Asset Management Strategy

MARCH 2021

PRIMARY DOCUMENT
FINAL VERSION
SUBMITTED BY PSD

Contents

Executive Summary

This asset management strategy provides a practical path and framework for Grey County to develop and maintain an effective asset management program and complete key tactical components within it, including improved asset datasets, better asset management governance, and asset management plans that meet provincial regulatory requirements under Ontario Regulation 588/17 (O. Reg 588/17).

The recommendations in the strategy are based on the County's current state assessment that identified gaps in asset management practices, procedures, and business processes; and, a comprehensive data gap analysis that evaluated the completeness of the County's infrastructure datasets. This strategy document also includes a state of the infrastructure report that will facilitate the County's compliance with O. Reg.

Beyond regulatory compliance, the strategy outlines key initiatives aligned with industry standard asset management objectives. These initiatives are selected to assist staff in achieving more advanced asset management maturity levels in the core elements of an asset management program. These elements are: Organization and People; Strategy and Planning; Asset Information; Asset Management Decisions; Risk Management; Levels of Service; and Financial Management. The elements are consistent across leading asset management associations and industry groups, including the Institute of Asset Management (IAM), the Global Forum on Maintenance and Asset Management (GFMAM), and the International Infrastructure Management Manual (IIMM).

Based on a comprehensive technical self-assessment survey and dialogues with departments, the County's overall current asset management maturity was rated as **intermediate**. Advancement in the County's asset management maturity will allow staff to better balance the cost, performance, and risk associated with delivering complex infrastructure programs and associated services.

During the current state assessment, we identified gaps in the County's asset management program, distributed across the seven core elements of asset management. These include gaps in capacity, e.g., people, knowledge, technical expertise, and business processes. Although not all process gaps are found in all departments, there is enough consistency in departmental processes and practices to make these gaps representative of the County's asset management program.

State of the Infrastructure

An important part of this engagement was the development of the current state of the infrastructure. After significant updates to the inventory, the estimated current replacement cost of Grey County's infrastructure portfolio was estimated to be $1.4 billion, a 63% overall increase from the County's 2016 asset management plan. The largest increase in portfolio valuation was seen in roads, due primarily to updated replacement costs, and how these costs were allocated across surface and base assets.

The state of the infrastructure section also includes data on asset condition. Collectively, 79% of the County's assets are in fair or better condition, with the remaining in poor or worse condition. This estimate was based on both age-based and actual field condition data. As assets age and their condition deteriorates, they will require replacement or significant rehabilitation. Consistent with the 2016 projections, the largest spike in asset replacement needs is forecasted to occur between 2041-2050. These projections are based on asset age, and where available, field condition.

To ensure its portfolio is financially sustainable, the County's annual capital requirements total approximately $44.9 million, or a target reinvestment rate of 3.2%. This is an 89.4% increase from 2016, attribute largely to changes in replacement costs. However, as a portion of the overall replacement cost of the total asset portfolio, these annual requirements remained stable, increasing by only 0.5%. In both reporting periods, the annual requirements represented approximately 3% of the total replacement cost of the asset portfolio.

The County currently allocates $21.3 million annually to its infrastructure program. When assessed against target reinvestment rates for each asset category, current funding levels produce an annual deficit of $23.6 million. Closing this deficit would require substantial and rapid increase to taxation revenues. This may not be feasible, nor desired.

To mitigate tax increases, our financial analysis instead integrates reinvestment levels recommended by the Canadian Infrastructure Report Card (CIRC). The CIRC is a joint project produced by several organizations, including the Federation of Canadian Municipalities (FCM), the Canadian Society of Civil Engineers (CSCE), the Canadian Network of Asset Managers (CNAM), and the Canadian Public Works Association (CPWA). The report card contains recommended reinvestment rates that can serve as benchmark for municipalities.

When assessed against CIRC reinvestment levels, Grey County's annual infrastructure deficit decreases to $11.5 million. Under this scenario, the County can close this annual funding short fall by implementing a 1.21% annual increase in taxation revenues over 15 years. We note that although the County's current reinvestment levels fall below CIRC recommended ranges, they remain slightly higher than the municipal averages in the CIRC sample.

Long Term Strategies

The strategy document is also designed to improve the County's overall asset management maturity. To do so, we developed four strategic priorities, with 20 recommendations; an additional 19 data-specific recommendations are also proposed. These four strategic priorities are:

- Strategic Priority 1: The Next Three Months
- Strategic Priority 2: Build Asset Management Culture and Capacity
- Strategic Priority 3: Enhance Data Quality
- Strategic Priority 4: Adopt Customer-centric View of Asset Management and Financial Planning

The first strategic priority is short-term, and designed to ensure the County is in full compliance with O. Reg 588/17 and its first reporting deadline in July 2022. Although significant portions of the required asset management plan have been completed as part of this engagement, further review, update, and verification by staff are needed. The County's forthcoming building condition assessments (BCA) will provide more accurate replacement cost and condition data that should be integrated into the analysis.

The second strategic priority focuses on making fundamental, long-term changes to how the County approaches asset management as a business process. One of the primary recommendations within this priority area is to complete business process mapping, identifying staff members who are responsible and accountable for completing core asset management processes. For Grey, we have identified 46 such processes specific to asset-centric departments that should be mapped; for finance, we have identified 36. Such exercises are critical for ensuring continuity of key asset management processes. They also help minimize confusion on roles and responsibilities, and assist decisionmakers in identifying efficiencies in how processes are completed.

The third strategic priority highlights the importance of data. Although essential improvements to the data were made as part of this project, work remains to be done. For example, much of the attribute data needed for risk and criticality models to function properly, is not available. Collecting this data and integrating it with CityWide™ will be important in producing reliable and meaningful risk matrices, allowing the County to do objective comparative analysis to rank projects. We also recommend staff conduct a semi-annual data gap analysis or data audit, ensuring that data gaps are addressed as they arise, and do not accumulate over time.

The final strategic priority aims to align spending with the broader context of Grey County. Recommendations include understanding and documenting various trends and influencers that may be reshaping the demands placed on various infrastructure assets; the COVID-19 pandemic has already caused fundamental shifts in how constituents work and where they may choose to live—both of which will have pivotal impacts on infrastructure investments.

We also recommend developing a better understanding of public affordability of infrastructure services. To fully fund the County's asset portfolio on an annual basis, an average household in Grey County would need to give up approximately 1.2% of its annual after-tax income. To make any adjustments to levels of service, including the quantity and quality of services offered, such data should be a central consideration.

Background

Purpose of this report

This asset management strategy is part of the County of Grey's current engagement with PSD to improve its long-term asset management program (RFP-CS-04-19). It is developed to assist County staff in closing key gaps in asset management related competencies, business processes, approaches, and practices. The strategy outlines strategic priorities that will serve as a framework for the development and ongoing administration of the County's asset management program. In addition to supporting long-term initiatives, the strategy also includes content that will expedite the development of future asset management plans, as required under Ontario Regulation 588/17 ("O. Reg").

Scope

Table 1 identifies the asset categories and their respective segments that form the basis of this strategy. Details for each asset class are found in the State of the Infrastructure section of the report.

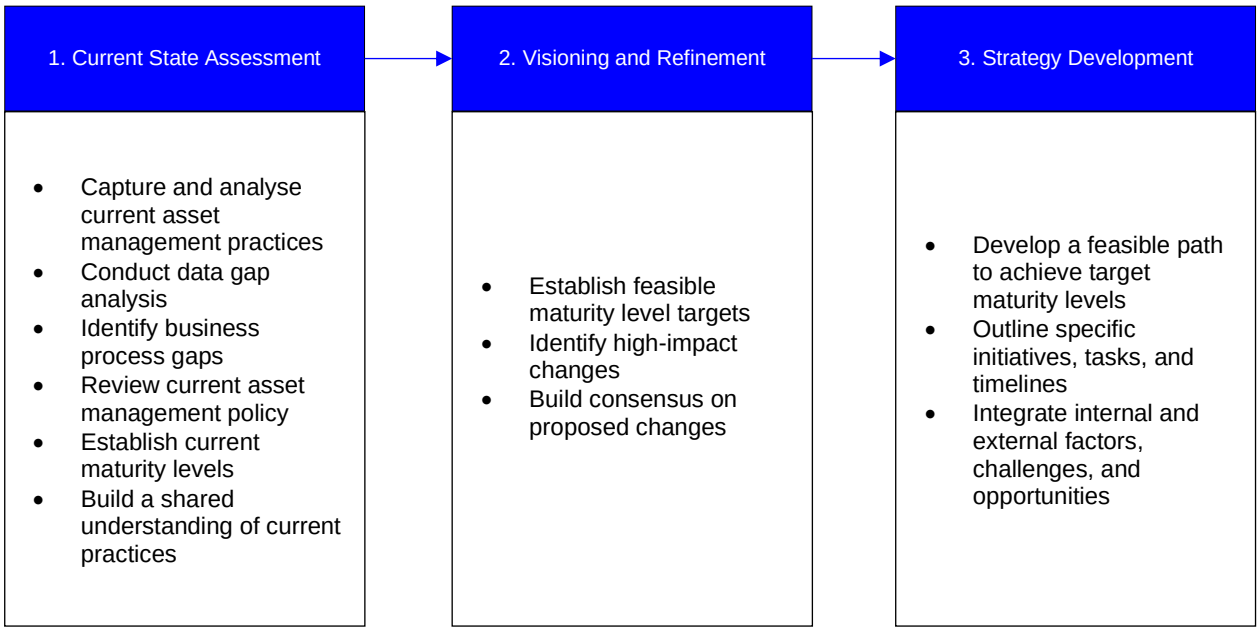
Table 1 Project Scope: Asset Classes

Asset Category	Segments
Roads	Surface and Base for Rural, Rural/Urban, Semi-urban, Urban; Traffic Signals
Bridges and Culverts	Bridges and culverts with a span greater than 3m
Buildings and Facilities	Child Care, Paramedic Services, General Government, Grey Roots, Historical Buildings, Long Term Care (Grey Gables, Lee Manor, and Rockwood Terrace), Transportation
Social Housing	Apartment Buildings, Building Interior and Exterior, Family Units, and various equipment, furniture, and appliances
Machinery and Equipment	Child Care, Paramedic Services, General Government, Grey Roots, Housing, Information Technology, Long Term Care (Grey Gables, Lee Manor, and Rockwood Terrace), Planning, Provincial Offences, Sign Shop, Social and Family Services, and Transportation
Vehicles	Paramedic Services, General Government, Social Services, and Transportation
Land Improvements	Child Care, Paramedic Services, General Government, Grey Roots, Long Term Care (Grey Gables, Lee Manor, and Rockwood Terrace), and Transportation

Methodology

The strategy is the culmination of a year-long collaboration with County staff, involving three distinct phases, beginning with a comprehensive current state assessment. Figure 1 illustrates the general path we followed in developing the County's asset management strategy. A description of each phase follows.

Figure 1 Developing the Asset Management Strategy: Project Path



Current State Assessment

The County's current state assessment took place in November 2019 through a full-day consultative workshop attended by 23 staff. In addition to departmental staff with direct knowledge of their respective asset portfolios, the workshop was also attended by senior management. The workshop was conducted in two steps: administration of a structured, technical survey; and, follow-up discussions with staff.

PSD's Asset Management Self-Assessment Tool, or AMSAT, is a technical survey that covers seven core elements of an industry standard asset management program, defined in Table 2.

These elements are considered core competencies, and are consistent across leading asset management associations and industry groups, including the Institute of Asset Management (IAM), the Global Forum on Maintenance and Asset Management and Maintenance (GFMAM), and the International Infrastructure Management Manual (IIMM). The survey includes questions for each of the seven elements, and is designed to assess the asset management maturity level of an organization.

Following the administration of the survey, we completed immersive dialogues with all departments to further understand current asset management practices and approaches, especially those related to data, lifecycle, risk, and levels of service.

The results of the AMSAT and the technical dialogues with staff were used to develop the current state assessment report. The current state established maturity levels across each of the seven elements of asset management, and outlined gaps and opportunities for improvement in the County's asset management program. A summary of the findings from the report is included in the 'Current State Assessment: Key Findings' section. The current state assessment report was completed in May 2020 and submitted to the project lead.

Table 2 Seven Key Elements of Asset Management

Seven Key Elements of Asset Management		
1	Organization and People	Review of existing organizational capacity and culture for asset management
2	Asset and Climate Change Data	Asset data completeness, management strategy, standards, and systems
3	Strategy & Planning	Alignment between asset management activities and corporate or strategic objectives
4	Asset Management Decision-making	Approach to lifecycle activities, including maintenance and rehabilitation, and project prioritization
5	Risk Management	Identification, understanding, and management of economic, financial, environmental and climate change related, social, and reputational risks
6	Levels of Service	Existing approach to the development and application of levels of service frameworks and their ongoing monitoring and review
7	Financial Strategy	The feasibility of current financial strategies to maintain a practical asset management program, and support current and proposed LOS

The current state assessment stage also included a data gap analysis of the County's current inventory as it is managed in CityWide™. The gap analysis identified critical gaps in both primary and secondary datasets. Primary datasets include information on asset replacement costs, estimated useful life (EUL), in-service date, condition, and historical cost. This data is foundational in developing the state of the infrastructure section.

Secondary datasets include additional attribute information for assets, including location, material, composition, etc. This information adds further clarity to the state of infrastructure analysis, and can be used to enhance risk management practices. The data gap analysis was completed in May 2020 and submitted to the project lead.

Visioning and Refinement

The results of the data gap analysis are summarized in the Data Gap Analysis: Key Findings section of this document. The gap analysis was used as a guiding document to prioritize work on subsequent

stages of this engagement, and gradually refine and update the County's infrastructure datasets. Ongoing discussions with the project lead, and other key stakeholders, further helped identify priority areas for the County's asset management program.

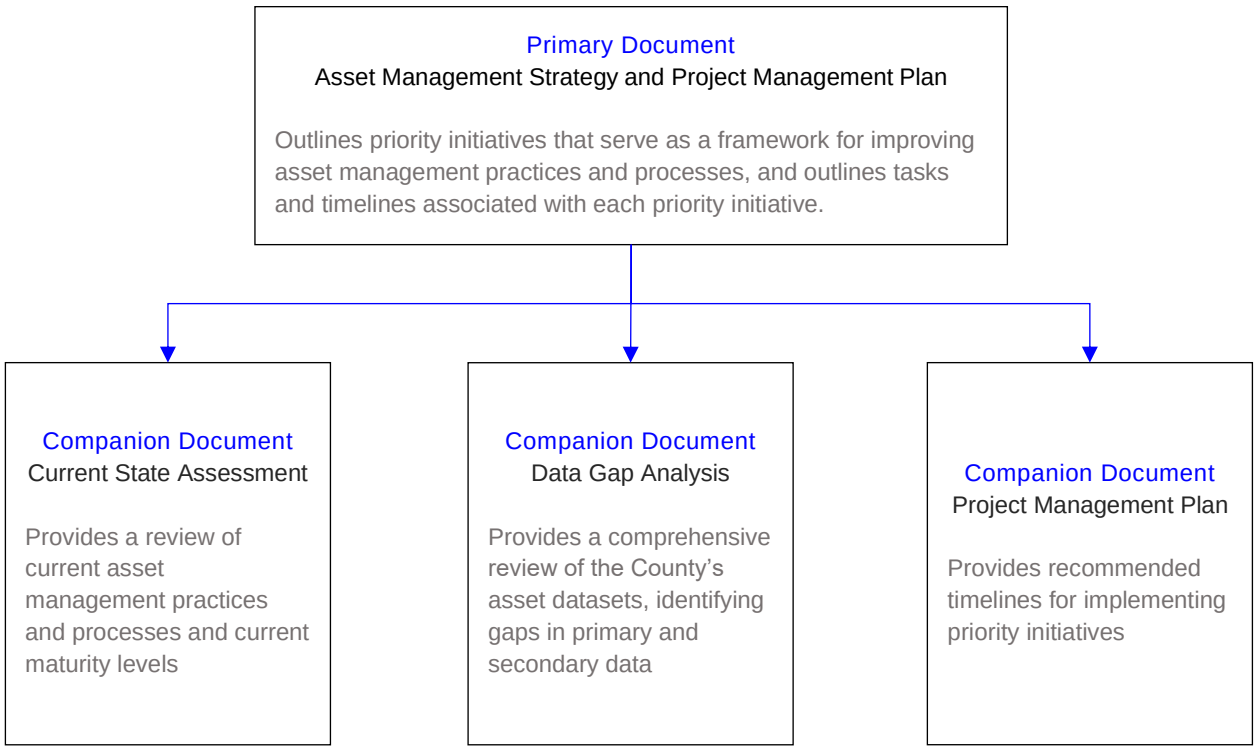
Strategy Development

This document is the County's recommended asset management strategy. Although a significant portion of the document is devoted to supporting the County in compliance with O. Reg, the strategy is also designed to eliminate or minimize process and practice gaps identified in the current state assessment. It should serve as a path to achieve and maintain higher asset management maturity for the County over the long-term.

Key Documents

Given the complexity of this engagement, one Primary Document and three Companion Documents were produced. Figure 2 summarizes the purpose of each document and the relationship between them.

Figure 2 Key Documents



Asset Management Strategy vs. Asset Management Plan

In the municipal sector, ‘asset management strategy’ and ‘asset management plan’ are often used interchangeably. Other concepts such as ‘asset management framework’, ‘asset management system’, and ‘strategic asset management plan’ further add to the confusion; lack of consistency in the industry on the purpose and definition of these elements offers little clarity. We make a clear distinction between the strategy and the plan.

An asset management strategy—this document—is typically a higher-level document, focusing on business processes, organizational practices, and key initiatives with associated timelines and resources designed to create and sustain an asset management program. It is intended to convert the asset management policy from a set of formal, institutionalized, but philosophical commitments into specific actions. While not a static document, the strategy should not evolve and change frequently—unlike the asset management plan. The strategy provides a long-term outlook on the overall asset management program development and strengthening key elements of its framework.

The asset management plan follows from the strategy, with a sharp focus on the current state of the municipality’s asset portfolio, and its approach to managing and funding individual service areas or asset groups. It is tactical in nature and provides a snapshot in time. For Grey County, the asset management strategy also includes key components of the asset management plan, such as the state of the infrastructure, and financial analysis.

Table 3 Asset Management Strategy vs. Asset Management Plan

Element	Asset Management Strategy	Asset Management Plan
Perspective	Corporate, strategic, and programmatic	Departmental, tactical, and asset-centric
Focus	People, business processes, and tools	Assets
Purpose	Improve organizational capacity to create and maintain an asset management program; optimize asset portfolio based on strategic goals	Improve asset performance to maintain or improve levels of service; optimize asset performance and funding
Updates	Infrequent, e.g. 5-years	Frequent, e.g., annually or biannually
Audience	Primary: Executive and council Secondary: Departmental	Primary: Departmental Secondary: Executive and council

Progress to date

Grey County has taken important steps towards developing its asset management program. The table below is adopted from the Institute of Asset Management (IAM), and identifies key asset management initiatives in progress or already completed by the County. It also illustrates the concept of 'line of sight', or alignment between the county's corporate strategic plan and various asset management documents. The strategic plan has a direct, and cascading impact on asset management planning and reporting, making it a foundational element.

Table 4 Status of Various Asset Management Documents

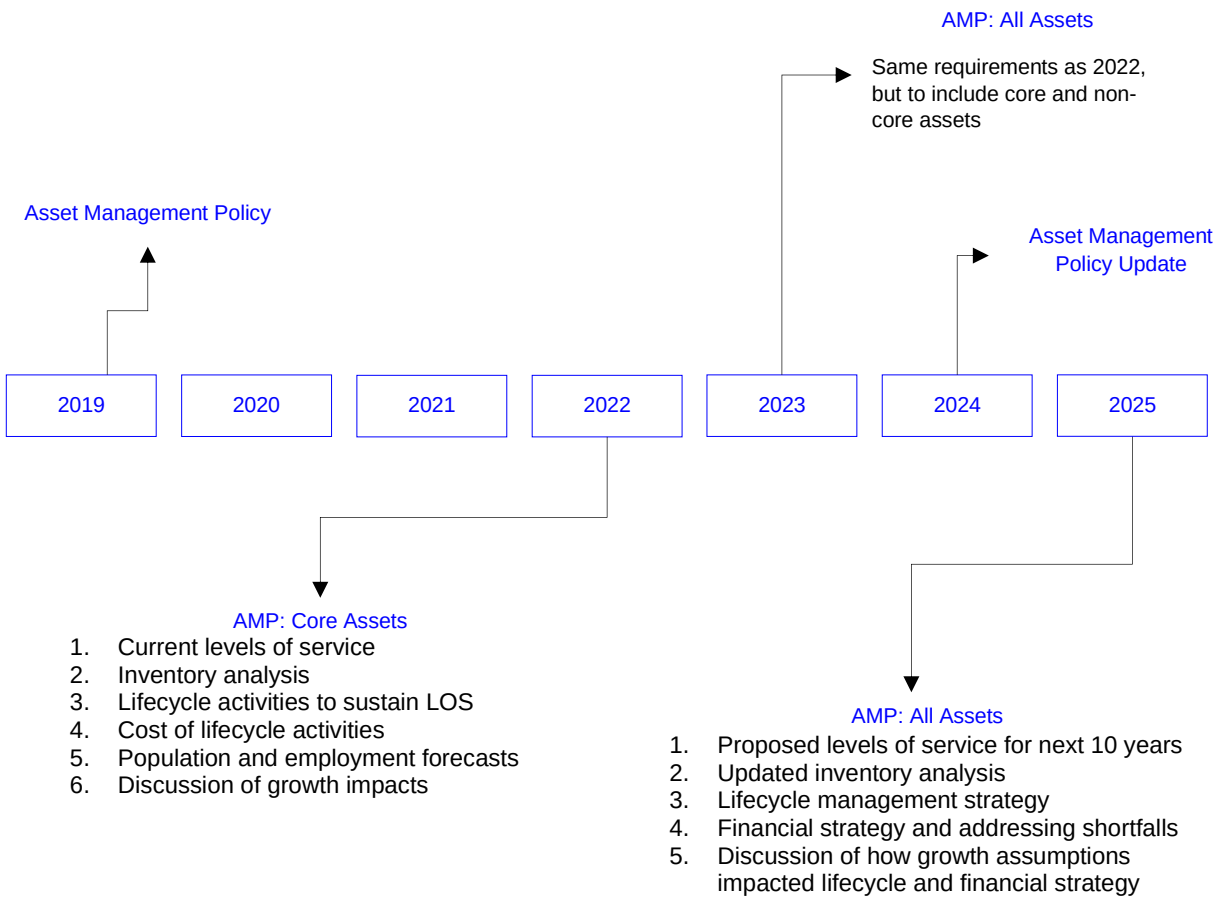
Initiative	Status	Updates
Corporate Strategic Plan	Completed	Completed in 2017. Update forthcoming.
Asset Management Policy	Completed	Completed in 2019 in accordance with O. Reg 588/17. Reviewed in 2020.
Asset Management Strategy	Completed	This document will be the County's first asset management strategy.
Asset Management Plan	Completed	Last iteration completed in 2016. Next iteration due by July 2022, in compliance with O. Reg 588/17.

Ontario Regulation 588/17

As part of the *Infrastructure for Jobs and Prosperity Act, 2015*, the Ontario government introduced Regulation 588/17 - Asset Management Planning for Municipal Infrastructure (O. Reg 588/17). Along with creating better performing organizations, more liveable and sustainable communities, the regulation is a key, mandated driver of asset management planning and reporting. It places substantial emphasis on current and proposed levels of service and the lifecycle costs incurred in delivering them.

In March 2021, the Ontario government amended the regulation to extend each previous reporting deadline by one year. As a result, AMPs previously required in 2021, 2023, and 2024 would now be required in 2022, 2024, and 2025, respectively.

Figure 3 Ontario Regulation 588/17 Timeline



Current State Assessment: Key Findings

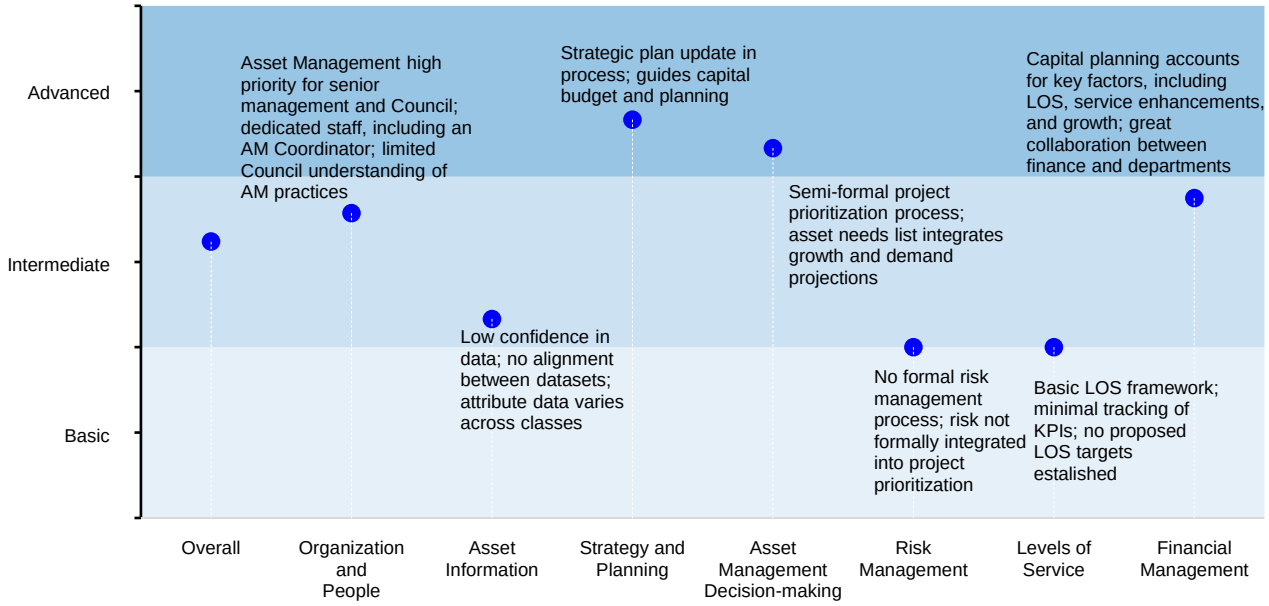
In this section, we summarize the results of Grey County's current state assessment. The assessment measures Grey County's asset management maturity and the degree to which the seven essential elements of asset management are implemented in the organization. Municipalities with advanced asset management maturity deliver desired services consistently, in a fiscally responsible manner, while minimizing the associated risks.

The assessment was used to identify capacity, knowledge, and business process gaps, determine high priority areas of improvement, and inform the development of this asset management strategy.

Asset Management Maturity

In our assessment, Grey County's overall asset management maturity was rated as intermediate, as illustrated in Figure 4. This maturity rating was based on the County's performance on the seven core elements of a strong asset management program. These maturity levels reflect different stages of asset management. Table 5 defines various asset management stages and identifies components commonly found within each.

Figure 4 Current Asset Management Maturity Levels



The County has implemented components typically found in the more mature (intermediate to advanced) stages of asset management, including an asset management policy that incorporates climate change considerations, and prior asset management plans. However, in our assessment, Grey County is in the asset management 'Capable' stage.

Table 5 Stages of Asset Management

Stages of Asset Management		
Stage	Description	Common Components
Learning	Municipality is building its knowledge on asset management, and actively assessing its own internal capacity and culture	Training, courses, workshops, knowledge-sharing, conferences, self-assessments
Capable	Municipality has adequate knowledge, skillsets, resources, and senior leadership commitment to begin implementing strategic asset management activities.	Understands what asset management entails (technical knowledge); how they link to the organizational goals and decision-making; their value; trends; a good cross-functional team
Implementing	Municipality is actively engaged in asset management. Still learning to balance asset management and lifecycle activities (e.g., prioritizing assets, networks, etc.)	An asset management policy, strategy, system, and plan are in place and actively guide decision-making; high data integrity, and strong data management practices; financial strategy to support asset management; levels of service framework (current); lifecycle framework; risk framework; capital prioritization framework (basic); internal and external communications program development
Proficient	Municipality implements data-driven asset management. Asset management is well-integrated with corporate/financial decision-making and value to constituents can be clearly demonstrated.	LOS framework (proposed); capital prioritization process (advanced); strong internal and external communications (to inform LOS); strong understanding of growth-related asset management activities and planning; potential alignment with ISO 50001
Innovating and Optimizing	Organization is continuously refining and enhancing its asset management program, resource and system gaps, and actively identifying ways to integrate emerging technologies and environmental trends into its asset management program.	Data governance strategy; strategic condition assessments (risk-based); asset management fully integrated with financial planning

Business Process and Practice Gaps

During the current state assessment, we identified gaps in the County's asset management program, distributed across the seven core elements of asset management. These include gaps in capacity, e.g., people, knowledge, technical expertise, and business processes.

Although not all process gaps are found in all departments, there is enough consistency in departmental processes and practices to make these gaps representative of the County's asset management program. These gaps are detailed in the Current State Assessment. To provide context to this strategy document, we repeat them in Table 6.

Table 6 Current State Assessment: Key Gaps in Business Processes, Practices, and Capacity by Core Asset Management Element

Element	Gaps
Organization and People	• Opportunity to improve council understanding of asset management and align it with staff • Ad-hoc internal communication, and limited external communication with public and key stakeholders
Asset Data	• Disparate and inconsistent datasets • Absence of centralized information may inhibit collaboration • Gaps in critical data (see Table 9) • No established cycle for updating replacement costs; last update prior to this engagement occurred in 2015 • No formal documentation protocols in place to ensure information is readily accessible
Strategy & Planning	• An updated strategic plan would provide direction for aligning asset management with the County's broader goals. • Current and forecasted demands for infrastructure are considered, but not formally integrated with asset management planning.
Asset Management Decisions	• Lack of documentation on lifecycle activities
Risk Management	• No approach to estimating asset criticality • Absence of a documented understanding of the various consequences of asset failure
Levels of Service	• Beyond MMS, the County has not systematically analyzed documented current levels of service • Proposed levels of service are not established
Financial Strategy	• Budget is developed to achieve key goals in the strategic plan, but success metrics are not tracked. • Opportunity to synchronize capital budgeting, levels of service, and risk

The current state helped establish current maturity levels for the County's asset management program across each element of asset management. Current maturity levels indicate that there are gaps in the County's asset management related business process, practices, and general capacity, likely to be shared across departments. However, the assessment also identified gaps specific to individual asset classes. Key process gaps by each asset class are summarized in Table 7.

Table 7 Current State Assessment: Key Gaps in Business Processes, Practices, and Capacity by Asset Class

Asset Class	Gaps
Roads	• Current, accurate replacement costs • No formal and documented risk framework • Inconsistencies between financial and public works datasets • No documented levels of service framework
Bridges & Culverts	• No formal and documented risk management framework • No documented levels of service framework • Inaccuracies in replacement costs
Buildings and Social Housing	• Lack of standardized asset componentization • Inconsistencies between financial and public works datasets • No formal and documented risk framework • No documented levels of service framework
Land Improvements	• No formal and documented risk framework • No documented levels of service framework
Vehicles, and Machinery & Equipment	• No formal risk management framework

Data Gap Analysis: Key Findings

To complete the data gap analysis, we reviewed the County's CityWide™ database for completeness against four key data types: Asset Identifier Data; Asset Attribute Data; Valuation Data; and Condition Data. Table 8 describes these data types in more detail.

The 'Common Data Fields' column is a non-exhaustive list of data that is commonly found within each Data Type. Some data, such as quantity, unique ID, replacement cost, and estimated useful life, is essential to understanding infrastructure portfolios and supporting basic asset management practices and processes. Other information, such as material composition, location, and exposure to extreme weather events, is required for more sophisticated programs and analytics, including building levels of service frameworks and risk models.

Table 8 The Four Types of Asset Data

Data Type	Description	Common Data Fields
Asset Identifier Data	Data used to identify, describe, structure or classify the asset within a hierarchy, and locate the asset geographically	• Category • Segment • Import ID (Unique ID) • Quantity • Location • Component Description • Segment (component category) • Component Name • Street Name • Street From and Street To • Segment Street Name • Asset Name and Description
Asset Attribute Data	Additional asset attribute data that further enhances and individualizes the asset information. This type of data includes linear data, GIS data, etc.; essential for risk frameworks	• Asset Material Composition • Asset Linear Data • Asset Function • Exposure to Extreme Weather Events
Valuation Data	Data that allows the organisation to value the assets, record and track depreciation, and generate critical state of the infrastructure (SOTI) analytics	• Historical Cost • In-Service Date • Estimated Useful Life (EUL) • Current Replacement Cost • Quantity (Length) • Estimated Useful Life • Quantity (Area)
Condition Data	Data used to prepare deterioration curves, identify asset needs, and estimate asset performance levels	• Assessed Condition Rating • Assessed By • Assessment Date

Table 9 provides an asset category-level summary of the percentage of assets in CityWide™ that contained data gaps in each of the four data types at the start of the project. Although many critical gaps were closed through the duration of the project, some persist due to constraints in time, resources, and available information. Elimination of these data gaps was prioritized based on their criticality to short- and long-term goals. Data that would facilitate the County's compliance with O. Reg 588/17 was collected and updated first.

Each asset can have many attributes, and it is common for assets to have gaps in attribute data. Attribute information varies by asset type, and can support more sophisticated forecasting and risk modelling.

Table 9 Percentage of Assets With Data Gaps at Project Onset

	Percentage of Assets With Gaps in:			
Asset Class	Identified Data	Valuation Data	Attribute Data	Condition Data
Bridges	0%	29%	63%	1%
Culverts	2%	3%	72%	8%
Facilities	21%	14%	85%	100%
Facilities – Social Housing	20%	23%	77%	100%
Fleet	3%	10%	54%	100%
Land Improvements	25%	11%	91%	100%
Machinery and Equipment	18%	14%	67%	100%
Machinery and Equipment – Social Housing	28%	10%	83%	99%
Road Network (Road Base)	0%	0%	49%	0%
Road Network (Road Surface)	2%	3%	37%	2%
Road Network (Traffic Signals)	0%	1%	99%	100%

In addition to the County's CityWide™ asset database, the gap analysis included a review of 13 other data sources. Table 10 summarizes the various data sources reviewed, and the total number of assets found within each data sets.

Table 10 Gap Analysis Data Sources

Dataset Source	Asset Type	Number of Assets
CityWide Asset Manager	Bridges	141
	Culverts (>3m)	65
	Facilities	153
	Fleet	81
	Land	146
	Land Improvements	29
	Machinery and Equipment	1321
	Road Base	517
	Road Surface	522
	Social Housing Facilities	358
	Social Housing Machinery and Equipment	392
	Traffic Signals	34
Culverts Under 3m – 2018-2019 inspections Excel Workbook	Storm Culverts	684
Culverts Under 3m Excel Workbook	Storm Culverts	1332
Digital Version of Bridge and Culvert Inventory August 2019 Excel Workbook	Bridges	1055
	Culverts	89
GC Storm Sewer Excel Workbook	Storm Sewer Lines	1918
GC Storm Structures Excel Workbook	Storm Structures	1867
Guide Rail Inventory - 2018 minor capital list Excel Workbook	Guard Rails	688
	Guide Rails (3 Cable)	635
	Guide Rails (Steel Beam)	61
Guard Rail Inventory - 2018 minor capital list Excel Workbook	Roads	516
PCI Yearly Data Summary Excel Workbook	Roads	508
Road Sections-Paved Shld Excel Workbook	Roads	516
Traffic Signals Table Excel Workbook	Traffic Signals	32

State of the Infrastructure

Portfolio Overview

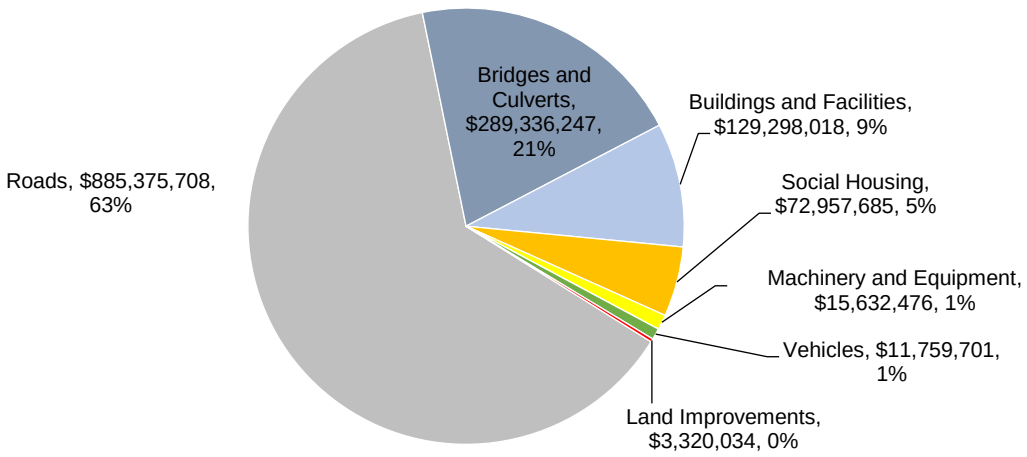
This section provides portfolio- and asset category-level details on Grey County's infrastructure. The Portfolio Overview section provides high-level analytics, including total current replacement cost of the County's assets, overall condition for all assets, asset age profiles, including average age and service life remaining, historical investment trends in infrastructure, and upcoming replacement projections. In subsequent sections, we provide similar detail for each individual asset category.

This section will support the County's compliance with Ontario Regulation 588/17.

Total Replacement Cost of Portfolio

Based on 2020 costing data and approach, the seven asset categories analyzed in this report had a total replacement cost of $1.4 billion. The County's roads network comprises 63% of its total asset portfolio, with bridges and culverts making up 21%.

Figure 5 Replacement Cost 2020: All Assets



Between 2016 and 2020, the County's asset portfolio increased by $542 million. This represents an increase of 63% from the 2016 Asset Management Plan (AMP), as summarized in Table 11.

Table 11 Comparative Analysis of 2020 and 2016 Asset Portfolios

Asset Category	Replacement Cost 2020	Assets In-Service Since 2017	Replacement Cost 2016	Change in Value	Percentage Change
Roads	$885,375,708	$9,780,941	$510,486,393	$374,889,315	73%
Bridges and Culverts	$289,336,247	$6,716,835	$162,209,201	$127,127,046	78%
Buildings and Facilities	$129,298,018	$25,357,592	$117,948,271	$11,349,747	10%
Social Housing	$72,957,685	$12,640,570	$50,930,188	$22,027,497	43%
Machinery and Equipment	$15,632,476	$4,247,777	$11,108,082	$4,524,394	41%
Vehicles	$11,759,701	$4,487,948	$10,208,103	$1,551,598	15%
Land Improvements	$3,320,034	$866,302	$2,776,500	$543,534	20%
Total	$1,407,679,870	$64,097,965	$865,666,738	$542,013,132	63%

Several factors can explain this increase, including new assets that may have been put into service, variations in asset quantity (e.g., road length), increases in service standards requiring additional infrastructure, and how replacement costs were derived. As with the 2016 AMP, various approaches were used to approximate current asset replacement costs. These included unit costing, user-defined costing, and inflating historical or previously adjusted costs.

Replacement costs should reflect the total costs associated with the full replacement or reconstruction of an asset. They should include the combined cost of materials, plant, labour, engineering, and administrative costs.

Historical cost inflation is typically used in the absence of unit cost data. It can be a reliable method for recently purchased and/or constructed assets where the cost is reflective of the total capital costs that the municipality incurred. As assets age, and new products and technologies impact procurement costs and construction methods, cost inflation becomes a less reliable technique to determine replacement cost.

The largest increase in portfolio valuation was seen in roads, due primarily to updated replacement costs, as summarized below.

Table 12 Roads Replacement Costs Updated in 2021

Segment	Cost Per Linear Metre	Other Elements and Auxiliary Infrastructure Included	Excluded
Rural Surface	$400	• Traffic Signage • Land Surveying • Guiderail • Overhead Flashing Lights • Culverts < 3M • Curb and Gutter (Semi-Urban) • Consulting (10%) • Permits • Driveways/entrances • Entrance Culverts • Asphalt Thickness* (two lifts) • Paved Shoulders (1.2m minimum) • Platform Widening (variable)	• Traffic Signal (separate asset) • Land Acquisition (project specific) • Utility Relocates • Environmental Assessment (project specific) • Catch Basins (included in storm)
Rural Base	$600		
Rural Total	$1,000		
Semi-Urban Surface	$550		
Semi-Urban Base	$600		
Semi-Urban Total	$1,150		
Urban Surface	$600		
Urban Base	$600		
Urban Total	$1,200		

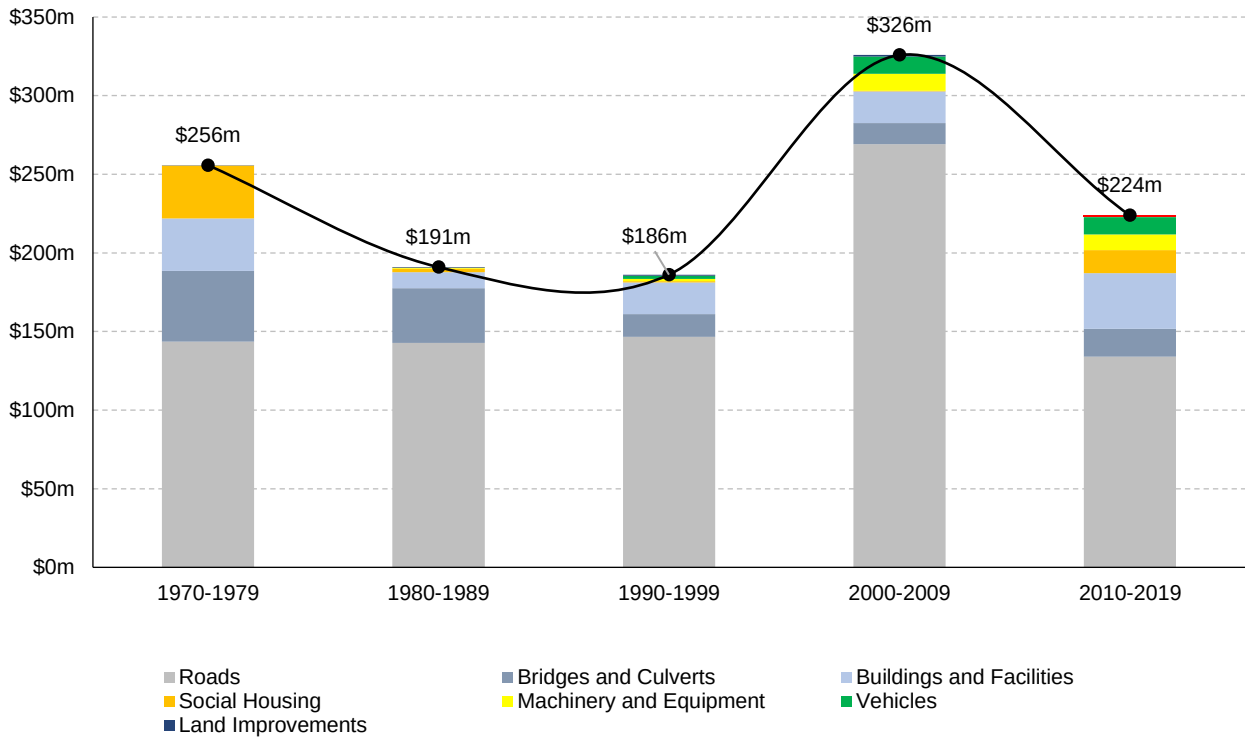
*Asphalt thickness (~ 100 mm) consists of surface and base course asphalt. The thickness of each course is dependant upon several factors (geotech, traffic counts, truck counts, environment, etc.). Typically the range is 40mm to 50mm for surface course and 50mm to 60mm for base course.

Historical Investments in Infrastructure

Historical investments in infrastructure can offer useful information and insights for roughly estimating future requirements. Figure 6 illustrates how Grey County has invested in various infrastructure programs since the 1970s. The information is derived from CityWide™ and includes only active inventory assets. Assets that may have been previously disposed are excluded from this analysis.

The County has consistently invested in its infrastructure over the last five decades, with the largest levels of investments made between 2000-2009. Reflecting their share of the total asset portfolio, most investments in each decade were allocated to the County's transportation services.

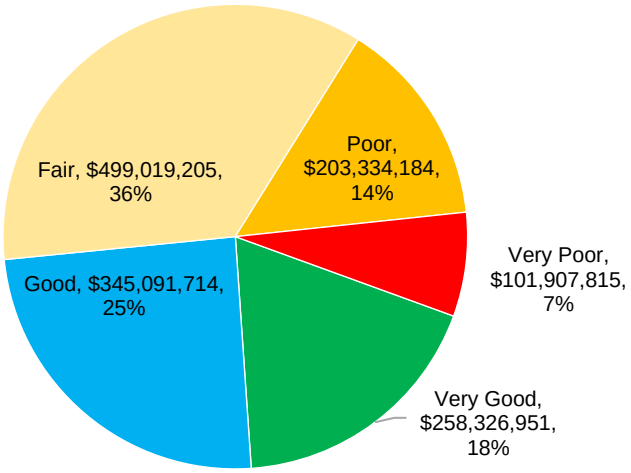
Figure 6 Historical Investments in Infrastructure



Portfolio Condition

The current condition of the assets provides critical information on asset performance, forecasted spending, and any risks to public health and safety. Collectively, 79% of the County's assets are in fair or better condition, with the remaining 21% in poor or very poor condition. This analysis relies on both age data and assessed condition data as available.

Figure 7 Portfolio Condition: All Assets

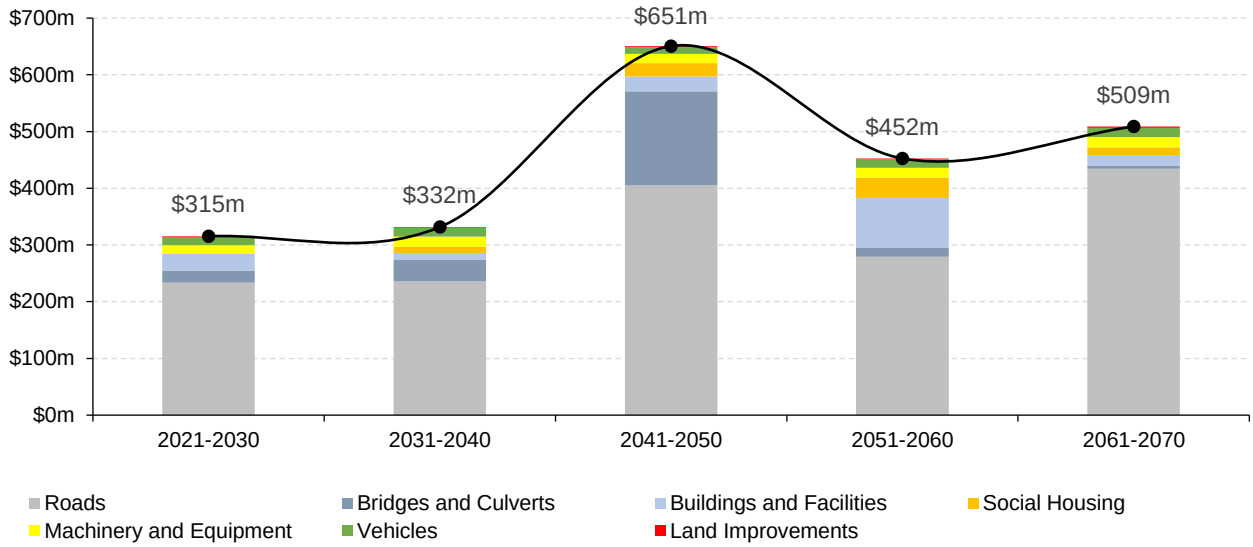


Projected Capital Replacement Needs

Given the many decades-long lifespan of most infrastructure assets, understanding upcoming replacement needs is essential for long-term capital planning. Figure 8 summarizes how capital investments will fluctuate over the next 50 years by asset category. These estimates rely on asset age and condition to determine when replacements must occur.

The County's 2016 AMP projected the two largest spikes in total capital investments between 2041-2045 and 2046-2050. The 2020 estimates are consistent with these projections, showing the largest spending spike between 2041-2050.

Figure 8 Projected Capital Replacement Needs 2021-2070



Infrastructure Backlog

The backlog is an estimate of investments in infrastructure that have been deferred over years. The estimate relies on a combination of asset age and, when available, field condition to determine investments that are needed today to close. As assets age, their performance typically declines, and as they reach the end of their useful life, they must be replaced. When these replacements are deferred, assets begin to accumulate backlogs. However, field condition assessments often identify many additional years of service life remaining, and often reduce backlogs considerably.

As summarized in Table 13, the County's total backlog as of 2020 was estimated at $71.2 million, or 5.1% of the total portfolio replacement value. Buildings and facilities comprise the largest share, at $49.5 million. As a percentage of replacement cost, roads and social housing had the lowest backlog, at 1.1% and 1.0%, respectively.

Table 13 Infrastructure Backlog as a Percentage of Replacement Cost

Asset Category	Estimated Backlog	As a Percentage of Replacement Cost
Roads	$9,543,533	1.1%
Bridges and Culverts	$4,938,829	1.7%
Buildings and Facilities	$49,519,075	38.3%
Social Housing	$697,662	1.0%
Machinery and Equipment	$4,581,184	29.3%
Vehicles	$868,658	7.4%
Land Improvements	$1,094,603	33.0%
Total	$71,243,544	5.1%

Average Annual Requirements

Annual capital requirements represent the amount the County should allocate annually to each asset category to meet replacement needs as they arise, prevent further accumulation of infrastructure backlogs, and achieve long-term sustainability. These figures are a function of the replacement cost of an asset and its estimated useful life.

As illustrated in Table 14, the County's average annual requirements increased from $23.7 million in 2016, to $44.9 million in 2021, a change of +89%. This is attributed primarily to changes in, and restructuring of, roads replacement costs. In addition to the 73% increase in roads replacement values, a larger portion of costs were redistributed to surfaces, which have a much lower estimated useful life—further increasing average annual requirements.

Table 14 Average Annual Requirements and 2020 vs 2016 Comparative Analysis

Asset Category	Annual Requirements 2020	Annual Requirements 2016	Change in Value	Percentage Change
Roads	$29,738,846	$13,704,000	$16,034,846	117%
Bridges & Culverts	$6,126,317	$3,386,000	$2,740,317	81%
Buildings and Facilities (and Land Improvements)	$4,342,098	$3,258,000	$1,084,098	33%
Social Housing	$1,287,079	$728,000	$559,079	77%
Machinery and Equipment	$1,753,937	$1,209,000	$544,937	45%
Vehicles	$1,459,672	$1,292,000	$167,672	13%
Land Improvements	$171,236	$122,000	$49,236	40%
Total	$44,879,184	$23,699,000	$21,180,185	89%

The replacement costs used for roads are considered to be current and accurate. This will improve the reliability of long-term planning.

It is also useful to calculate how annual requirements as a portion of replacement cost has changed since 2016. Table 15 illustrates that, although replacement costs increased sharply from 2016 estimates, overall, annual requirements as a percentage of replacement cost changed by only 0.5%.

Table 15 Annual Requirements as a Percentage of Replacement Cost: 2020 and 2016 Comparative Analysis

Asset Category	Annual Requirements as a Percentage of Replacement Cost 2020	Annual Requirements as a Percentage of Replacement Cost 2016	Change
Roads	3.4%	2.7%	0.7%
Bridges and Culverts	2.1%	2.1%	0.0%
Buildings and Facilities	3.4%	2.8%	0.6%
Social Housing	1.8%	1.4%	0.3%
Machinery and Equipment	11.2%	10.9%	0.3%
Vehicles	12.4%	12.7%	-0.2%
Land Improvements	5.2%	4.4%	0.8%
Total	3.2%	2.7%	0.5%

We note that similar to Grey County, most municipalities across Canada struggle with allocating sufficient funding each year, leading to much discussed infrastructure deficits. Closing these annual funding shortages and eliminating accumulated deferred maintenance needs are decades-long endeavours, and involve a critical and objective review of service levels.

Target and Actual Reinvestment Rates

The reinvestment of capital funds, through asset renewal or replacement, is necessary to sustain an adequate level of service. The reinvestment rate is a measurement of available (actual) or required (target) funding relative to the total replacement cost of the asset. By comparing the actual vs. target reinvestment rate, the County can determine funding gaps.

The target reinvestment rate is calculated by dividing the average annual capital requirements by the asset's replacement cost; similarly, the actual reinvestment rate is determined by using current available funding as a percentage of the asset's replacement cost. Table 16 illustrates Grey County's 2020 reinvestment rate with target levels. At this stage, we include only own-source funding.

Table 16 Target vs. Actual Reinvestment Rates – Own-source Funding Only

Asset Category	Target Reinvestment Rate	Actual Reinvestment Rate – Own-source Only	Gap
Roads	3.4%	0.7%	2.7%
Bridges and Culverts	2.1%	0.9%	1.2%
Buildings and Facilities, and Land Improvements	3.4%	2.5%	0.9%
Social Housing	1.8%	1.9%	-0.1%
Machinery and Equipment	11.2%	8.3%	2.9%
Vehicles	12.4%	8.3%	4.2%
Total	3.2%	1.1%	2.1%

The table shows that if only the County's own-source funding is used to support infrastructure investment, it would create an annual reinvestment gap of 2.1% on average.

Benchmarking Reinvestment Rates

The Canadian Infrastructure Report Card (CIRC) provides an assessment of the health of municipal infrastructure as reported by cities and communities across Canada. It is a joint project produced by several organizations, including the Federation of Canadian Municipalities (FCM), the Canadian Society of Civil Engineers (CSCE), the Canadian Network of Asset Managers (CNAM), and the Canadian Public Works Association (CPWA).

The report card contains recommended reinvestment rates that can serve as benchmark for municipalities. The CIRC suggest that, if increased, these reinvestment rates can "stop the deterioration of municipal infrastructure." The report card contains both a range for reinvestment rates that outlines the lower and upper recommended levels, as well as current municipal averages.

Figure 9 shows how Grey Count's actual own-source reinvestment compares with the CIRC's 2016 recommended ranges (light blue shaded areas) for each asset category. As CIRC does not identify social housing as an asset category, we have reused the reinvestment rates for buildings. For machinery, equipment, and vehicles, the CIRC does not provide a reinvestment range; as such we have used a standard 1% to 4% range.

Grey County's actual, own-source reinvestment rate falls below the CIRC recommended ranges for the core asset groups, roads and bridges. For buildings, including social housing, Grey's reinvestment is consistent with recommended ranges.

In addition, the figure also demonstrates that senior government support is essential for supplementing the County's own fiscal capacity, helping to substantially increase reinvestment rate for roads and buildings through various funding sources including the federal Gas Tax Fund, the Ontario Community Infrastructure Fund (OCIF), and grants for long-term care facilities.

Figure 9 Comparing Grey County's Actual Infrastructure Reinvestment Rates Against CIRC Recommended Rates

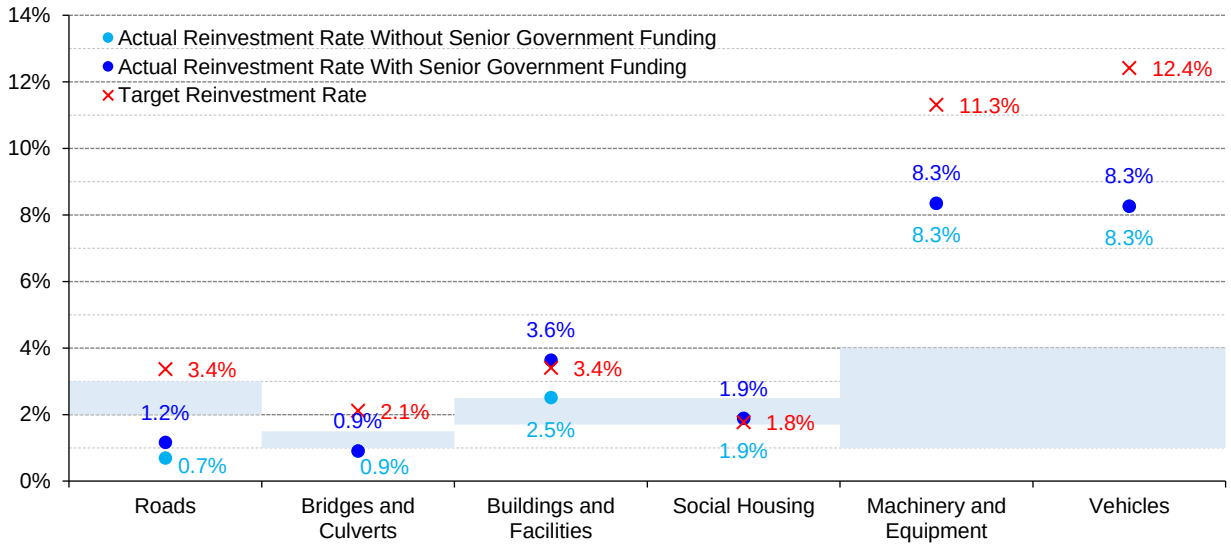
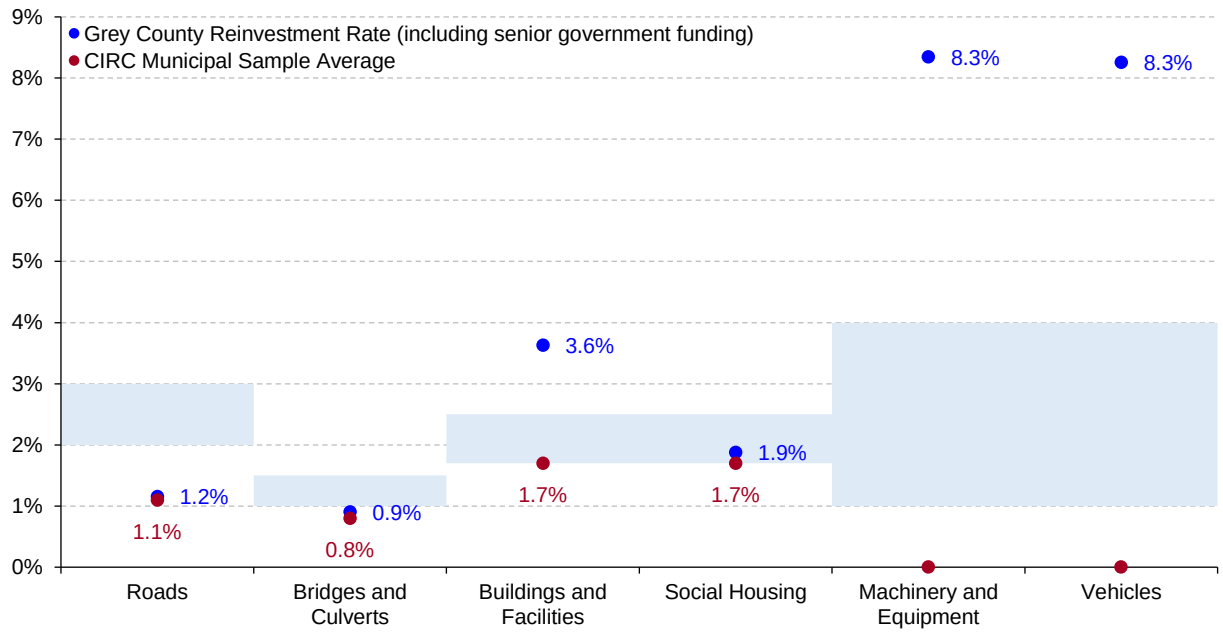


Figure 10 below shows the current reinvestment rate of municipalities in the CIRC sample in various asset categories. Although Grey County's actual, total reinvestment rate of 1.2% for its roads infrastructure falls below the CIRC recommended range and the target reinvestment rate, it is slightly higher than the municipal sample average of 1.1%. Similarly, the County's reinvestment rate of 0.9% for bridges is also higher than the CIRC average of 0.8%. No CIRC data was available for machinery, equipment, and vehicles.

Figure 10 Comparing Grey County's Actual Total Infrastructure Reinvestment Against CIRC Municipal Average Rates



Storm Infrastructure

The County is currently building and refining its storm infrastructure inventory. As a result, the analysis presented in this document excludes storm assets. The County's storm assets portfolio has a current replacement value of $29.7 million, and includes approximately 51.2km of storm pipes, and various appurtenances.

Figure 11 Category Overview: Storm

Category	Segment	Quantity	Replacement Cost	Costing Method
Storm	Pipes (Size in mm)			
	150	185m	$32,743	Cost Per Unit
	200	889m	$315,313	Cost Per Unit
	250	2,414m	$775,949	Cost Per Unit
	300	11,877m	$4,483,207	Cost Per Unit
	375	3,599m	$1,515,036	Cost Per Unit
	400	863m	$315,949	Cost Per Unit
	450	5,165m	$2,242,404	Cost Per Unit
	500	166m	$93,581	Cost Per Unit
	525	2,397m	$1,198,015	Cost Per Unit
	600	6,639m	$3,794,246	Cost Per Unit
	675	775m	$333,105	Cost Per Unit
	750	1,515m	$628,586	Cost Per Unit
	900	2,191m	$721,562	Cost Per Unit
	975	494m	$177,839	Cost Per Unit
	1050	356m	$78,564	Cost Per Unit

1200	1,410m	$47,253	Cost Per Unit
2100	66m	$19,787	Cost Per Unit
Other	10,178m	$3,885,492	Cost Per Unit
Catchbasins	906	$3,959,220	Cost Per Unit
Catchbasin Manholes	449	$2,883,625	Cost Per Unit
Chambers	2	$39,100	Cost Per Unit
Double Catchbasins	47	$237,820	Cost Per Unit
Double Ditch Inlet Catchbasin Manhole	37	$258,175	Cost Per Unit
Ditch Inlet	49	$338,100	Cost Per Unit
Ditch Inlet Catchbasin	32	$220,800	Cost Per Unit
Ditch Inlet Manhole	3	$18,975	Cost Per Unit
Manholes	159	$1,042,015	Cost Per Unit
Oil Grit Interseptors	1	$36,225	Cost Per Unit
Catchbasins	906	$3,959,220	Cost Per Unit
Catchbasin Manholes	449	$2,883,625	Cost Per Unit
	Total	$29,692,689	

Grey County 10-Year Capital Forecasts

Most asset management plans and strategies, including this document, are structured around individual asset categories, e.g., roads, bridges, buildings, etc., rather than departments or service areas. This approach provides essential performance data on infrastructure programs, but can create a disconnect between other long-term planning documents.

To improve continuity, this sections summarizes Grey County's 10-Year Capital Forecasts 2021-2030 at the departmental levels. The budget estimates are products of rigorous analysis conducted by staff to ensure that the County's assets remain in a state-of-good repair. Over the next decade, the County's capital expenditures are estimated to be $208.4 million, growing an average of 4.2% per year. The forecasts include strategic lifecycle projects to maintain, repair, and rehabilitate the County's infrastructure, as well as acquisition and construction of new assets.

System Generated Capital Requirements

Grey County uses CityWide™ as its primary asset management system. For each asset category, a CityWide™ system generated 10-year capital requirements table is provided. These estimates are developed at the asset network level, illustrate replacement needs only, and are built on available asset data, including quantities, replacement costs, age, or assessed condition. They can be different from actual capital forecasts. Effective componentization of assets along with consistent data updates, especially condition, and asset acquisitions and disposals typically improve the alignment between the system generated expenditure requirements, and the County's 10-Year Capital Forecasts.

Table 17 Grey County 10-Year Capital Forecasts 2021-2030

Department	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Corporate Services	1,043,600	1,052,100	1,075,200	1,078,200	1,082,700	1,087,600	1,095,400	1,098,900	1,104,500	1,107,600	10,825,800
Planning and Community Development	625,700	634,300	643,100	472,000	481,500	490,700	500,300	509,800	519,600	529,500	5,406,500
Social Services	2,184,000	2,200,500	2,217,400	2,234,500	2,251,900	908,700	926,900	945,400	964,200	983,500	15,817,000
Social Housing	1,424,800	1,453,300	1,482,400	1,512,000	1,542,200	1,573,000	1,604,500	1,636,600	1,669,300	1,702,700	15,600,800
Transportation and Public Safety	11,940,200	12,792,200	13,692,100	14,591,700	15,515,500	16,448,900	17,412,900	18,408,900	19,438,100	20,501,300	160,741,800
Total	17,218,300	18,132,400	19,110,200	19,888,400	20,873,800	20,508,900	21,540,000	22,599,600	23,695,700	24,824,600	208,391,900

The following sections will summarize the state of infrastructure for each category analyzed as part of this project. This information can be readily integrated for the County's first asset management plan in compliance with Ontario Regulation 588/17, to be completed by July 2021.

Roads

Category Overview

Table 18 summarizes the quantity and cost of the County's road network by segment. In total, roads and related assets were valued at $885.4 million as of 2021. The County owns and manages 869 kilometres of roadway. The table only summarizes assets that are currently managed in CityWide™, the County's asset management system.

Table 18 Category Overview: Roads

Category	Segment	Quantity	Replacement Cost	As a Percentage of Segment	Costing Method
Roads	Rural Surface	756km	$302,575,970	40%	Cost Per Unit
	Rural Base	756km	$448,568,862	60%	Cost Per Unit
	Sub-total Rural	756km	$751,144,833	100%	
	Semi-Urban Surface	66km	$36,281,689	48%	Cost Per Unit
	Semi-Urban Base	66km	$39,618,848	52%	Cost Per Unit
	Sub-total Semi-Urban	66km	$75,900,537	100%	
	Urban Surface	47km	$28,125,408	50%	Cost Per Unit
	Urban Base	47km	$28,125,408	50%	Cost Per Unit
	Sub-total Urban	47km	$56,250,816	100%	
	Traffic Signals	34	$2,079,522		CPI
		Total	$885,375,708		

Asset Condition

Figure 12 summarizes the average condition of the County's roads assets. Overall, 90% of the road network assets are in fair or better condition. Age was used as a proxy for estimating road base conditions and traffic signals.

Figure 12 Asset Condition: Roads

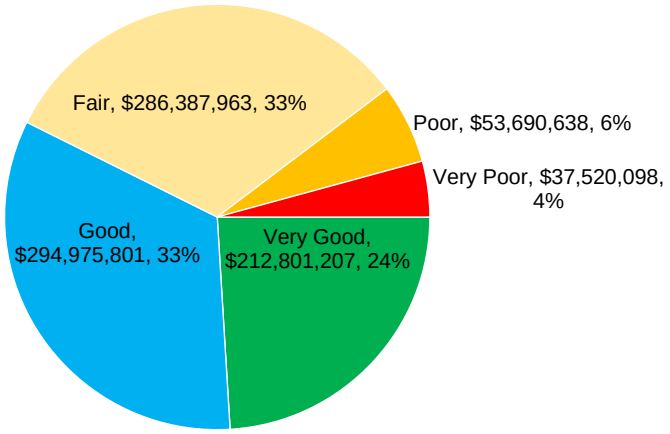


Table 19 summarizes the Pavement Condition Index (PCI) for the County's roads surfaces, and how it has evolved since 2014. The average PCI was 65.9 for 2020; this value has declined consistently since 2014. The 2020 median value suggests that half of all roads assessed had a PCI of greater than 68.8, while the remaining fell below this figure.

Table 19 PCI Values 2014-2019

PCI	2020	2019	2018	2017	2016	2015	2014	6-Year trend
Average	65.9	66.39	68.83	70.47	72.25	74.18	78.13	↘
Median	68.8	70.23	73.69	75.24	76.43	78.68	81.63	↘

Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

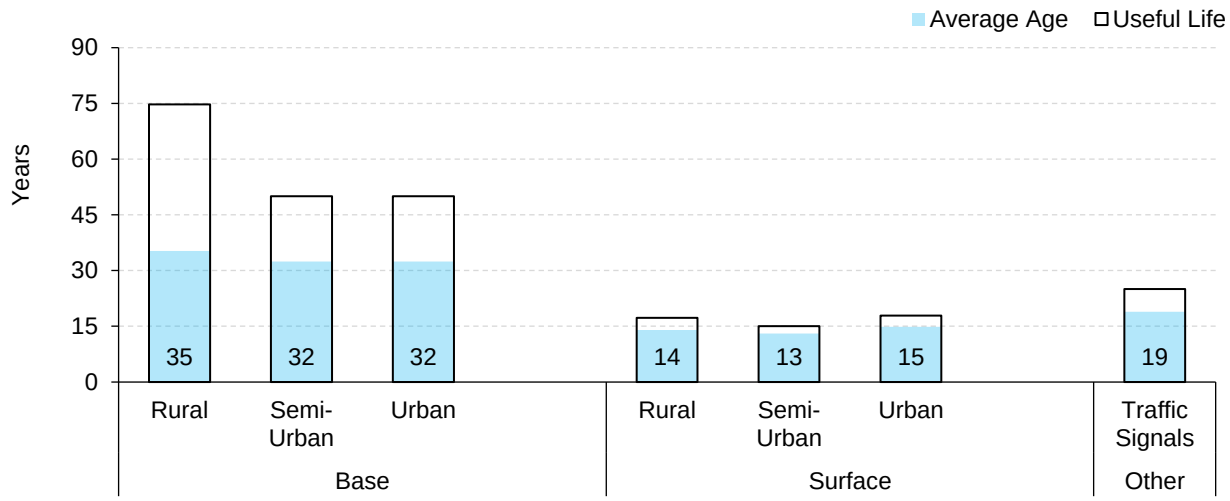
As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs can vary significantly within an asset category, from several years to many decades. Table 20 shows the EULs used for various road network assets.

Table 20 Estimated Useful Life (EUL) Data: Roads

Asset Category	Segment	Estimated Useful Life (EUL) in Years
Roads	Base	
	Rural	75
	Urban	50
	Surface	
	HCB	18
	LCB	7
	Rubberized Asphalt	15
	Warm Mix	18
	Traffic Signals	25

For additional context, Figure 13 compares the EUL for each segment against its average age. Both values are weighted by the replacement cost of each asset.

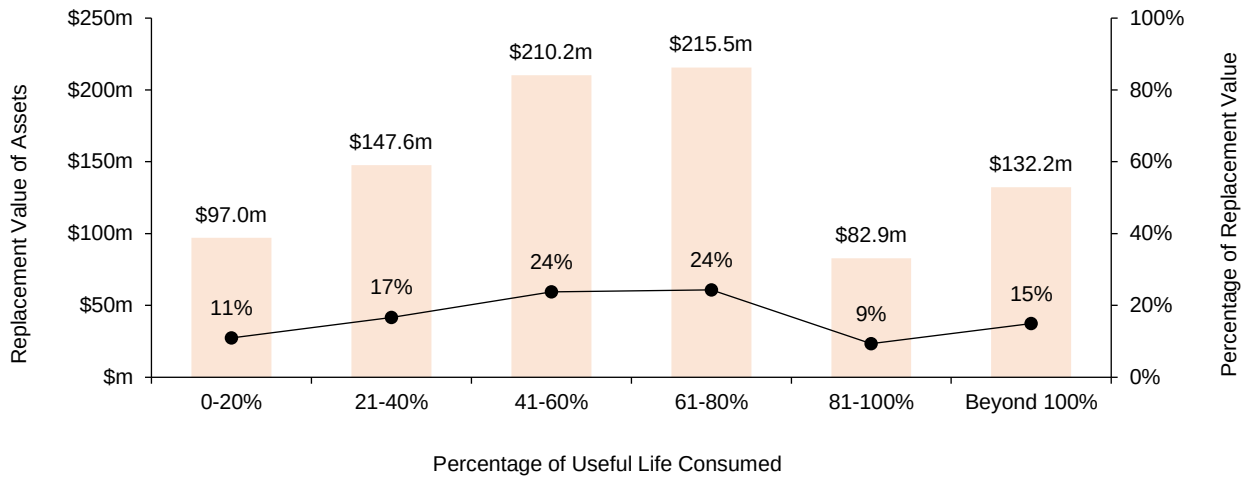
Figure 13 Average Age and Average Useful Life: Roads



In conjunction with condition data, an asset's age profile provides a more complete summary of the state of infrastructure than either metric alone. It can help identify assets that may be candidates for further review through condition assessment programs; inform the selection of optimal lifecycle strategies; and, improve planning for potential replacement spikes.

Figure 14 shows that approximately 15% of the County's roads assets, valued at $132.2 million remain in operation beyond their estimated useful life.

Figure 14 Percentage of Useful Life Consumed: Roads

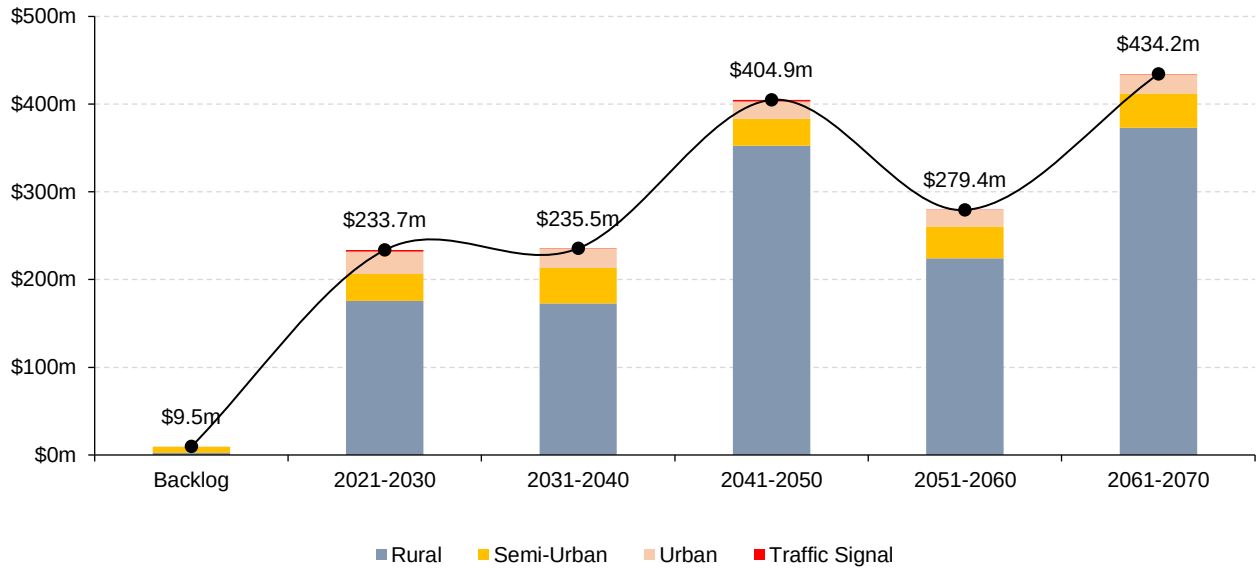


Projected Capital Replacement Needs

Figure 15 summarizes the capital replacement requirements for the County's roads and related assets from 2021 to 2070. The chart also illustrates a backlog of approximately $9.5 million, found primarily in the semi-urban segment. Two large replacement spikes are forecasted. The first, requiring investments totalling $404.9 million is projected to occur in 2041-2050, with the second in 2061-2070 when more than $434 million of roads assets will require replacement.

With proper lifecycle strategies and project prioritization, an asset's service life can be extended significantly, and these spikes can be mitigated and smoothed out over a longer time frame.

Figure 15 Project Capital Replacement Needs: Roads



Approach to Condition Assessments

The County's road network condition assessment program includes an annual roads needs assessment study conducted by staff. The process includes visual inspections that identify surface distresses, as well as estimates of pavement condition index (PCI) and ride comfort index (RCI). Ride quality relies on driver perception rather than objective analysis. Reflectivity testing is also completed annually. Traffic lights undergo annual condition inspections.

Lifecycle Analysis

The condition or performance of most assets will deteriorate over time. This process is affected by a range of factors including an asset's characteristics, location, utilization, maintenance history and environment. This section outlines the County's lifecycle frameworks and general approaches for its road network.

Staff rely on many factors to guide the selection of optimal lifecycle activities and treatment options, including asset condition, criticality, previous work completed, and opportunities to economize through project bundling or coordination. As such, the data contained in this section is illustrative and intended to provide a broad overview of roads lifecycle management.

PAVED ROADS LIFECYCLE APPROACH

The County's general approach to its paved roads network is detailed in Table 21.

Table 21 Lifecycle Approach: Paved Roads

Event Class	Description
Maintenance	• Patching is applied on an as-needed basis to repair and prevent pothole formations.
Preventative Maintenance	• Primarily consists of grout sealing applications to ensure that moisture is prevented from infiltrating beneath the asphalt surface layer. • Micro-surfacing is applied to select asphalt road surfaces in order to preserve and protect the underlying pavement structure and provide a new driving surface. Roads chosen for micro-surfacing application generally have low to moderate distress and narrow crack width.
Rehabilitation	• Rehabilitation is prioritized using Pavement Condition Index (PCI) and cost. • A grind and pave application is considered mid-life when the urban road surface exhibits significant deterioration. Rehabilitating the top asphalt layer ensures the life of the base and sub-base are extended. • Pulverize and pave is applied mid-life to deteriorating urban road surfaces in an effort to extend the life of road assets and prevent the need for full road reconstruction. • Cold in-place recycling with expanded asphalt mix (CIREAM) is applied to rural roads as a cost effective, mid-life rehabilitation strategy.
Replacement	• Full road reconstruction projects are coordinated in conjunction with underground infrastructure, sharing costs between the two services.

URBAN ROADS

The County's current lifecycle framework for urban roads consists of two mid-life rehabilitation events, which provide savings over the life of the assets when contrasted with an end-of-life replacement only strategy. In addition, these events can maintain higher condition levels throughout the life of the road than a full end-of-life replacement- or reconstruction-only strategy.

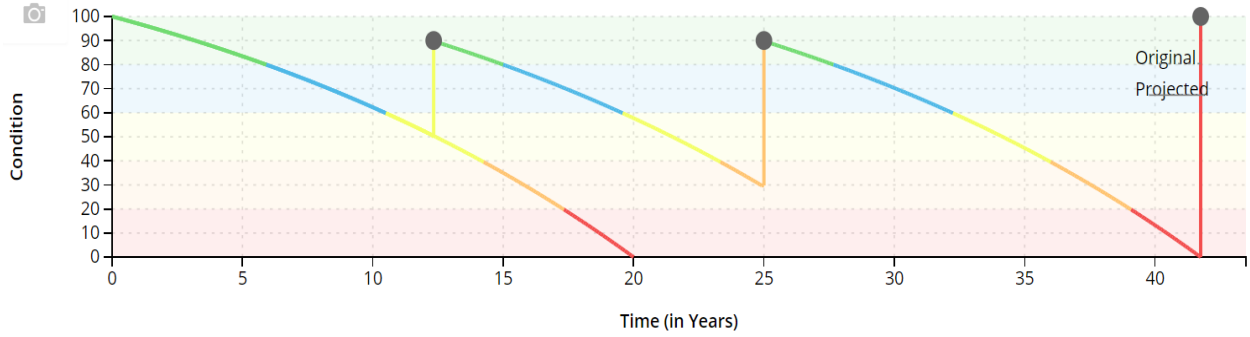
Fewer defects in the road provide a better riding surface, reduce financial, economic, and health and safety risks, and offer consistent and higher levels of service to the public. Surface level interventions, such as grind and pave, are also less disruptive than a full reconstruction.

Under this strategy, a grind and pave event is triggered when condition reaches 50%. The event increases the condition of the road segment to 90% at a cost of $235,000 per kilometre. The costs, event triggers, and forecasted impact of these lifecycle events on the condition of the County's urban road network are outlined in Table 22.

Table 22 Sample Lifecycle Strategy: Urban Roads

Event Name	Event Class	Event Range / Trigger	Impact	Cost/km
Grind and pave (10m)	Rehabilitation	50% Condition	90% Condition	$235,000
Pulverize and pave (16.5m)	Rehabilitation	Year 25	90% Condition	$550,000
Full reconstruction		End of life	100%	

Figure 16 Sample Lifecycle Strategy: Urban Roads



Developed in the County's asset management application, CityWide™, Figure 16 illustrates the above lifecycle strategy for urban roads on a deterioration curve.

RURAL ROADS

The County's current strategy for its rural roads network comprises two rehabilitation events and a preventative maintenance event. Similar to its strategy for urban roads, these interventions can improve the performance of the treated segments, providing a smoother riding surface and higher ride comfort rating. Full traffic volumes can be accommodated over the majority of the life of rural roads, critically important to local economic and industrial activity.

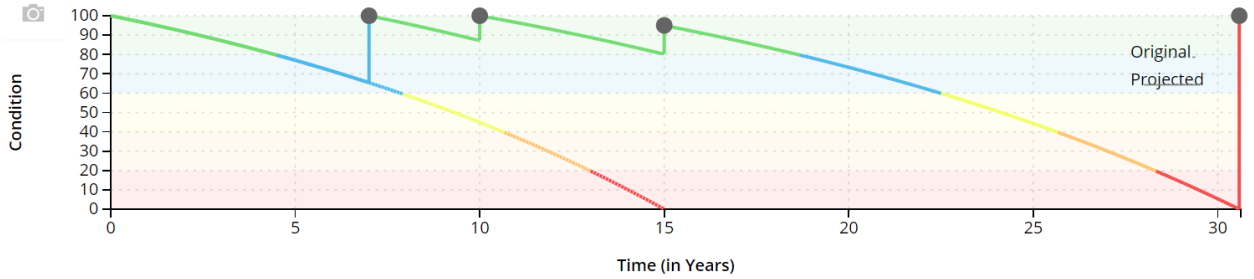
Under this strategy, a single overlay occurs in Year 7, and is expected to add 10 years to the service life of the treated road segment, at a cost of $130,000 per kilometre. The costs, event triggers, and forecasted impact of these lifecycle events on the condition of the County's rural road network are outlined in Table 23.

Table 23 Sample Lifecycle Strategy: Rural Roads

Event Name	Event Class	Event Range / Trigger	Impact	Cost/Km
Single Overlay	Rehabilitation	Year 7	Adds 10 years	$130,000
Micro-surface	Preventative Maintenance	Year 17	Adds 5 years	$85,000
Recycling (CIREAM, CIP)	Rehabilitation	Year 27-32	95% Condition	$350,000

Also developed in CityWide™, Figure 17 illustrates the above strategy for rural roads using a deterioration curve.

Figure 17 Sample Lifecycle Strategy: Rural Roads



SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements (replacement only) for the County's road network are illustrated in Table 24. These investments are needed in order to keep infrastructure in state of good repair.

Table 24 10-Year Annual Capital Requirements: Roads

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Rural	$5,943,413	$15,553,849	$6,545,958	$17,970,206	$12,058,948	$23,509,226	$22,924,047	$14,803,091	$26,853,386	$29,603,596
Semi-Urban	$610,914	$817,522	$4,369,070	$4,801,625	$11,092,119	$2,016,732	$1,293,809	$2,945,531	$1,514,379	$1,021,539
Urban	$262,510	$719,448	$2,890,670	$4,248,609	$706,532	$8,295,287	$1,692,359	$5,200,763	$1,388,144	$329,982
Traffic Signal	$0	$0	$1,686,153	$0	$0	$0	$0	$0	$0	$0
Total	$6,816,838	$17,090,819	$15,491,851	$27,020,440	$23,857,599	$33,821,246	$25,910,215	$22,949,385	$29,755,908	$30,955,117

Bridges and Culverts

Category Overview

Table 25 summarizes the quantity and cost of the County's bridges and culverts network by segment. In total, bridges and culverts were valued at $289 million as of 2020. The table only summarizes assets that are currently managed in CityWide™, the County's asset management system.

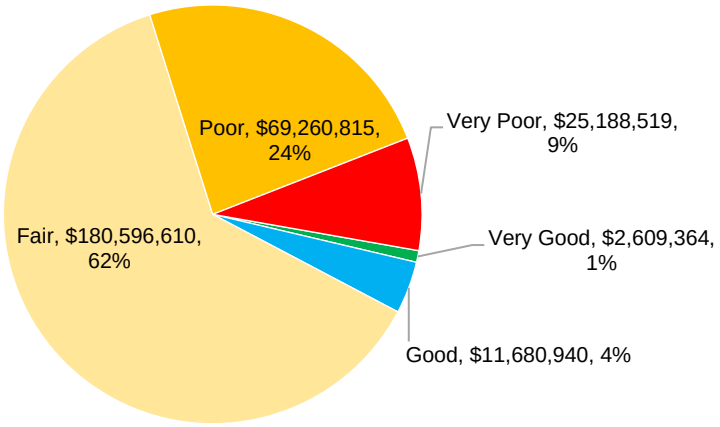
Table 25 Category Overview: Bridges and Culverts (>3m)

Category	Segment	Quantity	Replacement Cost	Costing Method
Bridges and Culverts	Bridges	134	$239,343,128	2020 and 2019 OSIM
	Culverts (>3m)	56	$47,865,188	2020 and 2019 OSIM
	CPR Trail	17	$2,127,931	2020 and 2019 OSIM
		Total	$289,336,247	

Asset Condition

Figure 18 summarizes the average condition of the County's bridges and culverts assets. Overall, 67% of the County's bridges and culverts assets are in fair or better condition. This data is based on the County's 2020 and 2019 Ontario Structures Inspection Manual (OSIM) reports.

Figure 18 Asset Condition: Bridges and Culverts



The County's average bridge condition index (BCI) from each inspection is illustrated in Table 26. We note that the County conducts its OSIM inspections on an alternating basis, hence, only a portion of its bridges and culverts are assessed through each biennial OSIM inspection.

Table 26 Bridge Condition Index (BCI)

OSIM Year	Average BCI	Replacement Cost of Assessed Assets
2020	40.5	$118,499,998
2019	50.5	$171,892,651

Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs can vary significantly within an asset category, from several years to many decades. Table 27 shows the range of EULs used for bridges and culverts. Although there is a large range for each asset type, the majority of decks have an EUL of 15 years; similarly, most structures carry an EUL of 50 or 75 years. Most culverts have an EUL of 40 or 50 years.

Table 27 Estimated Useful Life (EUL) Data: Bridges and Culverts

Asset Category	Segment	Estimated Useful Life (EUL) in Years
Bridges and Culverts	Bridges	
	Deck – Asphalt	15 – 96
	Deck – Concrete	15 – 82
	Deck – Gravel	15
	Structure	44 - 100
	Culverts	15 - 71
	CPR Trail	NA

For additional context, Figure 19 compares the average EUL for each segment against its average age. Both values are weighted by the replacement cost of each asset.

Figure 19 Average Age and Average Useful Life: Bridges and Culverts

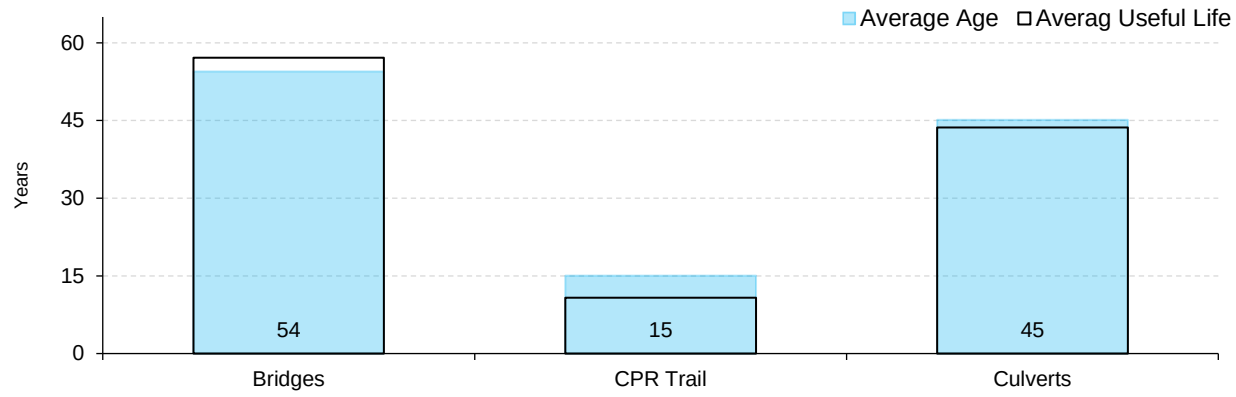
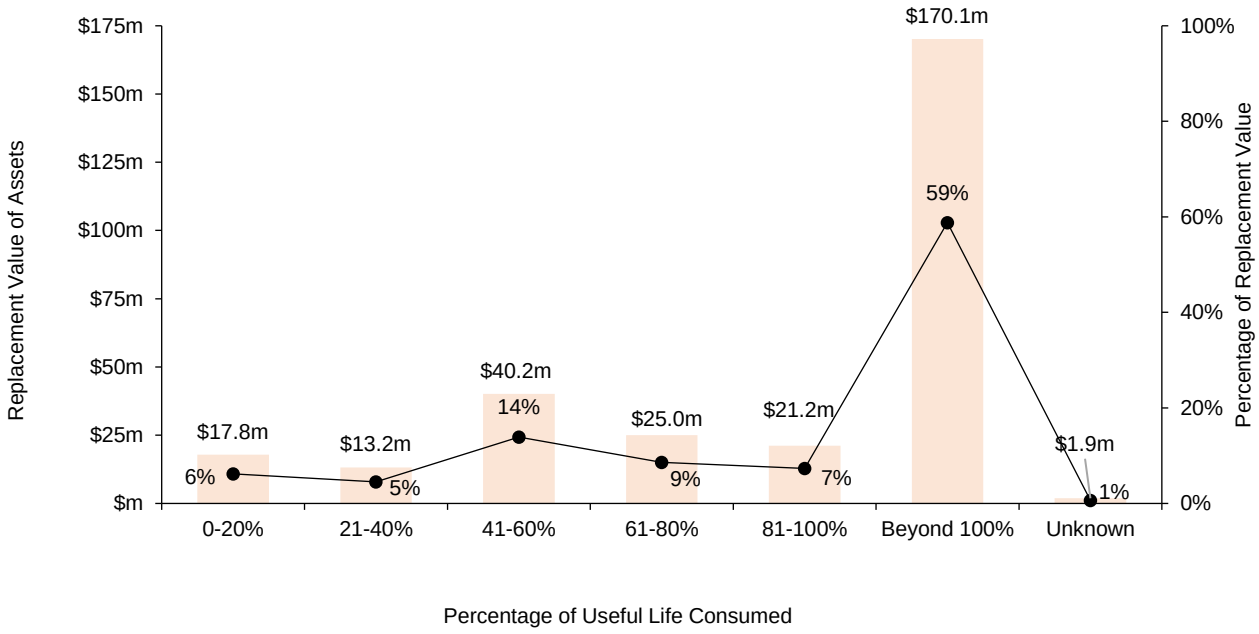


Figure 20 shows that approximately 59% of the County's bridges and culverts assets, valued at $170.1 million remain in operation beyond their estimated useful life.

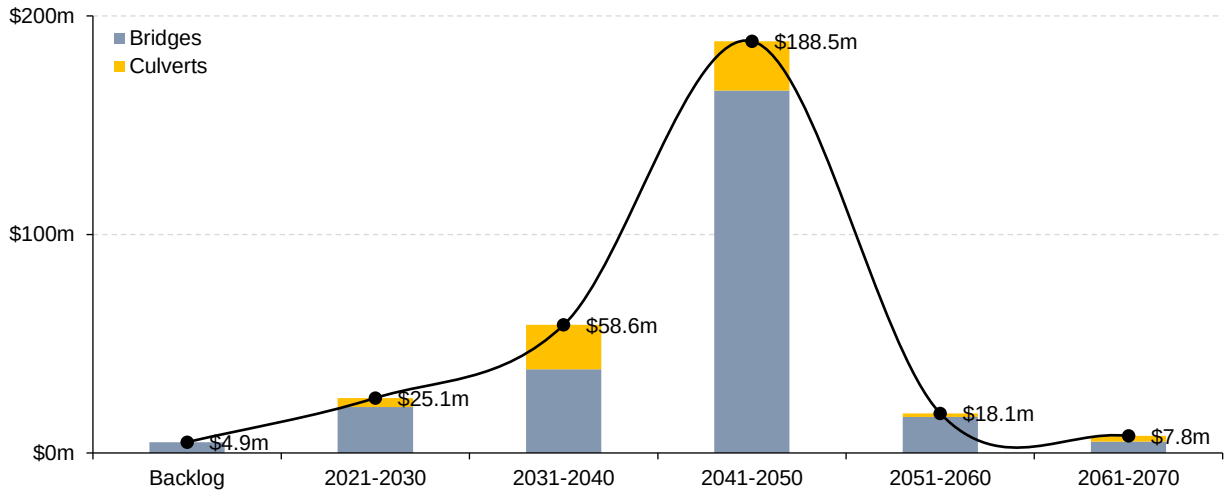
Figure 20 Percentage of Useful Life Consumed: Bridges and Culverts



Projected Capital Replacement Needs

Figure 21 summarizes the capital replacement requirements for the County's bridges and culverts assets from 2021 to 2070. The chart also illustrates a backlog of approximately $4.9 million. The largest forecasted spike in capital spending is expected to take place in 2041-2050, totalling $188.5 million. However, with proper lifecycle strategies and project prioritization, these spikes can be mitigated and smoothed out over a longer time frame.

Figure 21 Projected Replacement Need: Bridges and Culverts



Approach to Condition Assessments

Bridges and culverts inspections are regulated, and conducted every two years by qualified engineers in compliance with the Ontario Structure Inspection Manual (OSIM). Grey County conducts its inspections on a rotating cycle. The County's entire bridges and structural culverts portfolio was assessed between the 2019 and 2020 OSIM inspection cycles.

Lifecycle Analysis

All lifecycle strategies for the County's bridges and structural culverts are driven by its biennial OSIM inspections and the phase of the asset's lifecycle. Table 28 outlines the County's current lifecycle strategy for its bridges and culverts.

The 2020 OSIM reports an estimated repair and/or rehabilitation of $6.7 million for the 89 structures assessed. Bridge condition indices (BCI) are used to identify structures requiring immediate or short-term maintenance activities. The 2019 OSIM cycle reviewed 104 structures. The total repair and/or rehabilitation for these structures was estimated at $8.9 million. Structures identified as candidates for replacement also undergo load testing to determine if and when they should be replaced. Depending on the results of load tests, replacements can be deferred for up to five years, at which point a second load test is conducted.

Table 28 Lifecyle Strategy: Bridges and Culverts

Event Name	Event Class	Event Range/ Trigger	Impact (e.g., New Condition)	Cost ($/m^2)
Replacement (short span)	End-of-life replacement	BCI less than 30	New Condition: 100%	$4.5k - $5k
Replacement (long span)	End-of-life replacement	BCI less than 30	New Condition: 100%	$3.5k
Replacement (CSP culverts)	End-of-life replacement	BCI less than 30	New Condition: 100%	$3.5k
Replacement (CIP / pre-cast culverts)	End-of-life replacement	BCI less than 30	New Condition: 100%	$3.5k - $4k
Chip patch and seal	Maintenance	5 year	Change in Condition: 10%	$5k-$25k
Detailed deck condition survey	Maintenance/Rehab	Every 20-25 years	Inspection only	$30K-$100k
Soffit and Fascia repair	Maintenance/Rehab	20-25 years as needed	New Condition: 100%	$5k-$25k
Handrail/Barrier	Maintenance	7-10 years	Change in condition: 50%	$5k-$15k
Deck rehab	Rehabilitation	Every 20-25 years	New Condition: 100%	$50-$100k
Bridge washing	Maintenance	Annually	Change in Condition: 5%	$60K for all structures
Reconstruction	Replacement	10-20% condition	New Condition: 100%	$400k-$5m

Table 29 Lifecyle Strategy: Forestry and Trails

Event Name	Component	Event Range/ Trigger	Impact (e.g. New Condition)	Cost
Grading	All	5km / year	100% condition	NA
Grading	No surface replacement	2 – 3km / year	100% condition	NA
Improvement (e.g., grading, tree clearing, new trails)	Forest Trails	1 / year	Varies	NA
General maintenance (e.g. grass cutting)	All	Annual	Varies	NA
Inspection[1]	CP-Rail (non-winter season)	Monthly	None	NA
Inspection	Forest	As-needed	None	NA
Consultant inspection	Bridges & culverts	Every 5 years	None	NA
Inspection	Lookout (railings, benches and stairs)	Seasonally	None	NA

[1] Generally performed by ATV club

SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements (replacement only) for the County's bridges and culverts are illustrated in Table 30. These investments are needed in order to maintain existing levels of service and keep infrastructure in state of good repair. These, together with the County's 2020 and 2019 OSIM inspections, can assist in capital planning across a 10-year horizon.

Table 30 10-Year Annual Capital Requirements: Bridges and Culverts

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Bridges	$6,978	$206,130	$3,087,636	$707,131	$4,312,731	$2,395,800	$735,240	$5,647,535	$3,169,671	$787,954
Culverts	$0	$0	$2,762,627	$0	$0	$0	$755,273	$0	$41,789	$533,114
Total	$6,978	$206,130	$5,850,263	$707,131	$4,312,731	$2,395,800	$1,490,513	$5,647,535	$3,211,459	$1,321,068

Buildings and Facilities

Category Overview

Table 31 summarizes the quantity and cost of the County's buildings and facilities portfolio by segment. In total, buildings and facilities had a current replacement value of $129.3 million as of 2020. The table only summarizes assets that are currently managed in CityWide™, the County's asset management system. Buildings and facilities inventory shows minimal breakdown or componentization of primary assets into smaller segments or components, e.g., building shells, roofs, flooring, HVAC, etc. Most buildings and facilities are listed in the CityWide™ as single assets, e.g., 'Chatsworth Station'.

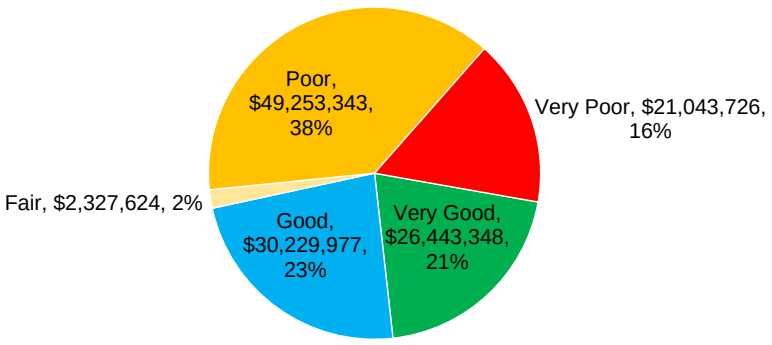
Table 31 Category Overview: Buildings and Facilities

Category	Segment	Quantity	Replacement Cost	Costing Method
Buildings and Facilities	Child Care	4	$1,690,443	CPI
	Paramedic Services	6	$3,710,480	CPI
	General Government	25	$34,929,992	CPI
	Grey Roots	14	$18,887,245	CPI
	Historical Buildings	4	$1,095,382	CPI
	Long Term Care - Grey Gables	33	$19,396,488	CPI
	Long Term Care - Lee Manor	14	$29,566,177	CPI
	Long Term Care - Rockwood Terrace	72	$9,228,387	CPI
	Transportation	43	$10,793,424	CPI
		Total	$129,298,018	

Asset Condition

Figure 22 summarizes the average condition of the County's buildings and facilities. Overall, based on age data, 54% of the County's buildings and facilities assets are in poor to very poor condition. The County is currently in the process of conducting a Buildings Condition Assessment (BCA), the results of which may be more accurate than age-based condition data used to estimate these values.

Figure 22 Asset Condition: Buildings and Facilities



Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

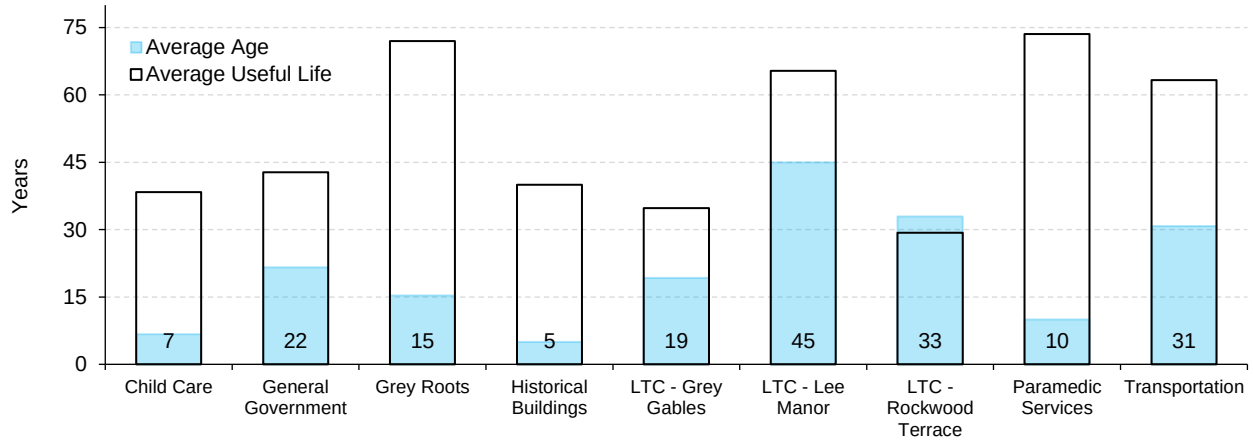
As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs can vary significantly within an asset category, from several years to many decades. Table 32Table 20 shows the EULs used for various buildings and facilities assets. In the absence of complete and efficient componentization, and given the substantial variety in the type of components that are typically found in buildings and facilities, estimated useful life data may not offer a representative profile of assets. As the County's BCA data is integrated with the asset inventory, a more efficient asset hierarchy can be developed and EUL data may be better structured.

Table 32 Estimated Useful Life (EUL) Data: Buildings and Facilities

Asset Category	Segment	Estimated Useful Life (EUL) in Years
Buildings and Facilities	Child Care	20-39
	EMS	6-75
	General Government	7-75
	Grey Roots	10-75
	Historical Buildings	40
	Long Term Care - Grey Gables	5-75
	Long Term Care - Lee Manor	15-67
	Long Term Care - Rockwood Terrace	8-30
	Transportation	10-75

For additional context, Figure 23 compares the EUL for each segment against its average age. Both values are weighted by the replacement cost of each asset.

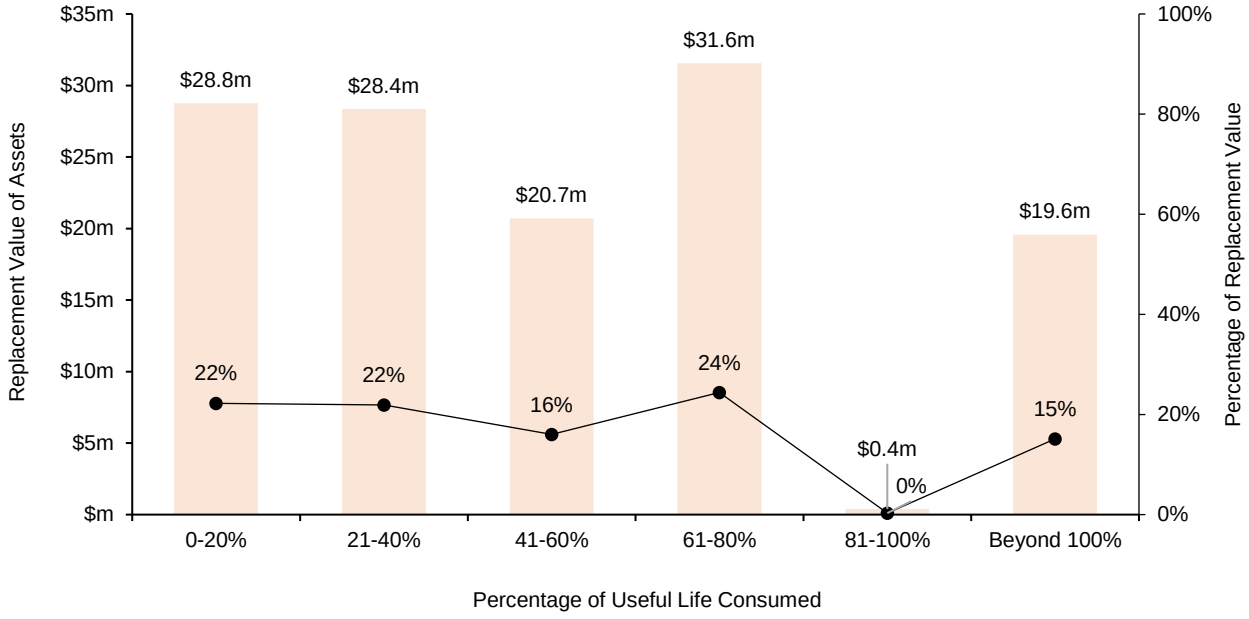
Figure 23 Average Age and Average Useful Life: Buildings and Facilities



In conjunction with condition data, an asset's age profile provides a more complete summary of the state of infrastructure than either metric alone. It can help identify assets that may be candidates for further review through condition assessment programs; inform the selection of optimal lifecycle strategies; and, improve planning for potential replacement spikes.

Figure 24 shows that approximately 15% of the County's buildings and facilities assets, valued at $19.6 million remain in operation beyond their estimated useful life. However, as with other analytics developed for buildings and facilities assets, improved componentization will provide more detailed, representative, and reliable data. Often, assets that may have exceeded their useful life remain fully functional and capable of delivering desired performance levels. Alternatively, a more detailed inventory may also reveal lifecycle needs requiring additional capital expenditures.

Figure 24 Percentage of Useful Life Consumed: Buildings and Facilities

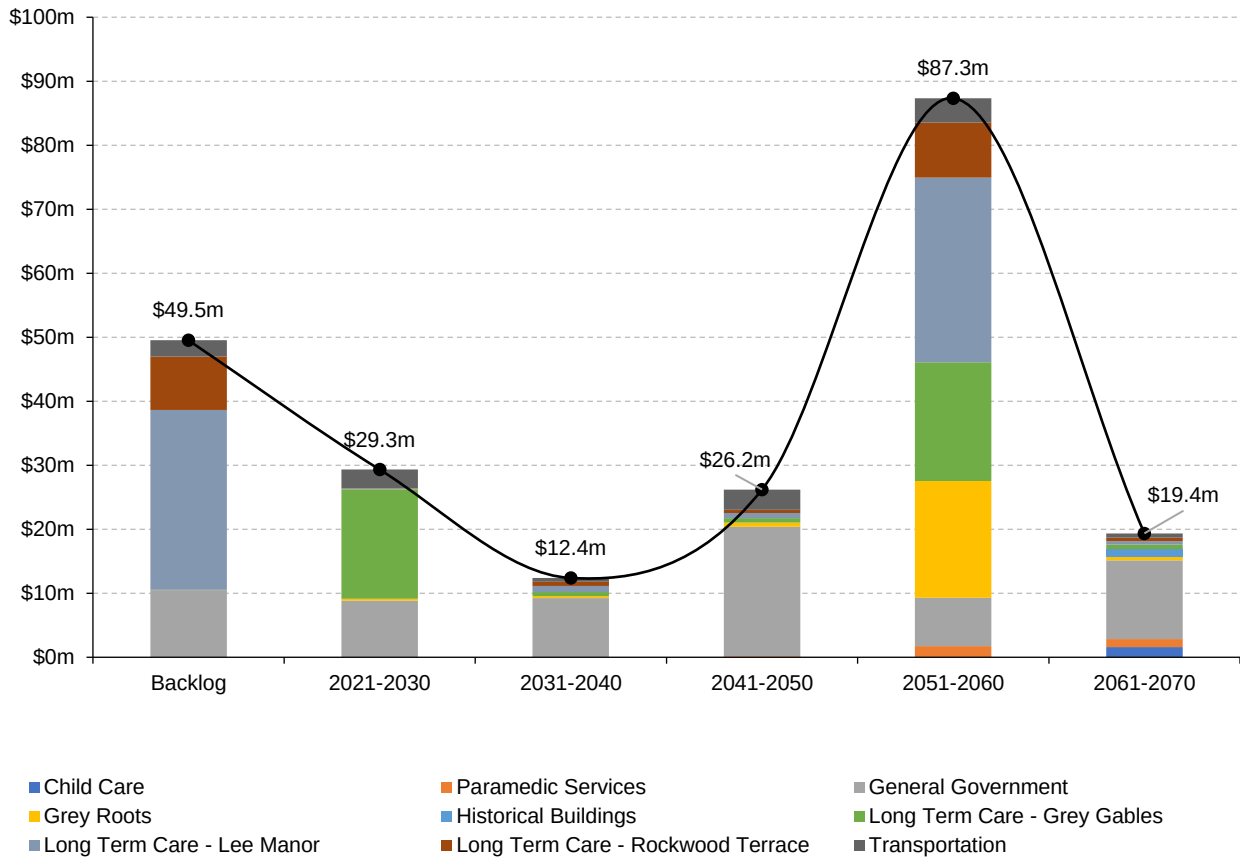


Projected Capital Replacement Needs

Figure 25 summarizes the capital replacement requirements for the County's buildings and facilities assets from 2021 to 2070. The chart also illustrates an age-based backlog of approximately $49.5 million, found primarily in Lee Manor; this value should be reconciled with building condition assessment data. The largest forecasted spike in capital spending is expected to take place in 2051-2060. However, with proper lifecycle strategies, these spikes can be mitigated and smoothed out over a longer time frame.

We also note that the County is in the planning stages of redeveloping Rockwood Terrace and Grey Gables long term care homes. A construction funding subsidy (CFS) of approximately $37.3 million will be available and paid over 25 years upon completion of the rebuilds. Rockwood Terrace comprises approximately $8.3 million of the total age-based backlog estimate.

Figure 25 Projected Replacement Need: Buildings and Facilities



Approach to Condition Assessments

The County's buildings and facilities portfolio, which includes social housing and Grey Roots Museum for the purpose of inspections, undergo standard building condition assessments, or BCAs. Energy audits are also completed; long-term care homes undergo monthly health and safety inspections in compliance

with the Ministry of Health and Long Term Care regulations. Social housing units are inspected every year for quality, functionality, condition, repair needs, and energy system efficiency.

Lifecycle Analysis

Lifecycle approaches to maintaining buildings and facilities in a state of good repair are component specific. The County's current lifecycle strategies include inspections of building envelope system, water circulation, roofs, and windows. The forthcoming BCAs will include four distinct deliverables: the BCA itself, which will identify all physical, operating, and functional requirements of the buildings portfolio; a reserve fund study (RFS) which will provide an estimate of the reserve capital funding requirements for the next 30 years on an annual basis for major repairs, replacements, and renovations; the facility condition index (FCI), to be presented for each building; and, an energy audit to assess the energy efficiency of buildings and identify conservation measures and capital projects.

Recommended lifecycle activities by major component type are illustrated in Table 33, along with the event trigger and forecasted impact.

Table 33 Lifecycle Strategy: Buildings and Facilities

Component Type	Component Sub-type	Treatment Option	Impact	Event Trigger (years)	
				Earliest	Latest
Sub- structure	N/A	Frost protection	Reduced deteriorate rate	25	30
		Drainage and Waterproofing	Reduced deterioration rate	25	50
Roof	Steel	Replacement	100% condition	50	60
	Membrane	Repair	20% condition added	13	20
		Replacement	100% condition	13	20
	Shingles	Replacement	100% condition	15	25
Exterior	Steel	Replacement	100% condition	50	60
	Brick	Replacement	100% condition	40	50
	Stone	Replacement	100% condition	40	50
Interior	All	Regular annual maintenance as identified through defects and regular inspections	Reduced deterioration rate	N/A	N/A
Services	Plumbing	Repair – annual maintenance cost per building	Variable life added	30	40
	Electrical	Repair-annual maintenance cost per building	Variable life added	30	40
	HVAC	Repair-annual maintenance cost per building	Variable life added	20	30
Commercial	Refrigeration	Replacement	100% condition	30	35
		Repair- preventative maintenance per service contract	Variable life added	1	1

County staff were able to provide partial information on current lifecycle strategies for two buildings: Lee Manor and Grey Roots. These are outlined in Table 34 and Table 35, respectively.

Table 34 Lifecycle Strategy: Buildings and Facilities – Lee Manor

Component	Sub-Component	Event Class	Event Range/ Trigger	Impact on condition or life	Cost
Air Handling Unit 101, 102, 103	Heating/Cooling	Preventative Maintenance	Annually	Variable life added	NA
Air Handling Unit 101, 102, 103	Heating/Cooling	Replacement	25-30 ears	New Condition: 100%	$240k-$600k
Boilers Heating #1/#2/#3	Heating	Preventative Maintenance	Annually	Variable life added	NA
Boilers Heating #1/#2/#3	Heating	Replacement	22-25 years	New Condition: 100%	$650k
Heat Exchangers	Pre-heating	Replacement	12 years	New Condition: 100%	$95k
Hot water tank	Comfort	Replacement	15 years	New Condition: 100%	$135k

Table 35 Lifecycle Strategy: Buildings and Facilities – Grey Roots

Component	Sub-Component	Event	Event Range/ Trigger	Impact on condition or life	Cost
Roof	Membrane	Moisture Repairs	As needed	Reduced deterioration rate	NA
	Membrane	Thermal imaging/scanning	Every 5 years	None	NA
	Membrane	Replacement	15-40 years	100% Condition	NA

SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements (replacement only) for the County's buildings and facilities are illustrated in Table 36. These investments are needed in order to maintain existing levels of service and keep infrastructure in state of good repair. With more efficient and complete componentization, and integration of BCA data, the County's 10-year capital plan can become better aligned with system generated requirements.

Table 36 10-Year Annual Capital Requirements: Buildings and Facilities

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Child Care	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Paramedic Services	$0	$0	$0	$0	$0	$0	$0	$0	$17,784	$0
General Government	$0	$0	$2,033,486	$3,493,773	$2,033,486	$0	$5,530,318	$0	$0	$5,540,702
Grey Roots	$0	$0	$0	$0	$0	$0	$0	$0	$312,766	$0
Historical Buildings	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Long Term Care - Grey Gables	$0	$7,113	$21,192	$23,852	$0	$3,533	$23,422	$143,506	$0	$51,296
Long Term Care - Lee Manor	$0	$0	$0	$0	$0	$0	$46,269	$0	$49,391	$0
Long Term Care - Rockwood Terrace	$0	$0	$0	$0	$0	$0	$0	$81,462	$0	$0
Transportation	$0	$0	$0	$0	$317,119	$12,075	$18,498	$0	$766,372	$403,516
Total	$0	$7,113	$5,206,749	$23,852	$1,849,861	$15,608	$1,112,219	$3,763,884	$17,283,957	$63,718

Social Housing

Category Overview

Table 37 summarizes the quantity and cost of the County's social housing portfolio by segment. In total, social housing assets were valued at $73 million as of 2020. The table only summarizes assets that are currently managed in CityWide™, the County's asset management system.

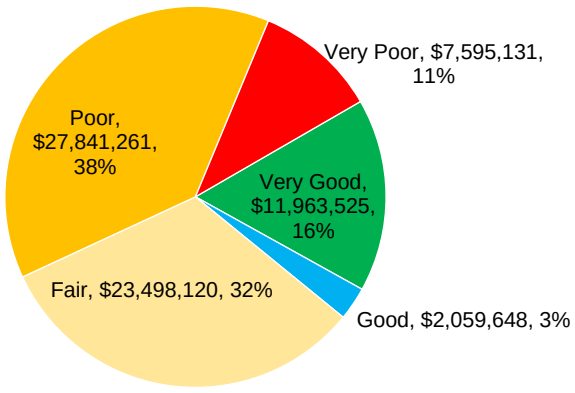
Table 37 Category Overview: Social Housing

Category	Segment	Quantity	Replacement Cost	Costing Method
Social Housing	Apartment Buildings	29	$42,697,964	CPI
	Building - Exterior	393	$5,479,058	CPI
	Building - Interior	99	$2,851,950	CPI
	Computers	16	$38,574	CPI
	Dryers	55	$69,647	CPI
	Family Units	7	$20,337,406	CPI
	Furniture	12	$32,446	CPI
	Lawn Tractors	17	$261,590	CPI
	Refrigerators	757	$507,680	CPI
	Stoves	724	$583,167	CPI
	Washing Machines	55	$98,203	CPI
		Total	$72,957,685	

Asset Condition

Figure 26 summarizes the average condition of the County's social housing. Overall, based only on age data, 50% of the County's social housing assets are in fair or better condition. The County is currently in the process of conducting a Buildings Condition Assessment (BCA), the results of which may be more accurate than age-based condition data used to estimate these values. The County is diligent in maintaining its social housing assets in a state of good repair to ensure tenant safety, security, and comfort.

Figure 26 Asset Condition: Social Housing



Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs can vary significantly within an asset category, from several years to many decades. Table 38 shows the EULs used for various social housing assets. In the absence of complete and efficient componentization, and given the substantial variety in the type of components that were found in the County's social housing inventory, estimated useful life data may not offer a representative profile of assets. As the County's BCA data is integrated with the asset inventory, a more efficient asset hierarchy can be developed and EUL data may be better structured.

Table 38 Estimated Useful Life (EUL) Data: Social Housing

Asset Category	Segment	Estimated Useful Life (EUL) in Years
Social Housing	Apartment Buildings	20-80
	Building - Exterior	10-50
	Building - Interior	8-30
	Computers	3-10
	Dryers	1-10
	Family Units	80
	Furniture	15
	Lawn Tractors	4-15
	Refrigerators	6-15
	Stoves	2-40
	Washing Machines	2-10

For additional context, Figure 27 compares the average EUL for each segment against its average age. Both values are weighted by the replacement cost of each asset.

Figure 27 Average Age and Average Useful Life: Social Housing

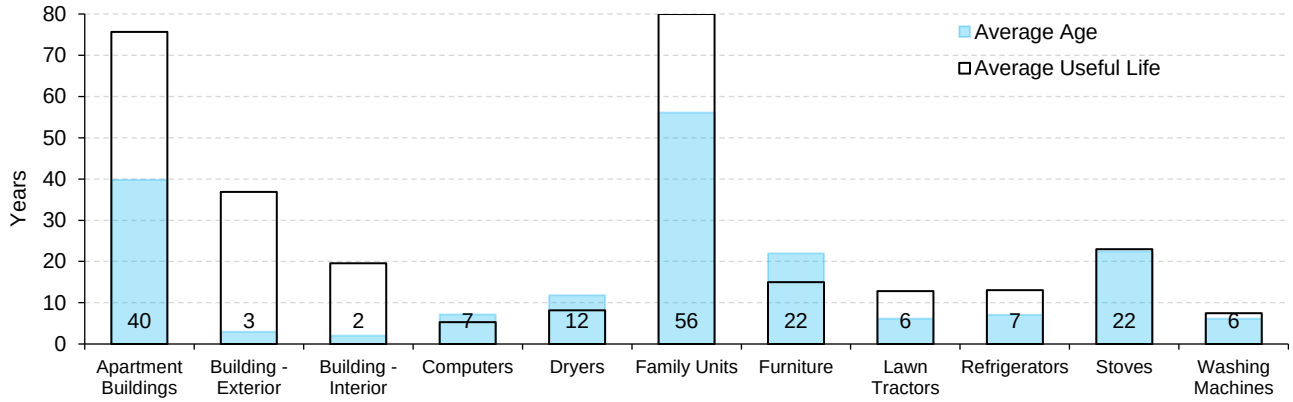
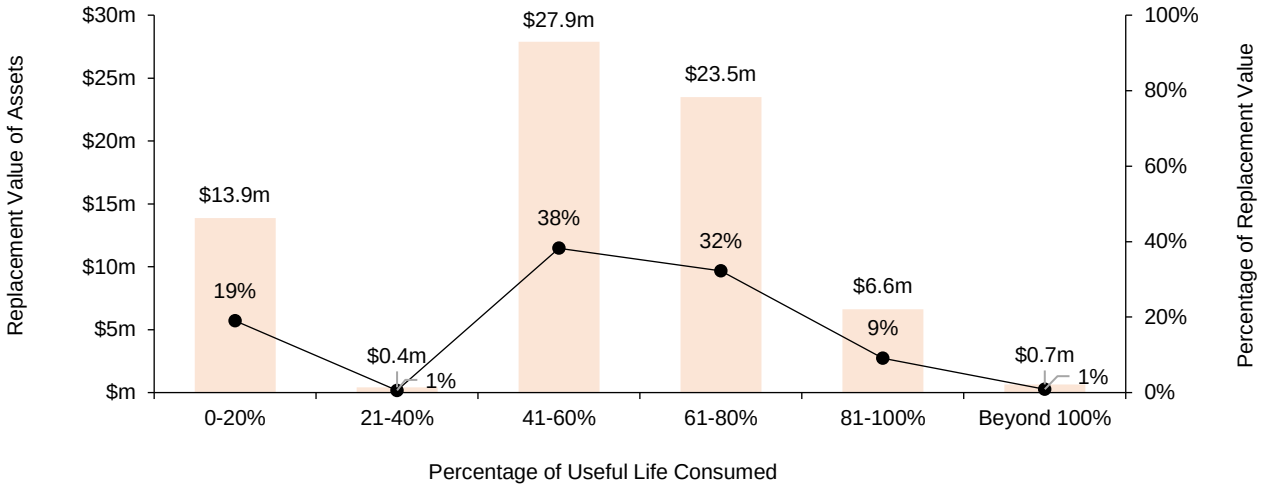


Figure 28 shows that a small portion of social housing assets, valued at less than $1 million remain in operation beyond their estimated useful life.

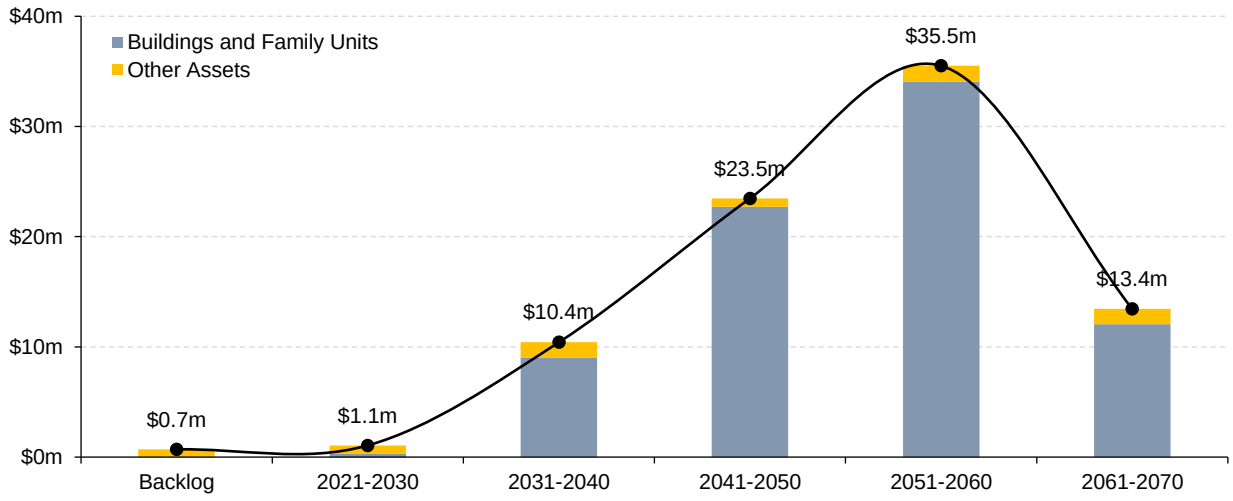
Figure 28 Percentage of Useful Life Consumed: Social Housing



Projected Capital Replacement Needs

Figure 29 summarizes the capital replacement requirements for the County's social housing assets from 2021 to 2070. The chart also illustrates a small backlog of approximately $0.7 million, found primarily in minor assets. The largest forecasted spike in capital spending is expected to take place in 2051-2060, totalling more than $35.5 million. However, with proper lifecycle strategies, these spikes can be mitigated and smoothed out over a longer time frame. Condition assessments will offer more reliable estimates of in-field asset needs and required expenditures to maintain asset performance.

Figure 29 Projected Replacement Need: Social Housing



Approach to Condition Assessments

Please see the buildings and facilities section of this report.

Lifecycle Analysis

Lifecycle strategies for social housing assets will be similar to those identified for the buildings and facilities assets. The County's forthcoming BCA will identify annual investment needs.

SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements for the County's social housing assets are illustrated in Table 39. These investments are needed in order to maintain existing levels of service and keep infrastructure in state of good repair. As with buildings and facilities, generating accurate capital forecasts in better alignment with the County's 10-year capital plan requires efficient and comprehensive componentization of social housing assets in CityWide™. These projections, along with the County's forthcoming BCAs, can be used to develop improved funding requirements estimates.

Table 39 10-Year Annual Capital Requirements: Social Housing

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Buildings and Family Units	$0	$78,139	$0	$0	$0	$21,557	$119,497	$46,053	$9,986	$51,969
Other Assets	$18,491	$17,429	$15,416	$55,911	$266,509	$28,278	$81,532	$26,795	$127,619	$94,751
Total	$18,491	$95,568	$15,416	$55,911	$266,509	$49,835	$201,029	$72,848	$137,605	$146,720

Machinery and Equipment

Category Overview

Table 40 summarizes the quantity and current replacement value of Grey County's machinery and equipment portfolio. In total, machinery and equipment assets were valued at $15.6 million as of 2020. The portfolio includes heavy equipment such as loaders, graders, and tractors. The table only summarizes assets that are currently managed in CityWide™, the County's asset management system.

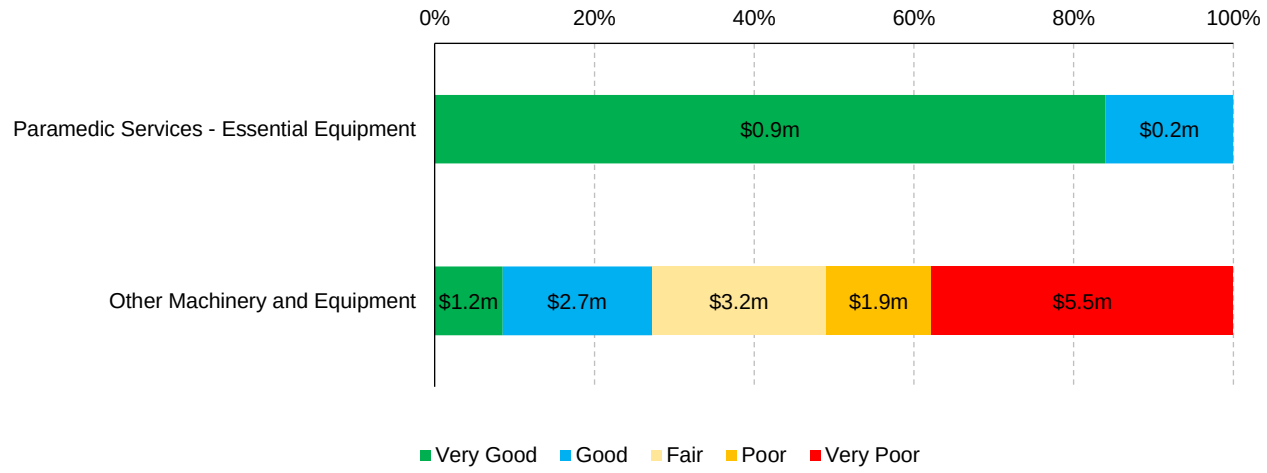
Table 40 Category Overview: Machinery and Equipment

Category	Segment	Quantity	Replacement Cost	Costing Method
Machinery and Equipment	Child Care	23	$28,275	CPI
	Paramedic Services	213	$1,621,776	CPI
	General Government	285	$976,083	CPI
	Grey Roots	110	$2,889,768	CPI
	Housing	2	$2,006	CPI
	Information Technology	188	$1,034,853	CPI
	Long Term Care - Grey Gables	560	$949,515	CPI
	Long Term Care - Lee Manor	725	$1,793,678	CPI
	Long Term Care - Rockwood Terrace	385	$1,101,165	CPI
	Planning	22	$59,485	CPI
	Provincial Offences	40	$47,059	CPI
	Sign Shop	5	$47,401	CPI
	Social and Family Service	142	$189,881	CPI
	Transportation	161	$4,891,531	CPI
		Total	$15,632,476	

Asset Condition

Figure 30 summarizes the average condition of the County's machinery and equipment using a combination of age and assessed condition. Overall, 48% of the County's non-paramedic machinery and equipment assets are in poor to very poor condition. All essential paramedic services assets, including defibrillators, stair chairs, and stretchers were in good to very good condition, based on age.

Figure 30 Asset Condition: Machinery and Equipment



Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs can vary significantly within an asset category, from several years to many decades. The County's machinery and equipment assets portfolio contains nearly 150 different components, or asset types, each with its own EUL. The data presented here is shown at the segment level.

Table 41 Estimated Useful Life (EUL) Data: Machinery and Equipment

Asset Category	Asset Segment	Estimated Useful Life (EUL) in Years
Machinery and Equipment	Child Care	3-5
	EMS	4-10
	General Government	3-20
	Grey Roots	3-40
	Housing	3
	Information Technology	3-15
	Long Term Care - Grey Gables	3-20
	Long Term Care - Lee Manor	3-30

Asset Category	Asset Segment	Estimated Useful Life (EUL) in Years
	Long Term Care - Rockwood Terrace	3-30
	Planning	3-15
	Provincial Offences	3-15
	Sign Shop	3-10
	Social and Family Service	3-15
	Transportation	3-40

For additional context, Figure 31 compares the average EUL for each segment against its average age. Both values are weighted by the replacement cost of each asset.

Figure 31 Average Age and Average Useful Life: Machinery and Equipment

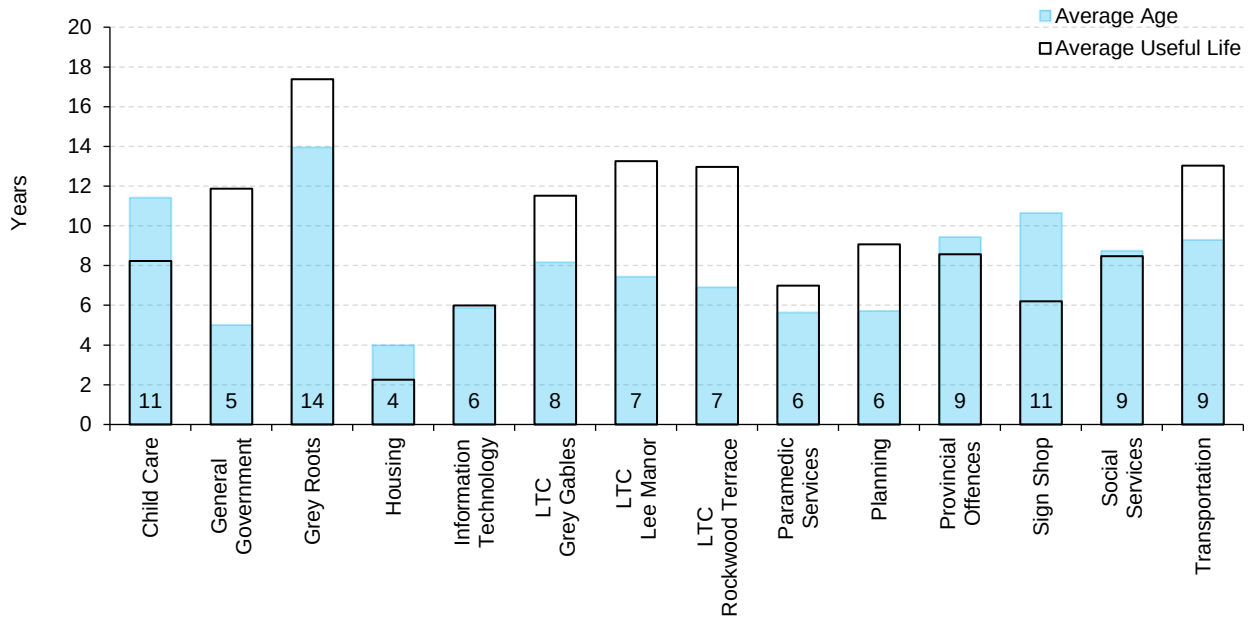
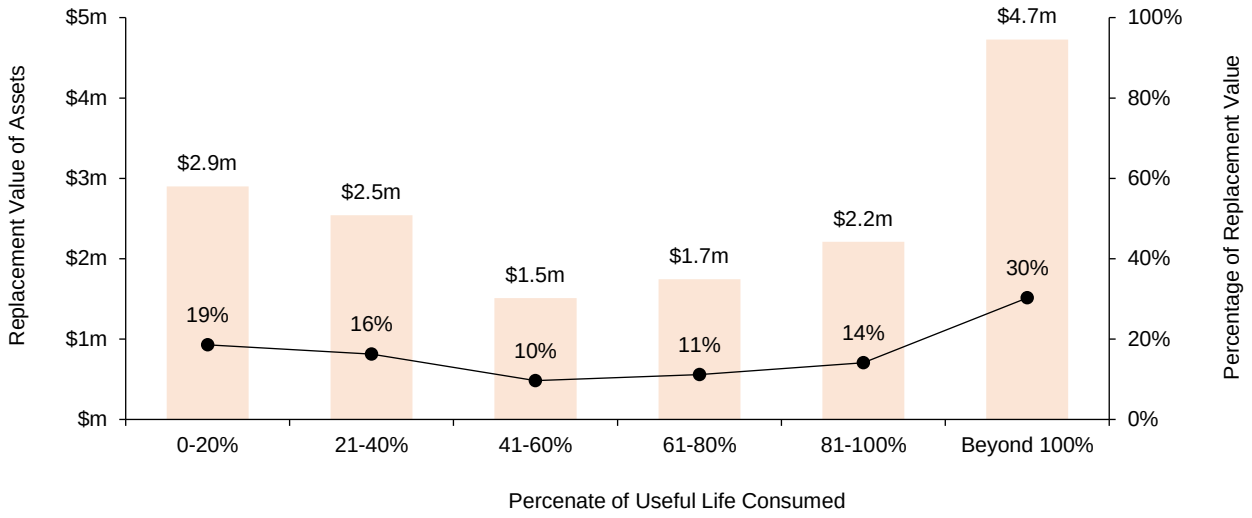


Figure 32 shows that approximately 30% of the County's machinery and equipment assets, valued at $4.7 million remain in operation beyond their estimated useful life.

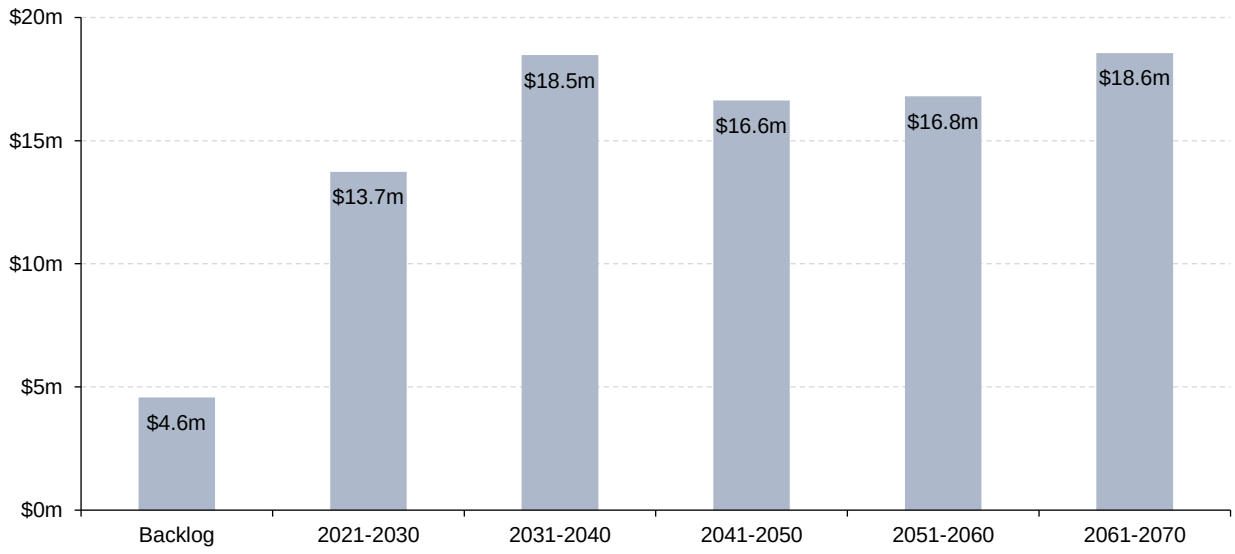
Figure 32 Percentage of Useful Life Consumed: Machinery and Equipment



Projected Capital Replacement Needs

Figure 33 summarizes the capital replacement requirements for the County's machinery and equipment assets from 2021 to 2070. The chart also illustrates a small backlog of approximately $4.6 million. The largest forecasted spike in capital spending is expected to take place in 2031-2040, totalling more than $18.5 million.

Figure 33 Projected Replacement Need: Machinery and Equipment



Approach to Condition Assessments

Machinery and equipment undergo annual inspections. Their condition and operability is assessed using a weighted point system based on hours, utilization, condition and repair costs.

Lifecycle Analysis

Small machinery and equipment typically do not require sophisticated lifecycle strategies. Manufacturers' recommendations on preventative maintenance are followed to maximize the lifespan of assets. Staff provided data on machinery and equipment strategies for the County's information technology assets, as outlined in Table 42 and Table 43. Lifecycle strategies for major equipment and vehicles are outlined in the vehicles section of this report.

Regulated equipment, such as defibrillators, stair chairs, and stretchers follow their own replacement cycles. Defibrillators are replaced every seven years; stretchers with a power load are disposed of after 10 years, as are stair chairs.

Table 42 Lifecycle Strategies: Information Technology Equipment

Event Name	Event Class	Event Range / Trigger	Impact	Cost
Computer / Server Replacement	Replacement	5 – 7 years	100% condition	Variable
Inspections	Maintenance	Variable	Performance check	N/A
Patching	Maintenance	Monthly - Quarterly	Improve performance	N/A
Software Base Monitoring	Maintenance	Continual	Improve Performance	N/A

Table 43 Lifecycle Strategies: Information Technology Communication Towers

Event Name	Event Class	Event Range / Trigger	Impact	Cost
Inspections	Maintenance	Every 3 years	Performance check	N/A
Routine Maintenance (galvanizing, tension on guide wires, antennas, safety)	Maintenance	Dependant on Inspections	Improve performance	Varies
Structural Assessment (condition, loading, Geotech, etc.)	Maintenance	Every 5 years	Improve Performance	Varies

SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements for the County's machinery and equipment are illustrated in Table 44. These investments are needed in order to maintain existing levels of service and keep infrastructure in state of good repair.

Table 44 10-Year Annual Capital Requirements: Machinery and Equipment

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Machinery & Equipment	$388,540	$1,098,470	$939,993	$1,428,773	$1,097,974	$2,618,873	$1,131,618	$1,909,224	$1,973,237	$1,141,442

Vehicles

Category Overview

Table 45 summarizes the quantity and cost of the County's vehicles portfolio by segment. In total, vehicles were valued at $11.8 million as of 2020. The table only summarizes assets that are currently managed in CityWide™, the County's asset management system.

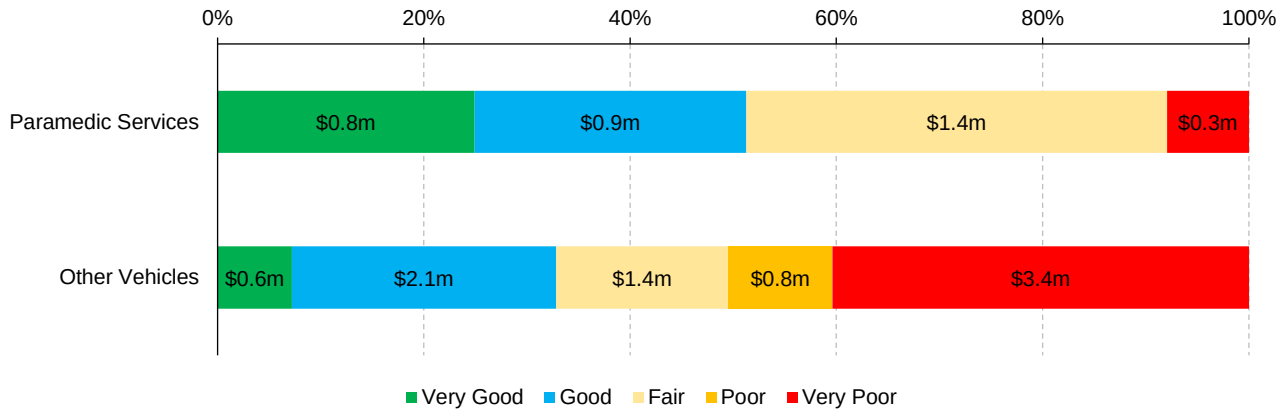
Table 45 Category Overview: Vehicles

Category	Segment	Quantity	Replacement Cost	Costing Method
Vehicles	Paramedic Services	23	$3,383,962	CPI
	General Government	1	$24,030	CPI
	Social Services	3	$125,575	CPI
	Transportation	53	$8,226,134	CPI
		Total	$11,759,701	CPI

Asset Condition

Figure 34 summarizes the average condition of the County's vehicles, based on a combination of age and assessed condition data. Overall, 48% of the County's non-paramedic vehicles assets are in poor to very poor condition. Currently, based on age-data only, the condition of two paramedic services vehicles is estimated to be very poor. Both Asset IDs 3558, an ambulance, and 3559, a duty supervisor vehicle, were placed into service in 2013, and have exceeded their estimated useful life. However, actual condition of ambulances is strictly maintained by staff to ensure patient health, safety, and security.

Figure 34 Asset Condition: Vehicles



Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs for the County's vehicles assets varied from five to 15 years; most assets have an EUL of 5-7 years.

Table 46 Estimated Useful Life, Asset Age, and Service Life Remaining in Years: Vehicles

Asset Category	Segment	Estimated Useful Life (EUL) in Years
Machinery and Equipment	Paramedic Services	5-15
	General Government	5
	Social Services	5/6
	Transportation	7-12

For additional context, Figure 35 compares the average EUL for each vehicle type against its average age. Both values are weighted by the replacement cost of each asset.

Figure 35 Average Age and Average Useful Life: Vehicles

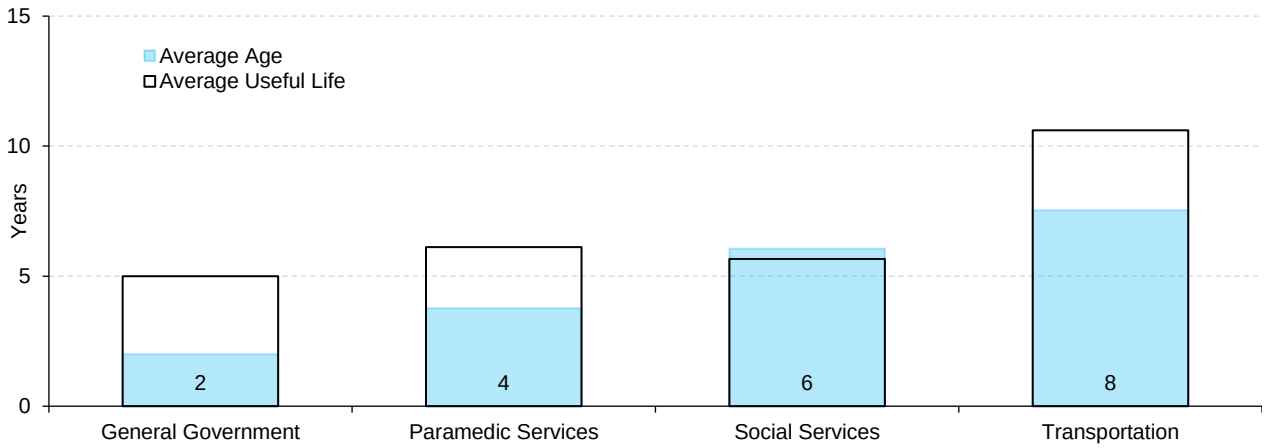
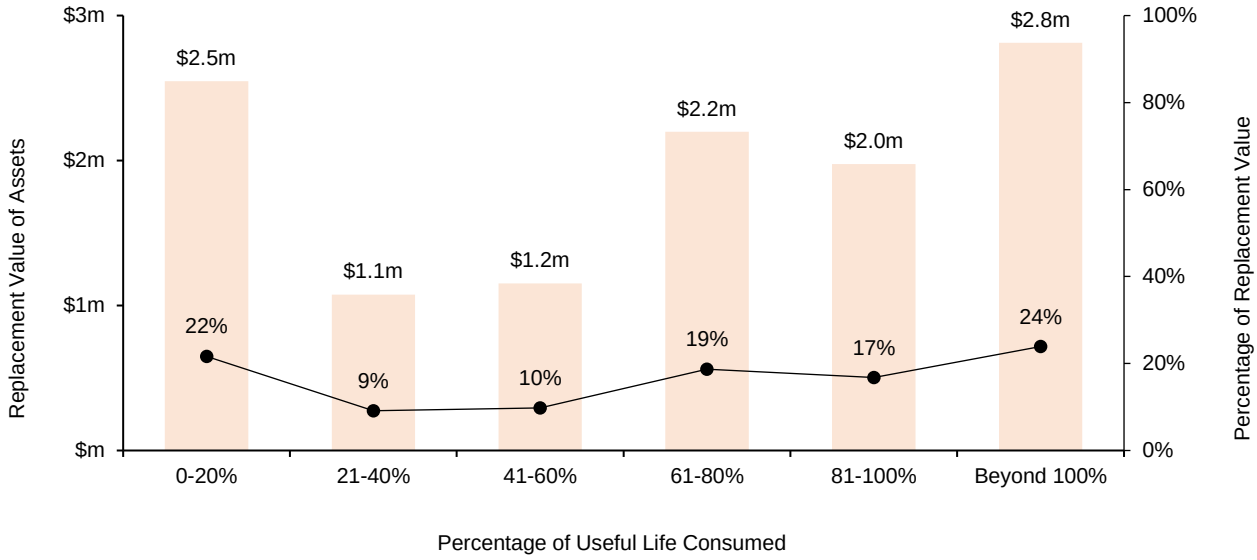


Figure 36 shows that approximately 24% of the County's vehicles assets, valued at $2.8 million remain in operation beyond their estimated useful life.

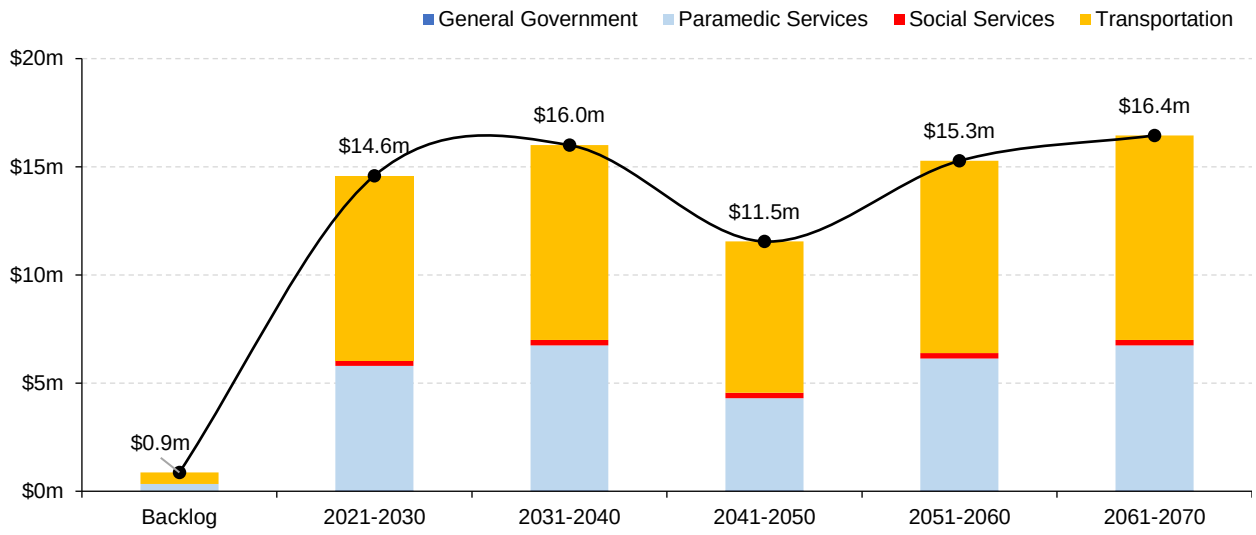
Figure 36 Percentage of Useful Life Consumed: Vehicles



Projected Capital Replacement Needs

Figure 37 summarizes the capital replacement requirements for the County's vehicles assets from 2021 to 2070. The chart also illustrates a small backlog of approximately $0.9 million. The County is expected to require consistent investments in its vehicles in each of the next five decades.

Figure 37 Projected Replacement Need: Vehicles



Approach to Condition Assessments

Machinery, equipment, and vehicles undergo annual inspections. Their overall state and operability are assessed using a weighted point system based on hours, utilization, condition, and repair costs.

Lifecycle Analysis

Lifecycle strategies for the County's vehicles assets vary based on vehicle type. Staff provided lifecycle activities for light duty, medium duty, and heavy duty vehicles. Regulated vehicles such as ambulances are replaced on a six year cycle.

The replacement of paramedic services vehicles is strictly guided by provincial regulations. Ambulances have a six year lifespan; community paramedic vehicles are kept for seven years; and duty supervisor vehicles are replaced every five years. Paramedic vehicles also undergo routine maintenance at established intervals, i.e., the earlier of every 10,000 kilometers or every three months.

Table 47 Lifecycle Strategies: Light Duty Vehicles

Event Name	Event Class	Event Range / Trigger	Impact	Cost
Daily Inspections	Maintenance	Daily	None	NA
Annual Inspection	Maintenance	Annual	None	NA
Routine Maintenance	Maintenance	Every 7,000 km (non-Paramedic)	Maintains Condition	NA
Sandblasting / Painting / Coating	Preventative Maintenance	Annually	Maintains Condition	NA
Component Rebuild	Rehabilitation	Per findings of annual inspection	10% - 25% added condition	NA
Disposal & Replacement	Replacement	End of Life	100% condition	NA

Table 48 Lifecycle Strategies: Medium Duty Vehicles

Event Name	Event Class	Event Range / Trigger	Impact	Cost
Daily Inspections	Maintenance	Daily	None	NA
Annual Inspection	Maintenance	Annual	None	NA
Routine Maintenance	Maintenance	Every 400 hours	Maintains Condition	NA
Sandblasting / Painting / Coating	Preventative Maintenance	Annually	Maintains Condition	NA
Component Rebuild	Rehabilitation	Per findings of annual inspection	10% - 25% added condition	NA
Disposal & Replacement	Replacement	End of Life	100% condition	NA

Table 49 Lifecycle Strategies: Heavy Duty Vehicles

Event Name	Event Class	Event Range / Trigger	Impact	Cost
Daily Inspections	Maintenance	Daily	None	NA
Annual Inspection	Maintenance	Annual	None	NA
Routine Maintenance	Maintenance	Every 250 hours	Maintains Condition	NA
Sandblasting / Painting / Coating	Preventative Maintenance	Annually	Maintains Condition	NA
Component Rebuild	Rehabilitation	Based on inspection	10% - 25% added condition	NA
Disposal & Replacement	Replacement	End of Life	100% condition	NA

SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements for the County's vehicles are illustrated in Table 50. These investments are needed in order to maintain existing levels of service and keep infrastructure in state of good repair.

Table 50 10-Year Annual Capital Requirements: Vehicles

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Vehicles	$2,121,980	$3,092,450	$855,824	$656,816	$1,143,892	$419,248	$1,199,237	$3,740,014	$598,999	$760,158

Land Improvements

Category Overview

Table 51 summarizes the quantity and cost of the County's land improvements portfolio by segment. In total, land improvements were valued at $3.3 million as of 2020.

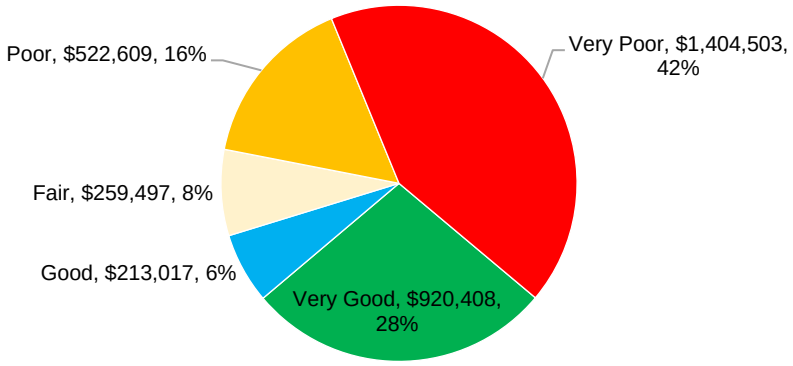
Table 51 Category Overview: Land Improvements

Category	Segment	Quantity	Replacement Cost	Costing Method
Land Improvements	Child Care	1	$28,469	CPI
	Paramedic Services	1	$58,233	CPI
	General Government	9	$950,287	CPI
	Grey Roots	3	$681,012	CPI
	Long Term Care - Grey Gables	3	$496,036	CPI
	Long Term Care - Lee Manor	5	$530,341	CPI
	Long Term Care - Rockwood Terrace	1	$56,135	CPI
	Transportation (Parking Lots)	4	$519,521	CPI
		Total	$3,320,034	CPI

Asset Condition

Figure 38 summarizes the average age-based condition of the County's land improvement assets. Overall, 58% of the assets are in poor to very poor condition. The County's upcoming Building Conditions Assessment (BCA) will provide a more accurate assessment of various land improvements assets, including parking lots, landscaping, fencing, and exterior lights.

Figure 38 Asset Condition: Land Improvements



Age Profile

An asset's age profile comprises two key values: estimated useful life (EUL), or design life; and the percentage of EUL consumed. The EUL is the recommended or industry-standard serviceable lifespan of an asset during which it can continue to fulfil its intended purpose and provide value to users, safely and efficiently.

As assets age, their performance diminishes, often more rapidly as they approach the end of their design life. EULs can vary significantly within an asset category, from several years to many decades. The County's land improvements assets contained a variety of assets, including signs, lighting, landscaping, and parking lots. As a result, EUL data has a wide range.

Table 52 Estimated Useful Life (EUL) Data: Land Improvements

Asset Category	Segment	Estimated Useful Life (EUL) in Years
Land Improvements	Child Care	40
	Paramedic Services	25
	General Government	8-20
	Grey Roots	20/25
	Long Term Care - Grey Gables	20
	Long Term Care - Lee Manor	20-29
	Long Term Care - Rockwood Terrace	52
	Transportation	40-81

For additional context, Figure 39 compares the average EUL for each segment against its average age. Both values are weighted by the replacement cost of each asset.

Figure 39 Average Age and Average Useful Life: Land Improvements

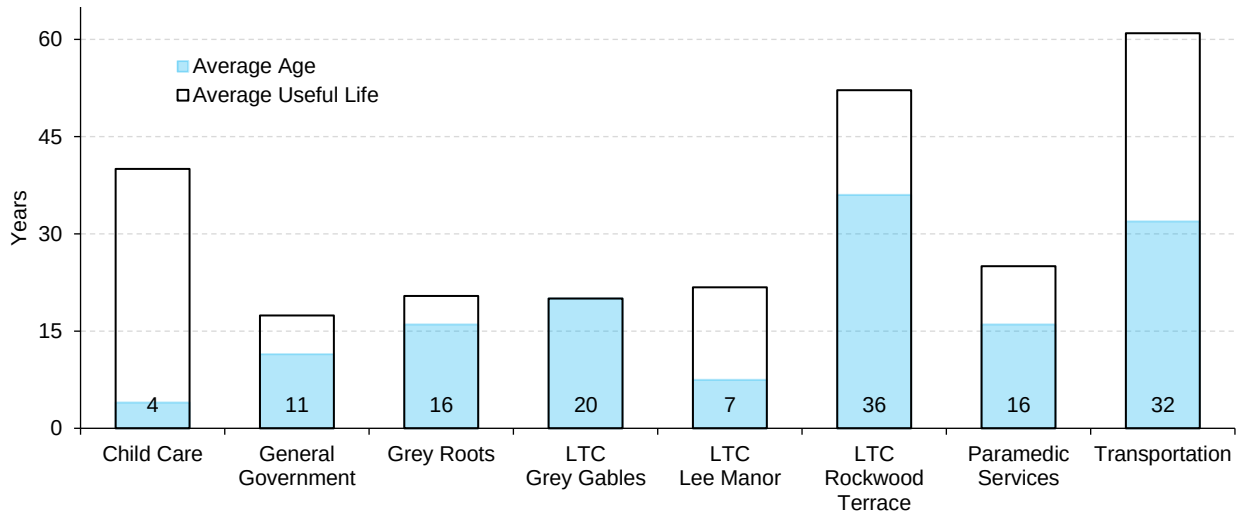
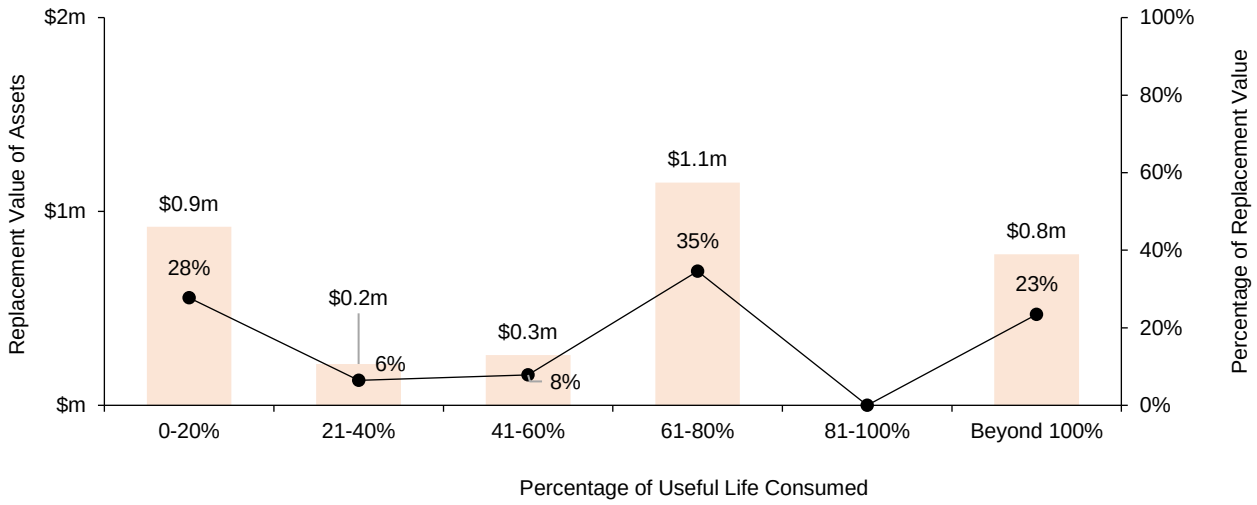


Figure 40 shows that approximately 23% of the County's land improvements assets, valued at $0.8 million remain in operation beyond their estimated useful life.

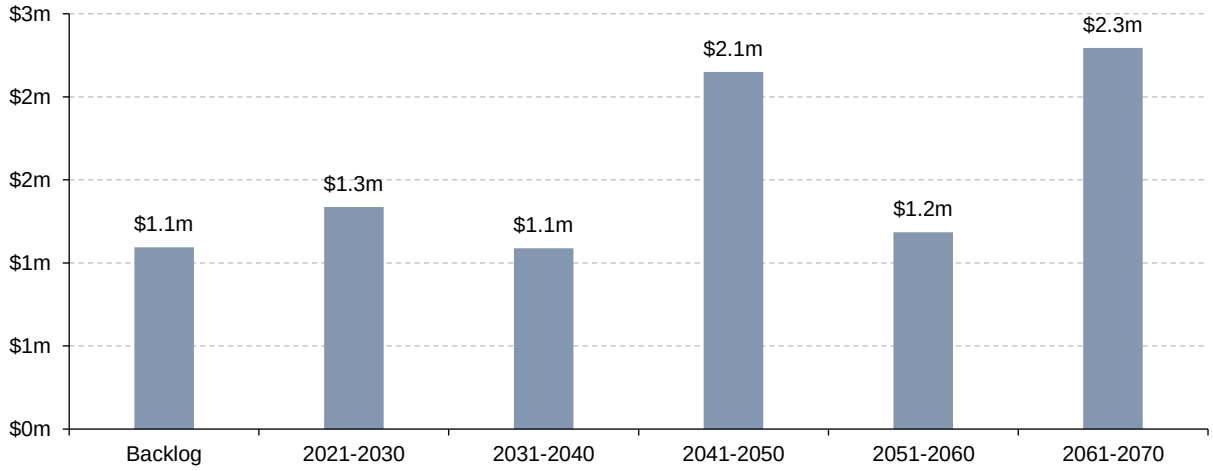
Figure 40 Percentage of Useful Life Consumed: Land Improvements



Projected Capital Replacement Needs

Figure 41 summarizes the capital replacement requirements for the County's land improvements assets from 2021 to 2070. The chart also illustrates a small backlog of approximately $1.1 million. The County's BCA will provide a more accurate estimate of deferred replacement and projected replacement needs.

Figure 41 Projected Replacement Need: Land Improvements



Approach to Condition Assessments

Please see the buildings and facilities section of this report.

Lifecycle Analysis

Land improvements are included in the buildings and facilities condition assessments, which will guide upcoming lifecycle activities and their associated costs.

SYSTEM GENERATED 10-YEAR CAPITAL REQUIREMENTS

Derived from CityWide™, the 10-year capital cost requirements for the County's land improvement assets are illustrated in Table 53. These investments are needed in order to keep infrastructure in state of good repair. These projections, along with the County's forthcoming BCAs, can be used to develop improved funding requirements estimates.

Table 53 10-Year Annual Capital Requirements: Land Improvements

Segment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Land Improvements	$0	$0	$0	$752,376	$0	$228,417	$0	$115,530	$113,713	$126,844

Risk and Criticality

Grey County's lowest asset management maturity score in its current state assessment was found in risk management. This is consistent across municipalities; risk assessments and management are typically confined to operations or field-level decision-making, and are not formally and systematically embedded into strategic capital investment decisions, or project prioritization frameworks.

Asset risk and criticality are essential building blocks of asset management and fundamental to producing comparative analyses of project business cases. An asset's risk profile should be a primary determinant in guiding spending decisions. In this section, we provide risk models and matrices that were built in close collaboration with County staff.

Why Risk and Criticality Assessments Matter

Risk or asset criticality, is a product of two variables: the probability that an asset will fail, and the resulting consequences of that failure event. It can be a qualitative measurement, (low, medium, high) or quantitative measurement (1-5), that can be used to rank assets and projects, identify appropriate lifecycle strategies, optimize short- and long-term budgets, minimize service disruptions, and maintain public health and safety. Our approach relies on a quantitative measurement of risk. The probability and consequence of failure are each scored from 1 to 5, producing a minimum risk index of 1 for the lowest risk assets, and a maximum risk index of 25 for the highest risk assets.

PROBABILITY OF FAILURE

Several factors can help decision-makers estimate the probability or likelihood of an asset's failure, including its condition, age, previous performance history, and exposure to extreme weather events, such as flooding and ice jams—both a growing concern for municipalities in Canada.

CONSEQUENCE OF FAILURE

Estimating criticality also requires identifying the types of consequences that the organization and community may face from an asset's failure, and the magnitude of those consequences. Consequences of asset failure will vary across the infrastructure portfolio; the failure of some assets may result primarily in high direct financial costs, but may pose limited risk to the community. Other assets may have a relatively minor financial value, but any downtime may pose significant health and safety hazards to the community.

Table 54 illustrates the various types of consequences that were integrated in developing risk and criticality models for each asset category and segments within. We note that these consequences are common, but not exhaustive.

Table 54 Asset Criticality: Consequences of Asset Failure

Type of Consequence	Description
Direct Financial	Direct financial consequences are typically measured as the replacement costs of the asset(s) affected by the failure event, including interdependent infrastructure.
Economic	Economic impacts of asset failure may include disruption to local economic activity and commerce, business closures, service disruptions, etc. Whereas direct financial impacts can be seen immediately or estimated within hours or days, economic impacts can take weeks, months and years to emerge, and may persist for even longer.
Socio-political	Socio-political impacts are more difficult to quantify, and may include inconvenience to the public and key community stakeholders, adverse media coverage, and reputational damage to the community and the municipality.
Environmental	Environmental consequences can include pollution, erosion, sedimentation, habitat damage, etc.
Public Health and Safety	Adverse health and safety impacts may include injury or death, or impeded access to critical services. The COVID-19 pandemic has also spotlighted the importance of maintaining essential equipment and facilities components to manage communicable diseases.
Strategic	These include the effects of an asset's failure on the community's long-term strategic objectives, including economic development, business attraction, etc.

Methodology

Grey County's risk and critically frameworks were developed in two stages. In stage one, we prepared preliminary or baseline models. In stage two, we refined the models based on staff feedback, and integrated them with CityWide™.

PRELIMINARY RISK MODELS

To develop preliminary risk models, we used two factors to estimate the probability of failure: asset condition and age. We assigned each factor a weighting out of 100% based on its ability to approximate likelihood of failure. For an asset's consequence of failure, we proposed several potential consequence types that were ranked, or weighted out of 100%, based on their respective potential to approximate asset criticality.

A challenge in developing such risk and criticality models is identifying valid, suitable data to help quantify the magnitude of these consequences; some consequences are easier to measure than others. Estimating the financial cost of an asset failure is simpler than estimating the reputational impact on the community and the organization. There is no standard, clear cut measurement that would approximate this. In such cases, we have proposed indirect measurements.

MODEL REFINEMENTS

In stage two, we hosted collaborative workshops with each department to review the preliminary models, and make necessary refinements. In most cases, staff offered important adjustments to how various consequences should be ranked and weighted. These models were built in CityWide™ and integrated with the County's asset inventory. The models are dynamic, and will automatically reflect any new attribute data that is loaded into the system. As a result, the risk matrices illustrated in this document will evolve over time, and likely become more accurate.

INTERPRETING THE MODELS

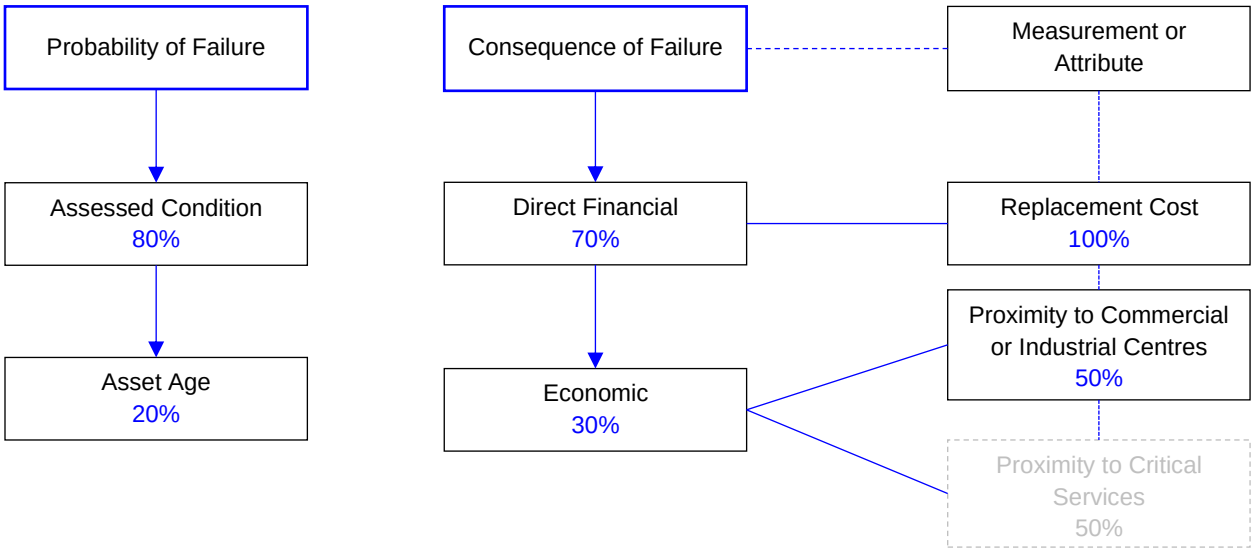
Figure 42 illustrates a typical, sample baseline risk model, relying on limited attribute data. In the model, two factors are used to estimate the probability of failure: assessed condition, and asset age. As assessed condition is considered a better indicator of an asset's performance and health, it is assigned a disproportionately high weighting of 80%. Asset age can also help predict failures and receives a weighting of 20%.

The consequence of failure for this asset, or asset type, includes two factors: direct financial, and economic. The asset is a substantial investment and expensive to replace. As such, the direct financial impact of its failure receives a weighting of 70%. Its failure is also expected to have an impact on the local economy. However, this impact isn't severe. As such, the economic consequence receives a relatively low weighting of 30%.

In this model, measuring the direct financial impact is simple, consisting only of the replacement value of the asset. However, measuring the scale or magnitude of indirect or economic consequences of failure is more complex. Unlike replacement costs, no singular value exists as a reliable estimate. As such, two asset attributes are used as alternative measurements, each with its own weighting: the proximity of the asset to commercial or industrial centres, and proximity to critical services. As both are considered equally important in estimating the magnitude of economic consequences, they each receive a weighting of 50%.

Much like replacement costs, asset size, material, length, these additional asset attributes require collection and input into the County's asset management database to be effective and reliable. If any attribute or measure required in the model is not available, the models developed in this report and built into CityWide™ will reweight the remaining attributes, or consequence of failure types.

Figure 42 Interpreting the Risk Models: Sample Model



Once factors for both the probability and consequences of failure have been identified, and the most suitable asset attributes have been selected, ranges for each factor and its associated attributes must be established to determine their respective position on a 1 to 5 scale. Once a score has been assigned for each factor and measurement, an asset's risk score can be determined by multiplying its individual score on probability and consequence. Assets with similar risk scores can then be classified on a risk matrix. Table 55 summarizes the average risk rating or score for each asset category.

Table 55 Average Risk Rating by Asset Category

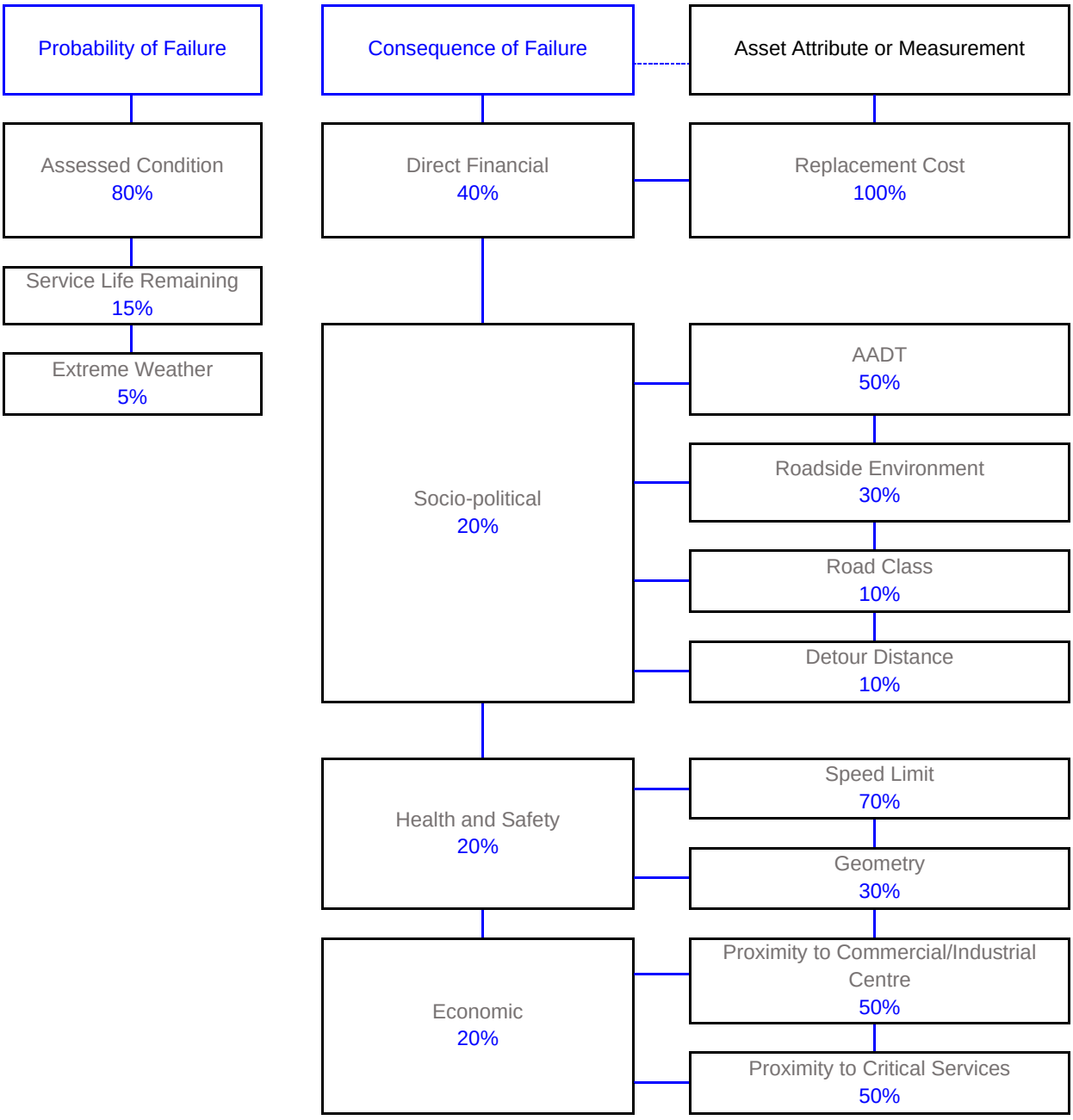
Category	Average Risk Rating (1-25)
Roads	6.2 – Moderate
Bridges and Culverts	13.6 – High
Buildings and Facilities	14.6 – Very High
Social Housing	13.7 – High
Machinery & Equipment	11.1 – High
Vehicles	10.9 – High
Land Improvements	15.4 – Very High

The following sections provide the risk and criticality analysis for each asset category. These models were developed in collaboration with staff.

Roads

Figure 43 illustrates the risk and criticality framework developed for Grey County's road network. Through discussion with staff, three factors were identified as informative for estimating the probability of failure. The direct financial impact of asset failure was identified as the most critical consequence, followed by socio-political, health and safety, and economic impacts.

Figure 43 Risk and Criticality Framework: Roads



ASSIGNING PROBABILITY OF FAILURE SCORE

Table 56 illustrates how each factor within the probability of failure can be scored along a range of 1 to 5. This rating can then be assigned to individual assets, or groups of assets.

Table 56 Scoring Probability of Failure Factor: Roads

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Pavement Condition Index (PCI)	75 – 100	1 – Rare
	55 – 75	2 – Unlikely
	30 – 55	3 – Possible
	10 – 30	4 – Likely
	0 – 10	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life	Greater than 20	1 – Rare
	10 – 20	2 – Unlikely
	5 – 10	3 – Possible
	1 – 5	4 – Likely
	0	5 – Almost Certain
Factor	Level	Probability of Failure Score
Extreme Weather Exposure	Minimal Exposure	1 – Rare
	Moderate Exposure	3 – Possible
	High Exposure	5 – Almost Certain

ASSIGNING CONSEQUENCE OF FAILURE SCORE

Table 57 illustrates how each factor under each consequence of failure can be scored along a range of 1 to 5. This rating can then be assigned to individual assets, or groups of assets.

Table 57 Scoring Consequence of Failure Factor: Roads

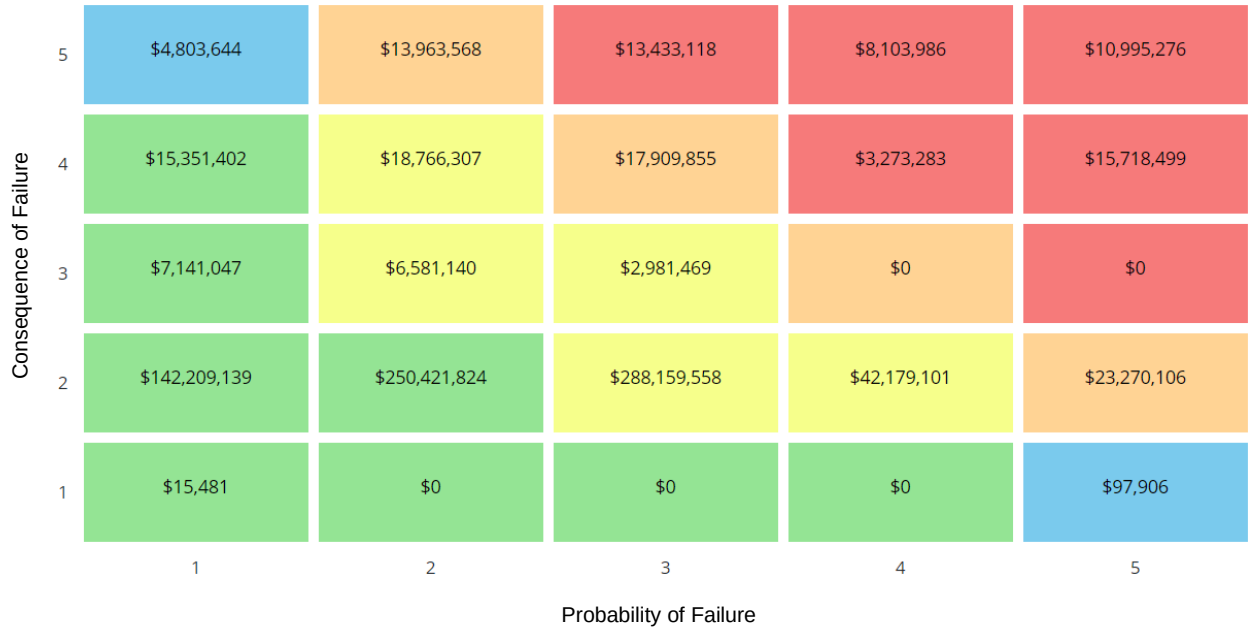
Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost ($/m)	$0 - $200	1 - Insignificant
	$200 - $400	2 – Minor
	$400 - $600	3 – Moderate
	$600 - $1,000	4 – Major
	Greater than $1,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Roadside Environment	Rural	1 - Insignificant
	Semi-Urban	3 - Moderate
	Urban	5 - Severe
Socio-political	Type	Consequence of Failure Score
Average Annual Daily Traffic (AADT)	0 – 1,000	1 - Insignificant
	1,000 – 2,500	2 - Minor
	2,500 – 5,000	3 - Moderate
	5,000 – 10,000	4 - Major
	Greater than 10,000	5 - Severe
Socio-political	Type	Consequence of Failure Score
Road Class	Local	1 - Insignificant
	Local Commercial / Industrial	2 - Minor
	Collector	3 - Moderate
	Collector Commercial / Industrial	4 - Major
	Arterial	5 – Severe
Health and Safety	Type	Consequence of Failure Score
Speed Limit (km/hr)	Less than 50	1 - Insignificant
	50 - 59	2 - Minor
	60 - 79	3 - Moderate
	80 - 89	4 - Major
	90 and Greater	5 – Severe

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Economic	Value	Consequence of Failure Score
Proximity to Commercial or Industrial Centres	More than 10km	1 - Insignificant
	5km – 10km	3 - Moderate
	Less than 5km	5 - Severe
Economic	Value	Consequence of Failure Score
Proximity to Critical Services	None	1 - Insignificant
	Schools & Long-term care (5 – 10 km)	2 - Minor
	Emergency – Hospitals, Police, Fire (5 – 10 km)	3 - Moderate
	Schools & Long-term care (0 – 5 km)	4 - Major
	Emergency – Hospitals, Police, Fire (0 – 5 km)	5 - Severe

RISK MATRIX

Based on the above criteria and reflecting available data attribute data, Figure 44 represents the risk matrix developed for the County's roads assets. The x-axis represents the probability of failure, scored from 1 to 5; similarly, the y-axis represents the consequence of failure, also scored from 1 to 5. The matrix shows that based on age, assessed condition, and replacement costs, approximately $11 million of roads assets are in the highest risk classification. As staff collect additional attribute data, assets may be reclassified and regrouped based on their new risk scores.

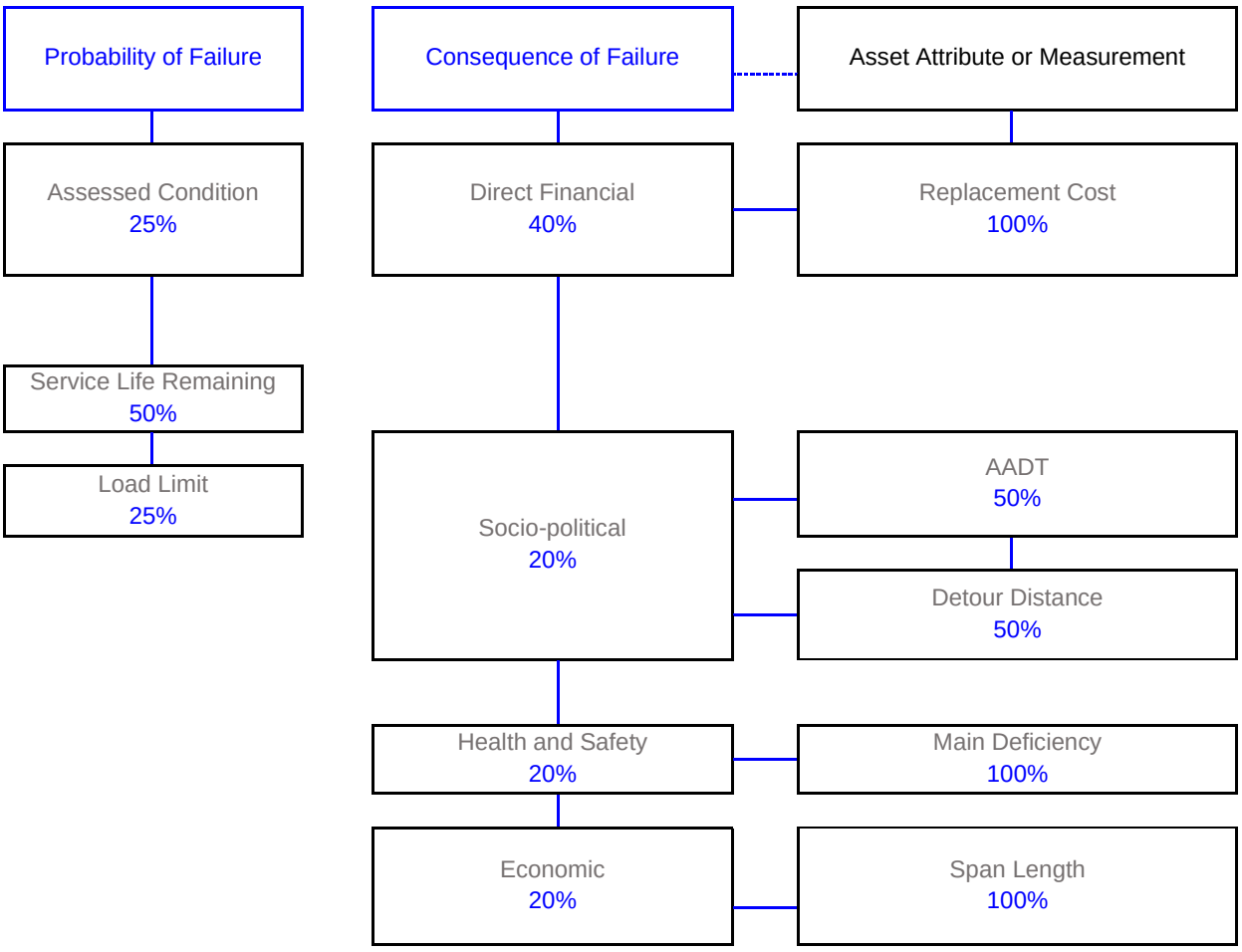
Figure 44 Risk Matrix: Roads



Bridges and Culverts

Figure 45 illustrates the risk and criticality framework developed for the Grey County's bridges and culverts. Through discussion with staff, three factors were identified as informative for estimating the probability of failure. The direct financial impact of asset failure was identified as the most critical consequence, followed by socio-political, health and safety, and economic impacts.

Figure 45 Risk and Criticality Framework: Bridges and Culverts



ASSIGNING PROBABILITY OF FAILURE SCORE

Table 58 illustrates how each factor within the probability of failure can be scored along a range of 1 to 5. This rating can then be assigned to individual assets, or groups of assets.

Table 58 Scoring Probability of Failure Factor: Bridges and Culverts

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Bridge Condition Index (BCI)	80 – 100	1 – Rare
	60 – 80	2 – Unlikely
	40 – 60	3 – Possible
	20 – 40	4 – Likely
	0 – 20	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life	Greater than 40	1 – Rare
	10 – 40	2 – Unlikely
	5 – 10	3 – Possible
	1 – 5	4 – Likely
	0	5 – Almost Certain
Factor	Tonnes	Probability of Failure Score
Load Limit	Greater than 25	1 – Rare
	25 - 20	2 – Unlikely
	20 - 15	3 – Possible
	15 - 6	4 – Likely
	5 and Under	5 – Almost Certain

ASSIGNING CONSEQUENCE OF FAILURE SCORE

Table 59 illustrates how each factor under each consequence of failure can be scored along a range of 1 to 5. This rating can then be assigned to individual assets, or groups of assets.

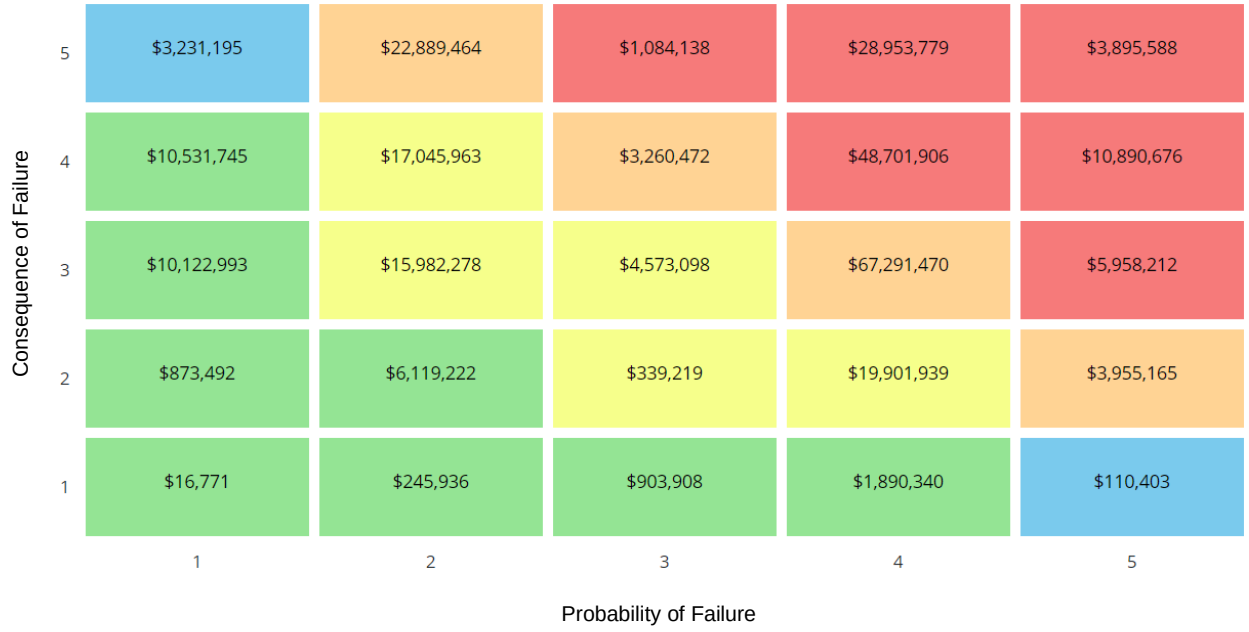
Table 59 Scoring Consequence of Failure Factor: Bridges and Culverts

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost ($/m)	$0 - $100,000	1 - Insignificant
	$100,000 - $600,000	2 – Minor
	$600,000 - $1,000,000	3 – Moderate
	$1,000,000 - $3,000,000	4 – Major
	Greater than $3,000,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Detour Distance (km)	Less than 1	1 - Insignificant
	1 - 5	2 - Minor
	5 - 10	3 - Moderate
	10 - 15	4 - Major
	Greater than 15	5 - Severe
Socio-political	Type	Consequence of Failure Score
Average Annual Daily Traffic (AADT)	0 – 1,000	1 - Insignificant
	1,000 – 2,500	2 - Minor
	2,500 – 5,000	3 - Moderate
	5,000 – 10,000	4 - Major
	Greater than 10,000	5 - Severe
Health and Safety	Type	Consequence of Failure Score
Main Deficiency	Rough Riding Surface	1 - Insignificant
	Minor Defect	2 - Minor
	Settlement / Movement	3 - Moderate
	Excessive Deformation	4 - Major
	Carrying Capacity or Pedestrian Vehicle Hazard	5 – Severe
Economic	Length	Score
Span Length (m)	Less than 2m	1 - Insignificant
	2m – 5m	2 - Minor
	5m – 8m	3 - Moderate
	8m – 10m	4 - Major
	Greater than 10m	5 – Severe

RISK MATRIX

Based on the above criteria and available attribute data, Figure 46 represents the risk matrix developed for the County's bridges and culverts assets. The x-axis represents the probability of failure, scored from 1 to 5; similarly, the y-axis represents the consequence of failure, also scored from 1 to 5. The matrix shows that based on age, assessed condition, and replacement costs, approximately $3.9 million of bridges and culverts assets are in the highest risk classification. As staff collect additional attribute data, assets may be reclassified and regrouped based on their new risk scores.

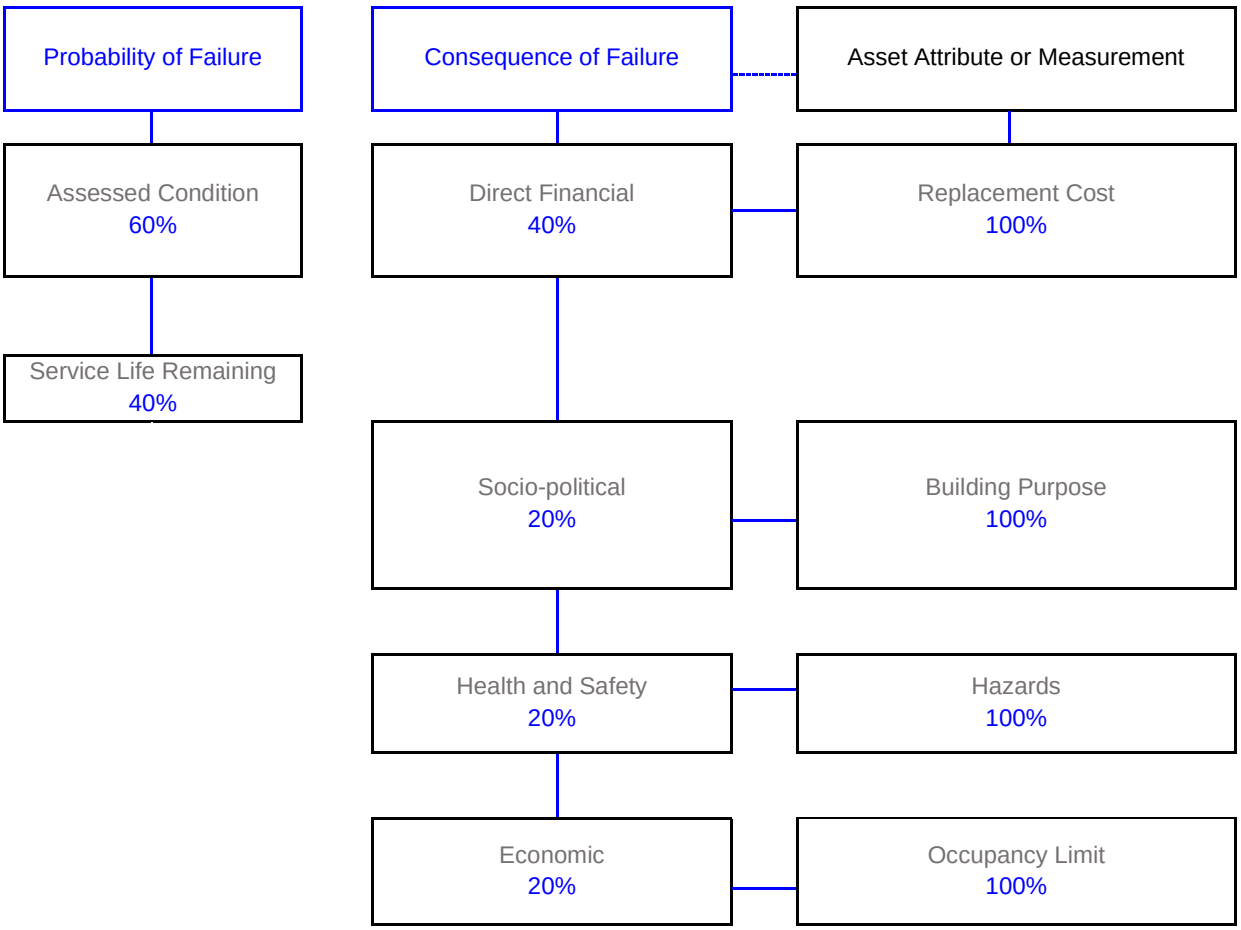
Figure 46 Risk Matrix: Bridges and Culverts



Buildings and Facilities

Given the variety of buildings and facilities under the County's purview, we developed several risk and criticality models, beginning with a more generic one that applies to most facilities in the portfolio, including social housing. Models specific to Grey Roots Museum and the County's long term care facilities are also developed.

Figure 47 Risk and Criticality Framework: Buildings and Facilities - General



ASSIGNING PROBABILITY OF FAILURE SCORE

Table 60 illustrates how each factor within the probability of failure can be scored along a range of 1 to 5. This rating can then be assigned to individual assets, or groups of assets.

Table 60 Scoring Probability of Failure Factor: Buildings and Facilities – General

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Assessed Condition	80 – 100	1 – Rare
	60 – 80	2 – Unlikely
	40 – 60	3 – Possible
	20 – 40	4 – Likely
	0 – 20	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life Remaining	Greater than 40	1 – Rare
	10 – 40	2 – Unlikely
	5 – 10	3 – Possible
	1 – 5	4 – Likely
	0	5 – Almost Certain

ASSIGNING CONSEQUENCE OF FAILURE SCORE

Table 61 illustrates how each factor under each consequence of failure can be scored along a range of 1 to 5. This rating can then be assigned to individual assets, or groups of assets.

Table 61 Scoring Consequence of Failure Factor: Buildings and Facilities - General

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $100,000	1 - Insignificant
	$100,000 - $600,000	2 – Minor
	$600,000 - $1,000,000	3 – Moderate
	$1,000,000 - $5,000,000	4 – Major
	Greater than $5,000,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Building Purpose	Storage	1 - Insignificant
	Community Centre / Tourism	2 - Minor
	Museum / Social Housing	3 - Moderate
	Transportation / Municipal Administration	4 - Major
	Ambulance & Health; Social Housing	5 - Severe
Health and Safety	Type	Consequence of Failure Score
Hazards	Minor Hazards	1 - Insignificant
	Trip/Height Hazards	2 - Minor
	Operating Machinery	3 - Moderate
	Hazardous Materials (e.g., asbestos, radon)	5 - Severe
Economic	Type	Consequence of Failure Score
Occupancy Limit	Less than 10	1 - Insignificant
	10 - 20	2 - Minor
	20 - 50	3 - Moderate
	50 - 100	4 - Major
	More than 100	5 – Severe

Figure 48 Risk and Criticality Framework: Buildings and Facilities – Long Term Care

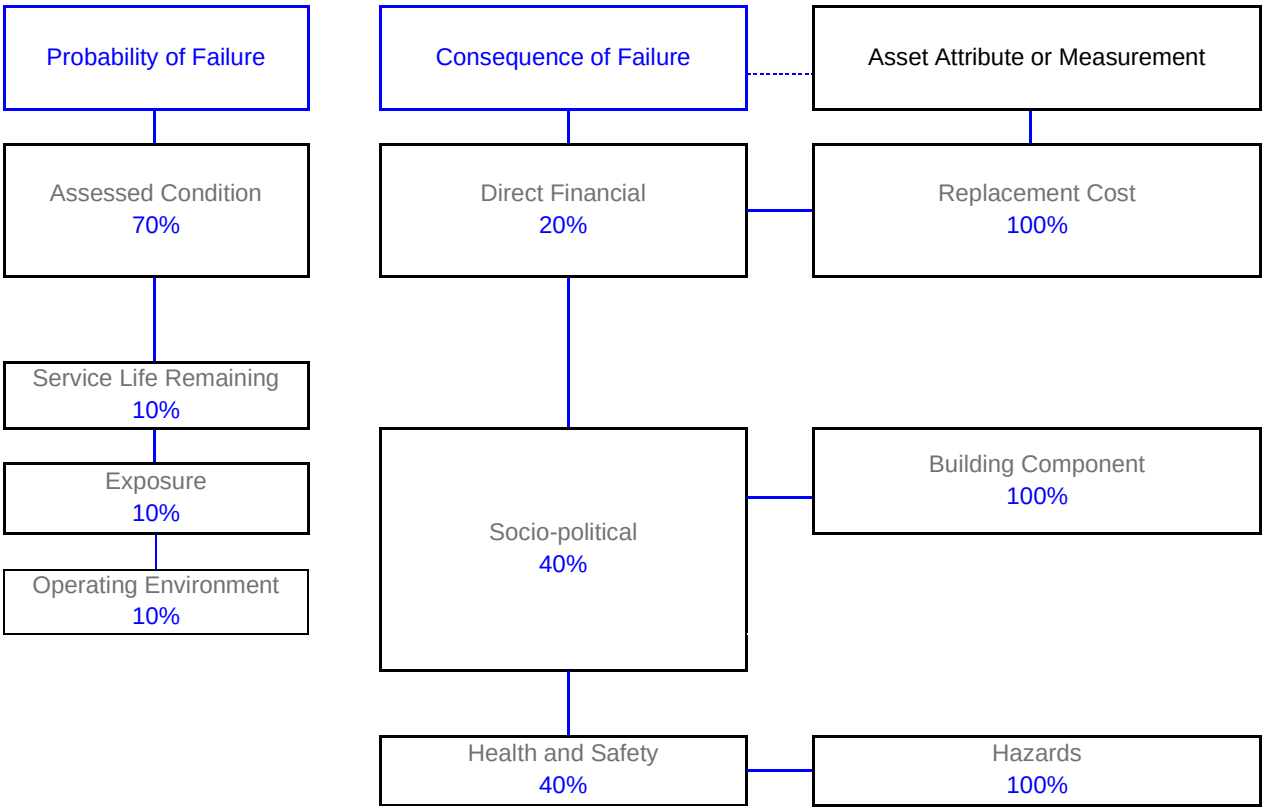


Table 62 Scoring Probability of Failure Factor: Buildings and Facilities – Long Term Care

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Assessed Condition	80 – 100	1 – Rare
	60 – 80	2 – Unlikely
	40 – 60	3 – Possible
	20 – 40	4 – Likely
	0 – 20	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life Remaining	Greater than 40	1 – Rare
	10 – 40	2 – Unlikely
	5 – 10	3 – Possible
	1 – 5	4 – Likely
	0	5 – Almost Certain
Factor	Component Type	Probability of Failure Score
Exposure to Elements	Interior	1 – Rare
	Rooftop Units, Windows, Chillers	5 – Almost Certain
Factor	Type	Probability of Failure Score
Operating Environment	Automated	1 – Rare
	Manual	5 – Almost Certain

Table 63 Scoring Consequence of Failure Factor: Buildings and Facilities – Long Term Care

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $100,000	1 - Insignificant
	$100,000 - $600,000	2 – Minor
	$600,000 - $1,000,000	3 – Moderate
	$1,000,000 - $5,000,000	4 – Major
	Greater than $5,000,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Building Component	Cosmetics	1 - Insignificant
	Ergonomics/Accessibility	2 - Minor
	Building Shell	3 - Moderate
	Climate Control	4 - Major
	Air Handling/Quality, Disinfection/Filtration	5 - Severe
Health and Safety	Type	Consequence of Failure Score
Hazards	Minor Hazards	1 - Insignificant
	Hazardous Materials (e.g. asbestos)	2 - Minor
	Room Spacing / Design	3 - Moderate
	Trip / Lighting	5 - Severe

Table 64 Risk and Criticality Framework: Buildings and Facilities – Grey Roots Museum

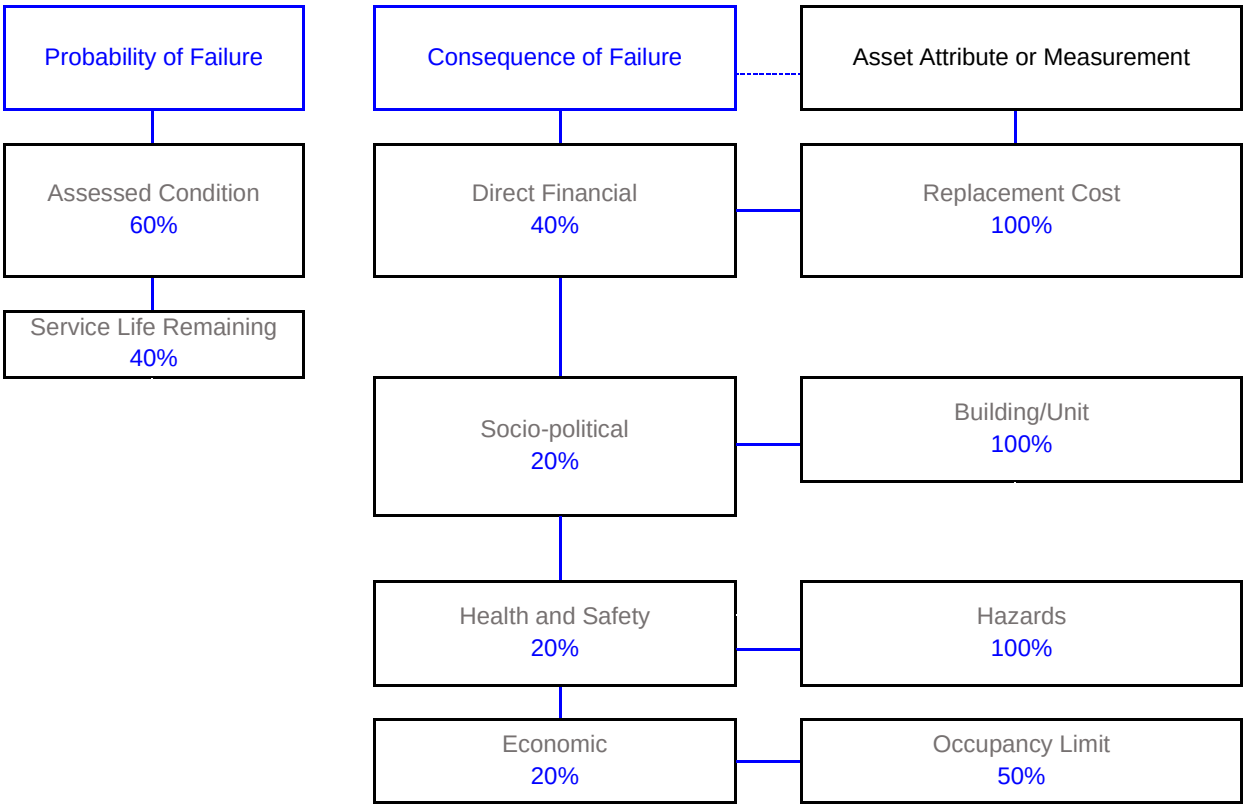


Table 65 Scoring Probability of Failure Factors: Buildings and Facilities – Grey Roots Museum

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Assessed Condition	80 – 100	1 – Rare
	60 – 80	2 – Unlikely
	40 – 60	3 – Possible
	20 – 40	4 – Likely
	0 – 20	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life Remaining	Greater than 40	1 – Rare
	10 – 40	2 – Unlikely
	5 – 10	3 – Possible
	1 – 5	4 – Likely
	0	5 – Almost Certain

Table 66 Scoring Consequence of Failure Factor: Buildings and Facilities – Grey Roots Museum

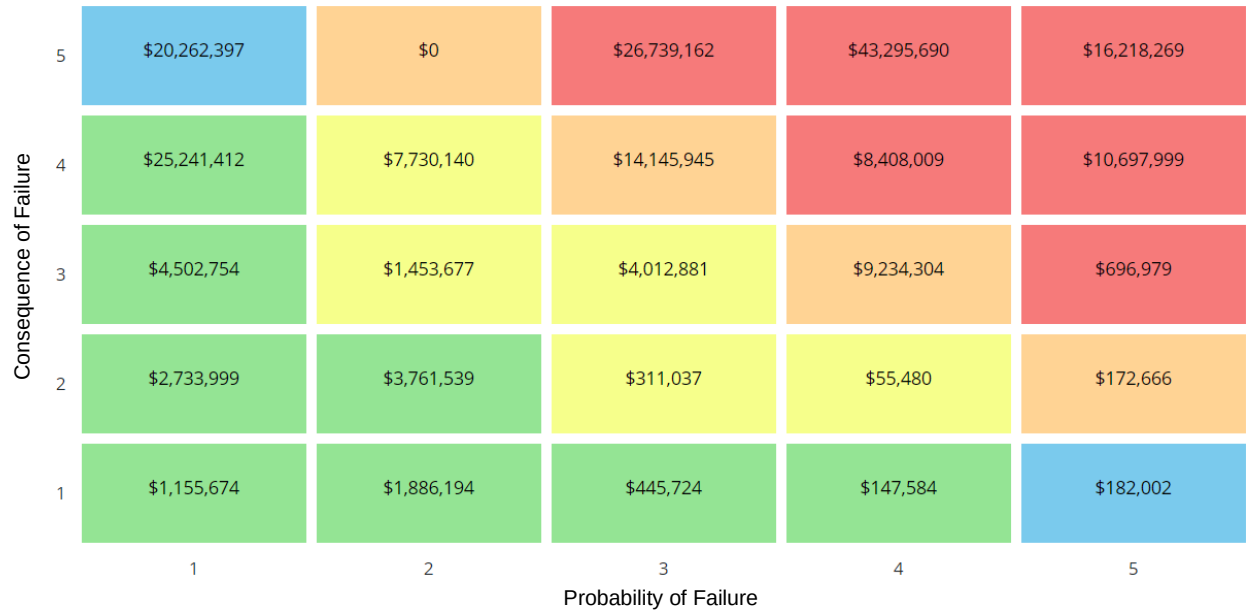
Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $250,000	1 – Insignificant
	$250,000 - $1,000,000	2 – Minor
	$1,000,000 - $5,000,000	3 – Moderate
	$5,000,000 - $10,000,000	4 – Major
	Greater than $10,000,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Building/Unit	Minor Exhibit	1 – Insignificant
	Administration	2 – Minor
	Storage	3 – Moderate
	Exhibit / Workshop	4 – Major
	Main Gallery Exhibit	5 – Severe
Health and Safety	Type	Consequence of Failure Score
Hazards	Minor Hazards	1 – Insignificant
	Trip / Height Hazards	2 – Minor
	Operating Machinery	3 – Moderate
	Steam	4 – Major
	Hazardous Materials (e.g. asbestos, radon)	5 – Severe
Economics	Range	Consequence of Failure Score
Average Visitors per day	Less than 50	1 – Insignificant
	50 - 100	2 – Minor
	100 - 150	3 – Moderate
	150 - 200	4 – Major
	More than 200	5 – Severe

RISK MATRIX

Based on the above criteria and available attribute data, Figure 49 represents the risk matrix developed for the County's buildings and facilities assets, including social housing. The x-axis represents the probability of failure, scored from 1 to 5; similarly, the y-axis represents the consequence of failure, also scored from 1 to 5.

The matrix shows that based primarily on age and replacement costs, approximately $16.2 million of buildings, facilities, social housing, and land improvement assets are in the highest risk classification. As staff collect additional attribute data, assets may be reclassified and regrouped based on their new risk scores.

Figure 49 Risk Matrix: Buildings and Facilities, Social Housing, and Land Improvements



Machinery and Equipment

Similar to buildings and facilities, given the variety of machinery and equipment under the County's purview, we developed individual risk and criticality models for information technology and paramedic services.

Table 67 Risk and Criticality Framework: Machinery and Equipment – Information Technology

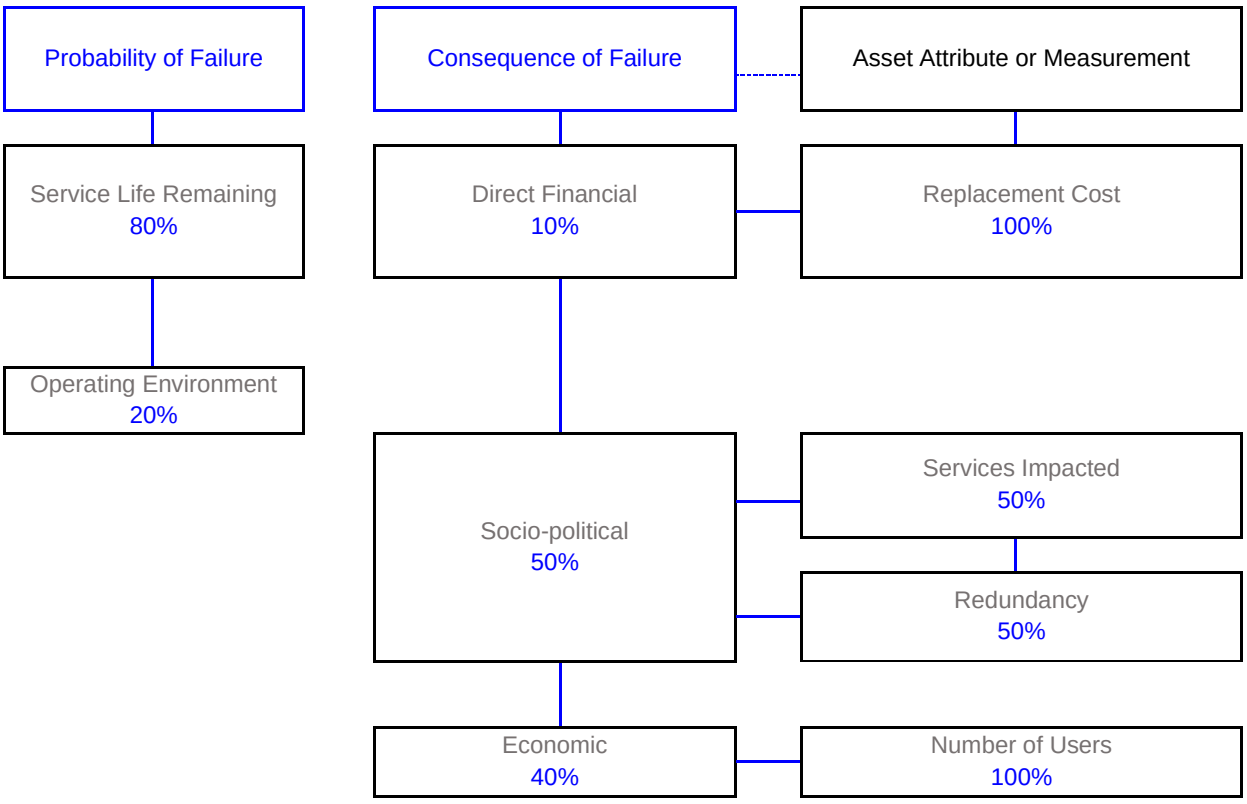


Table 68 Scoring Probability of Failure Factors: Machinery and Equipment – Information Technology

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Type	Probability of Failure Score
Operating Environment	Optimal Environment	1 – Rare
	Poor Cleanliness	3 – Possible
	Poor Temperature Control	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life Remaining	Greater than 5	1 – Rare
	4 – 5	2 – Unlikely
	2 – 3	3 – Possible
	1 – 2	4 – Likely
	Less than 1	5 – Almost Certain

Table 69 Scoring Consequence of Failure Factor: Machinery and Equipment – Information Technology

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $1,000	1 – Insignificant
	$1,000 - $5,000	2 – Minor
	$5,000 - $10,000	3 – Moderate
	$10,000 - $20,000	4 – Major
	Greater than $20,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Services Impacted	Administration	1 – Insignificant
	Frontline Services – Roads, Bridges & Culverts	2 – Minor
	Community, Tourism and Recreation Services	3 – Moderate
	Internal Services	4 – Major
	Critical Services – Long Term Care & Paramedic Services	5 – Severe
Socio-political	Type	Consequence of Failure Score
Redundancy	Full Redundancy	1 – Insignificant
	No Redundancy	5 – Severe
Economics	Range	Consequence of Failure Score
Number of Users	Individual	1 – Insignificant

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
	Business Unit or Team	2 – Minor
	Department	3 – Moderate
	Several Departments	4 – Major
	County-Wide	5 – Severe

Table 70 Risk and Criticality Framework: Machinery and Equipment – Communication Tower

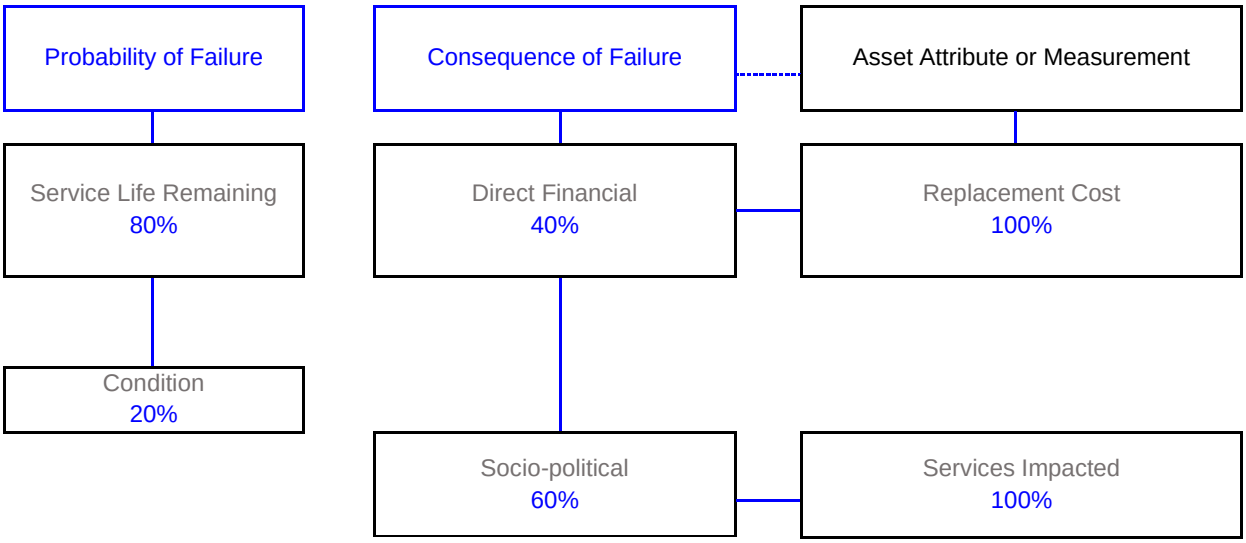


Table 71 Scoring Probability of Failure Factors: Communication Tower

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Operating Environment	80 - 100	1 – Rare
	60 - 80	2 – Unlikely
	40 - 60	3 – Possible
	20 - 40	4 – Likely
	0 - 20	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Projected Service Life Remaining	Greater than 40	1 – Rare
	10 – 40	2 – Unlikely
	5 – 10	3 – Possible
	1 – 5	4 – Likely
	Less than 1	5 – Almost Certain

Table 72 Scoring Consequence of Failure Factor: Communication Tower

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $10,000	1 – Insignificant
	$10,000 - $20,000	2 – Minor
	$20,000 - $50,000	3 – Moderate
	$50,000 - $100,000	4 – Major
	Greater than $100,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Services Impacted	Administration	1 – Insignificant
	Frontline Services – Roads, Bridges & Culverts	2 – Minor
	Community, Tourism and Recreation Services	3 – Moderate
	Internal Services	4 – Major
	Critical Services – Long Term Care & Paramedic Services	5 – Severe

Table 73 Risk and Criticality Framework: Machinery and Equipment – Paramedic Equipment

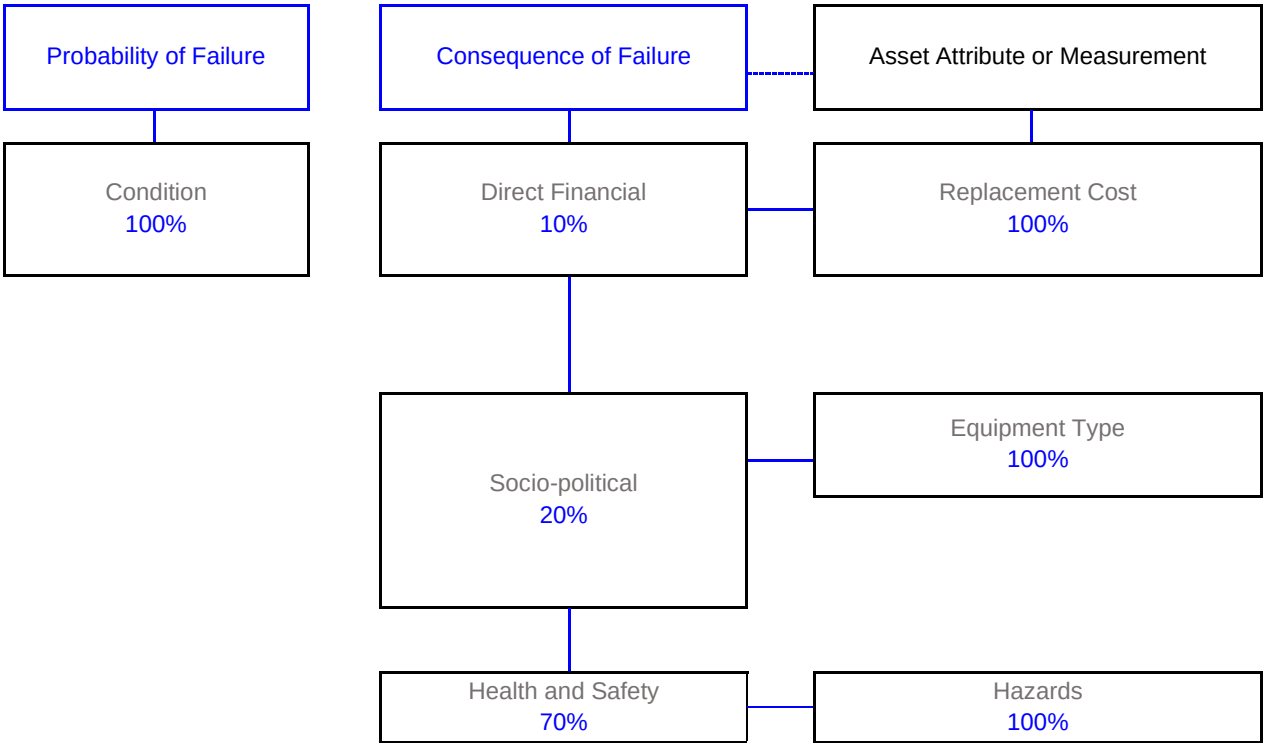


Table 74 Scoring Probability of Failure Factors: Paramedic Equipment

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Assessed Condition	80 - 100	1 – Rare
	60 - 80	2 – Unlikely

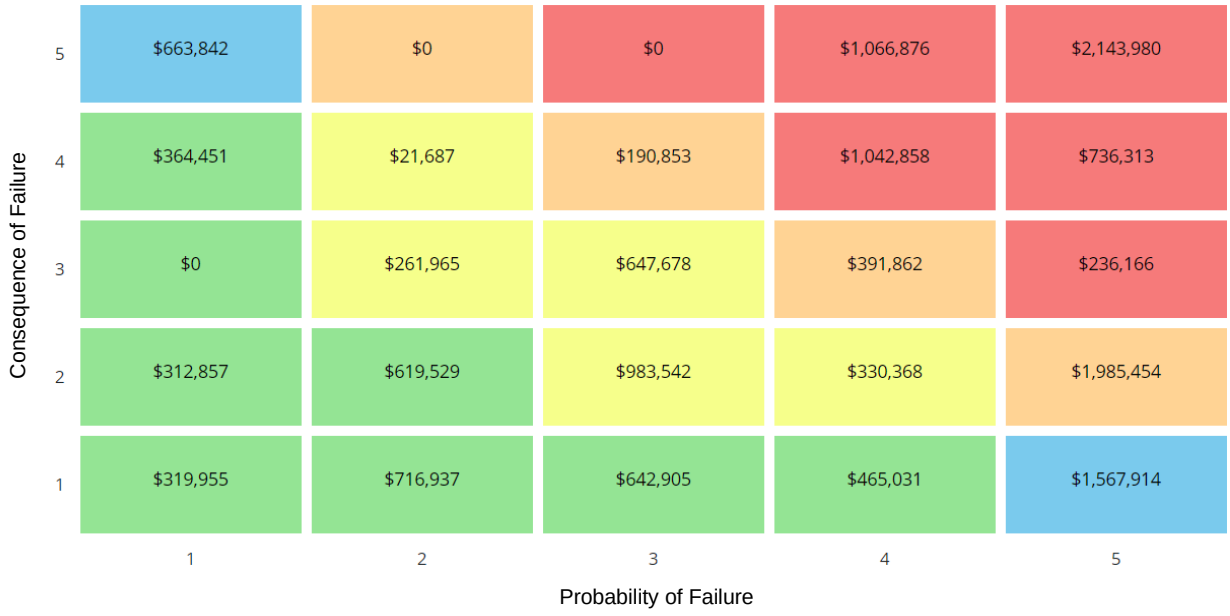
Table 75 Scoring Consequence of Failure Factor: Paramedic Equipment

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $5,000	1 – Insignificant
	$5,000 - $10,000	2 – Minor
	$10,000 - $20,000	3 – Moderate
	$20,000 - $50,000	4 – Major
	Greater than $50,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Equipment Type	Furniture / Appliances	1 – Insignificant
	Office Equipment	2 – Minor
	Computer Systems	3 – Moderate
	Health and Safety Equipment	4 – Major
	Patient Care Equipment	5 – Severe
Health and Safety	Type	Consequence of Failure Score
Hazards	No Hazards	1 – Insignificant
	Cutting / Crushing / Burning / Abrasion	3 – Moderate
	Compressed Gas / Poisonous Substance / Bio-Hazard	5 – Severe

RISK MATRIX

Based on the above criteria and available attribute data, Figure 50 represents the risk matrix developed for the County's machinery and equipment. The y-axis represents the probability of failure, scored from 1 to 5; similarly, the x-axis represents the consequence of failure, also scored from 1 to 5. The matrix shows that based on age, assessed condition, and replacement costs, approximately $2.1 million of machinery and equipment assets are in the highest risk classification. As staff collect additional attribute data, assets may be reclassified and regrouped based on their new risk scores. All essential paramedic services equipment, e.g., stretchers, defibrillators, and stair chairs were determined to be in the low or lowest risk categories.

Figure 50 Risk Matrix: Machinery and Equipment - All



Vehicles

We developed a unique risk and criticality model for the County's paramedic services vehicles and general purpose vehicles.

Table 76 Risk and Criticality Framework: Vehicles – General Purpose

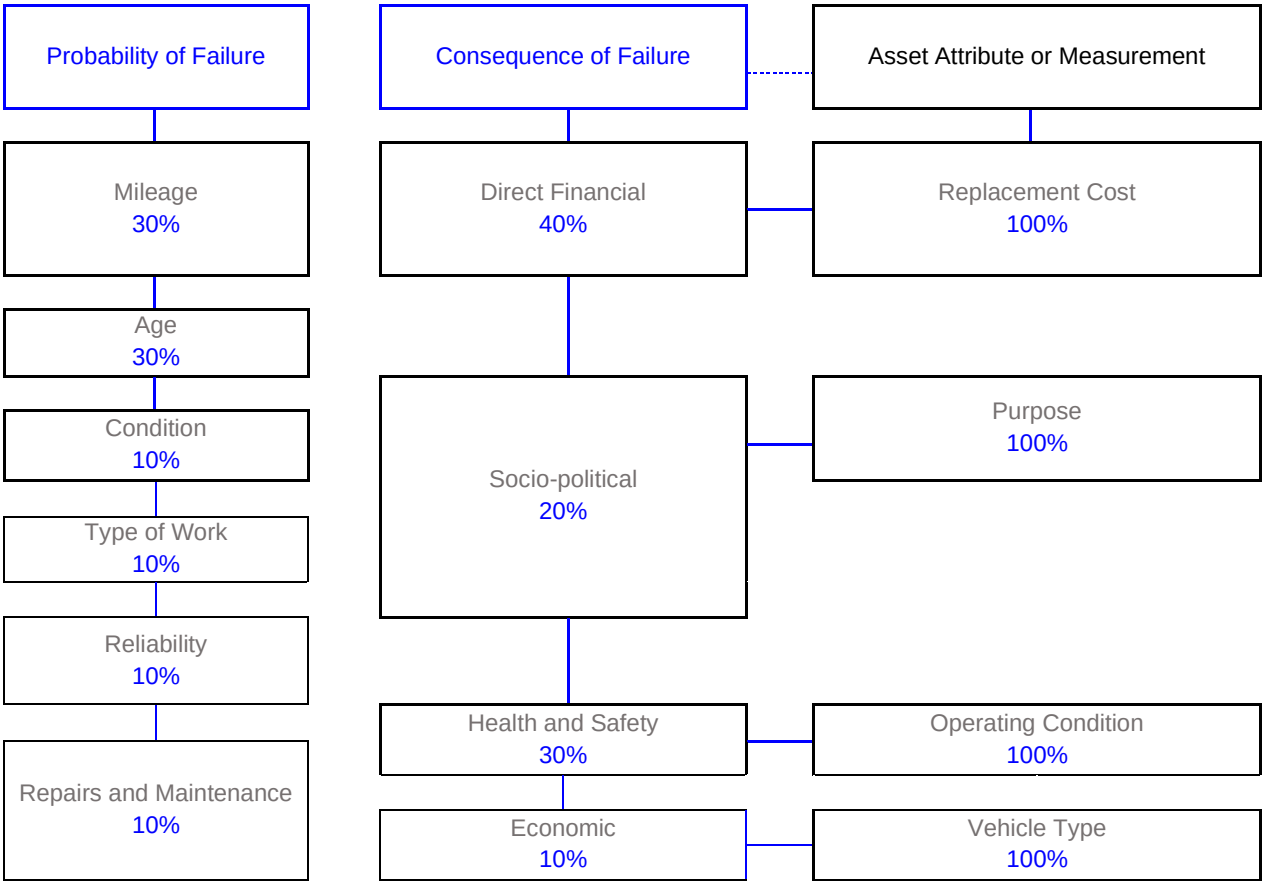


Table 77 Scoring Probability of Failure Factors: Vehicles – General Purpose

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Kilometers	Less than 50,000	1 – Rare
	50,000 – 100,000	2 – Unlikely
	100 – 150,000	3 – Possible
	150,000 – 200,000	4 – Likely
	More than 200,000	5 – Almost Certain
Factor	Number of Years	Probability of Failure Score
Age	Less than 5	1 – Rare
	5 - 8	2 – Unlikely
	8 - 12	3 – Possible
	12 - 15	4 – Likely
	More than 15	5 – Almost Certain
Factor	Value	Probability of Failure Score
Condition	80 - 100	1 – Rare
	60 - 80	2 – Unlikely
	40 - 60	3 – Possible
	20 - 40	4 – Likely
	0 - 20	5 – Almost Certain
Factor	Value	Probability of Failure Score
Type of Work	Light Duty	1 – Rare
	Medium Duty	3 – Possible
	Heavy Duty	5 – Almost Certain
Factor	History	Probability of Failure Score
Reliability	Very Reliable	1 – Rare
	Reliable	2 – Unlikely
	History of Minor Issues	3 – Possible
	History of Major Issues	4 – Likely
	Unreliable	5 – Almost Certain
Factor	Percentage of Replacement Cost	Probability of Failure Score
Repairs and Maintenance	Less than 5%	1 – Rare
	5% - 10%	2 – Unlikely
	10% - 20%	3 – Possible
	20% - 30%	4 – Likely
	Greater than 30%	5 – Almost Certain

Table 78 Scoring Consequence of Failure Factor: Vehicles – General Purpose

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $40,000	1 – Insignificant
	$40,000 - $100,000	2 – Minor
	$100,000 - $175,000	3 – Moderate
	$175,000 - $250,000	4 – Major
	Greater than $250,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Purpose	General Government	1 – Insignificant
	Social Services / Tourism	2 – Minor
	Transportation	3 – Moderate
	Paramedic Services	5 – Severe
Health and Safety	Type	Consequence of Failure Score
Operating Conditions	General Traffic	1 – Insignificant
	Construction Sites	3 – Moderate
	Emergency Driving	5 – Severe
Economic	Type	Consequence of Failure Score
Vehicle Type	Light Duty / Vans	1 – Insignificant
	Medium Duty / Trucks & Attachments	3 – Moderate
	Heavy Duty / Special Use	5 – Severe

Table 79 Risk and Criticality Framework: Vehicles – Paramedic Services

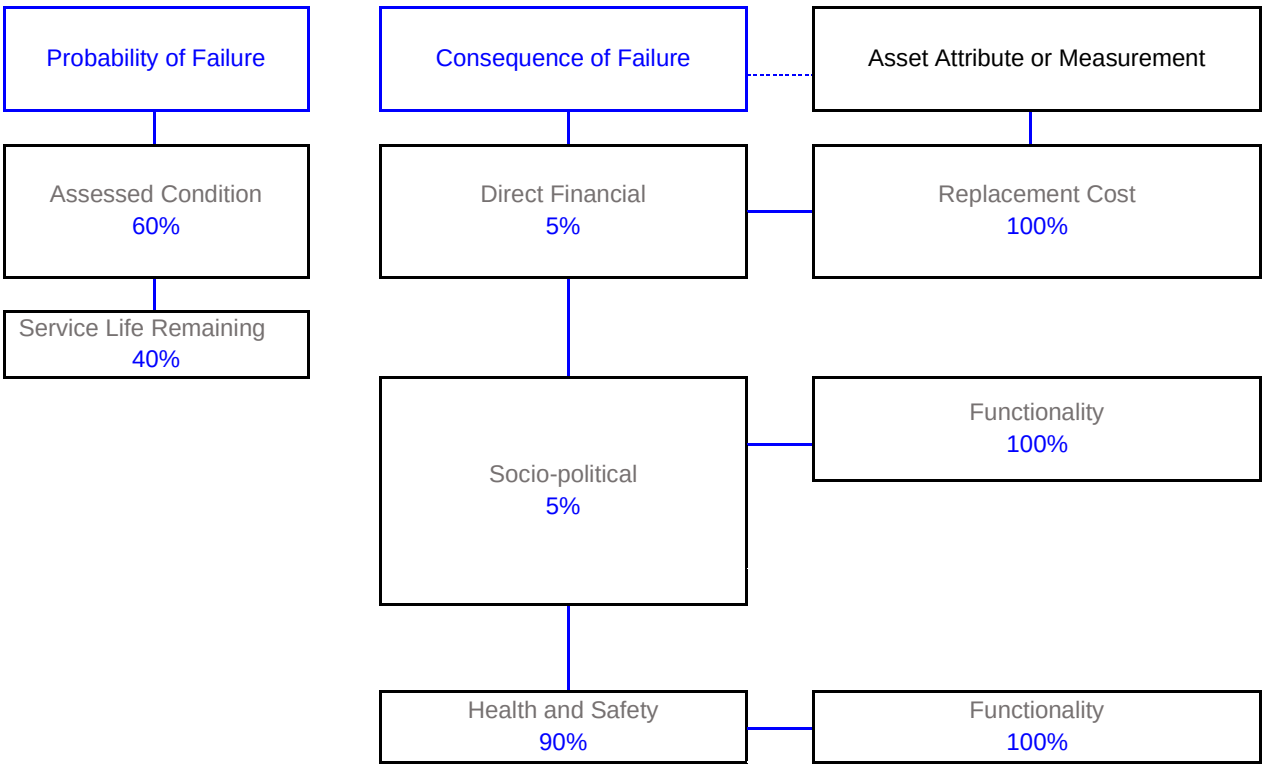


Table 80 Scoring Probability of Failure Factors: Vehicles – Paramedic Services

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Condition	80 - 100	1 – Rare
	60 - 80	2 – Unlikely
	40 - 60	3 – Possible
	20 - 40	4 – Likely
	0 - 20	5 – Almost Certain
Factor	Percentage	Probability of Failure Score
Projected Service Life Remaining	Greater than 80%	1 – Rare
	61-80%	2 – Unlikely
	41 – 60%	3 – Possible
	21 – 60%	4 – Likely
	Less than 20%	5 – Almost Certain

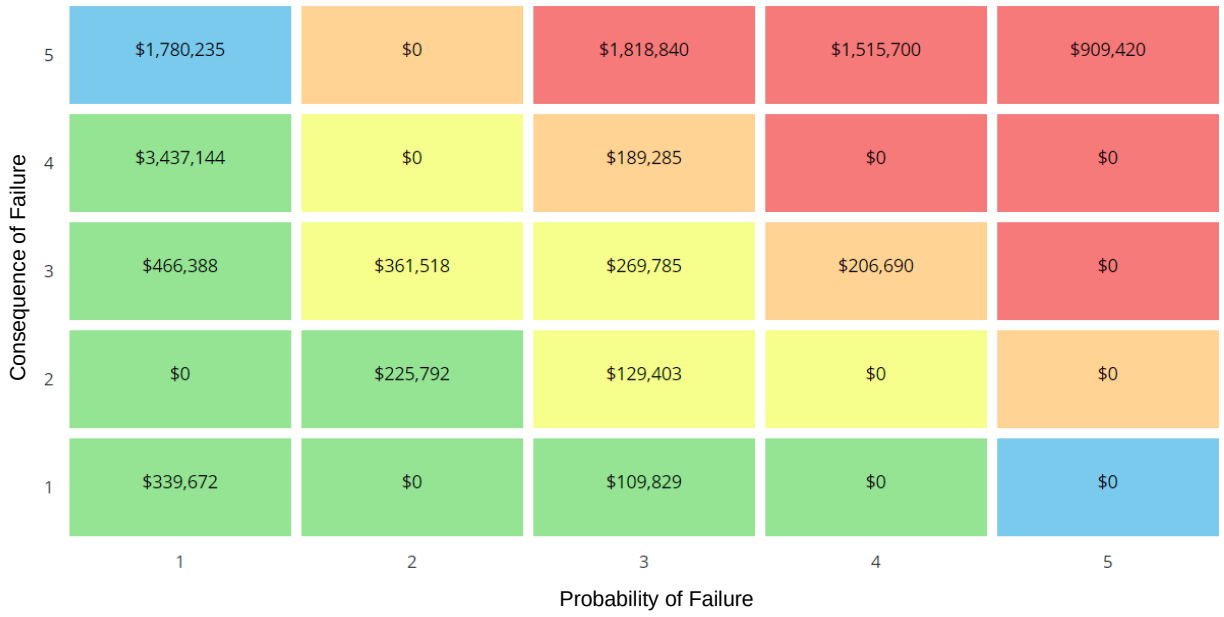
Table 81 Scoring Consequence of Failure Factor: Vehicles – Paramedic Services

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $25,000	1 – Insignificant
	$25,000 - $50,000	2 – Minor
	$50,000 - $100,000	3 – Moderate
	$100,000 - $150,000	4 – Major
	Greater than $150,000	5 – Severe
Socio-political Health and Safety	Type	Consequence of Failure Score
Functionality	Non-patient Transport	4 – Major
	Patient Transport	5 – Severe

RISK MATRIX

Based on the above criteria and available attribute data, Figure 50 represents the risk matrix developed for the County's vehicles. The y-axis represents the probability of failure, scored from 1 to 5; similarly, the x-axis represents the consequence of failure, also scored from 1 to 5. The matrix shows that based on age, assessed condition, and replacement costs, approximately $0.9 million of vehicle assets are in the highest risk classification. As staff collect additional attribute data, assets may be reclassified and regrouped based on their new risk scores. All paramedic services vehicles were determined to be in the low or lowest risk classifications.

Figure 51 Risk Matrix: Vehicles - All



Forestry and Trails

Although forestry and trails assets are not a separate asset category, we worked with staff to develop separate risk models for the various assets. Risk matrices for forestry and trails assets are included within the bridges portfolio.

Table 82 Risk and Criticality Framework: Forestry and Trails

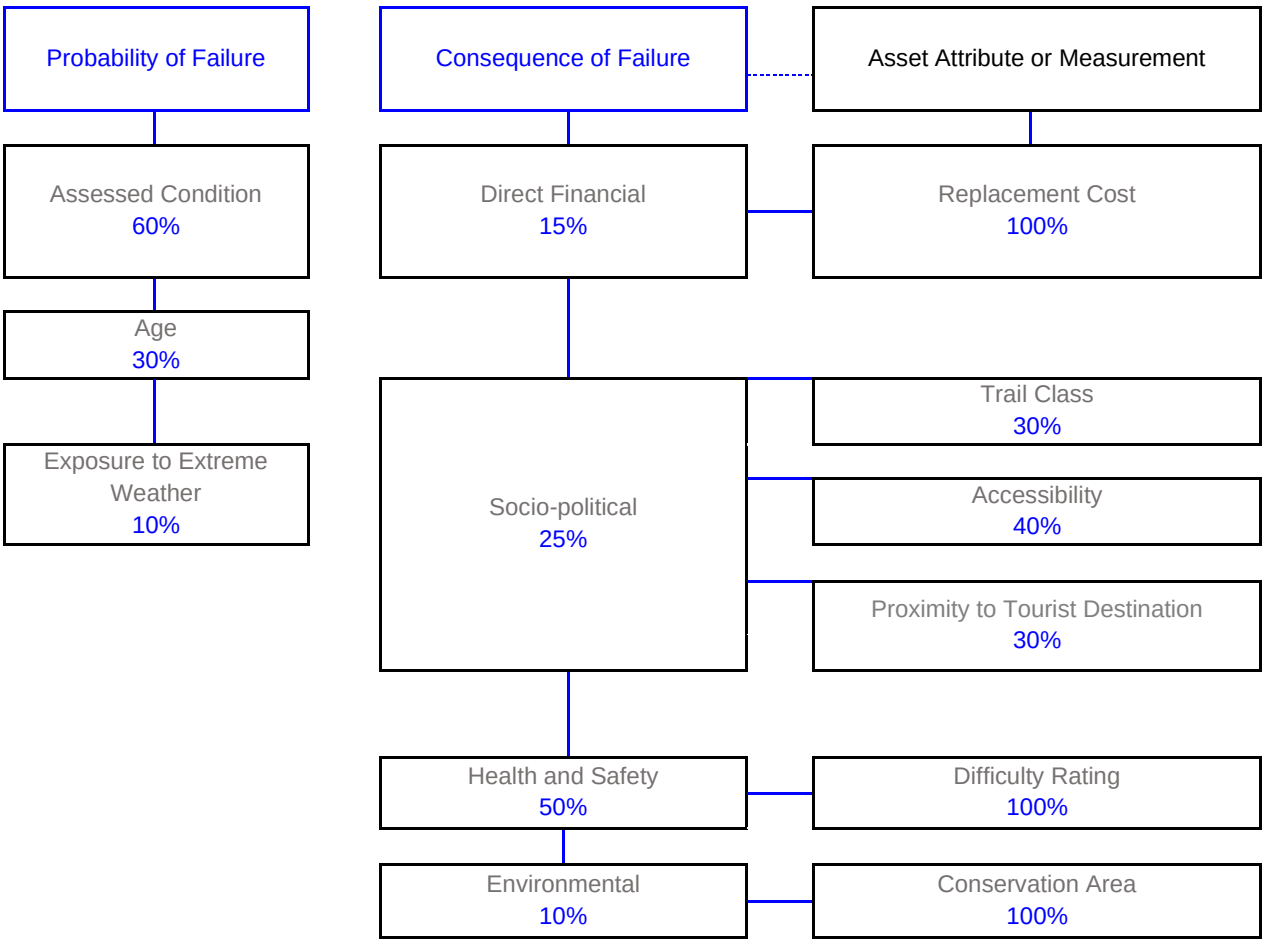


Table 83 Scoring Probability of Failure Factors: Forestry and Trails

Explanatory Factor	Range, Value, Type, or Qualitative Description	Probability of Failure
Factor	Value	Probability of Failure Score
Condition	80 - 100	1 – Rare
	60 - 80	2 – Unlikely
	40 - 60	3 – Possible
	20 - 40	4 – Likely
	0 - 20	5 – Almost Certain
Factor	Years	Probability of Failure Score
Age	Less than 5	1 – Rare
	5 - 10	2 – Unlikely
	10 - 20	3 – Possible
	20 - 40	4 – Likely
	More than 40	5 – Almost Certain
Exposure to Extreme Weather Events (e.g., washouts, ground movement, ice damage)	Minimal Exposure	1 – Rare
	Some Recorded Incidents	3 – Possible
	Recurring Issues	5 – Almost Certain

Table 84 Scoring Consequence of Failure Factor: Forestry and Trails

Type of Consequence	Range, Value, Type, or Qualitative Description	Consequence of Failure
Direct Financial	Range	Consequence of Failure Score
Unit Replacement Cost	$0 - $20,000	1 – Insignificant
	$20,000 - $50,000	2 – Minor
	$50,000 - $75,000	3 – Moderate
	$75,000 - $100,000	4 – Major
	Greater than $100,000	5 – Severe
Socio-political	Type	Consequence of Failure Score
Trail Class	Forest Trail	1 – Insignificant
	CP Rail-Trail	3 – Moderate
	Urban Sections of CP Rail-Trail	5 – Severe
Socio-political	User Type	Consequence of Failure Score
Accessibility	Pedestrian	1 - Insignificant
	Cycling / Cross-County	3 - Moderate
	ATV / Snowmobile / Equestrian	5 - Severe
Socio-political	Distance	Consequence of Failure Score
Proximity to Tourist Destinations (km)	10km	1 – Insignificant
	5km	3 – Moderate
	< 2km	4 - Major
Health and Safety	Rating	Consequence of Failure Score
IMBA Trail Difficulty Rating	Easy	1 – Insignificant
	Moderate	3 – Moderate
	Difficult	5 – Severe
Environmental	Status	Consequence of Failure Score
Conservation Area	Yes	1 – Insignificant
	No	5 – Severe

Levels of Service Analysis

Along with risk management, Grey County's lowest performance in its current state assessment was found in levels of service. Levels of service (LOS) indicate the quality, function, and capacity of an asset class (or service area). LOS should balance performance, risk, and overall program costs for an asset class. They include technical and customer-oriented metrics and key performance indicators (KPIs).

Customer-oriented levels of service (C-LOS) are designed to measure or approximate end-user experience with the service. For transparency and reporting, they should be understandable to the general public. Technical levels of service (T-LOS) are designed to measure the various activities and steps (inputs) that the organization takes to deliver the customer-oriented levels of service.

At Grey, beyond minimum maintenance standards (MMS), staff typically rely on informal metrics. Ontario Regulation 588/17 requires municipalities to report on specific KPIs for core assets in future iterations of asset management plans. For the County, these requirements are limited to its roads, bridges, and stormwater assets. Discretion is allotted to municipalities to determine how they provide performance reporting on non-core assets.

The few KPIs required under O. Reg 588/17, although valuable, may not offer an accurate evaluation of effectiveness or efficiency of any particular asset class. Assets, and asset networks are complex. Hundreds of KPIs may be required to provide reliable reporting.

A more practical approach to levels of service reporting, while inclusive of O. Reg 588/17 requirements, should focus on three broader parameters: the cost associated with delivering infrastructure services; the performance or condition of the assets within the portfolio; and, the risk associated with those assets.

This approach, consistent with ISO 55000 standard for asset management, allows organizations to calibrate any of the above parameters to achieve a balanced, sustainable levels of service approach. In this section, we discuss this approach further. We have developed KPIs for each asset class that can be used to supplement this approach for reporting purposes. Where data is available, current KPIs are populated to facilitate reporting for O. Reg 588/17.

The Three Levers of a Levels of Service Framework

Levels of service is an internationally recognized concept, employed across a variety of sectors, including public infrastructure. The International Standards Organization's ISO 55000 defines levels of service as the "parameters, or combination of parameters, which reflect the social, political, environmental, and economic outcomes that the organization delivers."

COST, PERFORMANCE, AND RISK

Levels of service are fundamentally about balancing three key parameters: cost, performance, and risk. An adjustment to one of these parameters will have a direct impact on the other two. For example, if higher asset performance is desired, additional funds will be needed as the asset may require more regular maintenance, increasing the cost of service delivery. This more enhanced, but costlier lifecycle program, may reduce the asset's risk profile.

A sustainable levels of service approach requires municipalities to periodically recalibrate these parameters. An imbalance in any of these three parameters can jeopardize the alignment of service delivery with community expectations, the strategic direction of the organization, and its fiscal capacity. Table 85 summarizes the cost, performance, and risk levels for each of the County's asset categories.

To estimate the cost associated with each asset class, we use the average annual capital requirement. For performance, we provide an estimate of the percentage of assets in fair or better condition. Similarly, for risk, percentage of assets with a high risk profile is quantified. Land improvements are included in the buildings and facilities category.

Table 85 shows that currently, 79% of the County's assets are in fair or better condition, and 24% carry a high risk rating. The total average annual requirements for the County's $1.4 billion portfolio total $44.9 million. Any discussions around rebalancing or adjusting levels of service targets should spotlight these three parameters. As with other areas of asset management, the validity of this approach to levels of service analysis relies principally on the quality of data and risk models. Key questions to discuss as part of this approach include:

- Can the community and the municipality afford to increase levels of service, based on how well we are funding our infrastructure program today?
- What is our risk tolerance? Can our asset portfolio take on more risk?
- Are there assets for which the current performance or condition can be reduced without detriment to the community?

Table 85 Cost, Performance, and Risk: All Assets

Asset Category	Cost Annual Requirements	Performance Percentage of Assets in Fair or Better Condition	Risk Percentage of Assets in Highest Risk Category
All Assets	$44,879,184	79%	2.4%
Roads	$29,738,846	90%	1.2%
Bridges and Culverts	$6,126,317	83%	1.3%
Buildings and Facilities*	$4,513,334	45%	13.7%
Social Housing	$1,287,079	50%	9.0%
Machinery and Equipment	$1,287,079	Non-Paramedic 48% Paramedic – 100%	13.7%
Vehicles	$1,459,671	Non-Paramedic 52% Paramedic – 100%	7.7%

Includes land improvements assets.

Levels of Service: Ontario Regulation 588/17 Reporting

Ontario Regulation 588/17 offers a limited approach to assessing the overall efficacy of an asset management program, requiring municipalities to provide data on specific customer- oriented and technical key performance indicators for core assets. The following tables are completed in accordance with O. Reg 588/17 requirements and provide current KPIs for the County's roads, and bridges and culverts assets.

Table 86 O. Reg 588/17 Levels of Service Reporting: Roads

Service Attribute	Qualitative Description	Current LOS (2019)	Action required for O. Reg Compliance
Community Levels of Service			
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity	The Transportation Services Department provides maintenance and construction on 869 kilometers of County Roads. County roads are used to connect member municipalities, and provide access to five provincial highways.	None Optional: Inclusion of road network map
Quality	Description or images that illustrate the different levels of road class pavement condition	Approximately 90% of the County's roads are in fair, good, or very good condition.	None
Technical Levels of Service			
Scope	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality		This data is required.
Quality	1. For paved roads in the municipality, the average pavement condition index value. 2. For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor)	The County's average PCI for 2020 was 65.9. The County does not own any unpaved roads.	

Table 87 O. Reg 588/17 Levels of Service Reporting: Bridges and Culverts

Service Attribute	Qualitative Description	Current LOS (2019)	Action required for O. Reg Compliance
Community Levels of Service			
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	County bridges support a variety of vehicles types, including heavy transport, commercial and industrial vehicles, agricultural equipment, motor vehicles, emergency vehicles, pedestrians, and cyclists.	None
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges. 2. Description or images of the condition of culverts and how this would affect use of the culverts.	67% of the County's bridges are in fair or better condition. 68% of the County's culverts are in fair or better condition. On average, the County's bridges and culverts are capable of maintaining regular utilization. There were no changes to the load limit recommendations for 104 structure assessed in the 2019 cycle.	None.
Technical Levels of Service			
Scope	Percentage of bridges in the municipality with loading or dimensional restrictions.	14 of the 134 bridges and structures have load restrictions (10%).	None.
Quality	1. For bridges in the municipality, the average bridge condition index value. 2. For structural culverts in the municipality, the average bridge condition index value.	1. 45.7 2. 46.4	None.

Levels of Service: Beyond O. Reg

In this section, we provide **additional** KPIs that we have developed for Grey County's core and non-core assets to track the performance of its infrastructure programs. These KPIs are not required through Ontario Regulation 588/17. Where data is available, we have prepopulated it. Staff are encouraged to use this framework and complete it over time.

Table 88 Recommended KPIs: Roads

KPI	Type of KPI	Current Level
Annual reinvestment rate	Customer-oriented and Technical	1.2%
Portion of average property tax allocated to roads	Customer-oriented	TBD
Number of service requests related to road condition	Customer-oriented	TBD
Operating and maintenance cost per km of road	Technical	TBD
Number of road closures due to extreme weather events	Customer-oriented and Technical	TBD
Ratio of reactive to proactive lifecycle expenditures	Technical	TBD
Average response time to minor repairs	Customer-oriented	TBD
General level of satisfaction with road network	Customer-oriented	TBD

Table 89 Recommended KPIs: Bridges and Culverts

KPI	Type of KPI	Current Level
Annual reinvestment rate	Customer-oriented and Technical	0.9%
Portion of average property tax allocated to bridges and culverts	Customer-oriented	TBD
Number of service requests related to bridge condition	Customer-oriented	TBD
Average operating and maintenance cost per unit	Technical	TBD
Number of bridge closures due to extreme weather events	Customer-oriented and Technical	TBD
Ratio of reactive to proactive lifecycle expenditures	Technical	TBD
Average response time to minor repairs	Customer-oriented	TBD
General level of satisfaction with bridge network	Customer-oriented	TBD
Percentage of bridges with clearance and/or load restrictions	Technical	TBD

Table 90 Recommended KPIs: Buildings and Facilities

KPI	Type of KPI	Current Level
Annual reinvestment rate	Customer-oriented and Technical	3.6%
Portion of average property tax allocated to buildings and facilities	Customer-oriented	TBD
Number of service requests related to facility condition	Customer-oriented	TBD
Average operating and maintenance cost per unit	Technical	TBD
Ratio of reactive to proactive lifecycle expenditures	Technical	TBD
Average response time to minor repairs	Customer-oriented	TBD
Number of unplanned facility closures	Customer-oriented	TBD
Number of injuries due to facility or component condition	Customer-oriented	TBD
Frequency of detailed facility inspections	Technical	TBD
Customer or user general level of satisfaction	Customer-oriented	TBD
Percentage of facilities meeting public health reporting requirements	Technical	TBD
Percentage of facilities meeting planned cleaning schedules	Customer-oriented and Technical	TBD
Percentage reduction in total facility energy consumption per year	Technical	TBD

Table 91 Recommended KPIs: Vehicles, and Machinery and Equipment

KPI	Type of KPI	Current Level
Annual reinvestment rate	Customer-oriented and Technical	8.3%
Portion of average property tax allocated to vehicles, machinery, and equipment	Customer-oriented	TBD
Percentage of assets out of service	Technical	TBD
Average time per service event	Technical	TBD
Number of planned maintenance events	Technical	TBD
Number of unplanned maintenance events	Technical	TBD

Financial Analysis

Infrastructure is expensive to build and even more expensive to maintain in a state of good repair. As illustrated in Figure 6, Grey County has made substantial investments over the last five decades in building its current infrastructure portfolio, with an estimated current replacement cost of $1.4 billion.

Most municipalities across Canada face annual infrastructure funding shortages or deficits, as well as existing, long-term infrastructure backlogs that have accumulated over years and decades. Each year, this backlog grows, and the quality of infrastructure degrades as projects are deferred due to funding constraints. Infrastructure disrepair can restrict economic activity, jeopardize public safety, lower the quality of life of residents, and expose organizations to financial risk. The condition of a community's infrastructure can also create political and reputational damage.

Most local governments have limited options to raise additional funds for infrastructure, relying primarily on tax levies, debt, and user fees. Rural and small municipalities are also less attractive for public-private partnerships (P3s) that can leverage private sector funds to deliver major projects. This makes senior government support critical, whether through matching formulas for major capital projects, or through grants and subsidies that can make additional capital available for municipalities.

Given the level of investment required, it will take many years or decades for municipalities to reach fiscal sustainability. In this section, we provide an analysis of Grey County's current fiscal framework for supporting its infrastructure portfolio. Where meaningful and practical, a comparison with the municipality's 2016 Asset Management Plan is also provided.

Annual Capital Requirements

Each year, investments must be made in infrastructure maintenance, renewal, rehabilitation, and replacement to ensure it remains in a state of good repair. The focus of this asset management strategy, and that of most municipal asset management plans, is typically annual capital expenditures. These target investment levels, or annual capital requirements, are dispersed across the lifecycle of the asset.

The objective is to ensure that when assets do reach the end of their useful life, sufficient funding is available to replace them in order to minimize service disruption. The annual requirements are directly proportional to the value of the infrastructure portfolio and the average useful life of assets contained within it.

Table 92 outlines current annual capital requirements by asset category. Based on a replacement cost of $1.4 billion, Grey County's annual requirements total approximately $44.9 million for the seven asset categories analyzed in this document, an increase of $21.2 million, or 89% since 2016. Roads comprise 66.3% of annual funding needs, consistent with their share of total replacement cost, at 62.9%.

However, due to substantial adjustments to roads replacement costs and how they are structured, annual requirements for the road network increased from $13.7 million in 2016 to $29.7 million in 2020, or 117%. See Table 14 Average Annual Requirements and 2020 vs 2016 Comparative Analysis for full details on how annual requirements for each asset category have changed since 2016.

Table 92 Average Annual Capital Requirements

Asset Category	Annual Requirements	Share of Total Annual Requirements	Share of Total Replacement Cost
Roads	$29,738,846	66.3%	62.9%
Bridges and Culverts	$6,126,317	13.7%	20.6%
Buildings and Facilities	$4,513,334	10.1%	9.4%
Social Housing	$1,287,079	2.9%	5.2%
Machinery and Equipment	$1,753,937	3.9%	1.1%
Vehicles	$1,459,671	3.3%	0.8%
Total	$44,879,184	100%	100%

Available Funding and Composition

Figure 52 shows how funding available for infrastructure through tax revenue has trended since 2018. Overall funding levels have remained stable. On average, the County has approximately $15.3 million of taxation revenue available annually for its infrastructure portfolio. Funding for land improvements has been included in the buildings and facilities category. We use these average values for further analysis and recommendations.

Figure 52 Average Annual Funding Available 2018-2020: Taxation Only

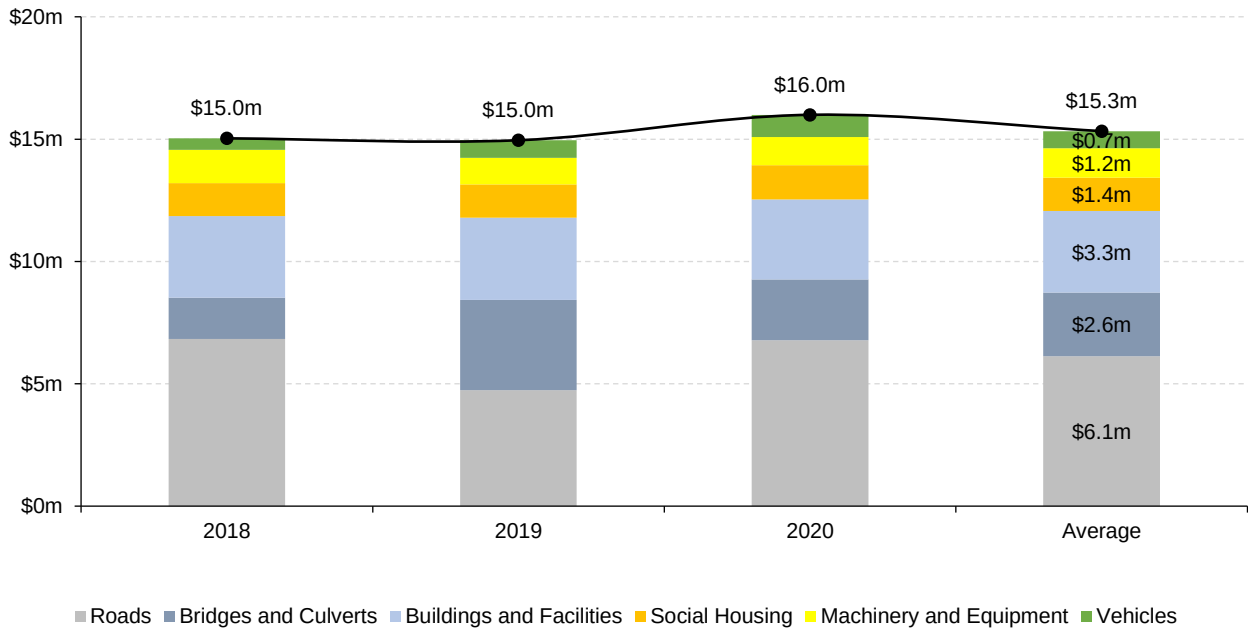


Table 93 summarizes all reliable and predictable sources of funding used by the County in 2020 for infrastructure purposes, including taxation, the Federal Gas Tax Fund, the Ontario Community Infrastructure Fund (OCIF), long-term care grants, and proceeds from disposal of assets. For 2020, a total of $21.3 million was available for capital purposes; tax revenues account for 71% of this funding.

However, similar to other municipalities in Ontario, Grey County relies considerably on senior government support to supplement infrastructure investments. Currently, 26.4% of the available funding comes from senior government grants and transfers.

Table 93 Average Annual Funding Available

Asset Category	Funding Available in 2020					
	Taxes (Average 2018-2020)	Gas Tax	OCIF	LTC Grants	Disposal of Assets	Total Funding Available
Roads	$6,120,045	$2,846,449	$1,279,946	$0	$0	$10,246,440
Bridges and Culverts	$2,615,268	$0	$0	$0	$0	$2,615,268
Buildings and Facilities	$3,322,663	$0	$0	$1,493,000	$3,387	$4,819,050
Social Housing	$1,369,668	$0	$0	$0	$0	$1,369,668
Machinery and Equipment	$1,201,455	$0	$0	$0	$103,012	$1,304,467
Vehicles	$697,643	$0	$0	$0	$273,396	$971,039
Total	$15,326,742	$2,846,449	$1,279,946	$1,493,000	$379,795	**$21,325,931**
Percentage of Total Funding	71.9%	13.3%	6.0%	7.0%	1.8%	100%

As illustrated in Table 94, roads comprise 62.9% of the County's total asset portfolio and consume 48% percent of available funding.

Table 94 Share of Total Funding by Asset Category

Asset Category	Share of Total Replacement Cost	Share of Total Annual Requirements	Share of Total Funding Available
Roads	62.9%	66.3%	48.0%
Bridges and Culverts	20.6%	13.7%	12.3%
Buildings and Facilities	9.4%	10.1%	22.6%
Social Housing	5.2%	2.9%	6.4%
Machinery and Equipment	1.1%	3.9%	6.1%
Vehicles	0.8%	3.3%	4.6%

We also note that the County is in the planning stages of rebuilding two of its long term care homes: Grey Gables, and Rockwood Terrace. Based on the most recent cost estimate of $280,000 per bed, the upfront construction costs of these two sites total approximately $71.7 million. Under current provincial programs, the County will receive an annual construction funding subsidy (CFS) of $1,493,000 upon completion of the facilities. This funding is included under 'LTC Grants' in Table 93 above.

These new facilities will offer higher levels of service. And, given their substantially higher replacement costs, the associated annual requirements or target reinvestment rates will also increase. Currently, annual requirements for these sites total $976,374, or 3.4% of the total replacement cost of $28.6 million. Using similar proportions, we can expect to see the annual requirements increase to $2,462,000 after the new facilities are complete. This will have a direct impact on the annual deficits as calculated for the buildings and facilities category.

Impact of Senior Government Funding

In Table 16, we compared target reinvestment rates with Grey County's actual reinvestment rates using only own-source revenues, including taxation and net proceeds from asset disposals. As illustrated in Table 95, senior government programs are also essential sources of infrastructure funding.

Overall, senior government support increases the County's overall reinvestment rate from 1.1% to 1.5%. The largest impact is seen in buildings and facilities, and roads. When using both own-source revenue and external funding, the County's annual reinvestment rate for roads increases from 0.7% of the replacement value, to 1.2%, bringing it closer in line with recommended target ranges.

Table 95 Impact of Senior Government Funding on Reinvestment Rates

Asset Category	Actual Reinvestment Rate – Own-source Only	Actual Reinvestment Rate with Senior Government Transfers	Impact
Roads	0.7%	1.2%	0.5%
Bridges and Culverts	0.9%	0.9%	0.0%
Buildings and Facilities	2.5%	3.6%	1.1%
Social Housing	1.9%	1.9%	0.0%
Machinery and Equipment	8.3%	8.3%	0.0%
Vehicles	8.3%	8.3%	0.0%
Total	1.1%	1.5%	0.4%

Annual Infrastructure Funding Deficits

Based on available funding, Table 96 summarizes the current funding levels for each asset category and any resulting infrastructure deficits. At current levels, the County is funding 47.5% of its long-term capital needs, a decrease of 15% since 2016 when asset categories were funded at 62% of their long-term capital needs.

Current funding levels create a total annual infrastructure deficit of $23.6 million for all asset categories. As with prior analysis presented in this report, however, these changes are attributed mainly to refinements and updates to roads replacement costs. The County's overall funding has remained consistent since 2018.

Although funding available for social housing saw a 53% drop from 2016, the category is funded at 106% of its long-term annual capital needs, resulting in a surplus. Social housing was also in a surplus position in 2016, when funding available was 160% of its annual requirements. However, we caution that in the absence of detailed building condition assessment data, these values may not be accurate.

Table 96 Funding Levels by Asset Category

Asset Category	Annual Infrastructure Deficit	2020 Funding Levels	2016 Funding Levels	Change	Funding Trend
Roads	$19,492,406	34.5%	57.0%	-23%	↘
Bridges and Culverts	$3,511,049	42.7%	36.7%	6%	↗
Buildings and Facilities	-$305,716	106.8%	81.8%	25%	↗
Social Housing	-$82,589	106.4%	159.8%	-53%	↘
Machinery and Equipment	$449,470	74.4%	60.6%	14%	↗
Vehicles	$488,632	66.5%	76.6%	-10%	↘
Total	$23,553,252	47.5%	62.0%	-15%	↘

At this stage, the annual deficits and funding levels are calculated by assessing available funding against average annual requirements, or the target reinvestment rates, as summarized below.

Table 97 Target Reinvestment Rates vs. Actual Reinvestment Rates

Asset Category	Target Reinvestment Rate	Actual Reinvestment Rate – All Funding	Gap
Roads	3.4%	1.2%	2.2%
Bridges and Culverts	2.1%	0.9%	1.2%
Buildings and Facilities, and Land Improvements	3.4%	3.6%	-0.2%
Social Housing	1.8%	1.9%	-0.1%
Machinery and Equipment	11.2%	8.3%	2.9%
Vehicles	12.4%	8.3%	4.2%
Average	3.2%	1.5%	1.7%

Table 98 compares target reinvestment rates (average annual requirements) against the reinvestment rates recommended in the Canadian Infrastructure Report Card (CIRC) 2016.

Table 98 Comparing CIRC Recommended Reinvestment Rates With Target Reinvestment Rates

Asset Category	Target Reinvestment Rate	CIRC Lower Target	CIRC Upper Target
Roads	3.4%	2.0%	3.0%
Bridges and Culverts	2.1%	1.0%	1.5%
Buildings and Facilities	3.4%	1.7%	2.5%
Social Housing	1.8%	1.7%	2.5%
Machinery and Equipment	11.2%	NA	NA
Vehicles	12.4%	NA	NA

Although the target reinvestment rates presented in this report are developed using industry-standard approaches and methodologies, reaching these funding levels for the County's road network may require substantial and rapid increases to tax revenues which may not be feasible nor desired. As such, in discussion with staff, we use the 'CIRC Lower Target' of 2.0% for roads as a benchmark for sustainable funding. For other categories, the target reinvestment rate is used.

Table 99 shows that using the CIRC lower target for roads reduces the total annual funding required from $44.9 million to $32.8 million. The overall annual deficit decreases to $11.5 million.

Table 99 Recalculating Deficits Using CIRC Reinvestment Rates

Asset Category	Replacement Cost	Recommended Reinvestment Rate	Funding Needed	Funding Available	Adjusted Annual Deficit
Roads (CIRC Lower Target)	$885,375,708	2.0%	$17,707,514	$10,246,440	$7,461,074
Bridges and Culverts	$289,336,247	2.1%	$6,126,317	$2,615,268	$3,511,049
Buildings and Facilities	$132,618,052	3.4%	$4,513,334	$4,819,050	-$305,716
Social Housing	$72,957,685	1.8%	$1,287,079	$1,369,668	-$82,589
Machinery and Equipment	$15,632,476	11.2%	$1,753,937	$1,304,467	$449,470
Vehicles	$11,759,701	12.4%	$1,459,671	$971,039	$488,632
Total	$1,407,679,870		$32,847,852	$21,325,931	$11,521,921

We use the 'Recommended Reinvestment Rate' and the 'Adjusted Annual Deficit' for further analysis.

Eliminating the Annual Deficit

Our approach to closing annual infrastructure gaps and reaching sustainability over the long-term relies primarily on instruments within the control of the County, namely taxation, debt, and use of existing reserves. We include reliable sources of funding from the provincial and federal governments, and base future funding levels on 2019 transfers. See Senior Government Funding, a note on evolving provincial and federal funding streams for infrastructure and asset management.

In 2019, Grey County's revenue from taxation totalled $58,254,078. As illustrated in Table 100, based on a current funding level of $21.3 million and an adjusted annual infrastructure deficit of $11.5 million, the County will need to increase its tax revenue by a total of 19.8% to eliminate this annual deficit.

Table 100 Tax Increase Required to Reach Full Funding

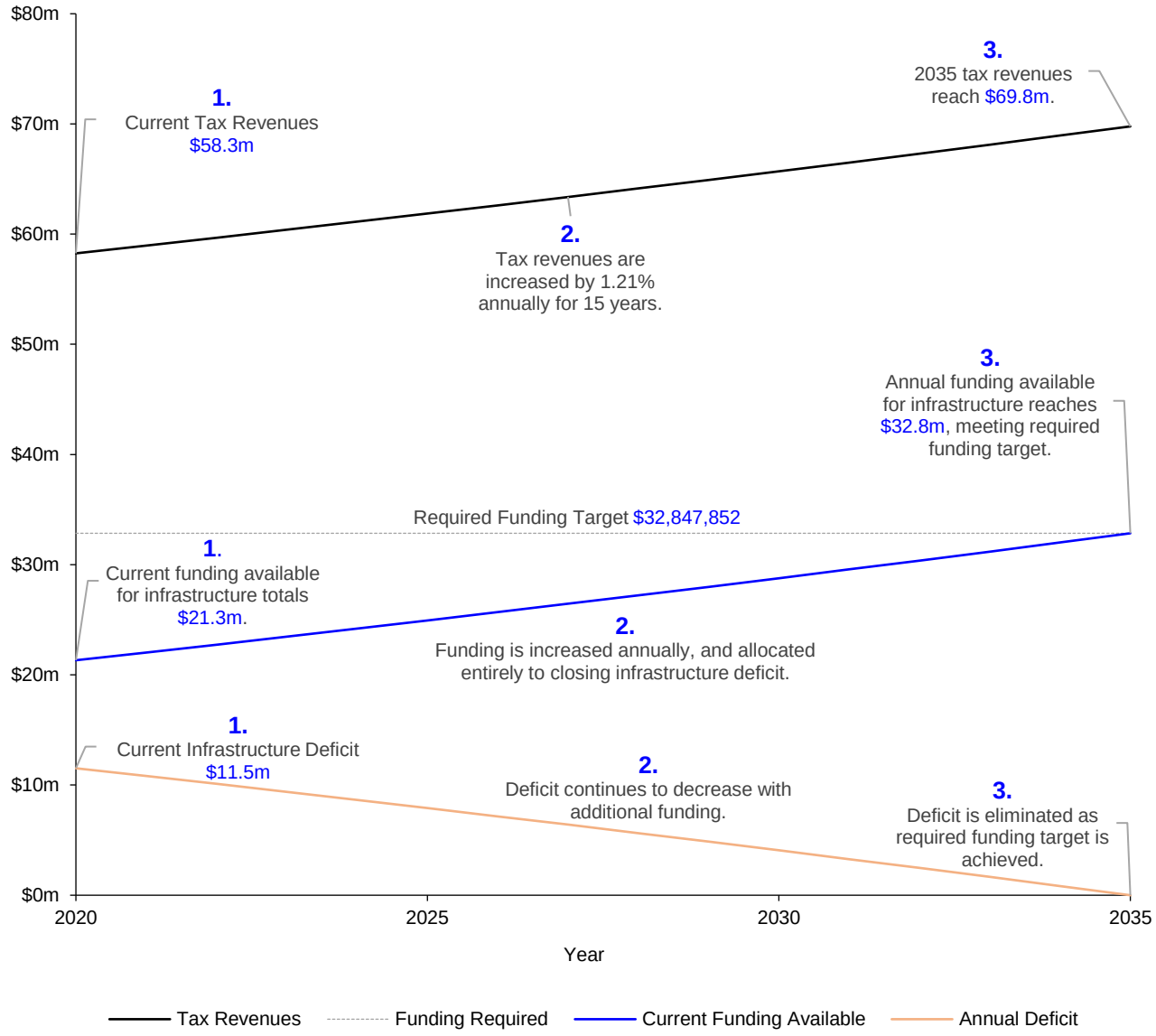
Measurement	2019 Actual	2016 Actual	5-Year Change	Percentage Change
Tax Revenues	$58,254,078	$52,900,000	$5,354,078	10.1%
Increase needed to close annual deficit	$11,521,921	$8,997,000	$2,524,921	28.1%
Effective tax Increase required	19.8%	17.01%	2.77%	16.3%
Annual tax increase required over:				
10 years	1.82%	1.7%		
15 years	1.21%	1.1%		
20 years	0.91%	0.9%		

In 2016, a tax increase of 17% was required to close the annual infrastructure deficit at the time. The 2016 asset management plan recommended a 15-year phase-in period, with a final recommended annual tax increase of 1.0% to reach full funding by 2030.

Current analysis shows that Grey County can close its annual infrastructure deficit by increasing its taxation revenues by 1.82% per year over 10 years; 1.21% per year over 15 years; or, 0.9% per year over a 20-year phase-in period. All scenarios assume that the annual increase in available funding resulting from the increase in tax revenue is allocated entirely to the deficit.

Based on the above analysis, we recommend that staff and council consider a 1.21% increase in tax revenues is over a 15-year phase in period. This scenario is illustrated in Figure 53.

Figure 53 Eliminating Annual Deficit: 15-Year Phase-in Period



Eliminating Infrastructure Backlogs

In addition to annual deficits, most municipalities have accumulated significant deferred rehabilitation and replacement needs over decades, leading to infrastructure backlogs or pent-up investment demands. As illustrated in Table 101, age-based and condition data shows that Grey County has an accumulated infrastructure backlog of $70.1 million, 70.6% of which is attributed to buildings and facilities. The County's transportation network comprises 13.6% of the backlog.

Table 101 Infrastructure Backlog by Asset Category

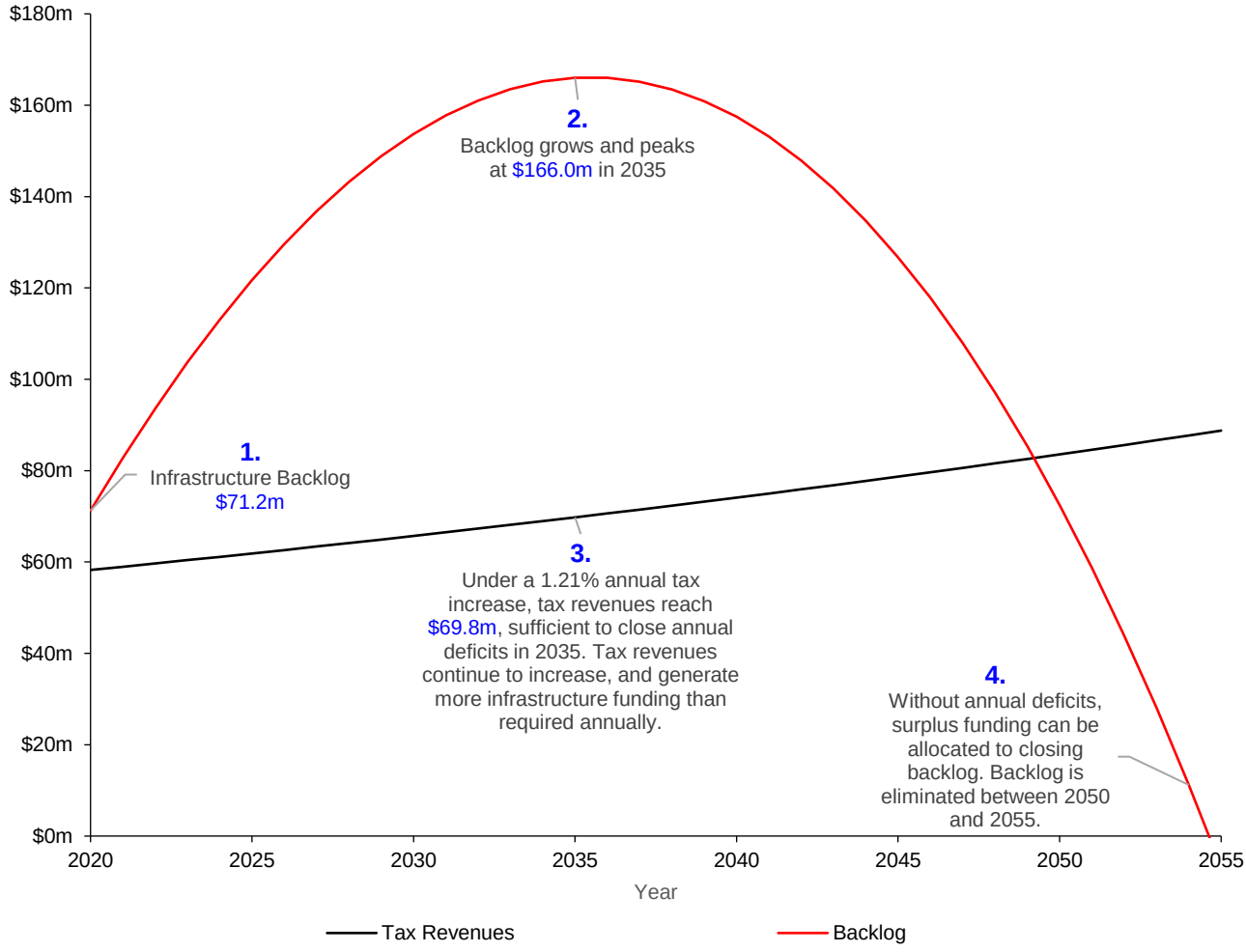
Asset Category	Backlog	Share of Total Backlog
Roads	$9,543,533	13.6%
Bridges and Culverts	$4,938,829	7.0%
Buildings and Facilities, and Land Improvements	$49,519,075	70.6%
Social Housing	$697,662	1.0%
Machinery and Equipment	$4,581,184	6.5%
Vehicles	$868,658	1.2%
Total	$70,148,941	100.0%

Under a 15-year phase-in period in which taxation revenues are raised by 1.21% annually, the County will close its infrastructure deficit in 2035. At this point, if this tax increase is maintained annually, funding over and above the annual requirements can be allocated to eliminating the infrastructure backlog. As illustrated in Figure 54**Error! Reference source not found.**, under this scenario, the County's infrastructure backlog is eliminated between 2054 and 2055.

We recognize that actual infrastructure backlogs may be significantly different, especially for buildings and facilities. The County's upcoming BCAs should identify with more accuracy the actual deferred rehabilitation and replacement needs for buildings and facilities.

Given the potential inaccuracies in the backlog, Figure 54 can be rather abstract. However, it serves to illustrate that if projects are continuously deferred, infrastructure backlogs can accumulate quickly, and take decades to eliminate. This can put the County's infrastructure programs in a reactive loop, in which a majority of infrastructure funding is consumed by deferred maintenance.

Figure 54 Eliminating the Infrastructure Backlog



Reserves and Debt Analysis

Across its seven asset categories, the County's current reserve levels totalled $41.6 million as of December 31, 2019. Capital infrastructure reserves can be used to augment current fiscal capacity, reduce backlogs, reduce debt levels and future borrowing for emergency projects, and flatten otherwise severe fluctuations in tax levy and utility rates to meet uneven annual capital needs.

The County's current reserves, which exclude Development Charge reserves, represent 3.0% of the total $1.4 billion replacement value of its asset portfolio. Table 102 illustrates this concept for each asset category. To put this in perspective, at the County's current reserve levels and assuming an average home price of $500,000, the average household in Grey County would have approximately $15,000 reserved for home repairs, maintenance, upgrades, and general physical upkeep.

Table 102 Comparing Reserves to Replacement Costs and Backlogs

Asset Category	Available Reserves	Reserves as a Percentage of Replacement Cost	Backlog as a Percentage of Reserves
Roads	$9,475,554	2.1%	100.7%
Bridges and Culverts	$4,853,421	1.7%	101.8%
Buildings and Facilities	$14,950,514	11.3%	331.2%
Social Housing	$6,606,499	9.1%	10.6%
Machinery and Equipment	$2,319,269	17.7%	197.5%
Vehicles	$3,412,892	29.0%	25.5%
Total	$41,618,150	3.0%	168.6%

The table shows that for most asset categories, reserves would either be insufficient for closing existing infrastructure backlogs, or require full depletion. However, we again note that field conditions may reveal a more accurate estimate of the backlog, allowing the County to better gauge how best to use available reserves.

In addition to reserves as a potential source of supplemental funding, the County may also be able to strategically reallocate reductions in debt repayments. Over the next six years, the County will be making annual debt repayments of $434,690, totalling $2,608,140. Beginning 2027, assuming no additional debt is taken on by the County, the annual payments may be reallocated for infrastructure.

Senior Government Funding

Federal and provincial governments provide supplementary funding to municipalities for infrastructure and asset management capacity building, as discussed below. While these are and/or have been consistent forms of funding for municipalities for many years, government funding structures and policy direction can change. As such, municipalities should be prepared for individual funding streams to change or disappear. However, although the structure of the transfers can evolve, both the province and federal government continue to provide reliable sources of funding for asset management and infrastructure programs.

Federal Gas Tax Funds

Gas Tax Funds have been, and will continue to be, a reliable source of funding for municipalities. Municipalities are provided a specific allocated amount each year, and the funding can be used for asset management capacity building.

Ontario Community Infrastructure Fund (OCIF)

OCIF has been available to municipalities through both a formula-based allocation and grant-based funding. However, the Ontario government ended the grant portion of the funding in 2020. They have continued the formula-based funding throughout 2020, maintaining the same approach that has been seen in past years.

Ontario Municipal Partnership Fund (OMPF)

This program primarily supports rural and northern communities across Ontario. There are five streams, which are renewed each year and provide communities with allocated funding. There have been cuts to this funding in the past year, constraining some municipal budgets. While this funding is not explicitly for asset management capacity building and/or software systems, it can allow eligible municipalities to use the funds to better manage fluctuations in funding.

Investing in Canada Infrastructure Program (ICIP)

This program is based on agreements between the federal government and each province. It has four streams: Public Transit, Green Infrastructure, Community, Culture and Recreation, and Rural and Northern Communities. The Ontario government works with the federal government to determine how the funding will be distributed throughout each stream. The Public Transit stream is allocated funding, whereas the other streams are determined through a grant system.

Strategic Priorities and Recommendations

The strategic priorities and recommendations identified in this section are derived primarily from Grey County's current state assessment, completed in May 2020. They are designed to reflect the County's current asset management maturity levels in each of the seven core elements of asset management, as summarized in Table 2. We've identified four strategic priorities and 20 associated recommendations; an additional 19, data-specific recommendations are also proposed. The four strategic priorities are:

- Strategic Priority 1: The Next Three Months
- Strategic Priority 2: Build Asset Management Culture and Capacity
- Strategic Priority 3: Enhance Data Quality
- Strategic Priority 4: Adopt Customer-centric View of Asset Management and Financial Planning

As part of this engagement, several key recommendations proposed in the current state assessment have already been addressed, either partially or in full. These are identified in Table 103.

Table 103 Status of Select Recommendations From the Current State Assessment

Recommendation	Status
Conduct data audit and gap analysis	Completed
Data componentization, e.g., UNIFORMAT II.	The County's forthcoming BCAs will address this recommendation.
Develop a lifecycle strategy for assets, defining the timing, impact, and cost of each activity	Completed
Estimate asset renewal needs based on asset age and available condition assessment data	Completed
Establish asset criticality methodology. Identify economic, financial, social, and environmental risk factors for each asset category.	Completed
Identify asset attributes within the asset inventory to serve as likelihood and consequence metrics for risk analysis	Partially complete
Define community and technical Levels of Service, utilizing the O. Reg. 588/17, MMS, Strategic Plan, and other documents	Mostly complete
Establish and track financial sustainability metrics, e.g., funding gaps, customer affordability, ratio of capital reserves to total replacement cost, annual debt capacity, etc.	Completed

Strategic Priority 1: The Next Three Months

By July 2022, municipalities across Ontario will be required to complete the first iteration of an asset management plan compliant with Ontario Regulation 588/17. The focus of the plan will be on core assets. The state of the infrastructure section developed as part of this engagement will be sufficient for meeting the requirements under the O. Reg. However, to ensure staff are confident as the deadline approaches, we recommend the following key actions over the next three months.

Recommendation 1. Verify state of the infrastructure data.

The state of the infrastructure section was developed based on the most current and accurate data available. This data may change, especially as new condition assessments are completed for the County's buildings portfolio. Staff are also building the County's storm infrastructure datasets. We recommend this section of the report is updated and verified to ensure a high degree of accuracy.

Recommendation 2. Strengthen staff understanding of regulatory requirements and workloads.

Ontario Regulation 588/17 requires extensive effort by municipal staff, and the development of more technically rigorous asset management plans than previously completed under the Municipal Infrastructure Investment Initiative (MIII). Although this document is produced in compliance with the O. Reg, improved understanding of the requirements will facilitate document review and internal approvals. We recommend regular communication to key stakeholders specific to these regulatory requirements.

We also note that although the completion of these asset management plans will likely be led by finance or treasury in most municipalities, all asset-centric departments will need to invest time and resources in collecting and verifying pertinent information ahead of each reporting deadline.

Recommendation 3. Collect missing levels of service data.

As part of this engagement, we developed and populated pertinent levels of service data for the County's core and non-core assets. For July 2022, O. Reg requires prescribed LOS reporting for only core assets; municipalities have discretion on how they report the performance of their non-core assets. In this regard, and although not required, we have developed KPIs that can be used for reporting purposes. As available, this data should be populated.

Strategic Priority 2: Build Asset Management Culture and Capacity

Most municipalities make significant improvements in advancing their asset management program on a project basis. As these projects, which include development of asset management policies or plans, come to a close, the momentum slows down, and the progress made is quickly eroded. Staff turnover can also reverse progress. To overcome this project-based approach, a shift in culture and improvements in fundamental business processes is needed.

Recommendation 4. Develop an asset management training and education program.

Grey County's maturity level in the 'Organization and People' element of asset management was rated as intermediate. Investing in staff education and training can yield significant long-term benefits. In addition, an improved understanding of foundational asset management principles and its intended outcomes at the council level is essential for developing and maintaining functional asset management program.

The County should establish a structured program for staff training on theoretical asset management concepts and standards; as feasible, members of council may also take part. Several organizations offer asset management training and certification, including the Institute of Asset Management (IAM), the Institute of Public Works Engineering Australia (IPWEA), and PEMAC Asset Management Association of Canada.

Education and learning need not take place through external resources. The County may consider developing high-level asset management specific training courses inhouse, made available to all staff. Within transportation services, asset management knowledge and understanding are considered advanced. This expertise can be leveraged by other asset-owning departments through internal cross-training opportunities. See Recommendation 5.

Asset management is considered a high priority among council and the senior management team (SMT). This alignment is vital for the success of any long-term program. The County also has a dedicated asset management coordinator (AMC), an asset management steering committee (AMSC), and a cross-functional asset management team (AMCFT) consisting of asset managers from all asset-owning departments. This creates a conducive environment to prioritize staff education, and elevate technical and conceptual understanding of asset management across the organization.

Lastly, field, or front-line staff are often excluded from learning opportunities, including education sessions. However, their insight can be crucial. The County should create opportunities for field staff to improve their asset management knowledge and understanding of the 'big picture'.

Recommendation 5. Establish communities of practice with suitable leads.

The communities of practice are informal meetings between members of the AMSC and the cross-functional team for the purpose of sharing and expanding asset management knowledge. Under discretion of the steering committee, communities of practice can meet at appropriate intervals, covering topics under the scope of the AMSC.

Topics can include the review and discussion of recent asset management program developments, lessons learned from previous projects, tactical strategies that can be implemented by other departments, and the presentation of resources (such as conference summaries or guest speakers) to advance the capacity and capability of the cross-functional team. It is key that a community of practice lead is assigned, ensuring that members continue to meet and share ideas.

Recommendation 6. Involve select field staff in strategic and financial planning discussions.

Select field staff should also have a platform to contribute to capital planning and budget decisions, as well as scoping requirements for service needs. Factoring in field staff as key stakeholders within project plans will reinforce to project managers that field staff will be at least consulted regarding technical elements of a project. In particular, field staff will have deep knowledge related to impacts of capital projects on operating requirements and risks associated with operational changes. Frontline staff can often provide insight on the historicity of assets that may have missed documentation.

Recommendation 7. Improve internal communications through a stakeholder communication plan.

Coordination and communication within and between departments are critical for the development and upkeep of an effective asset management program; these two elements are also the Achilles' heel in most municipalities. The County should develop an internal communication plan to facilitate systematic and regular communication between key stakeholders, including council, the asset management steering committee, the senior management team, and functional leads within departments.

The plan should clearly identify the audience for communication, the platform or method of communication, concise and compelling messaging that resonates with each stakeholder, and the frequency of communication. We recommend that all asset management-related communication should be centralized to the AMSC, and should originate specifically from the AMC. Initial communications can spotlight upcoming O. Reg requirements, how the regulation may impact each department, the County, and the community, and the type of effort required from each department to facilitate compliance.

Recommendation 8. Complete asset management-related business process mapping.

There are many asset management related tasks and processes that staff at Grey County execute throughout the year. Business process mapping (BMP) is a visual representation of how these tasks are completed across the organization, similar to workflow diagrams or flowcharts. It seeks to identify the staff members who are responsible for completing a particular task and those who are held accountable for the completion of the tasks.

This can be essential in ensuring continuity of major projects and initiatives, especially amidst any staff turnover. BPM can also help identify inefficiencies in how tasks are done, gaps in process completion, and pinpoint sources of potential miscommunication or confusion.

We recommend that each asset-owning department in the County complete a preliminary business process mapping exercise to identify which staff member(s) are responsible for completing various asset management related processes. In addition, we also recommend that, given their centrality to asset management, the finance department also complete a BPM exercise.

RACI charts offer a practical approach. A RACI chart is a simple matrix used to assign roles and responsibilities for each task, milestone, or decision on a project, initiative, or process. Table 104 defines the four roles in a RACI chart.

Table 104 Business Process Mapping Using RACI Charts

Role	Description
Responsible	Those who do the work to complete the task. There is **at least one** role with a participation type of Responsible, although others can be delegated to assist in the work required
Accountable	The one ultimately answerable for the correct and thorough completion of the deliverable or task, the one who ensures the prerequisites of the task are met and who delegates the work to those responsible. An Accountable must sign off (approve) work that the Responsible provides. There must be **only one** Accountable specified for each task or deliverable. An Accountable can also be Responsible.
Consulted	Those whose opinions are sought, typically subject-matter experts, and with whom there is two-way communication.
Informed	Those who are kept up-to-date on progress, often only on completion of the task or deliverable, and with whom there is just one-way communication.

Of course, asset management can have hundreds of business processes. It would be impractical to map all of them. We have identified 46 asset management related business processes for asset-owning departments, and 36 for finance that should be mapped. These are aligned with the seven elements of asset management, and illustrated in Table 105 and Table 106.

These charts should be circulated to each department. Upon completion, they should be centralized and updated with any staff changes.

Table 105 The 46 Core Asset Management Processes - Asset-owning Departments

Key Asset Management Processes for Each Element of Asset Management	Roads			
Element: Organizational Capacity	Responsible	Accountable	Consulted	Informed
Asset management education and communication	TBD	TBD	TBD	TBD
Establishing department priorities, including asset management	TBD	TBD	TBD	TBD
Ensuring adequate staff knowledge of asset management related competencies	TBD	TBD	TBD	TBD
Ensuring adequate staff capacity to carry out asset management related initiatives	TBD	TBD	TBD	TBD
Ensuring proper tools and processes exist to facilitate Asset Management Activities	TBD	TBD	TBD	TBD
Element: Asset Information	TBD	TBD	TBD	TBD
Data collection processes	TBD	TBD	TBD	TBD
Asset register updates and data input	TBD	TBD	TBD	TBD
Updating financial information (e.g. replacement costs)	TBD	TBD	TBD	TBD
Data governance, including asset register oversight and supervision	TBD	TBD	TBD	TBD
Develop condition assessment programs	TBD	TBD	TBD	TBD
Digitization of new assets (e.g. convert As-built to GIS or inventory data)	TBD	TBD	TBD	TBD
Field inspection data management (e.g. upload fleet inspection results to other systems)	TBD	TBD	TBD	TBD
GIS update and data input	TBD	TBD	TBD	TBD
Element: Strategy and Planning	TBD	TBD	TBD	TBD
Develop departmental service mission, vision, and strategic objectives	TBD	TBD	TBD	TBD
Develop departmental asset management approaches and practices	TBD	TBD	TBD	TBD
Coordinate Corporate goals and objectives with department	TBD	TBD	TBD	TBD
Service demand planning, including analysis, service goals, demand forecasting	TBD	TBD	TBD	TBD
Develop, review and update Continuity of Operations Plan	TBD	TBD	TBD	TBD
Long-range operations planning	TBD	TBD	TBD	TBD
Element: Asset Management Decision Making	TBD	TBD	TBD	TBD
Identify asset needs	TBD	TBD	TBD	TBD
Approve asset needs and develop needs list	TBD	TBD	TBD	TBD
Develop and optimize lifecycle program and strategies (activities, costs, timelines)	TBD	TBD	TBD	TBD
Develop infrastructure Master Plans	TBD	TBD	TBD	TBD
Prioritize projects, including cross-departmental coordination	TBD	TBD	TBD	TBD
Incorporate growth and new development projects to budgets	TBD	TBD	TBD	TBD
Element: Risk Management	TBD	TBD	TBD	TBD
Identify and document consequences of asset failure	TBD	TBD	TBD	TBD
Identify and document critical assets	TBD	TBD	TBD	TBD
Update systems with risk data (e.g. descriptions of risks, probability/consequence of failure)	TBD	TBD	TBD	TBD
Preparing and analyzing deficiencies report	TBD	TBD	TBD	TBD
Develop and manage risk models	TBD	TBD	TBD	TBD
Element: Levels of Service (LOS)	TBD	TBD	TBD	TBD
Identify, document, and monitor regulatory requirements	TBD	TBD	TBD	TBD
Establish proposed/desired/target levels of service	TBD	TBD	TBD	TBD
Determine costs to deliver current and proposed LOS	TBD	TBD	TBD	TBD
Develop technical and customer levels of service KPIs for performance monitoring/reporting	TBD	TBD	TBD	TBD
Produce performance reports and identify improvement gaps	TBD	TBD	TBD	TBD
Ensure programs are fully compliant with regulations	TBD	TBD	TBD	TBD
Communicate LOS performance to council and/or public	TBD	TBD	TBD	TBD
Performance monitoring and review	TBD	TBD	TBD	TBD
Element: Financial Management	TBD	TBD	TBD	TBD
Analyze short- and long - term capital requirements	TBD	TBD	TBD	TBD
Project operating and maintenance needs	TBD	TBD	TBD	TBD
Consolidate individual needs (e.g., across multiple facilities or buildings)	TBD	TBD	TBD	TBD
Coordinate with other departments, including finance, to determine priorities and budgets	TBD	TBD	TBD	TBD
Ensure alignment of budgets and priorities with strategic goals and LOS targets	TBD	TBD	TBD	TBD
Analyze the impact of proposed budgets on debt, reserve levels, taxes, and rates	TBD	TBD	TBD	TBD
Apply for grants and external funding sources	TBD	TBD	TBD	TBD
Optimize the use of various funding sources	TBD	TBD	TBD	TBD

Table 106 The 36 Core Asset Management Processes - Finance

Key Asset Management Processes for Each Element of Asset Management	Finance			
Organizational Capacity	Responsible	Accountable	Consulted	Informed
Establishing corporate priorities, including asset management	TBD	TBD	TBD	TBD
Ensure adequate staff knowledge of asset management related competencies	TBD	TBD	TBD	TBD
Ensure adequate staff capacity to carry out asset management related initiatives	TBD	TBD	TBD	TBD
Ensure adequate resources for asset management program	TBD	TBD	TBD	TBD
Provide asset management education and communication to all departments	TBD	TBD	TBD	TBD
Provide corporate oversight to departmental staff	TBD	TBD	TBD	TBD
Provide reporting of asset management program development	TBD	TBD	TBD	TBD
Endorsement and development of asset management governance structure	TBD	TBD	TBD	TBD
Asset Information				
Ensure asset register controls and protocols across all departments are consistent	TBD	TBD	TBD	TBD
Develop data governance, including asset register oversight and supervision	TBD	TBD	TBD	TBD
Communicate best practices on data management and approaches	TBD	TBD	TBD	TBD
Strategy and Planning				
Develop corporate service mission, vision, and strategic objectives	TBD	TBD	TBD	TBD
Develop corporate asset management approaches and practices	TBD	TBD	TBD	TBD
Coordinate corporate goals and objectives with departments	TBD	TBD	TBD	TBD
Conduct service demand planning, including analysis, service goals, demand forecasting	TBD	TBD	TBD	TBD
Ensure alignment of asset management with other key planning initiatives	TBD	TBD	TBD	TBD
Asset Management Decision Making				
Review departmental needs list	TBD	TBD	TBD	TBD
Review financial aspects of Master Plans	TBD	TBD	TBD	TBD
Prioritize projects, including cross-departmental coordination	TBD	TBD	TBD	TBD
Ensure proper life cycle management of assets is developed by all departments	TBD	TBD	TBD	TBD
Conduct corporate business case review and moderation	TBD	TBD	TBD	TBD
Risk Management				
Identify and analyze internal risks and pressures across all infrastructure programs	TBD	TBD	TBD	TBD
Document corporate level risks related to asset management programs	TBD	TBD	TBD	TBD
Identify and analyze residual risks of implementing financial plans	TBD	TBD	TBD	TBD
Communicate various reputational and corporate risks related to infrastructure services to council	TBD	TBD	TBD	TBD
Levels of Service (LOS)				
Establish proposed/desired/target financial indicators	TBD	TBD	TBD	TBD
Track financial indicators and assess trends	TBD	TBD	TBD	TBD
Ensure programs meet financial reporting needs	TBD	TBD	TBD	TBD
Communicate LOS performance to council and/or public	TBD	TBD	TBD	TBD
Integrate community feedback to adjust LOS	TBD	TBD	TBD	TBD
Financial Management				
Coordinate with other departments to determine priorities and budgets	TBD	TBD	TBD	TBD
Ensure alignment of budgets and priorities with strategic goals & levels of service targets	TBD	TBD	TBD	TBD
Analyze the impact of proposed budgets on debt, reserve levels, taxes, and rates	TBD	TBD	TBD	TBD
Develop, review, and update the Long-Range Financial Plan	TBD	TBD	TBD	TBD
Research and apply for grants and external funding sources	TBD	TBD	TBD	TBD
Optimize the use of various funding sources	TBD	TBD	TBD	TBD

Strategic Priority 3: Enhance Data Quality

Recommendation 9. Formalize data management through a data governance framework.

Data collection, gap analyses, and refinements are major initiatives that will produce important and marked improvements in the County's asset management program. To ensure these results are sustained, a data governance framework should be established that includes policies, procedures, and standards associated with the County's infrastructure data sets.

Data governance formalizes enterprise data management by establishing rigorous rules and guidelines through the lifecycle of datasets, from creation, storage, and usage, to archival, and destruction. Data governance should be initiated through a data governance policy. Similar to the County's asset management policy, the data governance policy should clearly identify key outcomes, and the role of each department, finance, the AMSC, the AMCFT, the AMC, information technology, relevant frontline staff, the SMT, and council, as it relates to infrastructure data.

The policy should also identify triggers that should mandate when key stakeholders are identified. Often, updates to datasets can take place in siloes, and key staff are not informed. The policy should also include a quality assurance process. This will ensure that the data used in asset management maintains continuous integrity.

Recommendation 10. Conduct semi-annual data audit and gap analysis.

As part of this engagement, we collaborated with staff to conduct a comprehensive gap analysis of the County's data inventory. The exercise identified gaps in primary and secondary asset datasets, including replacement costs, in-service dates, conditions, estimate useful life (data), and various asset attributes—information pertinent for asset management planning.

Such initiatives are essential for maintaining data quality. However, when done infrequently, it can become prohibitively difficult to analyse vast quantities of new data that may have accumulated over time. Simply gathering datasets and standardizing them for the analysis can be a substantial exercise on its own. As such, to build on the effort already expended, we recommend staff conduct a semi-annual data audit and gap analysis to identify opportunities for continuous refinement and standardization. The gap analysis should account for the six major criteria for data integrity, as outlined in Table 107.

Table 107 Criteria for Data Integrity

Criteria	Description
Complete	Do we have a complete inventory? Do all assets have at least primary data?
Valid	Does the data tell us what it should? Is it in the correct format?
Contemporaneous	Is the data current?
Accurate	Does the data reflect best estimates, industry standards, and staff judgement?
Attributable	Does the data have a (credible) source?
Consistent	Are asset records consistent across departments, e.g., (finance vs. department)

At minimum, the gap analysis should determine data maturity of the County's primary datasets. Primary data for an asset includes its quantity, replacement cost, in-service date, estimated useful life, and condition. This information can provide a reliable overview of asset portfolios ('current state of the infrastructure') and is integral in developing asset management plans.

In addition to primary data, data on risk, lifecycle, and levels of service should also form part of the gap analysis. Key findings from the data gap analysis should include, at minimum (non-exhaustive):

- Total number of datasets
- Comparative analysis between finance and departmental datasets
- Percentage and number of assets with primary data gaps
- Types of data gaps, e.g., % and number of road sections without current replacement cost
- Source of asset condition, e.g., percentage of assets with assessed condition available
- Percentage of assets without attribute data, e.g., physical properties, location data, risk-relate information

Table 108 provides potential attributes that may be used to benchmark data completeness for each asset class, beyond the needs for O. Reg 588/17 compliance.

Table 108 Potential Attribute Data

Asset Class	Possible Segments	Attributes
Road Network	Paved, Unpaved, Surface Treated, Sidewalk, Curb & Gutter	Length, Material, Thickness, Assessed Condition, Number of Lanes, Road Class, Quantity, Width, Location (street to and from)
Road Appurtenances	Signs, Streetlights, Traffic Signals, Control Signals, Fencing, Guardrails, Sound Barrier	Length, Material, Thickness, Height, Assessed Condition, Width, Type, Quantity, Supplier, Manufacturer, Color, Location (street to and from)
Bridges & Culverts	Bridges and Culverts	Bridge/Culvert type, Surface Material, Assessed Condition (BCI), Length, Deck Area, Annual Daily Traffic count (ADT), Detour Distance, Diameter, Manufacturer, Supplier, Location (street to and from)
Buildings & Facilities	Major components: Roofing, HVAC, Plumbing, Electrical, (Uniformat II Code is recommended for breakdown)	Material, Dimensions, Manufacturer, Supplier, Warranty, Color, Condition, Description, Location
Fleet, Machinery & Equipment	Emergency, Fire, Police, Public Works, Parks & Recreation, Agricultural, Administration, Social Services, Long-Term Care, Information Technology, Community Services	Type, Make, Model, Plate Number, Condition, Warranty, Location

Recommendation 11. Create and maintain an inventory of datasets.

Just as keeping an inventory of all tangible capital assets is important, in working with other municipalities, it has also been proven useful to maintain an inventory or list of all existing datasets pertinent to asset management—the intangible assets. This metadata can be used as a cross reference for all data gap analysis and reporting, and can be invaluable for new staff, allowing them to quickly

become acquainted with the depth and variety of data. The document can be a simple Excel spreadsheet, should be updated as new datasets are identified, and centralized for access by key stakeholders. To minimize corruptibility, it should also be governed under the data governance policy. Table 1099 provides a template that can be used.

Table 109 Keeping Stock of Asset Datasets

Department	Assets Included	Type of Data	Format	File Name and Path	Dataset Owner	Last Updated
Roads	Rural, Urban	Risk Attributes	Excel	*'roads_risk_2019.xls'*	Supervisor, Construction	September 2019
Bridges	Bridges and Culverts	OSIM Inspection	PDF	*Osim_2020.pdf*	Director	July 2020
Buildings	All buildings	BCA	PDF	*Bca_2020.pdf*	Directors	February 2020

Recommendation 12. Continue to refine asset inventory.

Following the data gap analysis, Grey County has taken important steps in refining its previous asset inventory, including updating quantities, replacement costs, and condition. Departmental staff will need to further contribute to the refinement of a more complete asset inventory for accurate reporting, including collecting and verifying asset inventory data, including estimated useful life, in-service dates, and replacement costs—all essential for developing reliable summary analytics on asset age, condition, and portfolio valuation.

Table 110 outlines, by asset categories, various data activities and tasks that should be completed. Many of the activities recommended were identified through the development of risk and criticality frameworks for each asset class. Please refer to the risk models for context, and as a reference for any applicable recommendation. Currently, as most attribute data was not available, the models rely primarily on age, condition, and replacement costs.

Table 110 Recommended Data Tasks by Asset Category

Asset Category	Data Task	Areas of Focus
All	• Assign Coordinated IDs for assets that link the primary database with all other databases. • Link GIS data to the primary asset inventory.	General Inventory Management and Reporting
Roads	• Quantities should be verified to improve alignment between base and surface. • Unit replacement costs should be further refined, considering the whole-cost of replacing the roads (construction, equipment, labour, administration, engineering, and contingency). • Where road reconstruction involves replacement of underground infrastructure, the County should define a cost sharing guideline. Generally, the replacement cost of the roads should only include excavation up to a suitable depth, and the remainder of the excavation and replacement of pipes to be included in the underground infrastructure cost.	General Inventory Management and Reporting

Asset Category	Data Task	Areas of Focus
	• Quantitative data related to exposure to extreme weather does not exist for roads. However, the County may be able to identify roads with historical susceptibility to washouts and other weather-induced deterioration. The three-point scale proposed in the road risk framework acts as a rough representation of exposure. • Staff may be able to obtain other attribute information identified as useful for risk models through existing documentation. For example, Road Class information can be obtained from the latest roads needs study. Generally, the class considers traffic counts, speed limit, and zoning. • Both proximity to Commercial/Industrial Centres and Critical Services can be reference from geospatial mapping. Roads within a buffer distance from either centre should be designated as per the rating scale. • Confirm AADT ranges presented in the risk model to match priorities of the County.	Risk and Criticality
Bridges and Culverts	• AADT ranges should be populated in CityWide™.	Risk and Criticality
	• Buildings Condition Assessment data should be uploaded into CityWide™ to improve accuracy of the state of the infrastructure for affected assets. • As the County's data in CityWide™ is not currently componentized according to Uniformat II code, an asset mapping exercise between BCA data and the current inventory may need to be undertaken. See note below on aligning disparate datasets.	General Inventory Management and Reporting
Buildings and Facilities	• For LTC and Grey Roots facilities, hazard assessments and operating environment metrics can be derived from staff interview and BCAs. These values should be assigned at the building component level to be used in the risk model • For Grey Roots, the ranges for average visitors per day should be verified. • The department of each asset has been used as a proxy for the 'Building Purpose' attribute. County staff should consider assigning a building purpose to each facility asset if the Department is not suitable. • 'Hazards' and 'Occupancy Limit' attributes can be obtained from upcoming building condition assessments (BCAs). These two metrics should be populated with data to ensure the risk and criticality model is complete.	Risk and Criticality
Vehicles	• For paramedic vehicles, categorize each vehicle as being Non-patient Transport or Patient Transport, and populate for the 'Functionality'. Completing this risk metric will allow all placeholders in the model to be complete	Risk and Criticality
Machinery and Equipment	• The Equipment Type metric can be populated by considering the name and description of each asset. • A review of the Paramedic Services Equipment inventory will be required to identify the specific Hazards associated with each piece of equipment, and populated in CityWide™.	Risk and Criticality

ALIGNING BUILDINGS AND FACILITIES DATA

Grey County's forthcoming building condition assessments will contain more granular data than that found in CityWide™. It is expected that the BCA will provide componentized data for the County's building portfolio. Alignment between the two datasets will be important for continuity, and better planning. However, it can be a difficult exercise. Below, we summarize the workflow of a typical mapping exercise we have completed with other municipalities:

1. Conduct comparative analysis between the two datasets, and identify the facilities and related components. This will determine the type of mapping exercise needed.
    a. A one-to-one match will mean there is a unique identifier that links the same asset in both datasets.
    b. A one-to-many match suggests the asset is pooled in the TCA inventory in CityWide™ and is disaggregated in the BCA.
    c. If there is no link or match apparent, manual linking will be required.
2. To ensure alignment with financial reporting, the historical cost of the pooled asset in CityWide™ should be allocated appropriately to the components. Determine how the total replacement cost of the facility in the BCA is allocated to the various components. The same proportions can be used to allocate historical cost.

Recommendation 13. Conduct a systems review and mapping exercise.

The systems review is an assessment of how different systems are used across each department, linked together or integrated, and the data available in each system. Data may include asset inventory, lifecycle, condition, worker orders, and financial reporting. Similar to business process mapping, a systems review and mapping exercise helps identify opportunities for greater alignment between different systems.

Strategic Priority 4: Adopt Customer-Centric View of Asset Management and Financial Planning

Demographic, social, economic, and environmental trends determine the composition of infrastructure and where investments should be made—which must evolve to keep up with changes. An aging population will require more long-term care homes, whereas a community competing to attract young families will prioritize investments in schools, recreational centres, and infrastructure that supports economic development.

Recommendation 14. Identify trends and influencers to optimize infrastructure portfolio.

Based on the 2015 Growth Management Strategy, Grey County's population is projected to increase to 105,400 by 2031. Based on the 2016 Census, the current population is 93,830. Over the 20-year period between 2016 and 2036, the County is expected to add 11,010 new residents. Over the same period, employment is forecasted to increased from 43,470 to 46,720.

However, these projections were estimated before the COVID-19 pandemic. The pandemic has had significant impact on how people work and where they choose to live—both of which will have cascading impact on infrastructure policy and planning.

Although an extreme outlier, the potential impacts of the pandemic on growth, and as a result, demand for and supply of key County services and programs, including infrastructure, should be considered with due diligence. In this regard, Grey County council has already taken important steps, requiring its next growth management strategy to include an analysis of COVID-related impacts.

Table 111 outlines how different infrastructure services and programs may be impacted by COVID-19. Although it will take time before the post-pandemic reality reaches a steady state, and planning and reviews can be done with more confidence, early analysis and discussion can help prime both internal stakeholders and the public.

Table 111 Impact of COVID-19 on Infrastructure Services

Service	Potential Impact on Service Levels	Impact of Spending
Transportation Services	More remote work will lead to decrease in daily commuters and traffic; residents may become more open to trade high quality roads for better internet connectivity	Opportunities to adjust lifecycle programs and find cost savings
Parks and Recreation	With continued protective measures, social distancing, and ongoing public health and safety concerns, outdoor spaces may see an increase in demand and community expectations. Residents may be more open to trade indoor recreation facilities for improved outdoor options	Lifecycle programs may see an increase to meet community expectations
Buildings and Facilities	Future indoor spaces may require redesign to better align with safety measures	Lifecycle programs may see a decrease in spending as fewer facilities are utilized; initial construction of projects still in planning stages may need to be reviewed and may experience cost escalation

In the same vein, the County should identify and document other key trends and influencers, and analyse how they may influence infrastructure programs, as well as asset management planning. These trends can impact service expectations, costs to deliver services, more stringent health and regulatory commitments that may increase capital and operating costs, and changing processes that require staff training and development

Recommendation 15. Improve understanding of public affordability of infrastructure services.

Levels of service should reflect public affordability. In 2015, the average after-tax income for all households in Grey County was $68,737, based on 39,560 households. Table 112 illustrates the percentage of its annual income that an average household in Grey County would need to give up to reach full funding for the County's annual infrastructure requirements.

Table 112 Annual Infrastructure Requirements as a Percentage of After-tax Income

Total Average Annual Requirements	Number of Household	Requirements per Household	Average After-tax Household Income 2015	Percentage of income needed for full funding
$32,847,852	39,560	$830	$68,737	1.2%

On average, each household in Grey County would need to allocate 1.2% of its annual after-tax income to fully fund the County's current infrastructure portfolio. Whether through grants or other subsidies through senior governments, all public infrastructure is ultimately funded by the public. Having this understanding can be helpful in delivering affordable and sustainable service levels, prioritizing investments, and when needed, making difficult but necessary decisions impacting programs and services.

Recommendation 16. Develop an external communication strategy.

Establishing proposed levels of service targets poses a considerable challenge for municipalities. Historical performance of assets, current asset condition, budget forecasts, and a good understanding of trends and influencers will provide a strong foundation for establishing preliminary levels of service targets. However, community feedback should also be integrated in planning and reporting.

The County should develop an external communication strategy. The strategy can include town halls, workshops, and surveys, giving residents an opportunity provide feedback on infrastructure services and outline their expectations. It also allows the County to discuss service trade-offs, the costs of service delivery, and the impact of changing service levels on taxes and rates.

Recommendation 17. Integrate risk and criticality with project prioritization.

A key outcome of this project was the development of risk and criticality models and frameworks. However, many of the attributes and the associated data needed in the models remains to be collected. Staff should collect pertinent data and integrate it with CityWide™. As data improves, the risk matrices and the risk classification of assets will become more reliable.

An asset's risk classification can help inform project prioritization, including identification of necessary lifecycle activities, and ultimately, allow the County to objectively assess the criticality of each asset and develop more advanced, data-backed infrastructure spending and investment strategies. With robust critical frameworks, investments in infrastructure will better reflect the importance of assets to Grey County, both as a corporation and as a community.

Recommendation 18. Integrate climate change adaptation with asset management planning.

Canada is warming twice as fast as the global average. In response, the County is currently developing a comprehensive Climate Change Action Plan (CCAP). Ostensibly, the focus of the CCAP is on "climate change mitigation efforts to reduce emissions created by the Corporation of Grey County (i.e., County services, fleet, public buildings, etc.) and the community (i.e. residents, businesses, institutions, visitors, etc.).

Rising temperatures are associated with more extreme weather events which can have dire effects on public infrastructure stock. Research indicates that Canada's public and private infrastructure stock, valued at more than $852 billion, will be exposed to significant risks in the coming decades. Climate change could cost Canada $21 to $43 billion per year by 2050. Floods are now the leading cause of damage to homes in Canada.

Increased climate variability introduces significant uncertainty into both existing infrastructure preparedness and planning for future infrastructure needs. Yet, the 2016 Canadian Infrastructure Report Card found that only 19% of municipalities formally integrate climate change adaptation into decision-making.

Although the County is taking an important step towards combating climate change by developing the CCAP, mitigation efforts must be supplemented by adaptation efforts. The vulnerability and resilience of the County's infrastructure should be a formal topic of discussion at the AMSC, AMCFT, and the SMT levels. Initially, we recommend focusing on identifying the type and level of risks posed by climate change to the County's infrastructure portfolio. This data should be documented and integrated with risk and criticality frameworks.

Recommendation 19. Pivot from reactive to proactive maintenance.

As part of this engagement, we also worked with each department to develop lifecycle frameworks. The frameworks included the timing, costs, and type of lifecycle intervention for major assets in the County's portfolio. Using the lifecycle framework as a benchmarking tool for intervention costs and timing, each department should quantify the percentage of total annual spending that is reactive, and establish realistic targets and timeframes for shifting the balance of spending towards more proactive (preventative and/or predictive) maintenance and rehabilitation. Classifying annual request and spends based on lifecycle stage will serve to highlight real program pressures.

Making this fundamental shift in spending is a long-term exercise, and improvements will be incremental. Condition assessment data, an understanding of the asset's criticality, its importance to delivering current and proposed levels of service, and linkages with other departments and asset networks, can help identify where this shift should take place first.

THE RATIONAL FOR PROACTIVE MAINTENANCE

The benefits of proactive maintenance, including costs avoidance and less downtime, appear over the long-term, making it an easy target for budget cuts. However, these benefits are clear and substantial. A study by Jones Lang Lasalle compared the costs of preventative and reactive maintenance across the real estate portfolio of a telecommunications firms.

The portfolio included 14 million square feet of mixed property and their various components, e.g., roofing, mechanical, electrical, and parking lots. The study showed that by prolonging the life of the assets and reducing major capital expenditures, an investment in preventative maintenance would not only pay for itself, but produce an ROI of 545%.

Recommendation 20. Review full-funding approach with SMT and council.

The financial analysis suggests that the County can achieve full funding for its infrastructure program under a 1.21% annual tax increase, over a 15-year phase in period. This is consistent with the County's 2016 asset management plan, which recommended a 1% tax increase over 15 years. This should be reviewed with council and the SMT, with clear focus on proposed levels of service, and public affordability.