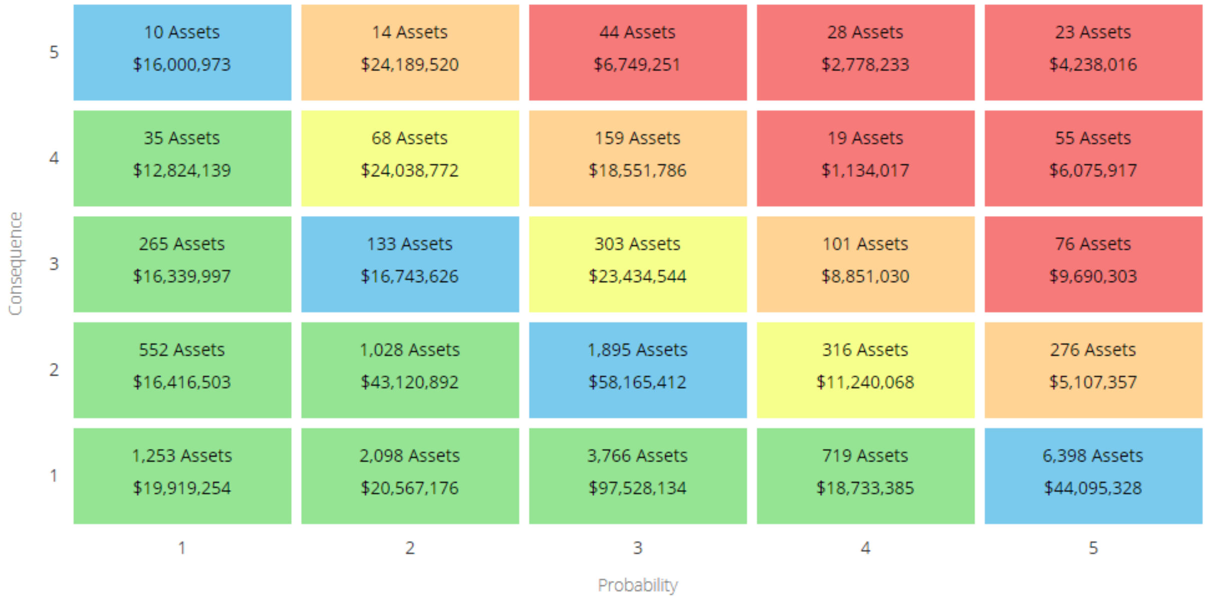


Figure 51 Distribution of Assets Based on Risk – Road System

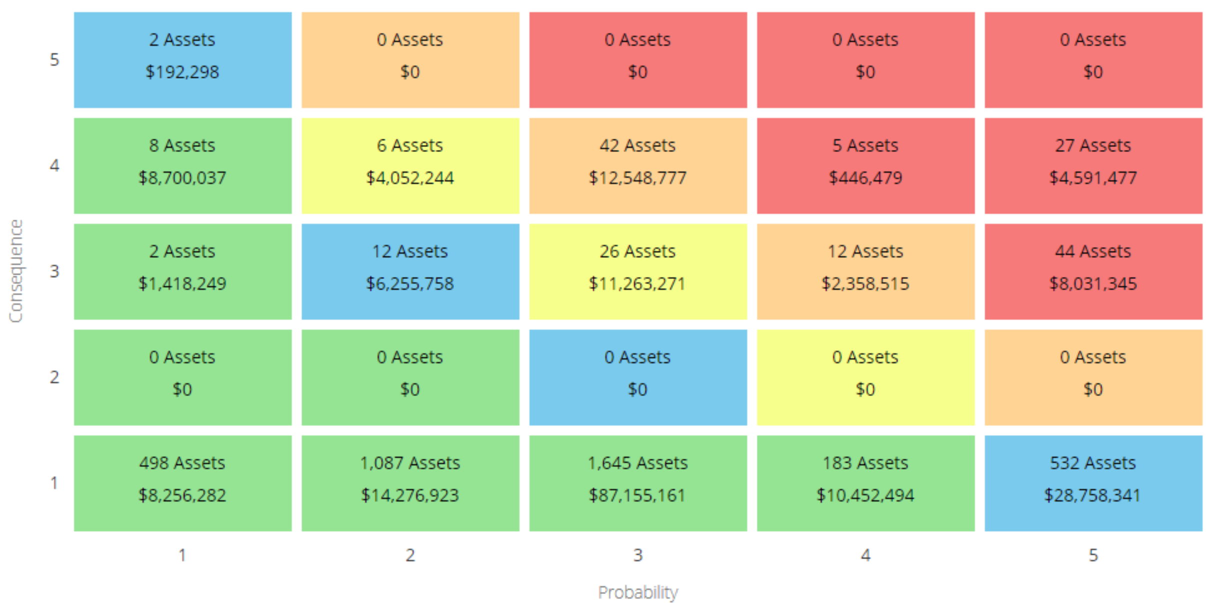


Figure 52 Distribution of Assets Based on Risk – Bridges & Culverts

Figure 53 Distribution of Assets Based on Risk – Water System

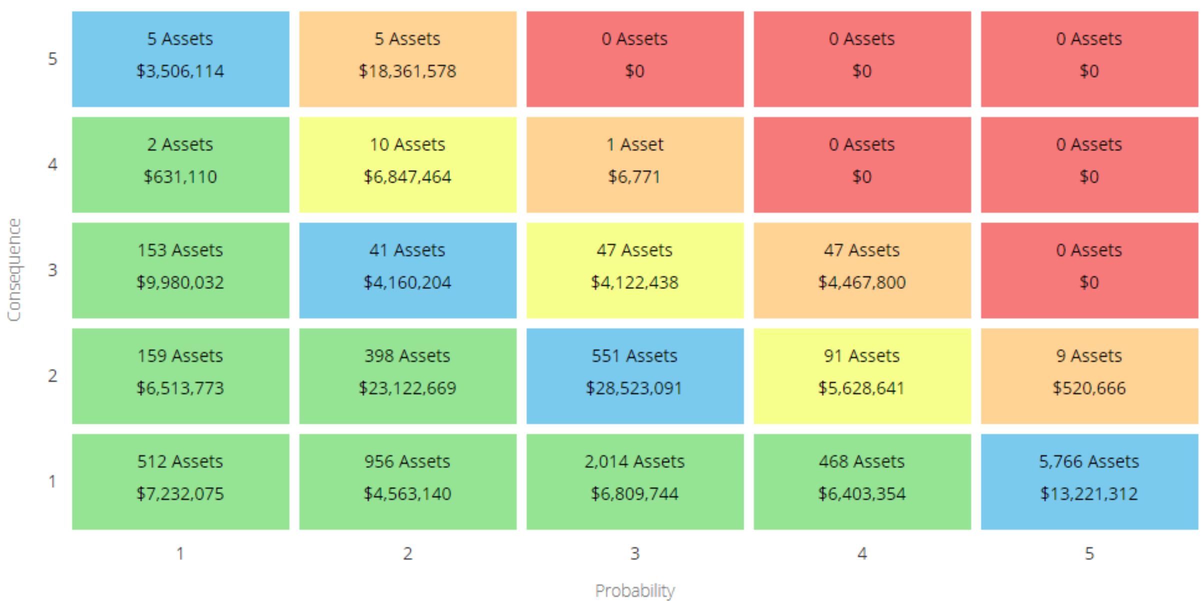


Figure 54 Distribution of Assets Based on Risk – Wastewater System

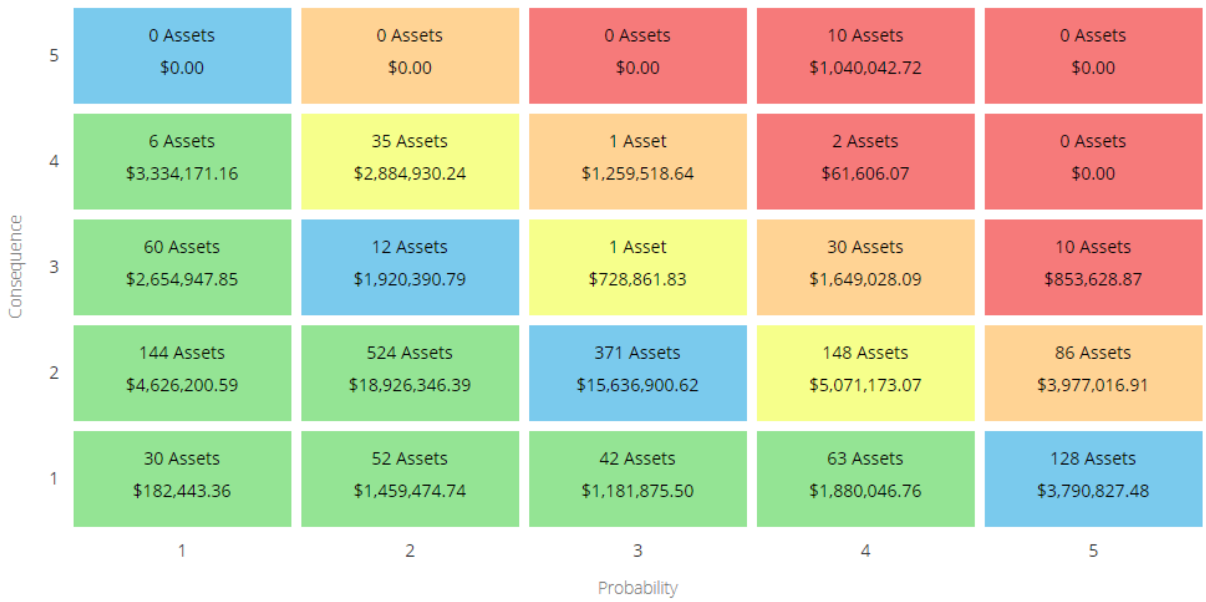


Figure 55 Distribution of Assets Based on Risk – Stormwater System

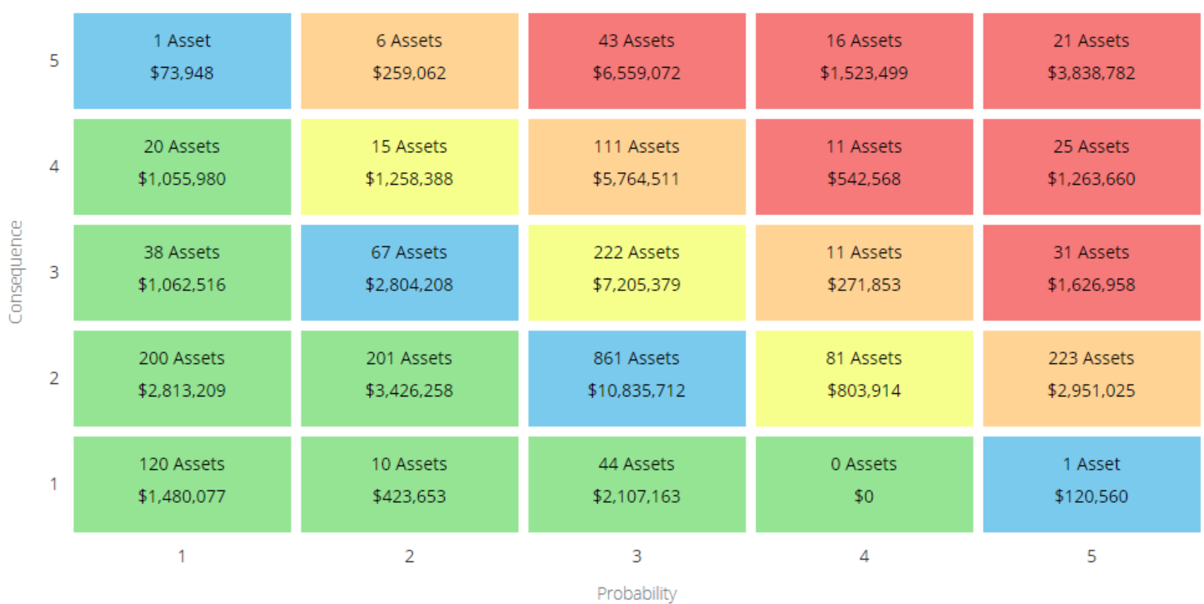


Figure 56 Distribution of Assets Based on Risk – Buildings & Facilities

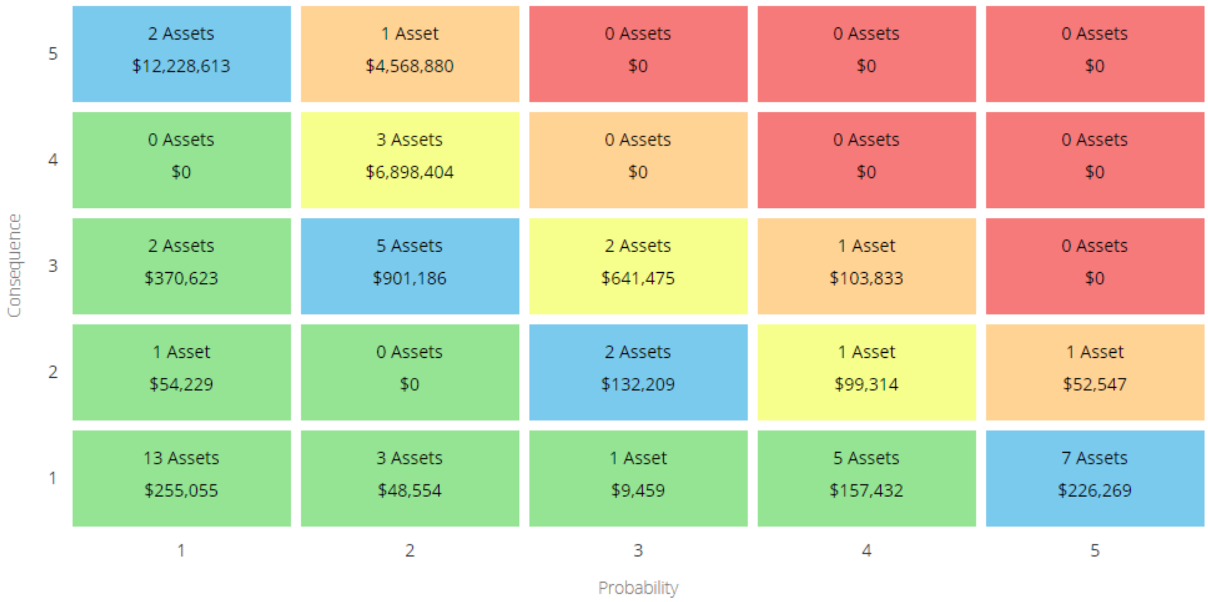


Figure 57 Distribution of Assets Based on Risk – Machinery & Equipment

IX. Financial Strategy

1. General Overview

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

Figure 58 Cost Elements

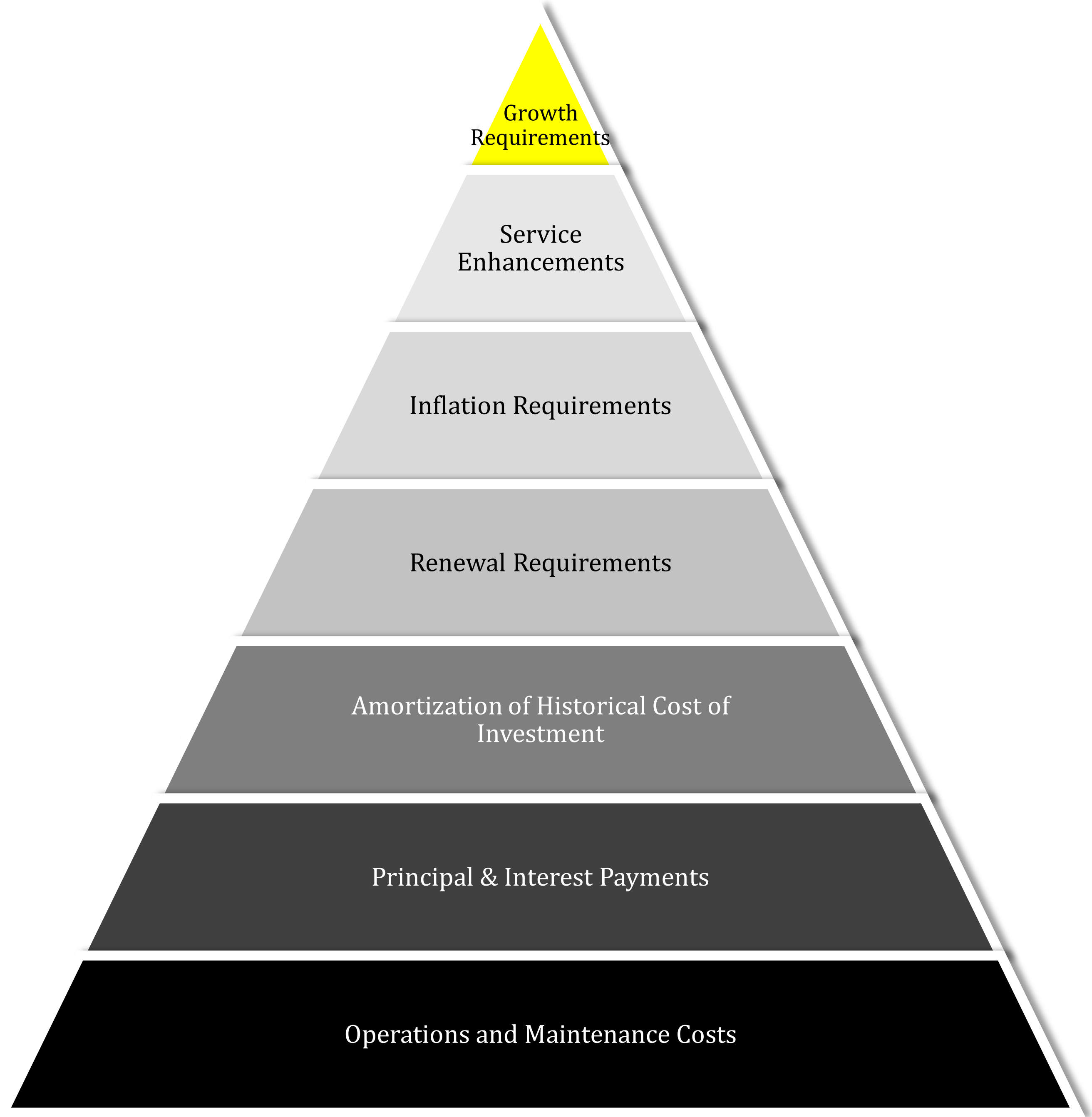


Figure 58 depicts the various cost elements and resulting funding levels that should be incorporated into AMPs that are based on best practices. Municipalities meeting their operational and maintenance needs, and debt obligations are funding only their cash cost. Funding at this level is severely deficient in terms of lifecycle costs.

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

This report develops a financial plan by presenting several scenarios for consideration and culminating with final recommendations. It includes recommendations that avoid long-term funding deficits. As outlined below, the scenarios presented model different combinations of the following components:

- 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), and requirements of anticipated growth (none identified for this plan)
- use of traditional sources of municipal funds including tax levies, rates, impact fees, reserves, debt, and sales taxes.
- use of non-traditional sources of municipal funds including, reallocated budgets, public partnerships, in construction.
- use of State and Federal funds, such as grants

If the financial plan component of an AMP results in a funding shortfall, a specific plan should be included that demonstrates how the impact of the shortfall will be managed. In determining the legitimacy of a funding shortfall, a City's approach to the following should be evaluated:

- In order to reduce financial requirements, consideration has been given to revising service levels downward.
- 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.

2. Financial Profile: Tax Funded Assets

2.1 Funding Objective

We have developed scenarios that would enable the City to achieve full funding within five to 20 years for the following assets: road system; bridges & culverts; buildings & facilities; and machinery & equipment. 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 32 and Table 33 outline, by asset class, the City's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by taxes.

Table 32 Infrastructure Requirements and Current Funding Available: Tax Funded Assets

Asset class	Average Annual Investment Required	Total Funding Available in 2018					Annual Deficit/Surplus
		Taxes	Fees	Reserves	Other	Total Funding Available	
Road System	5,499,000	0	0	0	0	0	5,499,000
Bridges & Culverts	34,000	0	0	0	0	0	34,000
Machinery & Equipment	241,000	0	0	0	0	0	241,000
Facilities	545,000	0	0	0	0	0	545,000
Total	6,319,000	0	0	0	0	0	6,319,000

2.3 Recommendations for Full Funding

The average annual investment requirement for the above categories is $6,319,000. Annual revenue currently allocated to these assets for capital purposes is $0 leaving an annual deficit of $6,319,000. To put it another way, these infrastructure categories are currently funded at 0% of their long-term requirements.

In 2018, Corinth has annual tax revenues of $11,400,000. As illustrated in Table 33, ***without consideration of any other sources of revenue***, full funding would require the following tax change over time:

Table 33 Tax Change Required for Full Funding

Asset class	Tax Change Required for Full Funding
Road System	48.2%
Bridges & Culverts	0.3%
Machinery & Equipment	2.1%
Facilities	4.8%
Total	55.4%

Due to other operating pressures, Corinth does not have capacity to increase tax revenues for capital purposes over the next 5 years. As a result, over the next 5 years infrastructure will continue to be fully debt funded. Starting in year 6, a capital funding levy is being introduced and phased in over a number of years. We are presenting two options:

- A funding solution that results in a capital model fully funded by current revenues.
- A funding solution that results in a capital model funded 50% by debt and 50% by current revenues

Option 1 - capital model fully funded by current revenues:
For this option, the budget for debt payments in year 6 of $2,842,000 will be phased down by 100% and reallocated for capital purposes as follows: 0% in years 1 to 5; 20% or $568,000 in years 6 to 10; 30% or $853,000 in years 11 to 15; 50% or $1,421,000 in years 16 to 20.

Through Table 34, we have expanded the above information to present multiple options. Due to the significant increases required, we have provided phase-in options of up to 20 years:

Table 34 Capital Model Fully Funded by Current Revenues

	Without Capturing Changes				With Capturing Changes			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit as outlined in table 32	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000
Changes in Debt Costs	N/A	N/A	N/A	N/A	0	-568,000	-1,421,000	-2,842,000
Resulting Infrastructure Deficit	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	5,751,000	4,898,000	3,477,000
Resulting Tax Increase Required:								
Total Over Time	**55.4%**	**55.4%**	**55.4%**	**55.4%**	**55.4%**	**50.4%**	**43.0%**	**30.5%**
Annually	11.1%	5.5%	3.7%	2.8%	11.1%	5.0%	2.9%	1.5%

Option 2 - capital model funded 50% by debt and 50% by current revenues:
For this option, the budget for debt payments in year 6 of $2,842,000 will be phased down by 50% and reallocated for capital purposes as follows: 0% in years 1 to 5; 10% or $284,000 in years 6 to 10; 15% or $427,000 in years 11 to 15; 25% or $710,000 in years 16 to 20.

Through Table 34, we have expanded the above information to present multiple options. Due to the significant increases required, we have provided phase-in options of up to 20 years:

Table 35 Capital Model Funded 50% by Debt and 50% by Current Revenues

	Without Capturing Changes				With Capturing Changes			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit as outlined in table 32	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000	6,319,000
50% Funded by Debt	-3,160,000	-3,160,000	-3,160,000	-3,160,000	-3,160,000	-3,160,000	-3,160,000	-3,160,000
Changes in Debt Costs	N/A	N/A	N/A	N/A	0	-284,000	-711,000	-1,421,000
Resulting Infrastructure Deficit	3,159,000	3,159,000	3,159,000	3,159,000	3,159,000	2,875,000	2,448,000	1,738,000
Resulting Tax Increase Required:								
Total Over Time	**27.7%**	**27.7%**	**27.7%**	**27.7%**	**27.7%**	**25.2%**	**21.5%**	**15.2%**
Annually	5.5%	2.8%	1.8%	1.4%	5.5%	2.5%	1.4%	0.8%

Considering all of the above information, we recommend the 20-year option of the 50/50 model in table 35 with the reallocations. This results in 50% funding from current revenues being achieved over 20 years by:

- starting in 2024, increasing tax revenues by 0.8% each year for the next 20 years solely for the purpose of phasing in 50% funding to the asset categories covered in this section of the AMP.
- when realized, reallocating the debt cost reductions to the infrastructure deficit as outlined above.
- phasing the debt funded portion of the capital plan from 100% to 50% as outlined above.
- increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in

Notes:

- 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 20 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 $10,763,000 for the road system, $0 for bridges & culverts, $547,000 for machinery & equipment and $0 for facilities. Prioritizing future projects will require the current data to be replaced by condition-based data. Although our recommendations include no further use of debt after 5 years, 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 City to achieve full funding within five to 20 years for the following assets: stormwater, water, and wastewater. 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 36 and Table 37 outline, by asset class, the City's average annual asset investment requirements, current funding positions, and funding increases required to achieve full funding on assets funded by rates.

Table 36 Summary of Infrastructure Requirements and Current Funding Available

Asset class	Average Annual Investment Required	Total Funding Available in 2016				Annual Deficit/Surplus
		Rates	To Operations	Other	Total Funding Available	
Wastewater System	1,177,000	3,288,000	-3,288,000	0	0	1,177,000
Water System	3,588,000	7,758,000	-7,758,000	0	0	3,588,000
Stormwater System	1,334,000	712,000	-712,000	0	0	1,334,000
Total	6,099,000	11,758,000	-11,758,000	0	0	6,099,000

3.3 Recommendations for Full Funding

The average annual investment requirement for wastewater system, water system and stormwater system is $6,099,000. Annual revenue currently allocated to these assets for capital purposes is $0 leaving an annual deficit of $6,099,000. To put it another way, these infrastructure categories are currently funded at 0% of their long-term requirements.

In 2018, Corinth has annual wastewater system revenue of $3,288,000, annual water system revenue of $7,758,000 and annual stormwater system revenue of $712,000. As illustrated in Table 37, without consideration of any other sources of revenue, full funding would require the following increases over time:

Table 37 Rate Change Required for Full Funding

Asset class	Rate Change Required for Full Funding
Wastewater System	35.8%
Water System	46.2%
Stormwater System	187.4%

We are presenting two options:

- A funding solution that results in a capital model fully funded by current revenues.
- A funding solution that results in a capital model funded 50% by debt and 50% by current revenues.

Option 1 - capital model fully funded by current revenues:
Wastewater system:
For this option, the budget for current debt payments of $690,000 will be phased down by 100% and reallocated for capital purposes as follows: 0% in years 1 to 5; 20% or $138,000 in years 6 to 10; 30% or $345,000 in years 11 to 15; 50% or $690,000 in years 16 to 20.

Water system:
For this option, the budget for current debt payments of $546,000 will be phased down by 100% and reallocated for capital purposes as follows: 0% in years 1 to 5; 20% or $109,000 in years 6 to 10; 30% or $273,000 in years 11 to 15; 50% or $546,000 in years 16 to 20.

Stormwater system:
For this option, the budget for current debt payments of $256,000 will be phased down by 100% and reallocated for capital purposes as follows: 0% in years 1 to 5; 20% or $51,000 in years 6 to 10; 30% or $128,000 in years 11 to 15; 50% or $256,000 in years 16 to 20.

Through Tables 37 and 38, we have expanded the above information to present multiple options. Due to the significant increases required, we have provided phase-in options of up to 20 years

Table 38 Without Change in Debt Costs

	Wastewater System				Water System				Stormwater System			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit	1,177,000	1,177,000	1,177,000	1,177,000	3,588,000	3,588,000	3,588,000	3,588,000	1,334,000	1,334,000	1,334,000	1,334,000
Change in Debt Costs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Resulting Infrastructure Deficit	1,177,000	1,177,000	1,177,000	1,177,000	3,588,000	3,588,000	3,588,000	3,588,000	1,334,000	1,334,000	1,334,000	1,334,000
Resulting Rate Increase Required:												
Total Over Time	**35.8%**	**35.8%**	**35.8%**	**35.8%**	**46.2%**	**46.2%**	**46.2%**	**46.2%**	**187.4%**	**187.4%**	**187.4%**	**187.4%**
Annually	7.2%	3.6%	2.4%	1.8%	9.2%	4.6%	3.1%	2.3%	37.5%	18.7%	12.5%	9.4%

Table 39 With Change in Debt Costs

	Wastewater System				Water System				Stormwater System			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit	1,177,000	1,177,000	1,177,000	1,177,000	3,588,000	3,588,000	3,588,000	3,588,000	1,334,000	1,334,000	1,334,000	1,334,000
Change in Debt Costs	0	-138,000	-345,000	-690,000	0	-109,000	-273,000	-546,000	0	-51,000	-128,000	-256,000
Resulting Infrastructure Deficit	1,177,000	1,039,000	832,000	487,000	3,588,000	3,479,000	3,315,000	3,042,000	1,334,000	1,283,000	1,206,000	1,078,000
Resulting Rate Increase Required:												
Total Over Time	**35.8%**	**31.6%**	**25.3%**	**14.8%**	**46.2%**	**44.8%**	**42.7%**	**39.2%**	**187.4%**	**180.2%**	**169.4%**	**151.4%**
Annually	7.2%	3.2%	1.7%	0.7%	9.2%	4.5%	2.8%	2.0%	37.5%	18.0%	11.3%	7.6%

Option 2 - capital model funded 50% by debt and 50% by current revenues:

Wastewater system:

For this option, the budget for current debt payments of $690,000 will be phased down by 50% and reallocated for capital purposes as follows: 0% in years 1 to 5; 10% or $69,000 in years 6 to 10; 15% or $172,000 in years 11 to 15; 25% or $345,000 in years 16 to 20.

Water system:

For this option, the budget for current debt payments of $546,000 will be phased down by 50% and reallocated for capital purposes as follows: 0% in years 1 to 5; 10% or $55,000 in years 6 to 10; 15% or $136,000 in years 11 to 15; 25% or $273,000 in years 16 to 20.

Stormwater system:

For this option, the budget for current debt payments of $256,000 will be phased down by 50% and reallocated for capital purposes as follows: 0% in years 1 to 5; 10% or $26,000 in years 6 to 10; 15% or $64,000 in years 11 to 15; 25% or $128,000 in years 16 to 20.

Through Table 39 and 40, we have expanded the above information to present multiple options. Due to the significant increases required, we have provided phase-in options of up to 20 years:

Table 40 Without Change in Debt Costs

	Wastewater System				**Water System**				**Stormwater System**			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit	1,177,000	1,177,000	1,177,000	1,177,000	3,588,000	3,588,000	3,588,000	3,588,000	1,334,000	1,334,000	1,334,000	1,334,000
50% Funded by Debt	-589,000	-589,000	-589,000	-589,000	-1,794,000	-1,794,000	-1,794,000	-1,794,000	-667,000	-667,000	-667,000	-667,000
Change in Debt Costs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Resulting Infrastructure Deficit	588,000	588,000	588,000	588,000	1,794,000	1,794,000	1,794,000	1,794,000	667,000	667,000	667,000	667,000
Resulting Rate Increase Required:												
Total Over Time	**17.9%**	**17.9%**	**17.9%**	**17.9%**	**23.1%**	**23.1%**	**23.1%**	**23.1%**	**93.7%**	**93.7%**	**93.7%**	**93.7%**
Annually	3.6%	1.8%	1.2%	0.9%	4.6%	2.2%	1.4%	1.0%	18.7%	9.4%	6.2%	4.7%

Table 41 With Change in Debt Costs

	Wastewater System				Water System				Stormwater System			
	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years	5 Years	10 Years	15 Years	20 Years
Infrastructure Deficit	1,177,000	1,177,000	1,177,000	1,177,000	3,588,000	3,588,000	3,588,000	3,588,000	1,334,000	1,334,000	1,334,000	1,334,000
50% Funded by Debt	-589,000	-589,000	-589,000	-589,000	-1,794,000	-1,794,000	-1,794,000	-1,794,000	-667,000	-667,000	-667,000	-667,000
Change in Debt Costs	0	-69,000	-172,000	-345,000	0	-55,000	-136,000	-273,000	0	-26,000	-64,000	-128,000
Resulting Infrastructure Deficit	588,000	519,000	416,000	243,000	1,794,000	1,739,000	1,658,000	1,521,000	667,000	641,000	603,000	539,000
Resulting Rate Increase Required:												
Total Over Time	**17.9%**	**15.8%**	**12.7%**	**7.4%**	**23.1%**	**22.4%**	**21.4%**	**19.6%**	**93.7%**	**90.0%**	**84.7%**	**75.7%**
Annually	3.6%	1.6%	0.8%	0.4%	4.6%	2.2%	1.4%	1.0%	18.7%	9.0%	5.6%	3.8%

Considering all of the above information, we recommend the 20 year option of the 50/50 model in table 41 with the reallocations. This results in 50% funding from current revenues being achieved over 20 years by:

- each year for the next 20 years, solely for the purpose of phasing in 50% funding to the asset categories covered in this section of the AMP, increase revenues as follows: wastewater system 0.4%; water system 1.0%; stormwater system 3.8%.
- when realized, reallocating the debt cost reductions to the infrastructure deficit as outlined above.
- phasing the debt funded portion of the capital plan from 100% to 50% as outlined above.
- increasing existing and future infrastructure budgets by the applicable inflation index on an annual basis in addition to the deficit phase-in.

Notes:
- 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.
- 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 and provides financial sustainability over the period modeled, the recommendations do require prioritizing capital projects to fit the resulting annual funding available. As of 2018, age based data shows a pent up investment demand of $169,000 for the wastewater system, $8,855,000 for the water system and $0 for the stormwater system. Prioritizing future projects will require the age based data to be replaced by condition based data. Although our recommendations include no further use of debt after 5 years, the results of the condition based analysis may require otherwise.

X. 2018 Infrastructure Report Card

The following infrastructure report card illustrates the City'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 42 2017 Infrastructure Report Card

Asset class	Asset Health Grade	Funding Percentage	Financial Capacity Grade	Average Asset Class Grade	Comments
Roads	D	0%	F	F	Based on 2018 replacement cost, and primarily age-based data, over 39% of assets, with a valuation of $210 million, are in good to very good condition; 21% are in poor to very poor condition. The City is underfunding its assets. Tax-funded categories are funded at 0% while rate-funded categories are funded at 0%.
Bridges & Culverts	B	0%	F	D	
Water System	C	0%	F	F	
Wastewater System	C	0%	F	F	
Stormwater System	D	0%	F	F	
Buildings & Facilities	B	0%	F	D	
Machinery & Equipment	F	0%	F	F	
		Average Asset Health Grade	C		
		Average Financial Capacity Grade	F		
		Overall Grade for the City	F		

XI. Appendix A: Grading and Conversion Scales

Table 43 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 44 Financial Capacity Scale

Letter Grade	Rating	Funding percent	Timing Requirements	Description
A	Excellent	90-100 percent	☑ Short Term ☑Medium Term ☑Long Term	The City 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 City 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 City is underprepared to fund its medium- to long-term infrastructure needs. The replacement of assets in the medium-term will likely be deferred to future years.
D	Poor	40-59 percent	☒/☑ Short Term ☒Medium Term ☒Long Term	The City 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 City 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 City may have to divest some of its assets (e.g., bridge closures, arena closures) and levels of service will be reduced significantly.