COUNTY OF WELLINGTON

Asset Management Plan

Core Assets

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Executive Summary

In response to the **Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure (O. Reg. 588/17),** the County of Wellington “the County” has taken a pro-active approach in preparing a detailed Asset Management Plan, “AM Plan.” This version of the plan is in compliance with the deadline of July 1, 2022; AM Plan for *core assets.* This AM Plan addresses current levels of service and the associated costs of maintaining that service for the following assets:

- Roads
- Bridges and Culverts
- Stormwater

As the County’s assets continue to age, it becomes increasingly important to formalize processes to determine how a group of assets is to be managed over the full asset lifecycle to ensure that safety standards, legislative requirements, and expected levels of service continue to be the most cost effective for residents of the County.

This AM Plan aligns with the County’s Strategic Asset Management Policy completed as part of O. Reg. 588/17. The Policy identifies the municipal goals the AM plan supports, how the budget is informed, AM planning principles, considerations for climate change, and a commitment to provide opportunities for stakeholder input.

This AM Plan contains the following for each of the core assets:

- Data Quality Assessment and Modeling Assumptions
- Inventory and Condition information, including mapping
- Estimated Replacement Cost, Funding Requirements, and Funding Strategies
- Risk Analysis and Lifecycle Event information
- Current Levels of Service Metrics

In compliance with O. Reg. 588/17, the County will prepare an updated AM Plan in 2024 that includes all municipal assets and in 2025 that includes proposed levels of service. Subsequent to completing the requirements of the regulation, the AM Plan will be updated every 5 years. Interim changes made to sections of the AM Plan will occur annually in order to update the Financial Analysis and Detailed 10-Year Financial Forecast for Capital Assets. This will ensure continued alignment with the County’s most current ten year capital plan and the detailed data and information outlined in this AM Plan.

The full version of the AM Plan will be made available to the public on the County website (www.wellington.ca)

EXECUTIVE SUMMARY (CONT'D)

Inventory

Asset	Quantity	Total Replacement Cost	Ten Year Average Capital Needs	Ten Year Average Replacement Needs	Annual Requirement
Roads	703.56 km	$213,672,750	$14,858,433	$10,735,611	$10,458,922
Bridges	104	$240,584,686	$8,066,002	$6,041,290	$4,722,291
Culverts	94	$32,807,469			
Storm Network (pipes)	36,513.35 m	$133,761,893	$362,423	$362,423	$1,913,606
Storm Network (structures)	1,443 units	$7,215,000			
TOTAL		**$628,041,798**	**$22,924,435**	**$17,139,324**	**$17,094,819**

Note: Replacement costs are in 2020 dollars. Backlog refers to asset(s) overdue for replacement.

Capital Needs: This value represents the funding needs to perform the lifecycle events (including replacements) that are scheduled for a specified year. Backlogs from previous years are accounted for in the current year and will be carried forward into each subsequent year until the replacement is completed.

= SCHEDULED AND BACKLOG REPLACEMENT COST + SCHEDULED LIFECYCLE ACTIVITIES COST

Replacement Needs: This value represents the funding needs to replace the assets that are scheduled for a specified year. Backlogs from previous years are accounted for in the current year and will be carried forward into each subsequent year until the replacement is completed.

= SCHEDULED AND BACKLOG REPLACEMENT COST

Annual Funding Requirement: This value represents the annual funding needed to perform all lifecycle events, including the replacement of an asset over its estimated useful life. Annual Funding Requirement calculates an average over the whole life of an asset assuming all lifecycles events are completed throughout, so there are no backlogs to account for.

$$= \frac{\text{ASSET REPLACEMENT COST + ALL LIFECYCLE ACTIVITIES}}{\text{ESTIMATED USEFUL LIFE OF ASSET}}$$

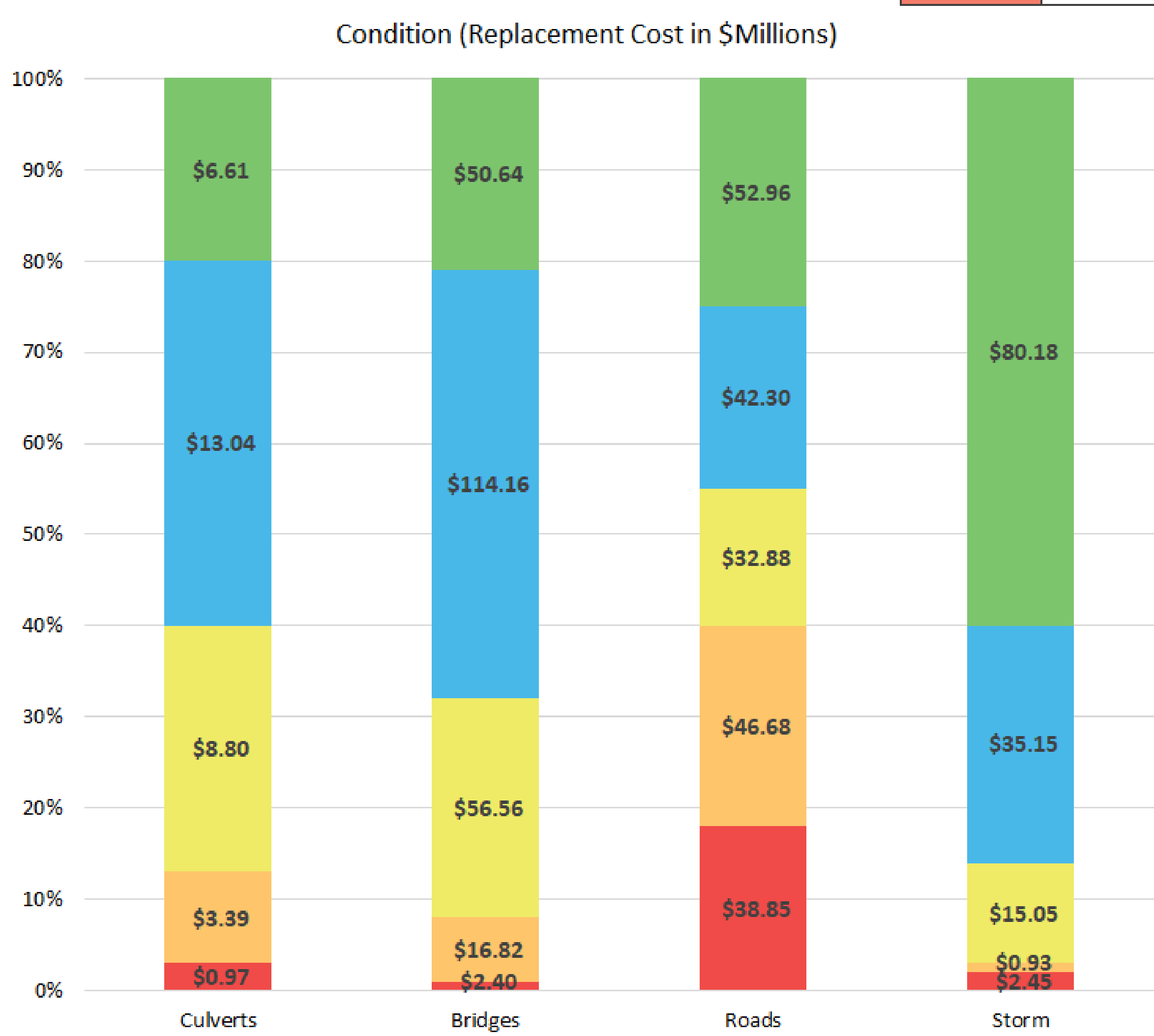
EXECUTIVE SUMMARY (CONT'D)

Condition

The graph below shows what the percentage is for each asset class, and where it falls within each category of the condition scale. The total replacement cost of all the assets within the corresponding category are summarized below. The core assets included in this plan have an overall *Good* condition.

Condition assessments are conducted on a regular basis and reported annually. The condition will be updated annually to reflect completed construction and up-to-date assessments.

Scale	Definition
Very Good	Fit for the future.
Good	Adequate for now.
Fair	In need of attention.
Poor	At risk of failure.
Very Poor	Unfit for sustained service.



Note: This graph represents the condition as of December 31, 2020.

Executive Summary (CONT'D)

Risk

A risk assessment is conducted on County assets using a matrix to assess the probability and consequence of failure. Assets are grouped into five categories; Very Low, Low, Moderate, High, and Very High.

Asset	Very Low (1-4)	Low (5-7)	Moderate (8-9)	High (10-14)	Very High (15-25)	Total
Roads	134 Assets 279.16 km $84,806,250	96 Assets 214.29 km $64,992,640	41 Assets 113.63 km $34,773,300	50 Assets 96.21 km $29,020,160	1 Asset 0.27 km $80,400	322 Assets 703.56 km $213,672,750
Bridges	31 Assets 31 units $53,165,360	32 Assets 32 units $83,665,817	22 Assets 22 units $56,179,034	19 Assets 19 units $47,574,475	0 Assets - -	104 Assets 104 units $240,584,686
Culverts	32 Assets 32 units $9,165,725	33 Assets 33 units $11,763,716	13 Assets 13 units $5,964,995	15 Assets 15 units $5,403,826	1 Asset 1.00 units $509,207	94 Assets 94 units $32,807,469
Stormwater Pipes	1,281 Assets 34,120.69 m $122,499,290	78 Assets 1,979.58 m $6,453,437	18 Assets 299.70 m $4,560,253	4 Assets 114.38 m $248,913	0 Assets - -	1381 Assets 36,513.35 m $133,761,893
Stormwater Structures	1,436 Assets 1,436 units $7,180,000	7 Assets 7 units $35,000	0 Assets - -	0 Assets - -	0 Assets - -	1443 Assets 1443 units $7,215,000

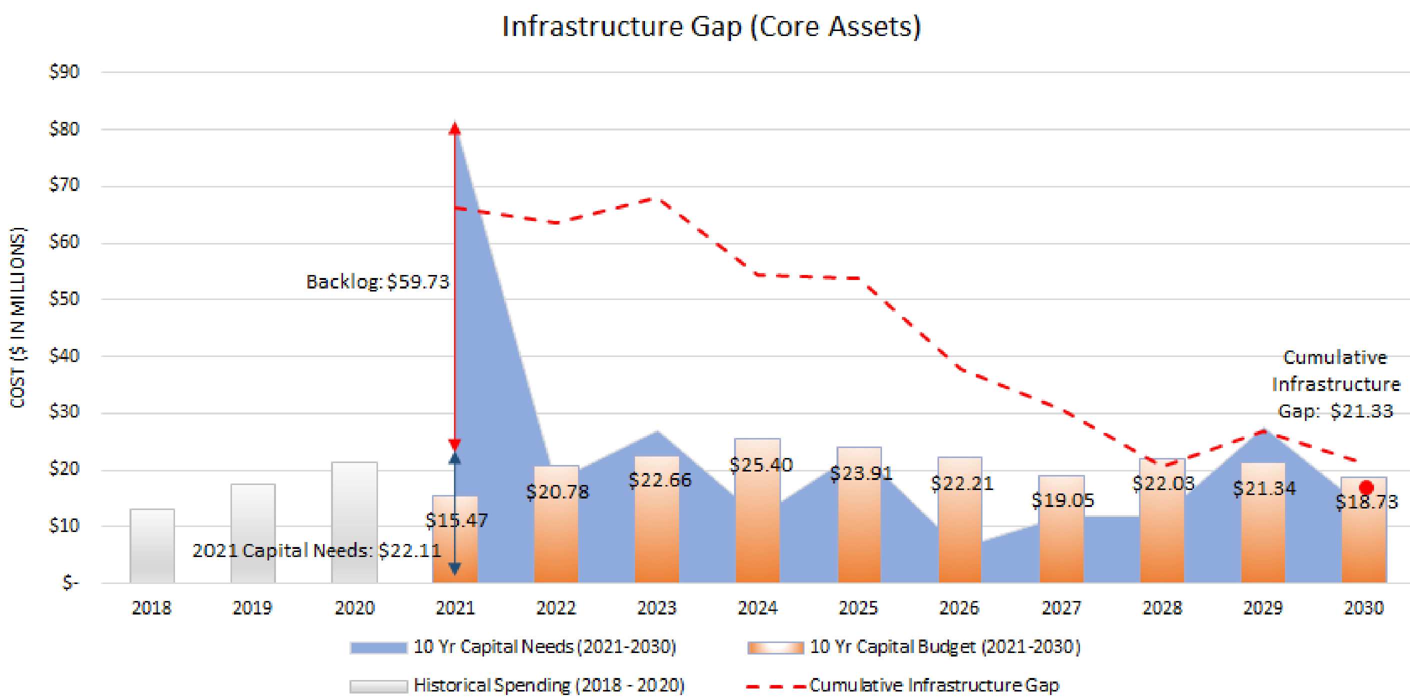
The factors used to estimate the probability of failure vary by asset class, and may include things like construction material, condition assessments and age. The consequence of failure varies for each asset class, and may include the impact of failure on health and safety, the environment, strategic objectives, or the financial health of the County. The probability of failure is multiplied by the overall consequence of failure to arrive at a risk score, which is plotted on a risk matrix and provides a summary of critical assets.

EXECUTIVE SUMMARY (CONT'D)

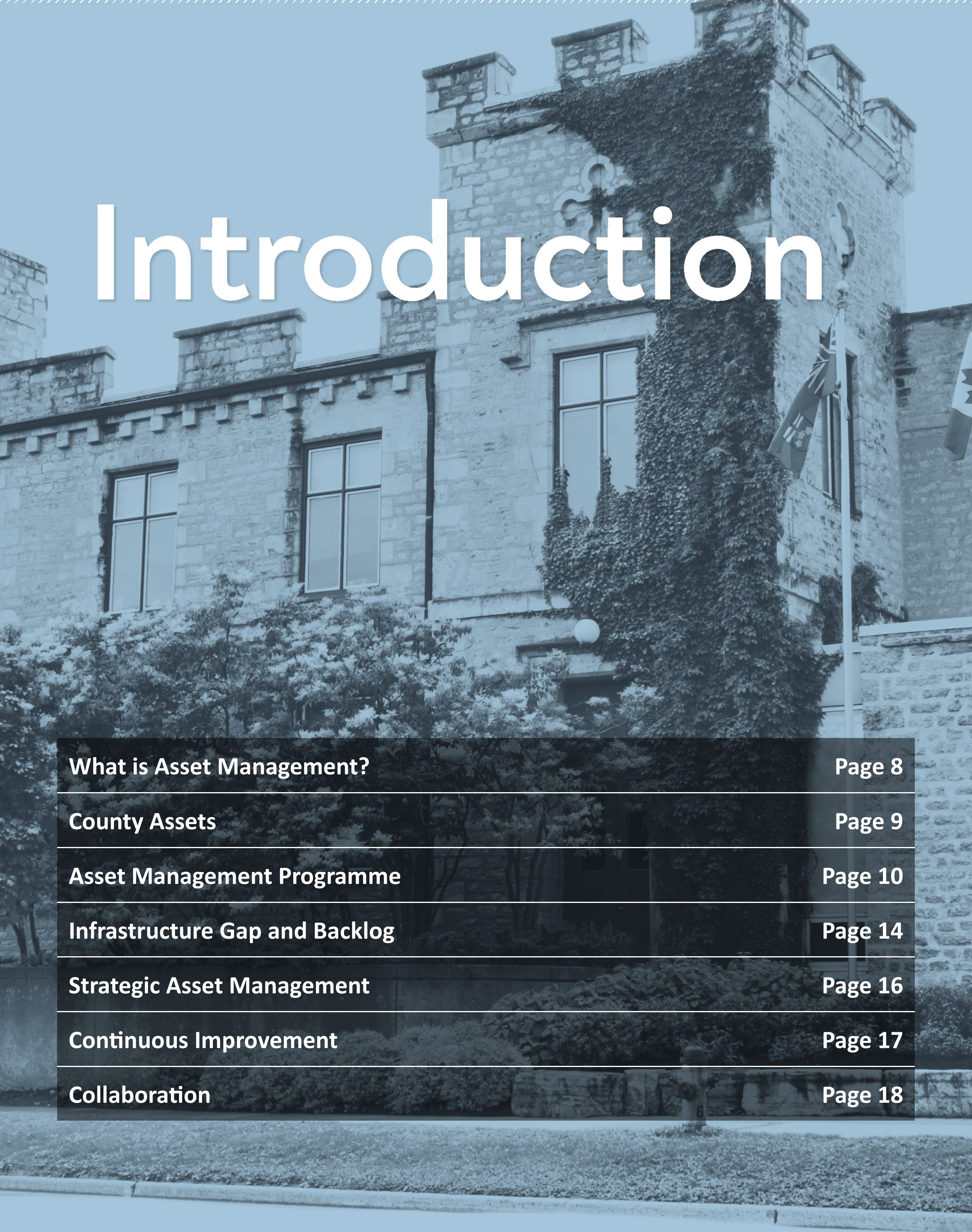
Infrastructure Gap and Backlog

The graph below measures the difference between what the County plans to invest (ten-year capital budget for 2021-2030) and what needs to be invested (ten-year capital needs for 2021-2030) in order to sustain the current levels of service and overall condition. The 2022 proposed budget has been incorporated to better reflect available funding over the 10 year period. As the AMP evolves to include more asset classes and better data in future versions, this gap is expected to increase.

The current infrastructure gap is projected to decrease over the next 10 years resulting in a cumulative gap of $21.33 Million. In order to address the backlog of $59.73M and maintain the overall average condition and levels of service, the County will need to increase funding to eliminate or mitigate the gap.



An inflation rate of 3.5% has been applied to both projected capital budget and projected capital needs. Both measures only account for the road network, bridges, culverts, and storm water network. Other asset classes such as facilities and vehicles & equipment have yet to be incorporated in future versions. Certain expenditures have also been excluded from available funding such as: Condition studies, warranty works, and expenditures funded by development charges, growth related debentures, and municipal recoveries.



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WHAT IS ASSET MANAGEMENT?

Asset management (AM) is an integrated set of processes and practices that minimize the lifecycle costs of owning, operating, and maintaining assets, at an appropriate level of risk, while continuously delivering established levels of service. The core catalysts for the establishment of an organization-wide Asset Management Programme (AMP) include the increasing costs associated with providing a range of services to residents, population change, and the impacts of climate change within the context of a challenging municipal funding model.

AM planning is the process of making the best possible decisions regarding the building, operation, lifecycle events, renewal, replacement, and disposal of assets.

AM planning allows municipalities to make informed asset investment decisions, prioritizing investments, improving financial performance, managing risk, improving organizational sustainability, and improving efficiency and effectiveness.

The five key elements of AM (Fig. 1.1) are:

1. Providing a defined level of service and monitoring performance;
2. Managing the impact of demand changes (growth as well as decline) through demand management, infrastructure investment, and other strategies;
3. Taking a lifecycle approach to developing cost-effective management strategies for the long-term that meet that defined level of service;
4. Identifying, assessing, and appropriately controlling risks; and
5. Having a long-term financial plan which identifies required expenditures and how they will be funded.

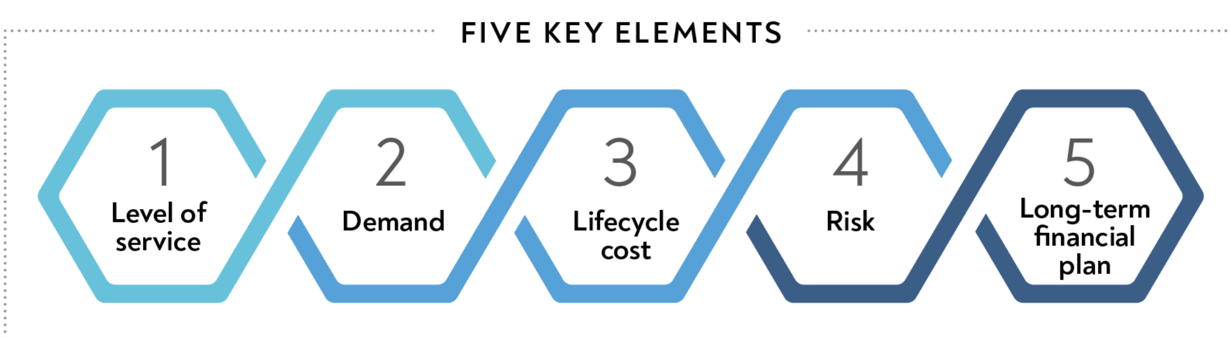

Fig. 1.1 The five key elements of AM. Source: International Infrastructure Management Manual.

COUNTY ASSETS

County assets are essential to the delivery of municipal services. They allow for the efficient flow of people and products, support cultural enrichment and economic development initiatives, and contribute to the quality of life for residents across the County. Fundamentally, infrastructure assets exist to provide services to our communities.

The County of Wellington provides a wide range of services to our residents by maintaining capital assets across the County, including 1,400 km of roadways, over 100 bridges, more than 3,200 social and affordable housing units, several libraries, child care centres, and long term care facilities. The County also maintains a fleet of vehicles and equipment, IT assets, landfill sites, and waste facilities across the County.

Assets are broadly defined as "things that have actual or potential value to the County." This definition encompasses everything from roads, bridges and culverts, to library books (Fig. 1.2). All of these assets allow the County to provide critical services to residents. This AM Plan meets the requirements under Ontario Regulation 588/17 for Core Assets which include; roads, bridges, culverts, and stormwater assets. Future versions of the plan will include additional asset classes, such as buildings, vehicles and equipment.

Fig. 1.2 The County libraries are considered assets, as are the different components that make up the libraries. Future versions of the AM plan will contain details on the non-core assets and their components such as library books.

Asset Management Programme

Completion of AM Plans is coordinated through the AM Programme area at the County. An advanced AM Plan consists of:

1. **A complete and accurate inventory**. Knowing what the County owns, where it is, and what condition it is in allows the County to predict future lifecycle events and renewal costs, identify any liabilities, and manage risks.
2. **A performance tracking system**. Knowing how well the County assets are performing and how reliable they are provides the County with information to predict when asset performance will drop to an unacceptable levels, and schedule required interventions.
3. **A focus on levels of service**, to ensure the County provides the best services in the most cost-effective way.
4. An **optimized lifecycle events strategy**, to allocate resources efficiently.
5. A **demand management strategy** that enables planning for future infrastructure investments.
6. **Integration** of the AM plan with capital and operating budgets.

Based on the *State of Maturity Report* completed in 2020, the County's AM capacity is at an intermediate level, with informal AM practices in each department. While these practices vary in completeness and complexity, the common theme across the organization was the need to improve the degree of consistency in data collection and management practices, formalize risk assessment procedures, and work toward improving data quality.

Data quality is critical to AM. Having an up to date, comprehensive asset data inventory is crucial for making informed, timely decisions regarding optimal infrastructure investments. In addition to detailed technical data, the data collected for each asset class includes:

- **Valuation** data: used to calculate replacement costs, track depreciation, and understand the financial useful lives of County assets;
- **Capital Investment** data: identifies the cost and frequency of the capital events for each asset, a better estimate of the lifecycle costs of owning an asset;
- **Condition** data: defines the current condition of County assets and provides us with an understanding of the rate of deterioration of our infrastructure;
- **Performance** data: provides us with an idea of the levels of service provided by County assets;
- **Risk** data: enables the County to prioritize investments based on the likelihood and consequence of asset failure.

Improving the quality of the data available will enhance modeling capacity and will provide more reliable estimates of investment needs for both the short-term and long-term financial plans at the County.

Asset Management Programme (CONT'D)

In 2013, the County demonstrated a commitment to AM through the approval of a corporate AM policy and programme. The purpose of this policy was to promote a corporate approach to the management of assets using best practices to support the delivery of services to the community. The policy established the first governance model and defined organizational accountability and responsibility for corporate AM. The first AM plan was completed and followed the guidelines provided by the "Ontario Ministry of Infrastructure: Guide for Municipal Asset Management Plans."

Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure

In 2017, O. Reg 588/17 was released outlining the new requirements for municipal AM planning. The Compliance timelines are phased in over a 6-year period (Table 1.1)

Date	Requirement	Description
July 1, 2019	Strategic Asset Management Policy	The policy identifies municipal goals the AM plan supports, how the budget is informed, AM planning principles, considerations for climate change, and a commitment to provide opportunities for stakeholder input.
July 1, 2022	Asset Management Plan (Core Assets)	The plan must address current levels of service and the associated costs of maintaining that service for water, wastewater, roads, bridges, culverts and storm water assets.
July 1, 2024	Asset Management Plan (All municipal assets)	The plan must address current levels of service and the associated costs of maintaining that service for all municipal assets.
July 1, 2025	Proposed Levels of Service	Builds on the 2024 requirement by including a discussion of proposed levels of service, what activities will be required to meet proposed levels of service, and a strategy to fund those activities

Table 1.1 Ontario Regulation 588/17 requirements.

In response to this new regulation, the County and its member municipalities formed an AM Working Group in order to collaborate and share strategies for implementation. Also, to produce comparable reporting and align budgets for future shared capital projects, and to share GIS resources. In addition, the County established an internal Working Group with representation from each department in order to plan for compliance with the new regulation.

In 2019, the County updated its corporate AM policy in order to comply with the requirements under O. Reg 588/17. The Strategic AM Policy outlines the fundamental AM principles that will be incorporated into the County's overall Corporate AMP.

Asset Management Programme (cont'd)

Long-Term Financial Sustainability Strategy

The County of Wellington developed a Long-Term Financial Sustainability Strategy to guide investment decisions across the County. This strategy is needed to address current and future asset expenditure requirements. Investment in infrastructure will be based on long-term requirements and consider the level of service guided by the AM plan. The County will not allow for unplanned reduction in service levels or permit County infrastructure to deteriorate.

Strategic Action Plan

In accordance with the Strategic Action Plan which was adopted in 2019, the County has accomplished the following actions:

- Created a new Long-Term AM Plan for Core Assets based on best management practices and guided by the principles of long-term financial sustainability
- Aligned the planning horizon of the new AM Plan with the annual budget and 10-year planning process
- Allocated resources to support the new AM Plan rollout and implementation
- Implemented new AM software in collaboration with its member municipalities

ASSET MANAGEMENT PROGRAMME (CONT'D)

Service Efficiency Review

In November 2019, the County of Wellington and its seven member municipalities completed an Operational Service Efficiency Review. The review identified several opportunities to improve AM services between municipalities including the following:

- Establish and implement a county-wide AM System with centralized GIS functions and data, including shared/ dedicated AM expertise
- Establish consistent AM performance measurements and a centralized performance management system
- Implement consistent standards for infrastructure and asset condition assessments
- Deploy and use mobile digital tools for AM activities in order to reduce paper records

In addition, the County developed a corporate AM framework and updated the existing governance policy based on industry best practice. This identified the need for additional resources in order to support an integrated and sustainable approach to service delivery across the county, including coordinating with the seven member municipalities within the County.

In 2020, the County allocated additional resources in AM and undertook the implementation of AM software in order to consolidate and centralize all asset data across service areas. The County, and its seven member municipalities, all use a common software system for AM. As part of this project, the County moved forward with its AM Programme development initiative and completed the following key elements required in AM planning:

- State of AM Maturity Report
- Condition Assessment Protocols
- Risk Analysis & Modelling Framework
- Levels of Service Development

Infrastructure Gap and Backlog

In 2009, all municipalities across Canada were required to incorporate Tangible Capital Assets (TCA) into their financial statements (PSAB standard 3150). In order to implement this standard, municipalities were required to prepare inventories by asset class, determine age, useful life, and historical cost. This raised the level of awareness on both the cost and ownership of the assets themselves and allowed municipalities to understand and better anticipate future investment needs. PSAB 3150 forced a needed shift towards longer-term planning and sustainability practices.

Construction of infrastructure surged across Canada from the 1950-70's due to growth, modernization, and urbanization following the end of WWII. The following decades saw little investment in infrastructure maintenance, and as a result, a significant proportion of infrastructure across Canada has fallen into disrepair. Poor planning and under-investment have left Ontario with the most serious infrastructure deficit in its history. The burden of this deficit falls largely on municipalities, leading to key decision making.

The County maintains approximately $1.10 billion of assets. Some assets are relatively new, or recently repaired, while others are approaching the end of their useful lives and have significant investment needs. Our communities are faced with an aging and quickly deteriorating asset base but have limited revenues to rehabilitate or replace those assets. The County must balance the ongoing operating needs of newer assets with the more capital intensive repair and rehabilitation needs of older assets.

Assets that have reached the end of their estimated useful life, but have not been replaced have resulted in a funding backlog; as they represent assets that currently fall into the *Poor* to *Very Poor* condition category which are beyond repair and in need of immediate replacement. The backlog for some asset classes may be significant. For example, the road network has a large number of roads in *Very Poor* condition and are overdue for replacement. In order to accommodate for this backlog, the costs associated with the funding gap are added on to the first year (2021) of the ten-year capital needs forecast.

The Infrastructure Gap can be defined as the difference between the ten-year capital needs and the available funding (ten-year capital budget). Accurately defining and addressing the gap is an ongoing and integrated process that relies on complete asset inventories, comprehensive condition assessments, clearly defined lifecycle events, and alignment with budget categories. As the available data improves, and the long-term financial plan and AM plan are further integrated, analyses relating to the state of County Infrastructure and the investment gap will become more refined.

INFRASTRUCTURE GAP AND BACKLOG (CONT'D)

The County of Wellington invests in the renewal of its infrastructure through the ten-year capital budget. The graph below (Fig 1.3) measures the difference between what the County plans to invest (ten-year capital budget for 2021-2030) and what needs to be invested (ten-year capital needs for 2021-2030) in order to sustain the current levels of service and overall condition.

The current infrastructure gap is projected to decrease over the next 10 years resulting in a cumulative gap of $21.33 Million. Although the County is going in the right direction, this indicates that planned investment in asset lifecycle initiatives does not fully address the needs of the County's infrastructure. In order to address the backlog of $59.73M and maintain the overall average conditions and levels of service, the County will need to increase funding to eliminate or mitigate the gap. This can be done by increasing the annual capital contributions by $2.13 Million per year.

In addition, if the County aims to make improvements to the network and its overall condition, as well as improve the levels of service, funding requirements will need to be further increased over time.

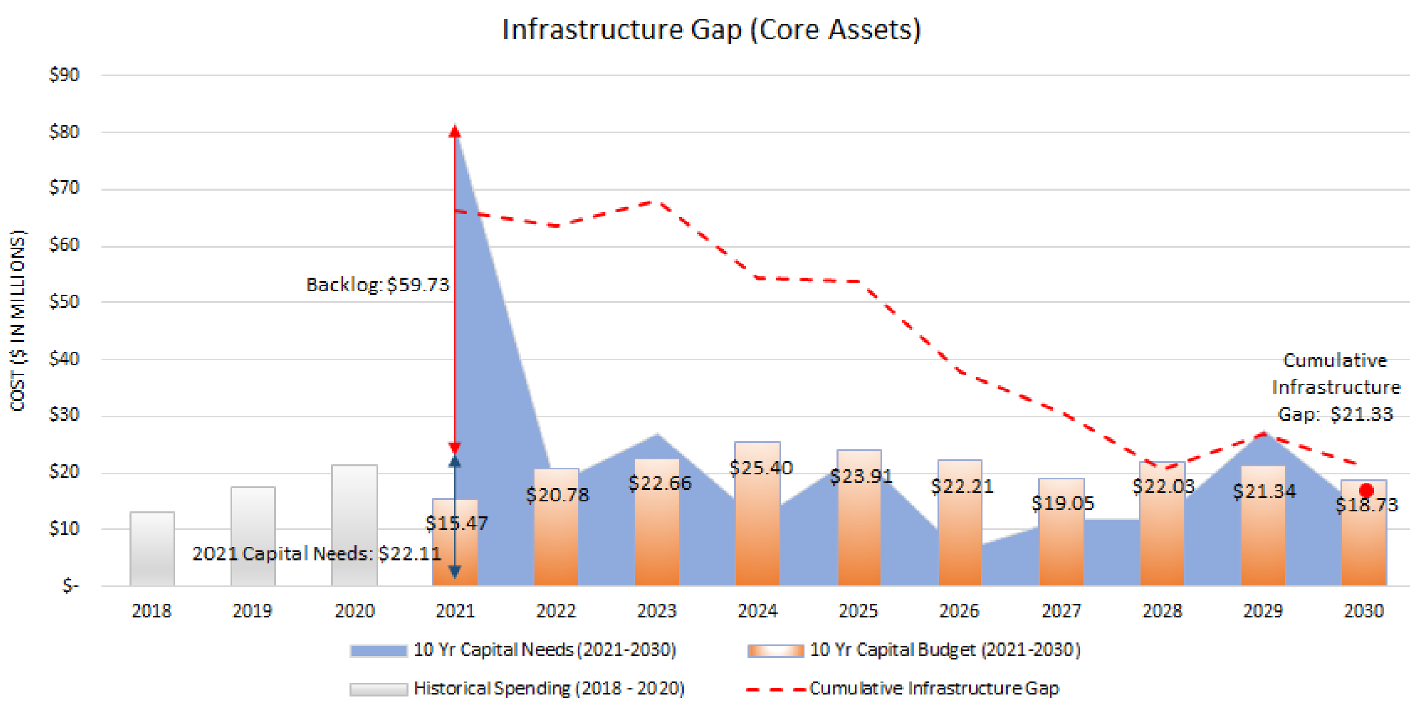

Fig. 1.3 A graph showing the infrastructure gap for the County's core assets. An inflation rate of 3.5% has been applied to both projected capital budget and projected capital needs. Both measures only account for the road network, bridges, culverts, and storm water network. Garage facilities are excluded. The ten-year capital budget also excludes expenditures funded by development charges, growth related debentures, and municipal recoveries.

Strategic Asset Management

The County adopted the *Strategic Asset Management Policy* in June of 2019. The policy is in compliance with O. Reg. 588/17 and it outlines the fundamental AM principles that will be incorporated into the County's overall AM Programme. The County provides a wide range of services to the community that require the ownership and responsible operation, maintenance, rehabilitation, and retirement of physical assets. The intent is to maximize benefits, reduce risk, and provide acceptable levels of service to the community in a sustainable manner. The County is committed to continually improving its AM strategy by incorporating elements of various strategic policies and plans, including the *County of Wellington Strategic Action Plan* and *the Long Term Financial Sustainability Strategy.* AM planning will be concurrent with the County's overall goals, plans, and policies in order to support the following community objectives:

Continuous Improvement

This plan is a living document. As AM practices evolve and improve, the completeness and quality of future plans will improve, as will the capacity to plan for future infrastructure investment needs. Once the requirements of the regulation have been met; a comprehensive update of the AM plan will take place every five years, and annual reports will be submitted to County Council to summarize the state of the assets and AM related activities throughout the year.

Each section in this AM Plan contains a data maturity scale, which gives an idea of the confidence the County has in its modeling, based on the quality of the data available. It also gives the County an idea of key data gaps, and the priorities for ongoing improvement.

Each section also includes a strategy for improving the management of those assets. Some asset classes, such as the storm water infrastructure, may have limited data, and the key strategic goals for that asset class may include data quality improvements. Other classes may have identified a large infrastructure gap, and the strategy may be more focused on the allocation of available funding to address the gap.

In order to guide the continuous improvement of the Corporate Asset Management Programme as a whole, the following short and long term goals have been identified (Table 1.2).

Short-Term Goals	Long-Term Goals
• Ensure compliance with O.Reg. 588/17 for both core and non-core assets. • Define replicable methodology for calculating replacement costs for non-core assets. • Develop preliminary risk matrices for non-core assets. • Build data collection templates for all County assets to better align with CityWide AM software. • Define standard operating procedures for the AM software. • Upload and review non-core asset data to ensure accuracy and completeness. • Incorporate operating budget costs (i.e. lifecycle costs) into the funding models for core assets.	• Integrate growth projections and master plans (e.g. RoadMap), Development charge study and Climate Change Mitigation Plan into the AM Plan. • Define target levels of service for core assets. • More closely integrate the ten-year budget forecast with the AM Plan. This includes re-aligning the budget to better reflect asset categories, as well as adopting a common asset identification system to better allocate costs to assets. • Collaborate with Member Municipalities.

Table 1.2 Short-and long-term priorities for the development of the County AMP as a whole.

COLLABORATION

There are ongoing opportunities for the County to work with its seven member municipalities to establish a county-wide asset management service delivery approach. County roads lead into member municipality local streets, storm water pipes managed by the County are fed by those managed by member municipalities, and the County owns and maintains assets throughout the member municipalities, including bridges and buildings. Capital lifecycle events of our assets impacts our member municipalities, and as a result, coordinated AM practices are necessary to optimize AM across the County.

Throughout the process of establishing a corporate AM Programme, the County has engaged representatives from all seven member municipalities, to share best practices and resources. The County and member municipalities have all implemented common AM software to aid in tracking AM activities and enabling predictive analyses relating to infrastructure investment.

Components of lifecycle management, including condition assessment scales, risk models, and performance measurement have been reviewed to determine the degree to which common definitions, matrices, and procedures can be adopted. We are continuously evaluating opportunities for further collaboration and efficiency across the County.

In addition, the County has utilized best practices including tools and templates provided by the Federation of Canadian Municipalities (FCM), Municipal Finance Officers' Association (MFOA), and neighbouring municipalities where appropriate for research and peer review.

The County will provide opportunities for public engagement where residents and other stakeholders served by the County can provide input into asset management planning through the existing Strategic and Master Planning processes.

Key Concepts

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CONDITION

The County assesses the condition of its assets on a regular basis in order to evaluate regulatory and service level requirements, and to inform short- and long-term funding decisions. Condition assessments are critical for the long-term planning process, as they provide information on the current state of infrastructure.

Condition assessment programmes and ratings differ by asset class and are based on generally accepted engineering principles specific to the services that they support. Details on condition assessments for core assets are provided in the service area summaries of this plan.

In order to better understand the technical metrics, a five point descriptive scale (Table 2.1) was developed based on the assets overall condition and type of work required.

Scale	Definition
Very Good	**Fit for the future.** The asset is in very good condition, typically new or recently rehabilitated. Regular maintenance should be undertaken to keep the asset in very good condition.
Good	**Adequate for now.** The asset is physically sound and is in good condition, with some elements showing general signs of wear that require attention. Regular maintenance should be undertaken to keep the asset in this condition. Typically, the asset has been used for some time but is still within early to mid-stage of its expected life.
Fair	**In need of attention.** The asset shows general signs of deterioration, and is performing at a lower level than originally intended. Some components of the asset are becoming physically deficient and component replacement may be necessary. Maintenance requirements and costs are increasing. The asset is in need of either minor capital repairs, or additional maintenance.
Poor	**At risk of failure.** The asset is approaching the end of its useful life, and exhibits significant deterioration. Major repairs are required, with significant capital investment. Ongoing monitoring and inspection of the asset condition are required.
Very Poor	**Unfit for sustained service.** The asset is in unacceptable condition with widespread signs of advanced deterioration, and has a high probability of failure. Should the asset fail, there is a risk of the asset out being out of service. Maintenance costs are unacceptable and rehabilitation is not cost-effective. The asset is in need of major replacement or refurbishment. Ongoing monitoring and inspection of the asset condition are required.

Table 2.1 Five-point condition scale used to rank the condition ratings of all County assets.

RISK

A risk assessment is conducted for every asset to evaluate how likely an asset is to fail, and what the impact of that failure would be for the community (Fig. 2.1).

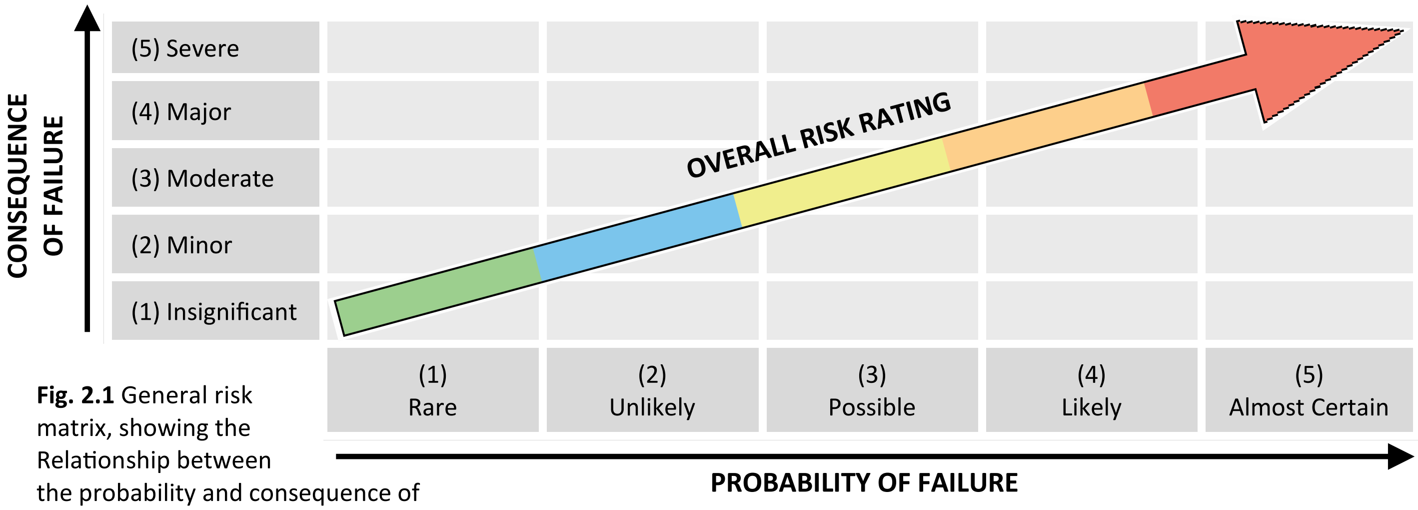


Fig. 2.1 General risk matrix, showing the Relationship between the probability and consequence of asset failure and the overall risk rating.

The probability of failure represents the likelihood that an asset will not achieve the desired level of service, or will not be able to fulfill a certain need. If the condition of an asset deteriorates, the probability of failure will increase. However, even assets with a high condition score can be at risk of failing to meet community needs, if they no longer meet regulatory requirements or are inadequate to meet changing demand.

The factors used to estimate the probability of failure vary by asset class, and may include things like construction material, condition assessments and age. The consequence of failure varies for each asset class, and may include the impact of failure on health and safety, the environment, strategic objectives, or the financial health of the County. The probability of failure is multiplied by the overall consequence of failure to arrive at a risk score, which is plotted on a risk matrix (Fig. 2.1) and provides a summary of critical assets.

Critical assets are defined as those that would have significant impacts on our communities, should they fail. These assets are monitored closely to ensure that the County is proactively managing any risks of failure. Critical assets include key infrastructure like roads and bridges, as well as assets that are central to service networks, like large stormwater pipes that manage significant water flow.

The application of the risk model allows the County to prioritize resources, ensure vital services are available, streamline inspection programmes, optimize operations and maintenance programmes; and prioritize and optimize capital budget programme delivery.

Lifecycle Events

Asset ownership costs can be broken down into three categories: initial purchase or procurement costs, operating costs, and disposal costs (Fig. 2.2). Once in service, assets are renewed and rehabilitated at regular intervals in order to extend their useful lives. While initial investment costs may be significant, the ongoing lifecycle events' costs over the life of the asset make up the bulk of the cost of asset ownership.

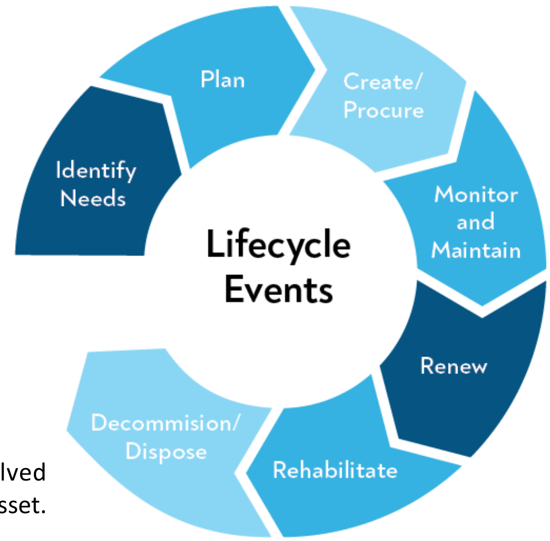


Fig. 2.2 The activities involved over the lifecycle of an asset.

Estimated Useful Life

The estimated useful life of an asset reflects how long the County expects to be able to use an asset. This is referred to as the *estimated* useful life because the *actual* useful life may be different. A new road may show signs of rapid deterioration far ahead of what would be expected. At the same time, an old asset may have been maintained well enough that it can serve far longer than what was estimated. The estimated useful life of an asset can be combined with its condition to get a better understanding of how long the asset can be used.

Once the estimated useful life is established it is plotted along a "deterioration curve" (Fig. 2.3). This curve represents the change in condition based on scheduled events over the assets lifecycle. The curve typically includes events in the deterioration model which increase the estimated useful life of the asset over time.

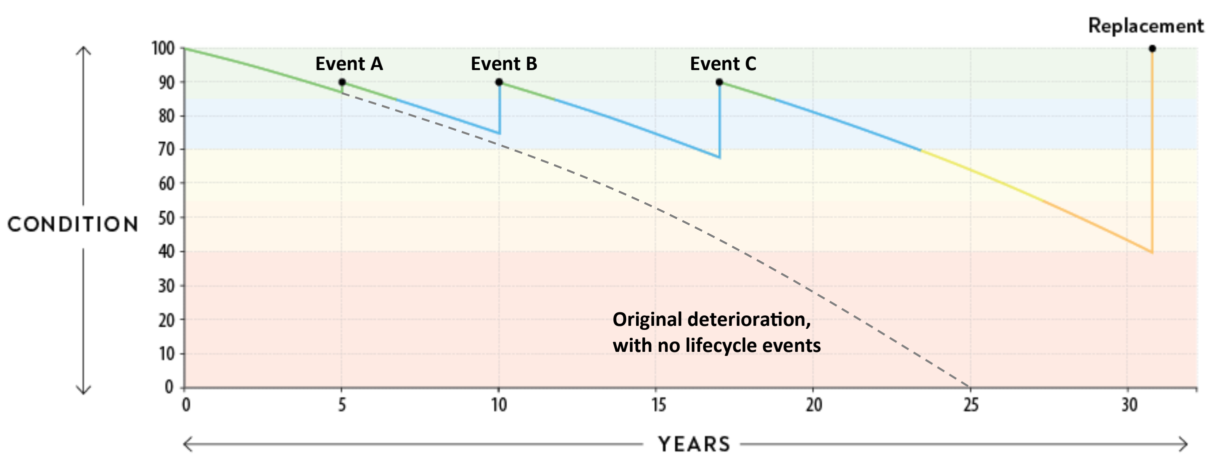


Fig. 2.3
Sample deterioration curve, showing the original deterioration, as well as planned capital maintenance and rehabilitation.

Demand Management

Demand is driven by a number of factors, including population growth, demographic shifts, changes in the types of services and the ways in which the County is expected to provide those services, land-use changes, economic development trends, and environmental shifts. Anticipated changes in demand need to be incorporated into long-term planning as well as their effects on County infrastructure.

Increases or decreases in demand can significantly affect what (and how many) assets will be needed to meet the needs of communities. Infrastructure demand trends are analyzed to determine whether they are ongoing, long-term trends such as population and demographic shifts, or more cyclical in nature, such as seasonal variation in demand. This enables the County to predict impacts on future budgets and plan accordingly.

Economic trends, such as tourism growth, housing affordability, and changes in household disposable income also affect the types of services provided and how they are funded. County residents are also increasingly reliant on technology, which impacts services. Changes in technology can create the need for new or improved services and infrastructure, including provision of broadband in rural communities.

The County is also witnessing a demographic shift with an aging population in need of significant support, including infrastructure investments to enhance mobility and accessibility throughout communities. Population growth and demographic shifts will necessitate additional infrastructure investment, including widening roads and bridges to prevent congestion, increasing child care capacity, and making waste collection programmes as efficient as possible.

DEMAND MANAGEMENT (CONT'D)

The population of the County of Wellington is projected to grow to roughly 140,000 residents by 2041 (Fig. 2.4). This growth is not evenly distributed across the County, with the majority of growth concentrated in Centre Wellington (Fig. 2.5).

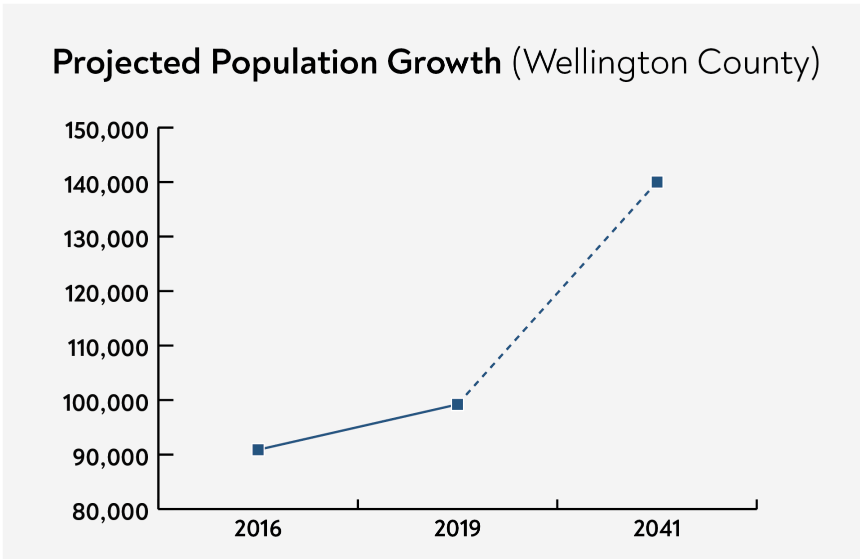


Fig. 2.4 Wellington County projected population growth, 2016-41. Source: 2016 Development Charge Study.

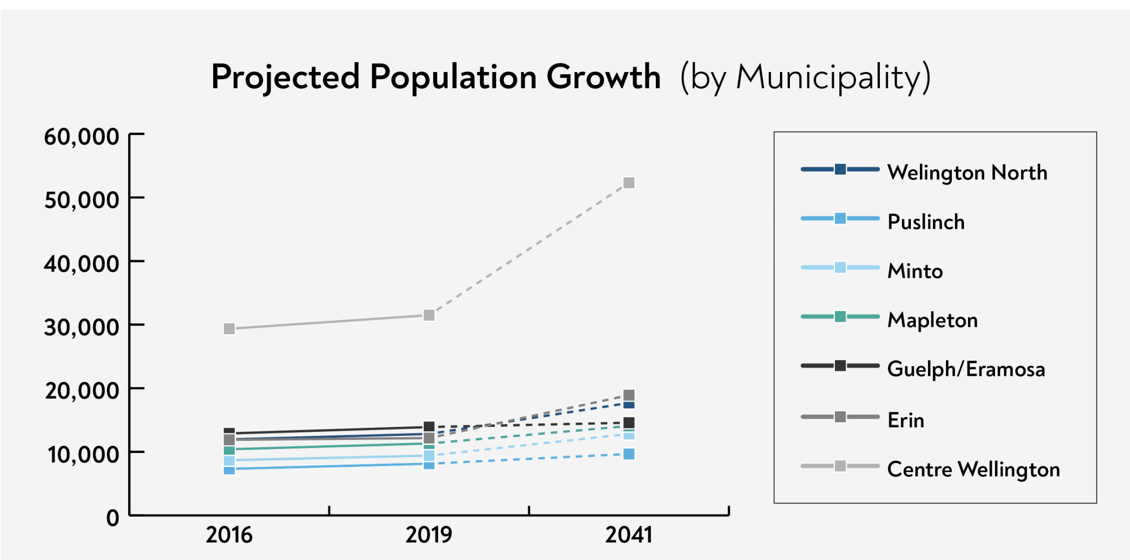


Fig. 2.5 Member municipality projected population growth, 2016-41. Source: 2016 Development Charge Study.

The number of households in the County is expected to increase by almost 40% between 2019 and 2041, growing from roughly 35,000 households to over 48,700. As in the projected population growth, household growth will be concentrated in Centre Wellington, which will see 60% growth in the next 20 years. This will place a significant burden on infrastructure across the County, with some variation across member municipalities.

Climate Change

The County of Wellington is projected to see many climate-related changes in the future. Based on the County Climate Change Mitigation Plan, the two most noticeable changes will likely relate to temperature and precipitation. The County is projected to see:

- An increase in average annual temperatures
- An increase in the number of days annually when local temperatures are greater than 30 degrees Celsius
- An increase in average annual precipitation, the frequency of extreme events, and snowfall intensity.

The County has already begun to see the impacts of a changing climate on Ontario infrastructure. A July 2013 storm that resulted in flash flooding across the GTA became the most expensive natural disaster in Ontario history (*source: OSWCA; The State of Ontario's Water and Wastewater infrastructure, March 2018*). In February of 2018, a state of emergency was declared across southwestern Ontario due to heavy rain and melting snow. These previously rare "100-year" storm events are becoming much more common, placing additional pressure on existing infrastructure.

Some assets are at higher risk of climate change events and are more vulnerable to failure. For example, County roads within the 100-year floodplain are more vulnerable to worsening storms, and the County stormwater infrastructure will also need to be able to cope with the additional environmental stressors.

County Council endorsed a climate change mitigation plan for the County of Wellington in 2021 entitled "Future Focused." This plan seeks to integrate climate change into our decision-making by developing actions and policy to lead the community in the reduction of greenhouse gas emissions. This will ensure the County of Wellington continues to deliver superior public service resulting in healthy and safe communities within resilient and sustainable ecosystems, now and in the future.

Climate change adaptation is an inevitable, major investment that is made up of an array of projects that help our communities withstand the consequences of a changing climate.

Enhancing our natural infrastructure aids in climate change mitigation (Fig. 1.9). More details regarding the plan and climate change mitigation strategies can be found on the County of Wellington website.

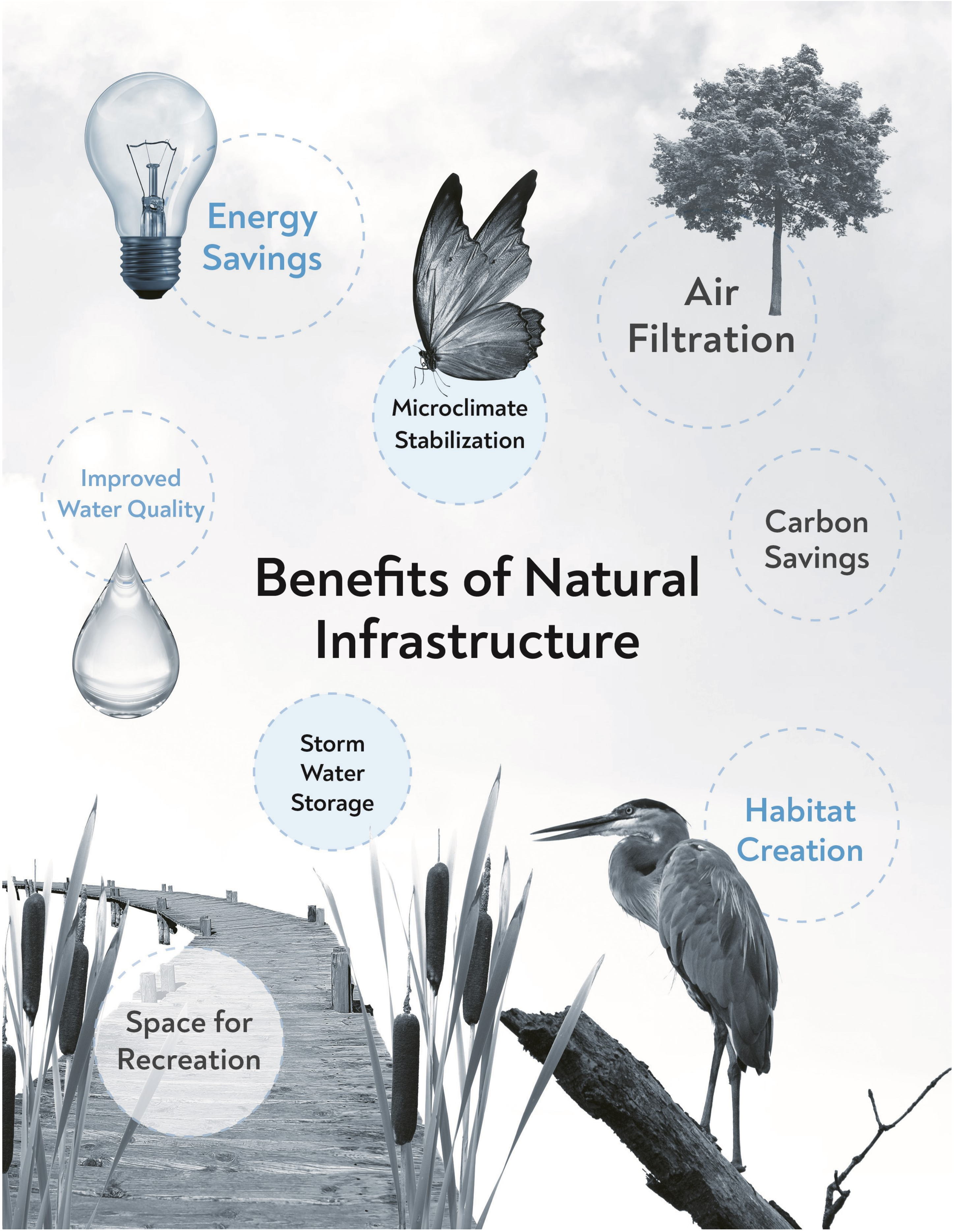


Fig. 1.9 Enhancing our natural infrastructure aids in climate change mitigation

Replacement Cost

The replacement cost is the cost that the County would incur if it were to replace an asset for an identical asset in 2020 dollars.

The replacement cost for assets being replaced by "like" assets can be estimated using a number of methods:
The method used to estimate replacement costs is informed by available data, and by whether the estimates are replicable and comparable year-over-year.

Method	Description
Property Insurance Values	Replacement costs identified in the most recent insurance contract.
Asset Assessments	Internal staff or external consultants estimate the cost to replace entire structures or components of structures.
Inflated Historical Cost	The original purchase price is inflated to the current dollar value to estimate the cost of replacing the asset today.
Current Market Cost	Applying recent acquisition costs to assets as a proxy for the current cost to replace.

The County has developed models to estimate the replacement costs of the core assets (roads, bridges and culverts, and stormwater assets). Future versions of the AM Plan will contain replacement cost estimates for all County assets, including our social housing units, County administration buildings, and all other assets not included in this plan.

The replacement costs will be updated on a annual basis to reflect changes in input costs, such as construction materials, parts, and labour. This will provide a more accurate estimate of our infrastructure funding needs, and will enable the county to better predict future costs.

Funding Needs

This AM Plan outlines capital funding needs using three different measures. All three measures are calculated using County data and the models within the Asset Management Software. These measures will provide a guideline for the County to prioritize needs over wants. These calculations are useful to forecast the funding needs and compare to the 10-year capital budget forecast, and identify any funding gaps.

Capital Needs: This value represents the funding needs to perform the lifecycle events (including replacements) that are scheduled for a specified year. Backlogs from previous years are accounted for in the current year and will be carried forward into each subsequent year until the replacement is completed.

- **Includes:** Asset Lifecycle Events (including replacements), Backlog in current year

= SCHEDULED AND BACKLOG REPLACEMENT COST + SCHEDULED LIFECYCLE ACTIVITIES COST

Replacement Needs: This value represents the funding needs to replace the assets that are scheduled for a specified year. Backlogs from previous years are accounted for in the current year and will be carried forward into each subsequent year until the replacement is completed.

- **Includes:** Asset Replacements, Backlog in year 1
- **Excludes:** Asset Lifecycle Events

= SCHEDULED AND BACKLOG REPLACEMENT COST

Annual Funding Requirement: This value represents the annual funding needed to perform all lifecycle events, including the replacement of an asset over its estimated useful life. Annual Funding Requirement calculates an average over the whole life of an asset assuming all lifecycles events are completed throughout, so there are no backlogs to account for.

- **Includes:** Asset Replacements, Asset Lifecycle Events
- **Excludes:** Backlog

$$= \frac{\text{ASSET REPLACEMENT COST + ALL LIFECYCLE ACTIVITIES}}{\text{ESTIMATED USEFUL LIFE OF ASSET}}$$

Financing Strategy

The Long-Term Financial Sustainability Strategy helps guide investment decisions across the County. It consists of nine core principles, as follows:

Principle		Description
1	**Ensure Long-Term Financial Health**	The County's financial position will allow it to continue to achieve its obligations over the long-term, without undue pressure on taxpayers.
2	**Predictable Infrastructure Investment**	Investments will be based on long-term plans, based on levels of service.
3	**Responsible Debt Management**	The amount and cost of servicing new debt will not negatively affect the County's credit rating.
4	**Strategic Use of Reserves and Reserve Funds**	Reserves and Reserve Funds will be funded to the levels required for their purposes, as set out in the Reserve and Reserve Funds policy.
5	**Competitive Property Taxes**	The County will strive to achieve reasonable and responsible property tax rates to ensure that the County continues to be a desirable place to live, work, and play.
6	**Deliver Value for Money**	The County will continuously seek efficiency and quality improvements in the way services are managed and delivered.
7	**Appropriate Funding for Services**	The County will determine how and when user fees are utilized, and ensure that growth pays for growth via the use of development charges.
8	**Diversify our Economy and Enhance our Assessment Base**	The County will promote economic development activities to enhance the assessment base to ensuring every ratepayer is paying their fair share.
9	**Protect and Preserve Intergenerational Equity**	The County will strive to maintain a strong financial position while establishing fair sharing in the distribution of resources and obligations between current and future taxpayers.

FINANCING STRATEGY (CONT'D)

These principles (Fig. 2.6) guide the County's infrastructure investment strategies. As the County gains a better understanding of the infrastructure investment needs and the available funding, the County will need to make important decisions regarding investment priorities, risk management, and climate change mitigation. The County will also need to evaluate the ways in which it analyzes the benefits of its investments, the long-term operating budget implications of its capital projects, and how it measures the performance of its assets against investments. All of these decisions and processes will be informed by these nine principles and the County Strategic Action Plan.

Fig. 2.6 Nine principles of the Long-Term Financial Sustainability Strategy.

The County of Wellington's capital budget and ten-year plan is supported by several sources of revenue. These sources are described below.

The County funds infrastructure renewal activities through a combination of the following:

- Current Revenues
- Capital Reserves
- Federal Funding: Canada Community Building Fund (CCBF), formerly Federal Gas Tax
- Government Subsidies
- Recoveries from other Municipalities
- Development Charges and Debt
- Debt

FINANCING STRATEGY (CONT'D)

Current Revenues

Historically, the net County share of roads capital works has largely been funded through current year appropriations from the tax levy. This ensured capital activities fell within the envelope of current year tax dollars. Although this strategy worked well to keep tax rates reasonable, it is best practice to contribute to capital reserves for the replacement and refurbishment of capital assets.

The 2022 roads capital budget and forecast has largely been funded from the Roads Capital Reserve, rather than current revenues. This is in alignment with the principles of Predictable Infrastructure Investment, Long-Term Financial Health, and Strategic Use of Reserves within The Long-Term Financial Sustainability Strategy.

Capital Reserves

Capital Reserves are an important component of the capital financing strategy and are used extensively by the County. The roads capital reserve was established to fund the replacement and renewal of roads capital assets, provide funding for budget adjustments at time of tender and for road and bridge emergencies. Contributions to the reserve enhance the County's capacity to handle current and future capital roads needs.

The goal of the roads capital reserve is to fund capital requirements over a 1 –2 year term. Where current revenue was used historically, capital reserves will now be used to fund renewal works and enable predictable investments based on long-term plans.

The 10-year Capital Budget (2021 - 2030) includes $441.1 million for infrastructure related-capital requirements. Typical funding of this reserve is capital project savings, annual operating transfers and Aggregate Resources Act revenue.

Canada Community Building Fund (formerly Federal Gas Tax)

Since 2006, the County of Wellington has received approximately $34.8 million in Federal Gas Tax funding. The intent of this funding is to provide up-front, predictable long term funding to Provinces and Territories to help address local infrastructure priorities. The County has planned to utilize $32.4 million for AM and infrastructure improvements to its network of roads, bridges and culverts over the next 10 years.

FINANCING STRATEGY (CONT'D)

Government Subsidies: Ontario Community Infrastructure Fund

The provincial subsidy revenues are identified from the Ontario Community Infrastructure Fund (OCIF) formula-based funding. The Province has committed additional funds to this programme for 2021. The County's allocation is $1.86 million in the proposed 2022 budget and County staff have assumed this level of funding through to 2031, however the Province has not committed to providing this funding long-term.

Recoveries

Recoveries from other municipalities are budgeted for shared projects. Recoveries in the Roads Division are used for capital works on boundary roads and bridges shared with neighbouring municipalities.

Development Charges and Debt

Development charges are determined through the development charge background study in accordance with the County's development charge by-laws. Study updates are scheduled over 2021-2022. The County funds growth-related work through development charges.

Debt

Debt financing will be used only when necessary to ensure the tax levy remains reasonable and to ensure reserve balances are adequate to meet the future needs of existing capital assets. It is best practice to contribute to Capital Reserves for the replacement / refurbishment of capital assets as this reduces the need for debt financing.

The proposed 2022-2031 10-year capital budget includes $7 million in debt financing for two County bridge structures located on Wellington Road 109. These structures were identified as part of the WR 109 Strategic Bridge Strategy and summarized in the 2015 Bridge and Culvert Appraisal report.

Other Funding Options

User Fees are not currently used at the County but could be considered in the future. For example; stormwater user fees have recently been implemented in a number of urban municipalities to help fund the rising infrastructure costs of increased rainfall due to the impacts of climate change.

Levels of Service

The foundation of the AMP is an understanding of the expected levels of service provided to the community. Infrastructure investment decisions are based on the types of services and the quality of service that County residents expect (Fig. 2.7).

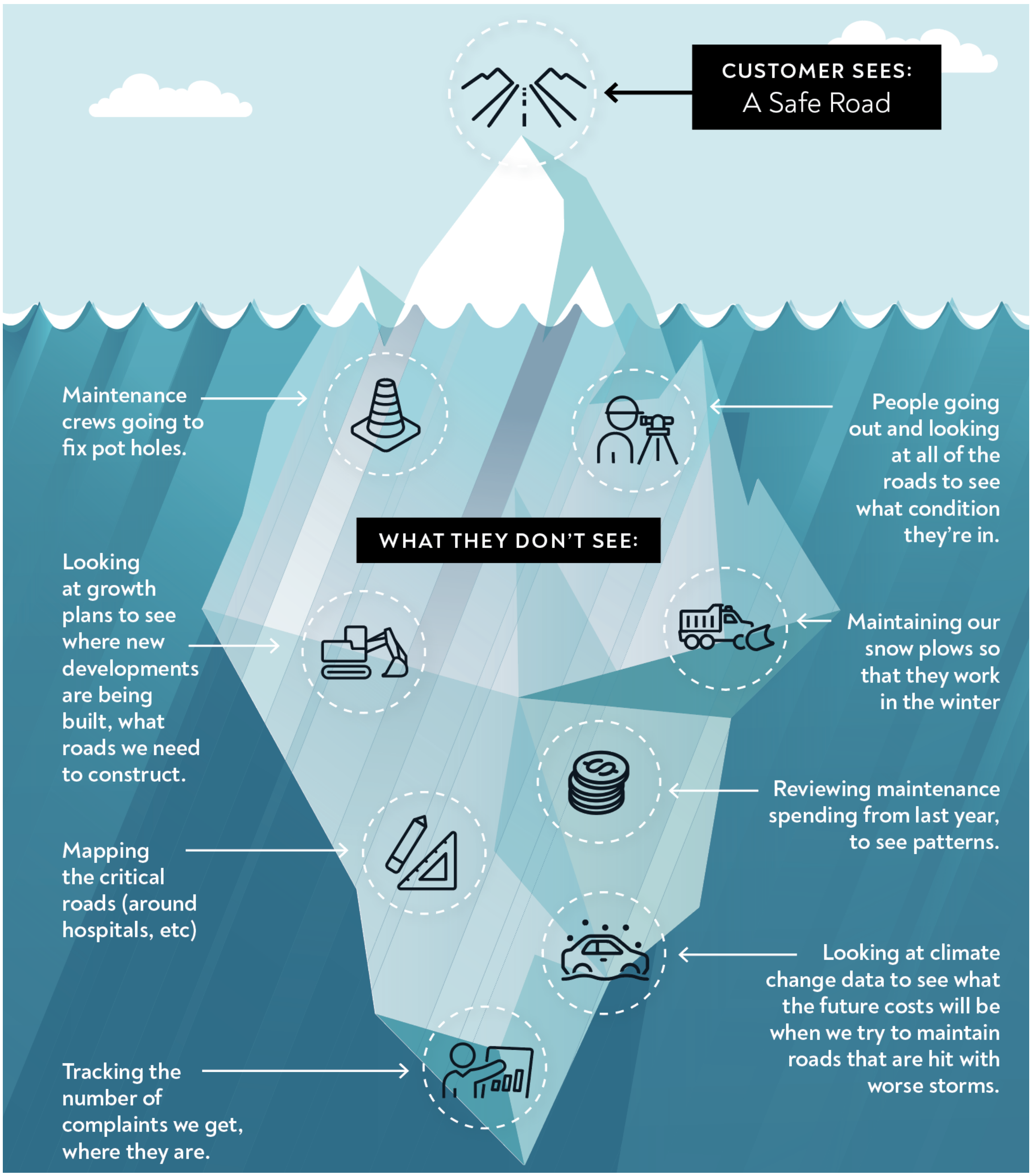


Fig. 2.7 Levels of service can be segmented into the services our residents see, such as safe roads, and the technical metrics that we track internally in order to measure the services provided.

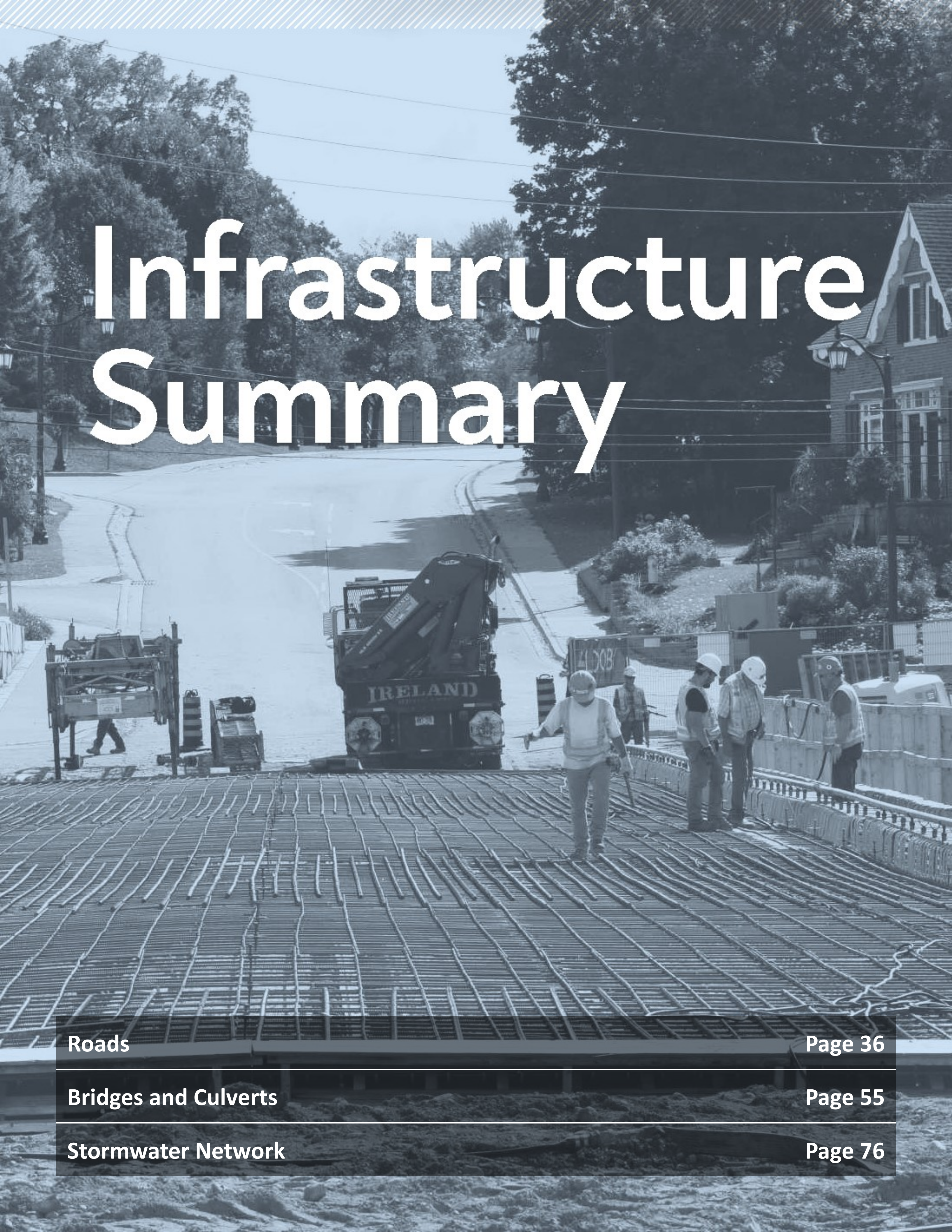
Levels of Service (cont'd)

Levels of service provide the link between higher-level strategic goals at the County level and the more technical, day-to-day activities done at the departmental level. By measuring our performance across the organization (Fig. 2.8), the County can monitor its progress towards achieving its objectives.

This AM plan reflects the costs associated with delivering the current levels of service being provided to County of Wellington residents. Levels of service metrics have been established for all county service areas, including the core assets, that are presented within the service area summaries of this plan. The levels of service metrics will be updated annually with data from the previous year. Where data is not currently available, the County will establish a data collection strategy in order to provide required metrics.

Fig. 2.8 The County strives to provide the best services to our residents. To do so, the County measures things like the time it takes to plow roads after a storm.

Infrastructure Summary



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Bridges and Culverts	**Page 55**
Stormwater Network	**Page 76**

Asset
Management
Plan

ASSET DETAILS

Roads

ROADS

County roads are at the core of the transportation system, and support essential community services. As a rural County, the surface area that needs to be covered by our road network is extensive, while the population supporting the investments in the network through property taxes is relatively small compared to more urban areas. As a result, maintaining our road network is a significant financial challenge.

The County maintains 703.6 km of roads, or 1,425.9 lane-km of roads. Road lengths measured along the center line of the road are reported in kilometers, whereas lane-kilometers take into consideration the number lanes on the road, which better reflects the lifecycle events costs of the road. More than 50% of County roads were built prior to 2004 (Fig. 3.1) . Additionally, in 1998, 103 km of roads were downloaded onto the County from the Province.

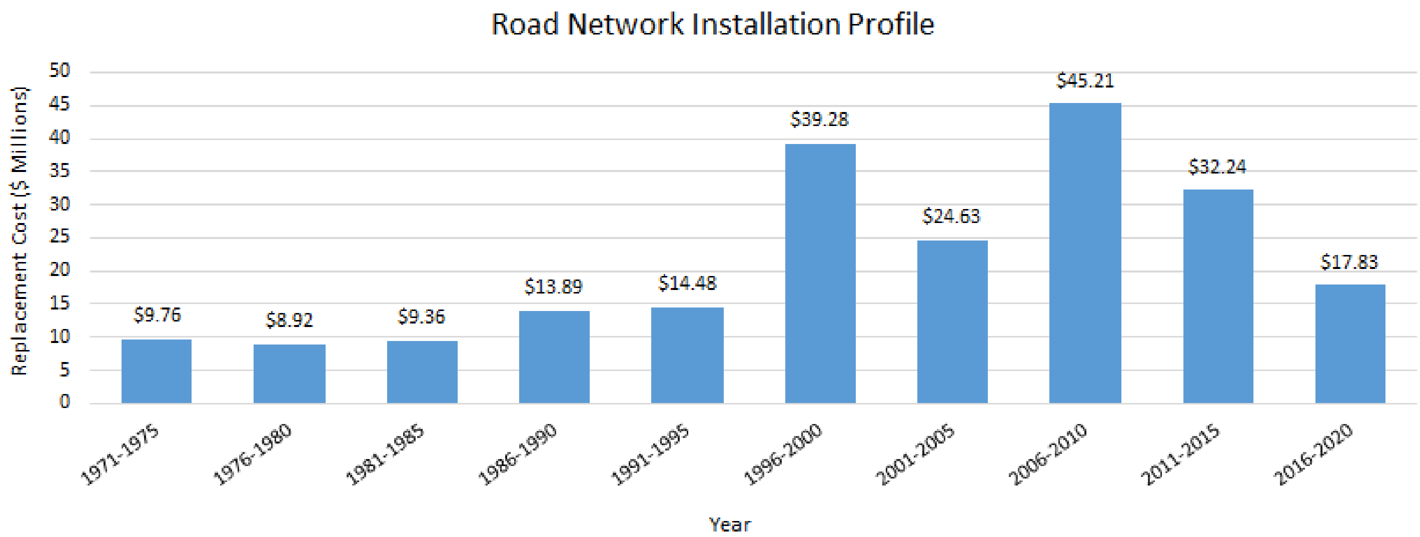


Fig. 3.1 County road network installation dates and associated replacement cost, 2020.

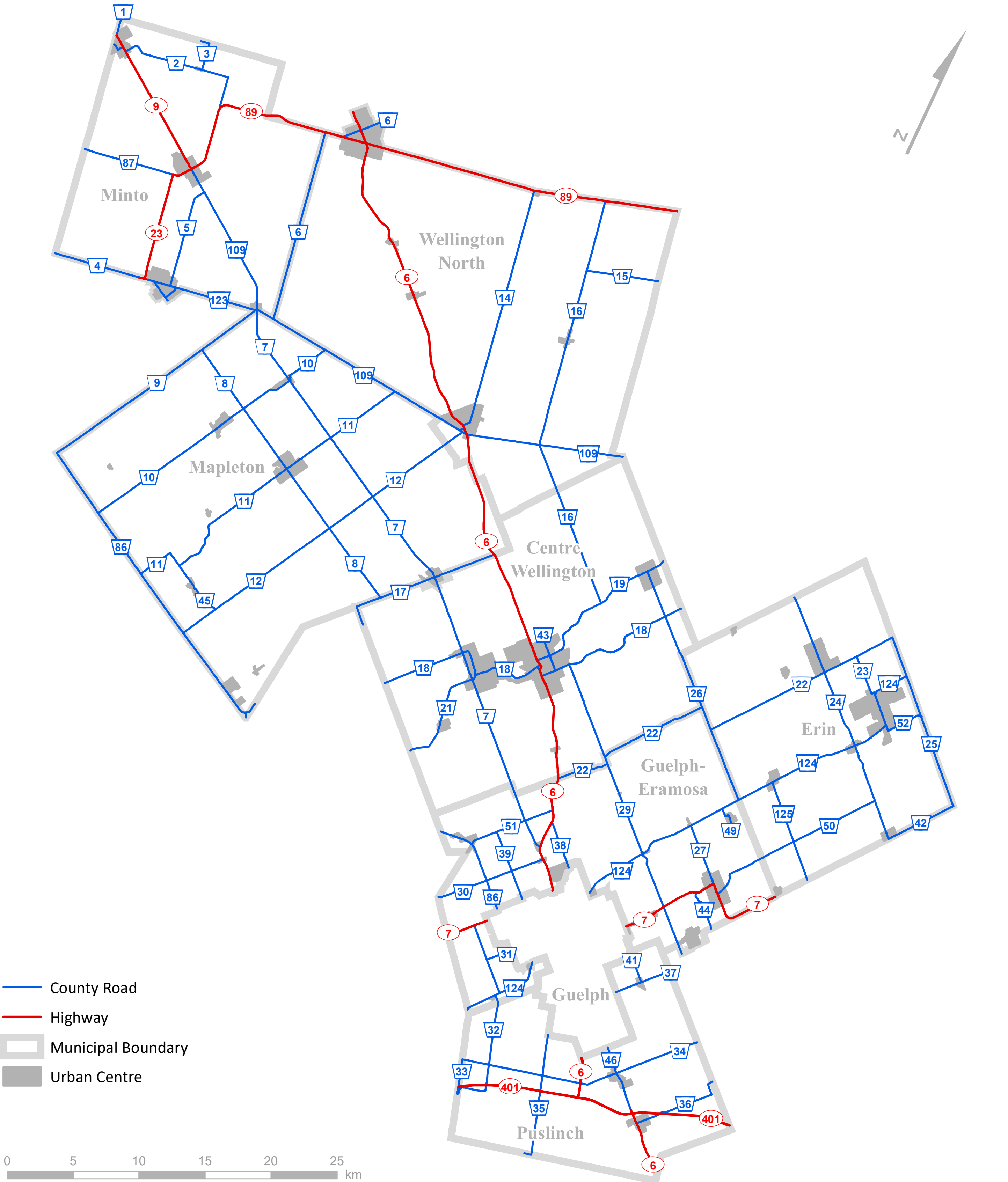
County roads are divided into classes, as per the Minimum Maintenance Standards (O.Reg. 239/02). Roads with higher posted speed limits and higher average daily traffic require more frequent inspection, and more rapid responses to any identified deficiencies such as pot holes and debris.

The transportation network inventory also includes intersections, parking lots, retaining walls, and traffic control assets such as street signs. This inventory will be included in future versions of the AM Plan.

Road Class	Patrolling Frequency	Length (km)	Length (lane-km)
Class 2	2 times every 7 days	175.8	368.4
Class 3	Once every 7 days	413.3	828.6
Class 4	Once every 14 days	111.8	223.7
Class 5	Once every 30 days	2.6	5.2

Table 3.1 Classes of County roads.

ROADS (CONT'D)


Minto
Wellington North
Mapleton
Centre Wellington
Erin
Guelph-Eramosa
Guelph
Puslinch
N
County Road
Highway
Municipal Boundary
Urban Centre
0
5
10
15
20
25
km

Data Quality

	Level 1	Level 2	Level 3	Level 4
Inventory	Inventory data is incomplete.	Inventory data Is complete.	Inventory data is complete and accurate.	**Inventory data is complete, accurate, and in a centralized, accessible format.**
Condition	No condition data exists. Condition is approximated by age.	Condition data exists for these assets.	Condition data was collected recently for these assets.	**Condition data is complete and accurate, and regularly updated. Data is centralized and accessible.**
Risk	Critical assets and services are understood by department staff, but no risk models exist.	**Risk is estimated according to a draft risk model. Some parameters lack sufficient data.**	Complete risk models exist for this asset class, and critical assets have been identified.	Risk management strategies have been developed for critical assets, and department budgets reflect risk-based priorities.
Lifecycle Strategy	Lifecycle events required to maintain current levels of service are not documented.	Lifecycle events required to maintain current levels of service are documented.	**Capital budget costs of lifecycle events are built into the funding models. Operating costs are not included.**	Capital and operating costs are built into the funding model. Projected lifecycle events are defined, and funding shortfalls are identified.
Financial Sustainability Strategy	Budgets are based on prior year spending.	Asset replacement schedules have been built into the long-term capital forecast.	**Replacement and maintenance costs have been built into long-term capital forecasts.**	Replacement and maintenance costs have been built into long-term capital and operating forecasts. Demand forecasts inform the budget.
Levels of Service	Services provided by this asset class are understood by departmental staff, but not formally measured.	**Performance metrics are defined to measure levels of service.**	Performance metrics are defined and a data collection strategy exists for all metrics.	Proposed levels of service have been identified, alongside their financial impacts. Trends in performance measures are tracked and regularly reported.

Model Assumptions

Estimated Useful Life

1. The estimated useful life of the road surface is 25 years, without intervention. By including lifecycle events, the useful life of the road is extended and delays replacement to 31 years.
2. The roads, on average, deteriorate along the 25-year deterioration curve in CityWide. The curve represents the rate of deterioration, the estimated useful life, and the projected condition for roads of a certain age.

Replacement Cost Calculation

1. When a paved County road requires replacement, in the majority of these occurrences the granular base can be retained, unless the road is found to be structurally insufficient or stormwater beneath the road requires replacement. In which case, the costs of excavating the base are allocated to the stormwater network.
2. The cost to replace a road segment is $150,000 per lane-km. This is based on an estimate provided by the County engineering department, and is reflective of recent reconstruction projects. This value will be updated annually to reflect changes in material and labour costs.

Condition

1. The current state of the County road network is based on the Pavement Condition Index (PCI). This metric was assessed in 2018 by external consultants, along with County staff. The Dec 31, 2020 value is a *projected* condition value, based on the deterioration curve of the road.
2. An update to the road condition assessment will be conducted every three years, starting in 2021.

Lifecycle Events

1. The Lifecycle Events model for the road network represents the total capital investment over their useful life. These events and their associated costs per lane-km were provided by the engineering department. See Table 3.5.
2. Lifecycle Events in this version of the AM plan are all funded through the capital budget. As a result, this plan reflects the capital needs of the road network. Future versions of the plan will include operating maintenance activities such as shoulder surfacing and drainage, and will inform both the capital and operating budgets.

Model Assumptions (cont'd)

Funding

1. The Annual Funding Requirement represents the annual funding required to complete all lifecycle events (including replacements) on the road network over an estimated useful life of approximately 31 years.
2. The replacement needs and capital needs are calculated at a specified year which accounts for the timing of the replacement and all other lifecycle events. Due to the backlog of roads in *Very Poor* condition from previous years, a ten-year average of the capital needs will be higher than the annual funding requirement.
3. The funding models all reflect the cost of maintaining the County road network in its current state. Any improvements to the network or changes in levels of service will come at an additional cost.
4. The impacts of growth and climate change mitigation are not included in this AM plan (see Table 1.2).

Risk

1. The parameters used in the risk model are based on the available data. Additional parameters may be included in future versions of the plan.
2. The inclusion of different parameters, or the change of weighting attributed to existing parameters, may impact the overall risk profile of the network. Any updated to risk models will be highlighted in future versions of the plan.

Levels of Service

1. The Levels of Service represent the performance metrics of the road network.
2. Levels of Service annotated with an asterisk (*) are required to be reported by O.Reg. 588/17. Other metrics listed in the plan were chosen by the County engineering department to reflect the quality of service provided.
3. There is no data for some of the performance metrics listed. These metrics will be included in future versions of the plan, once data becomes available.

Estimated Useful Life

The average estimated useful life without lifecycle events of a road surface is 25 years. A typical pavement lifecycle is best illustrated by a Pavement Deterioration Curve (Fig. 3.2).

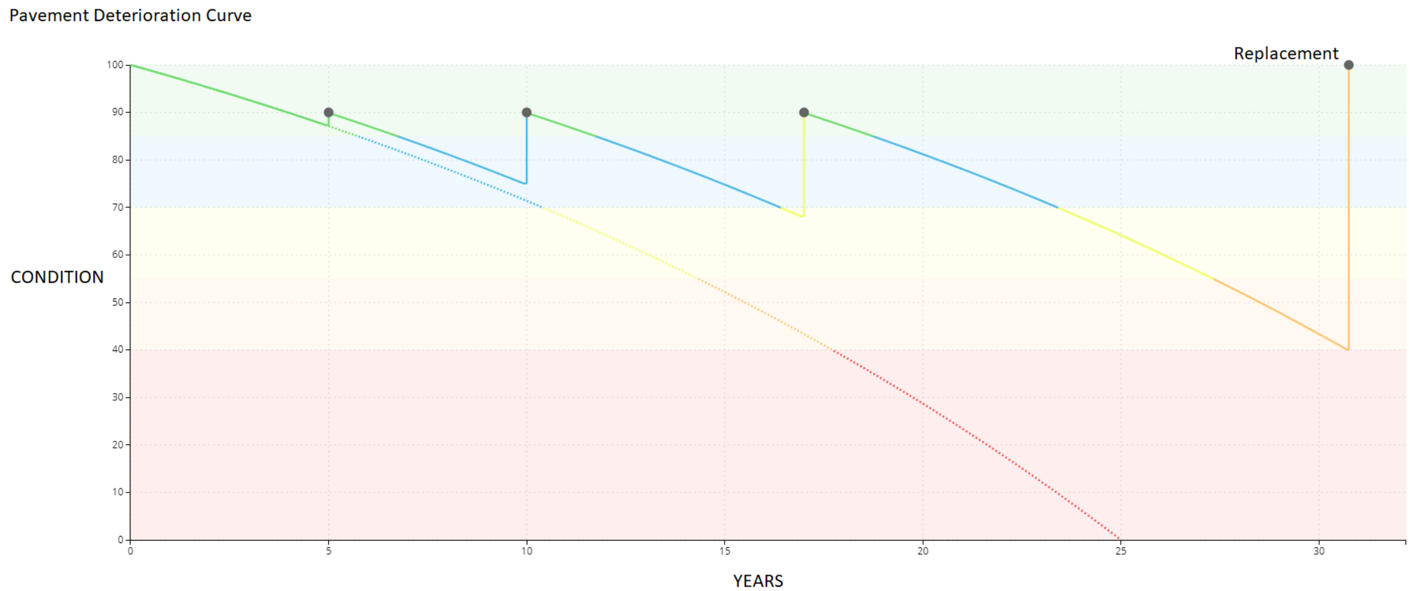


Fig. 3.2 Pavement deterioration curve, representing average deterioration over the lifecycle of the road.

New road segments deteriorate relatively slowly at first. As more cracks are exposed in the wearing surface, the rate of deterioration increases, until the road reaches the end of its useful life.

This curve informs when the County should intervene in maintaining the road segment. Patching cracks in new roads, for example, is a cost-effective way of extending the useful life of the road by slowing the rate of deterioration.

The deterioration curve is based on an estimate of the condition of the road over its useful life. However, new roads may deteriorate faster than anticipated if, for example, environmental stressors prove to be more detrimental than anticipated. Similarly, older roads that would be expected to be in *Poor* condition and at the end of their useful life may actually be in fairly good condition because of excellent initial construction and low daily traffic. Therefore, relying solely on the age of the road and its estimated useful life is not sufficient to determine when lifecycle events should be completed. Instead, the County uses a combination of road condition and age to plan lifecycle events.

CONDITION

The County Engineering Department determines the overall condition of the road surface using the Pavement Condition Index (PCI) rating. The PCI ranges from 0 to 100, with 0 being the worst possible condition, and 100 being the best possible condition (Fig. 3.3 and Table 3.2). PCI evaluations are performed for all County roads every three years, with the next assessment scheduled for 2021.

The Riding Condition Rating (RCR) is also assessed, with higher ratings reflecting more comfortable driving conditions. Most County roads have a posted speed limit of 80 km/hr. requiring a higher PCI to maintain a comfortable rating.

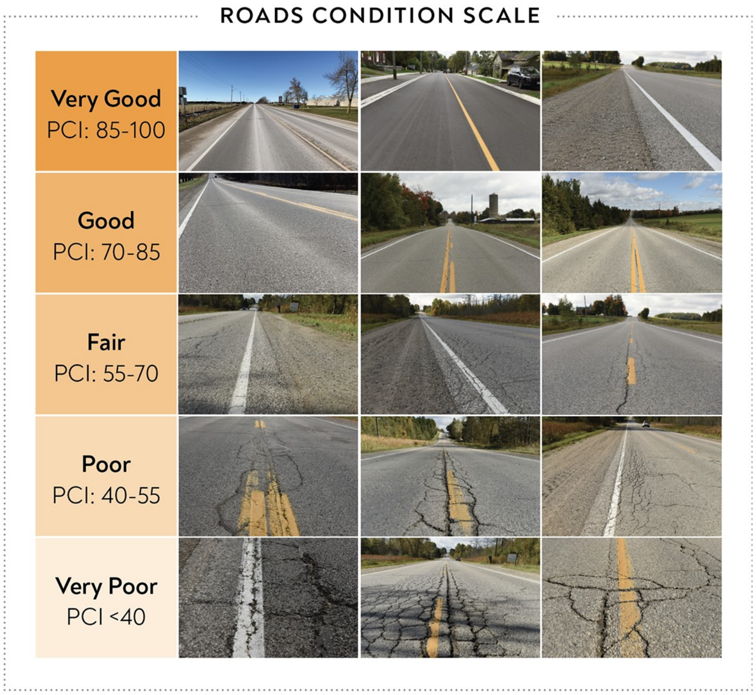


Fig. 3.3 These images of County roads reflect the different condition ranges.

Scale	PCI	Service Level	Associated Work
Very Good	85—100	The road segment is relatively new, or newly reconstructed. There are no visible cracks and no structural issues. The ride is smooth.	Minor maintenance
Good	70—85	The road segment is starting to exhibit few, if any, signs of surface deterioration, random cracks, and rutting. The ride is relatively smooth.	Crack sealing, spot drainage
Fair	55—70	The road segment is exhibiting signs of surface deterioration, random cracks, rutting, and some patching of surface defects. The ride is becoming rough.	Crack sealing, spot drainage, micro surfacing, bonded wearing course, re-ditching
Poor	40—55	The road segment shows signs of deterioration, cracks, rutting, and patching of surface defects that occurs over 50 percent of the surface. Some structural issues are starting to show. The ride is uncomfortable.	Resurface, asphalt recycling, re-ditching, reconstruction
Very Poor	<40	The road segment is reaching the end of its useful life. There are significant structural issues with large visible cracks, rutting and patching surface defects that occurs over 75 percent of the surface. The road is difficult to drive at the posted speed limit .	Reconstruction, widen, resurface, asphalt recycling, re-ditching

Table 3.2 This scale is used to translate the PCI score onto a five-point condition scale.

CONDITION (CONT'D)

The average condition of the County road network is **64 PCI**, which means that the network is in *Fair* condition. The average condition of the network in 2018 was **71 PCI**, which indicates a downward trend in the overall condition of the road network.

Figure 3.4 shows the distribution of the road network condition, from *Very Good* to *Very Poor*, with the associated replacement costs of assets in each condition rating category.

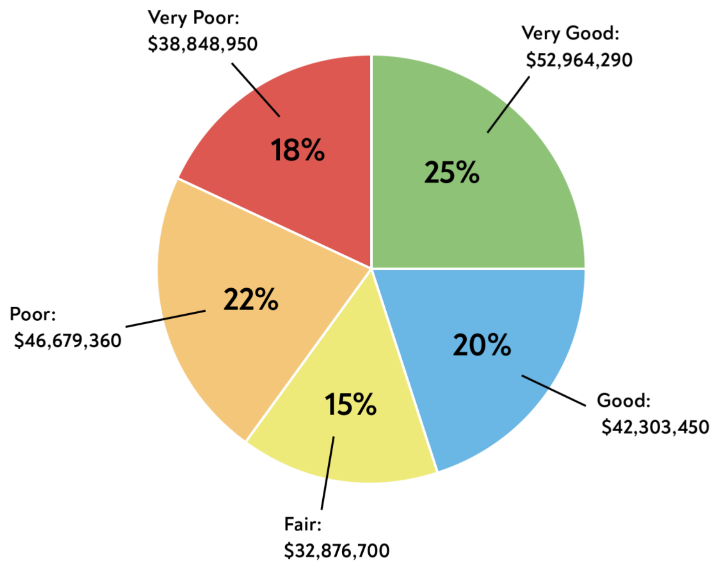
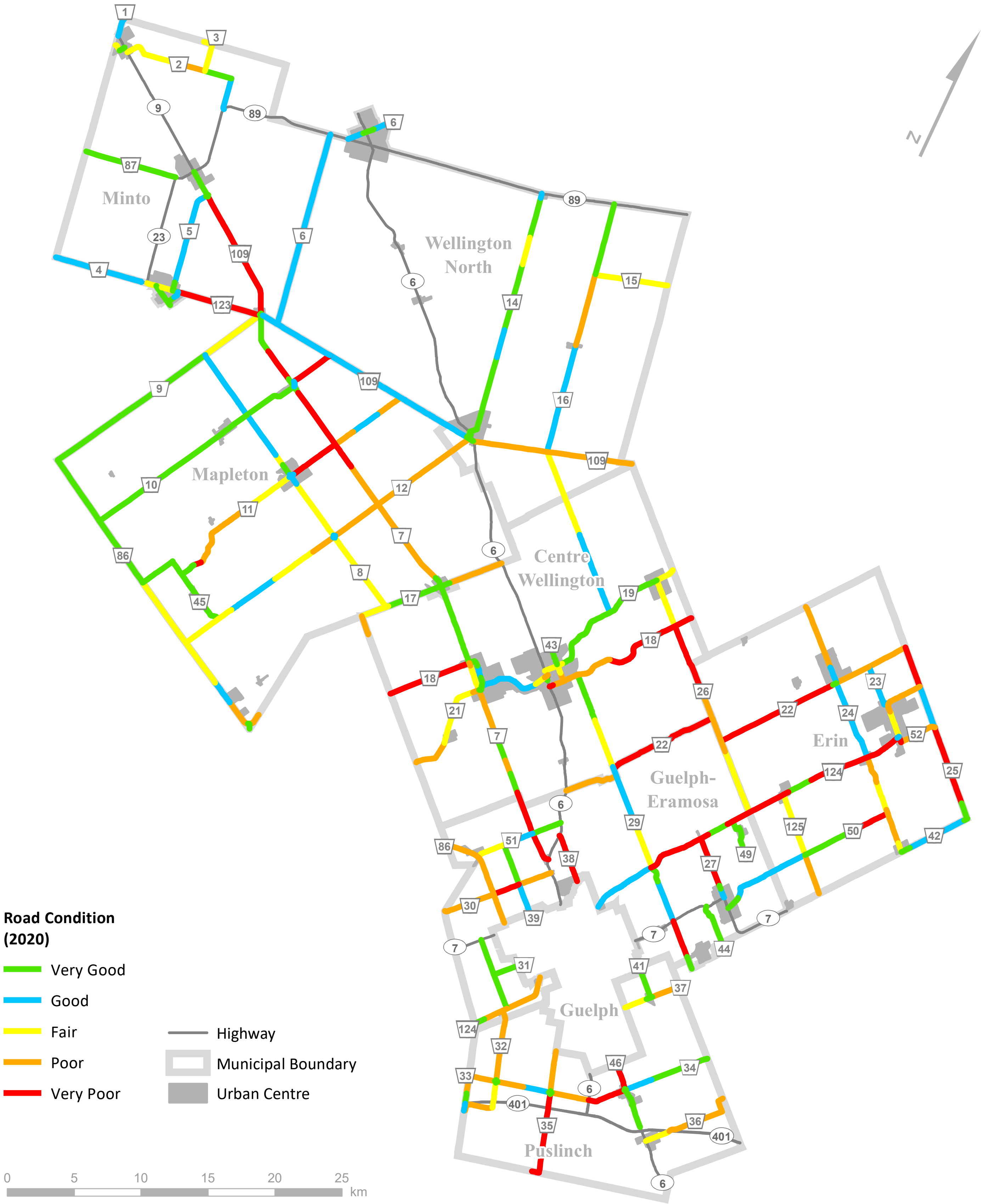


Fig. 3.4 County road network condition, by replacement cost. 2020.

There are a number of factors contributing to the decline in overall road condition from the 2018 assessment and the 2020 average projected condition:

- The 2020 average PCI is a measure of projected condition. It is based on the 2018 assessed condition, which is then plotted onto the deterioration curve to provide an estimate of the condition of the road two years later. This may not be the actual condition of the road. An updated road condition assessment is schedule for 2021.
- There is a significant backlog of roads in *Very Poor* condition that need replacement or rehabilitation. This backlog existed in 2018 as well, and has continued to grow and impact the average condition rating of the network.
- The reason for the growth of this backlog is a lack of lifecycle needs identified through asset management planning for large rehabilitation projects as well as regular lifecycle events such as crack sealing. As a result, the Engineering department has adopted a "worst-first" approach to maintaining roads, by including those roads in poorest condition in the 10-Year Capital Plan. With the additional investment in AM software that allows for more detailed planning and scenario analysis, as well as additional funding, the Engineering department will be able to prioritize higher-return projects such as timely maintenance of relatively new road segments.
- The investments listed in this plan assume that the County wishes to maintain the existing condition of the network. To improve the condition of the road network, investments beyond those listed in this plan will need to be made.



Minto
Wellington North
Mapleton
Centre Wellington
Erin
Guelph-Eramosa
Guelph
Puslinch
Road Condition (2020)
Very Good
Good
Fair
Poor
Very Poor
Highway
Municipal Boundary
Urban Centre
0
5
10
15
20
25
km
N

RISK

The risk analysis for Roads is the product of the likelihood of road failure and the consequence of failure. Table 3.3 illustrates the parameters used to represent the probability and consequence of failure for roads.

Probability of Failure	Consequence of Failure	
Condition (PCI)	Roadside Environment	Average Annual Daily Traffic (AADT)
Average Annual Daily Traffic (AADT)	Road Class	Speed Limit
		Percent of Road Within Floodplain

Table 3.3 Probability and consequence of failure parameters currently included in the County roads risk model.

Road condition approximates the likelihood of failure, while the AADT serves as a measure of the rate of deterioration. Roads with higher traffic counts will experience more stress on the wearing surface, and will deteriorate more quickly than those with lower traffic counts. The roadside environment is an indication of the type of stormwater infrastructure associated with the road. Roads with additional underground stormwater infrastructure are a higher priority, because the failure of those roads impacts additional services. Road Class is a function of the Speed limit and AADT and is a measure of relative importance should they fail. The speed limit is also a measure of safety, with the maintenance of roads with higher speed limits being a priority. Finally, some county roads are located within a floodplain, and are at a higher risk of flooding during severe storms. These roads are identified as priorities for maintenance.

Figure 3.5 shows the distribution of County roads by risk class. Green represents the replacement costs of roads that are *Very Low* risk, while red reflects the highest (*Very* High) risk roads. Using the parameters above, the vast majority of County roads are classified as *Low* risk. Table 3.4 identifies the sole County road in the Very High risk category.

Roads Risk Classifications

Very Low (1-4)	Low (5-7)	Moderate (8-9)	High (10-14)	Very High (15-25)
134 Assets	96 Assets	41 Assets	50 Assets	1 Asset
279.16 km	214.29 km	113.63 km	96.21 km	0.27 km
$84,806,250	$64,992,640	$34,773,300	$29,020,160	$80,400

Fig. 3.5 Risk classifications for County roads incl. the number of assets, road centerline length, and total replacement costs, 2020.

Road Segment	From	To	Replacement Cost	Addressed in 2021-30 Financial Plan	Probability of Failure	Consequence of Failure	Overall Risk Rating
WC18 18021S*	Tower Street	St. David Street	$80,400	Yes (2024 & 2026)	4.75 Possible	3.58 Moderate	17.02 Very High

Table 3.4 County road in the *Very High* risk category, 2020.
*This road segment will be addressed in conjunction with the adjacent road segments, included in a project scheduled for 2024.

Lifecycle Events

Over the life of the pavement, different lifecycle events are scheduled in order to extend the estimated useful life. There are four main Lifecycle events that are scheduled on County paved roads:

1. **Crack sealing:** the patching of cracks on the road surface.
2. **Micro surface resurfacing:** A cold mix asphalt blend of high quality aggregates and emulsified asphalt, that is mixed and spread with a machine over the road surface. This treatment extends the life of the pavement surface, and seals minor cracks and other irregularities.
3. **Mill and pave resurfacing:** involves the removal, recycling, and replacement of the top layer of asphalt. This is required when surface cracking is more extensive.
4. **Full replacement / reconstruction:** the complete replacement of the road surface. The depth of the asphalt replacement depends on a variety of factors, including the condition of the road being replaced. This treatment is applied to sections of pavement where replacement is more cost-effective than treatment.

The following table shows the trigger for each of the events for a typical road surface, the impact of the event, and its cost per lane-km. For example, crack sealing is scheduled when a road reaches the age of 5 years. Once it is completed, the condition of the road is presumed to be improved, to roughly 90 PCI, and the cost is expected to be roughly $2,200 per lane-km.

The key parameters in the lifecycle cost model for the road infrastructure assets are found in Table 3.5, and each will be reviewed on an annual basis to ensure that it is as accurate as possible.

Treatment	Class	Budget	Timeline	Impact	Cost per lane-km
Crack Seal	Maintenance	Capital	Age = 5 years	Set condition to 90 PCI	$2,200
Micro Surface	Maintenance	Capital	Age = 10 years	Set condition to 90 PCI	$13,500
Mill and Pave	Rehabilitation	Capital	Age = 17 years	Set condition to 90 PCI	$60,000
Replacement	Replacement	Capital	Condition = 40 PCI	Set condition to 100 PCI	$150,000

Table 3.5 Roads capital budget for the Lifecycle Events, 2020.

LIFECYCLE EVENTS (CONT'D)

The following list outlines the lifecycle strategy for a County road. The lifecycle is visually represented in Figure 3.7.

- The new road starts at a Pavement Condition Index (PCI) of 100, and begins deteriorating along a 25-year useful life deterioration curve. Although a road remains useful up to 25 years without intervention, the County's minimum requirements necessitates a replacement at 40 PCI which is at 17 years.
- When the road is 5 years old, a crack seal event is applied, which improves the condition back to 90 PCI and extends the estimated useful life of the road by approximately one year.
- The road then continues to deteriorate along the same curve for another 5 years, at which point a micro surface event is scheduled, which will also increase the PCI to 90 and extends the estimated useful life by approximately 5 years.
- After further deterioration, at 17 years, the road will receive a mill and pave event, which will set the condition back up to 90 PCI and extend the estimated useful life of the road by another seven years.
- As a result, the original estimated useful life of 25 years is extended. Without intervention, the County would have had to replace the asset at approximately 17 years, to meet minimum requirements and maintain current levels of service. With intervention, the County delays the replacement to approximately 31 years.

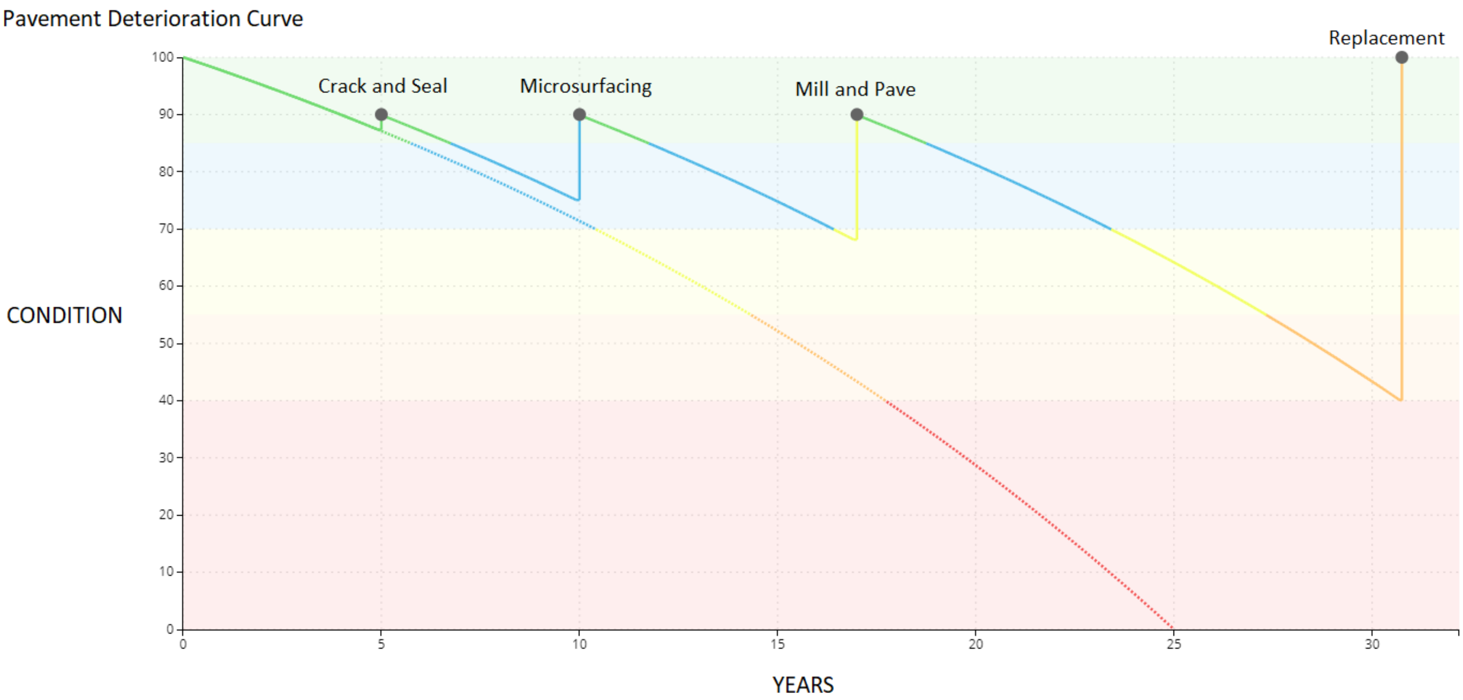


Fig. 3.7 The deterioration curve of an average County road, adjusted to include the lifecycle event. The estimated useful life is extended from 17 years to 31 years with timely maintenance of the roads.

Replacement Value

A typical pavement structure is composed of different layers of material which receives the loads from the above layer, spreads them out, and then passes them on to the layer below and so on. The structure of a road is comprised by the subgrade, granular base, base course asphalt, and surface asphalt. Proper drainage is also important to ensure a high quality long lived pavement.

To replace a section of road that is past its useful life, two broad strategies can be employed: replacing the road surface to varying depths depending on the extent of deterioration, or replacing the entire road segment, including the base. The County applies a strategy of replacing/recycling the asphalt component of the road structure, leaving the granular base in place, when the driving surface of the road is nearing the end of its useful life.

The total cost to replace all County roads

$213,672,750

Fig. 3.8 Cross-section of a road segment.

To replace the surface of the road, it is estimated, for this plan, that the cost per lane-km is $150,000. This reflects the average cost of the most recent road rehabilitation projects. This estimate will be updated on an annual basis to incorporate shifts in material and labour costs that may result in significant changes to the estimated replacement costs.

Annual Funding Requirement

Future demand on the road network will be shaped by utilization and growth. Shifting changes in utilization, such as changing transportation preferences, may reduce the pressure on County road networks. On the other hand, increasing population density and an increase in heavy truck volumes may increase the load on County roads and accelerate deterioration, requiring more frequent and earlier intervention.

The annual funding requirement is a metric that provides an average of the combined cost of lifecycle events and asset replacements over their useful life. For the road network, the annual funding requirement is a combination of each of the three lifecycle event costs (crack seal, micro surface, and mill and pave) and the replacement cost for each County road. The annual funding requirement calculation does not incorporate a backlog.

The annual funding requirement for the road network

$10,458,922

The total cost to maintain all roads over their useful life is $321,611,866. When the lifecycle events are completed on the road network, its estimated useful life is extended to approximately 31 years . Dividing the total network cost by the new estimated useful life results in the annual requirement of $10.46 million (Table 3.6).
Note: *This cost assumes that the lifecycle events are done on schedule for all roads across the County. It also assumes that the costs for replacement and lifecycle events are accurate. Finally, it assumes that the life of the roads is extended to approximately 30 years and 9 months with the lifecycle events, based on the deterioration curve. This value may not be accurate for all roads, as they may deteriorate differently based on a variety of factors.*

Total Network Replacement Cost	Total Network Lifecycle Events Cost	Total Network Cost	Estimated Useful Life With Lifecycle Events	Annual Funding Requirement
$213,672,750	$107,939,116	$321,611,866	31 Years	$10,458,922

Table 3.6 Annual requirement for the road network. Calculated as the total replacement and lifecycle events costs of all County roads, divided by the extended estimated useful life of an average road segment, 2020.

The annual requirement cost alone does not adequately account for the annual budget for roads, because it does not take into consideration the **backlog** of roads in which replacements are overdue.

Capital Needs 2021-30

Table 3.7 shows the lifecycle events (including replacements) for the road network for 2021-30. The ten-year average capital needs of $14,858,433 is higher than the annual requirement of $10,458,922. This is due to the large backlog of roads from previous years that are in *Very Poor* condition and require immediate attention. This amount is included in the $42,661,650 in the first year of the ten-year forecast

Year	Crack Seal	Micro Surface	Mill and Pave	Asset Replacement	Total
2021	$51,929	$516,510	$1,531,080	$42,661,650	$44,761,169
2022	$44,178	$1,025,568	$2,594,538	$7,008,296	$10,672,579
2023	$84,893	$497,622	$2,491,241	$16,217,972	$19,291,727
2024	$31,763	$622,581	$2,244,355	$6,511,611	$9,410,310
2025	$71,157	$422,145	$7,703,437	$7,706,879	$15,903,618
2026	$743,140	$378,461	$1,541,664	$2,386,181	$5,049,446
2027	$122,080	$321,975	$4,755,300	$5,041,914	$10,241,270
2028	$282,507	$618,706	$2,920,644	$7,314,588	$11,136,445
2029	$113,428	$231,491	$5,799,148	$4,114,567	$10,258,635
2030	$134,249	$518,597	$2,813,838	$8,392,449	$11,859,134
TOTAL	$1,679,325	$5,153,655	$34,395,246	$107,356,106	$148,584,333
AVERAGE ANNUAL	$167,933	$515,366	$3,439,525	$10,735,611	$14,858,433

Table 3.7 Lifecycle Events cost of County roads for 2021-30. Values inflated 3.5% from 2021.

Taken together, the annual requirement, the ten-year average replacement needs, and the ten-year average capital needs provide a range for capital funding required which can potentially guide the ten-year capital budget forecast (Table 3.8).

Annual Requirement	Ten-Year Average Replacement Needs	Ten-Year Average Capital Needs
$10,458,922	$10,735,611	$14,858,433

Table 3.8 These averages provide a baseline for optimal capital funding. Annual funding will need to be increased to address the existing backlog and continue to complete the recommended Lifecycle Events schedule. This funding maintains the road network in its current condition. Improvements in condition will require additional funding.

CAPITAL NEEDS 2021-30 (CONT'D)

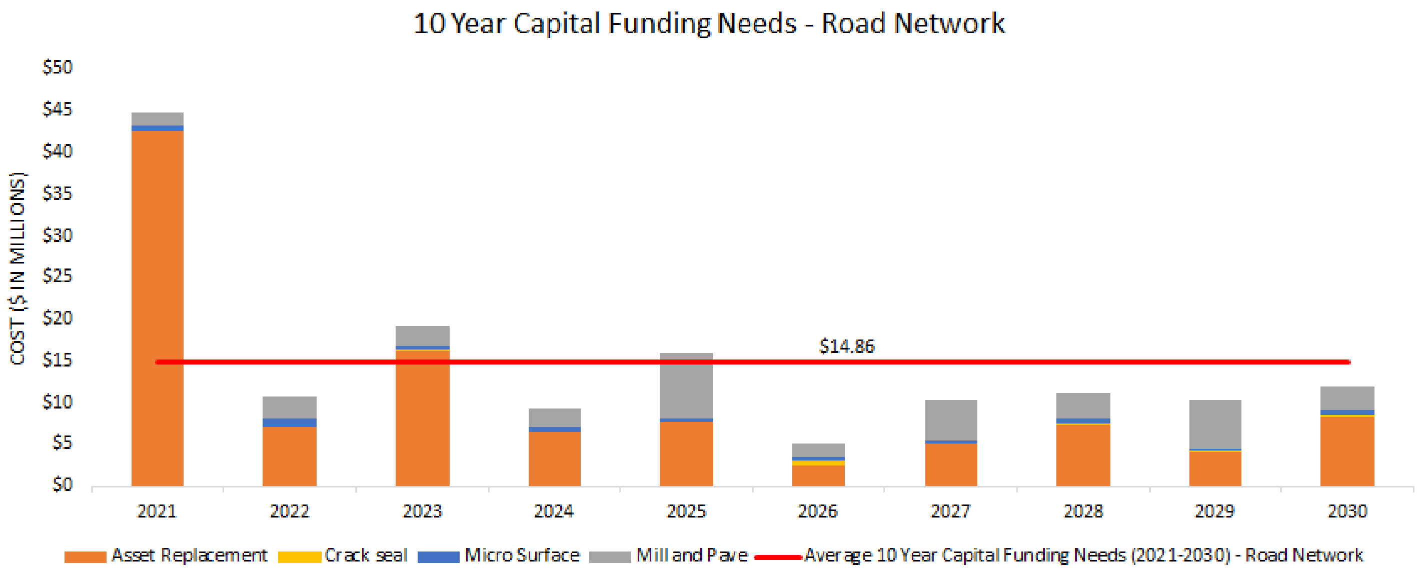


Fig. 3.9 Ten-year capital funding needs for the road network, 2021-2030. The backlog of *Very Poor* roads is reflected by the orange 'Asset Replacement' bar in 2021.

The County has a number of roads that are in *Very Poor* condition, and require replacement. These roads make up the backlog of roads that are in urgent need of replacement, which make up a large portion of $42,661,650 (Fig. 3.9).

The County must balance the costs of addressing this backlog with the lifecycle events costs of maintaining the rest of the network. This depends on available funding and staff capacity, as well as changes in material and labour costs that may impact the estimated funding required.

It is insufficient to focus solely on the replacement of *Very Poor* roads, because the rest of the network will continue to deteriorate without proper maintenance. It is more expensive to rehabilitate or replace a road than to maintain it.

Additionally, these figures reflect the costs associated with keeping the overall condition of the network in its *current state* (i.e. an average PCI of 64). Should the County set a higher target PCI for the average condition of the road network, the lifecycle strategy would change, and annual funding needs would increase. For example, additional crack sealing events may be scheduled for new roads to keep them in *very good* condition as long as possible. Rehabilitation events such as mill and pave resurfacing may be done earlier than at the 17-year mark, to increase the condition of those roads earlier, and improve the overall condition of the network.

Levels of Service

The County road network is maintained to provide a safe and efficient means of transportation. The network is inspected in accordance with the Minimum Maintenance Standards for Municipal Highways, wherein the Provincial government mandates the frequency of the inspection of roads based on traffic volume and posted speed limits. Roads with higher volumes and higher speed limits are required to be inspected more frequently.

Table 3.9 contains a list of performance metrics established by the County engineering department to measure the levels of service provided by the County road network. Metrics without data (N/A) are included in the short-term data collection goals of the department, and will be included in future versions of the plan. The COVID-19 pandemic resulted in a pause of non-critical maintenance activities, resulting from reduced temporary summer staffing levels. Additional trend analyses will also be available in future plans, once more data is collected.

	2019	2020
Accessibility & Reliability		
Lane-km of roads (MMS classes 1 and 2) *	N/A	367
Lane-km of roads (MMS classes 3 and 4) *	N/A	1,052.3
Lane-km of roads (MMS classes 5 and 6) *	N/A	5.2
# of road closures per year	6	8
# of unplanned road closures per year related to maintenance	N/A	N/A
Average # of days to complete pothole repair requests	N/A	N/A
Average duration of road closure (days) (planned)	N/A	N/A
Average duration of road closure (days) (unplanned)	N/A	N/A
Safety		
% of signs inspected for reflectivity	N/A	N/A
# of reported motor vehicle crashes	625	507
Affordability		
Operating and maintenance costs for paved roads per lane-km	$11,468	$15,272
Operating and maintenance costs for unpaved roads per lane-km	$10,494	$1,573
Winter control costs per lane-km	$7,961	$5,437
Annual capital reinvestment rate	N/A	5.62%
Sustainability		
Average pavement condition index for paved roads *	67.81%	64.89%
Average surface condition for unpaved roads *	61.29%	57.33%

Table 3.9 Performance metrics for the road network. Metrics with an asterisk (*) are required to be reported by O.Reg. 588/17.

Strategy

Master Planning / Studies

The Road Master Action Plan (RMAP) will review current and future network requirements to accommodate future population and employment growth projected in the County. The RMAP will be utilized as a background document for the County's future Development Charges Background Study and Official Plan Review. It will also guide capital project prioritization to meet the needs across the County and integrate with corporate asset management

Addressing the Backlog

Approximately 40% of the road network is rated in *Poor* to *Very Poor* Condition. These assets are at risk of failure or are unfit for sustained service. The County is addressing the needs of these assets using the following strategies:

- Replacing approx. 30 kms/year within the existing roads construction budget
- Increase the pavement preservation and the mill and pave programmes from $1.10 million per year in 2020 to $2.00 million per year in 2021. The intent of these programmes is to keep the roads in *fair* or above condition and prevent them from falling into the *Poor* or *Very Poor* category
- Condition inspections will be completed every 3 years and will inform the 10 year capital budget process

Renewal Projects

The County uses a mix of proactive and reactive planning on the road network. Assessed condition is used to identify priority locations, which is supplemented by a ride comfort rating (rideability). Other considerations include: Annual Average Daily Traffic (AADT) volumes, road classifications and springtime load restrictions. In addition, coordination with member municipal projects is also considered. Road replacement and resurfacing projects consider coordination with growth related needs and other assets, such as bridges and stormwater structures.

Data Quality

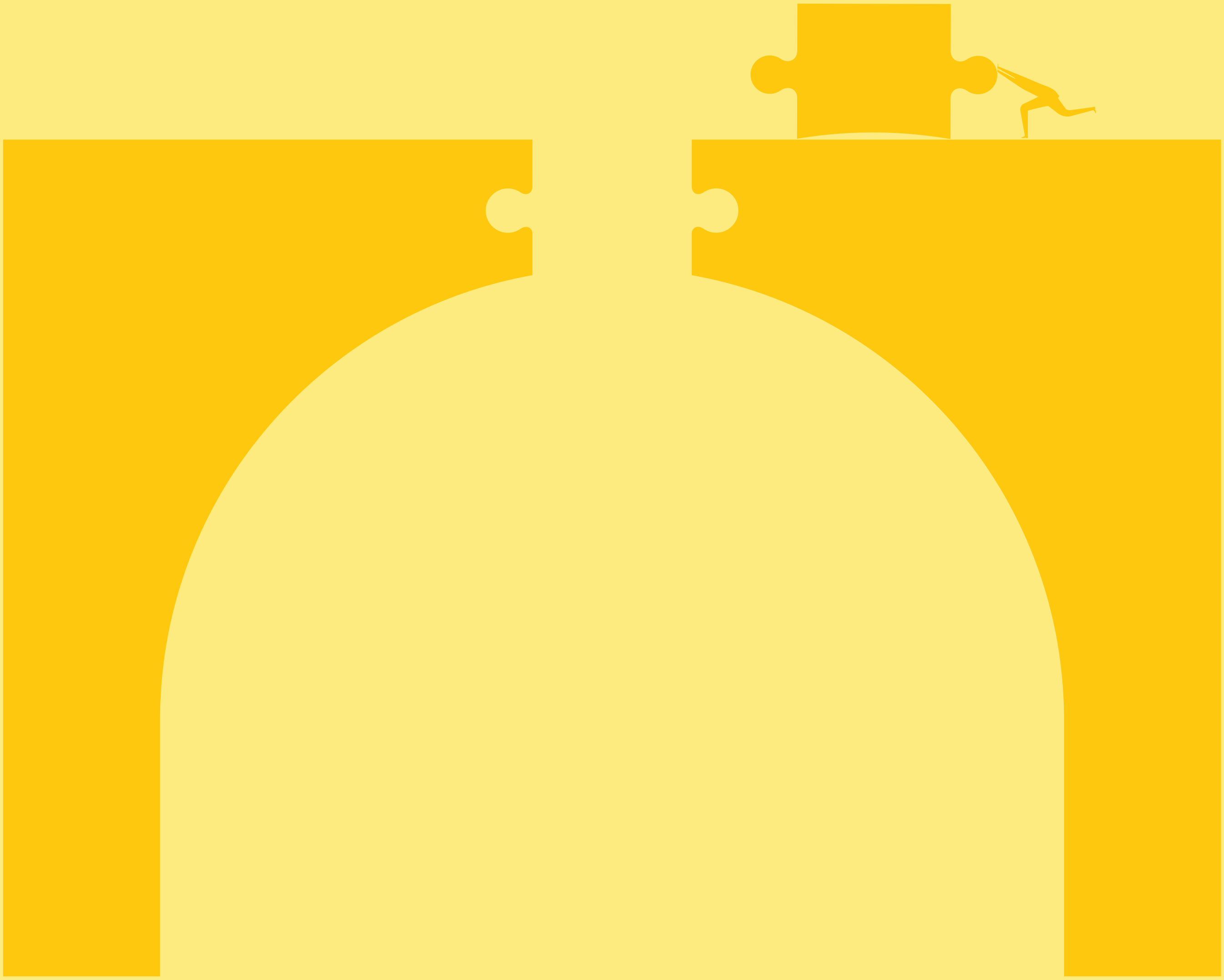
The County has committed to the following data quality initiatives:

- Define and implement procedures to update replacement cost annually using actuals from existing contracts
- Collect data for all Levels of Service metrics and report annually
- Ensure future condition inspections align with previous years to ensure consistency in methodology
- Separate storm costs from road base costs in order to better inform the gap
- Modify existing terminology to better align with the budget
- Further identify and incorporate asset lifecycle events (including costs)

Asset
Management
Plan

ASSET DETAILS

Bridges and Culverts



Bridges and Culverts

In accordance with the Canadian Highway Bridge Design Code, a bridge is defined as "a structure that provides a roadway or walkway for the passage of vehicles, pedestrians, or cyclists across an obstruction, gap, or facility and is greater than 3m in span."

Culverts are defined as "a structure that forms an opening through soil", as per the Canadian Highway Bridge Design Code. Culverts included in the Ontario Structures Inventory Manual (OSIM) inspection have a span greater than or equal to 3 meters, and more than 600 mm of cover. Smaller culverts are not assessed based on OSIM methodology, and are not included as part of this AM plan.

The County currently maintains 104 bridges. The County also maintains a total of 94 OSIM culverts.

BRIDGES AND CULVERTS (CONT'D)

DATA QUALITY

	Level 1	Level 2	Level 3	Level 4
Inventory	Inventory data is incomplete.	Inventory data Is complete.	Inventory data is complete and accurate.	**Inventory data is complete, accurate, and in a centralized, accessible format.**
Condition	No condition data exists. Condition is approximated by age.	Condition data exists for these assets.	Condition data was collected recently for these assets.	**Condition data is complete and accurate, and regularly updated. Data is centralized and accessible.**
Risk	Critical assets and services are understood by department staff, but no risk models exist.	**Risk is estimated according to a draft risk model. Some parameters lack sufficient data.**	Complete risk models exist for this asset class, and critical assets have been identified.	Risk management strategies have been developed for critical assets, and department budgets reflect risk-based priorities.
Lifecycle Strategy	Lifecycle events required to maintain current levels of service are not documented.	**Lifecycle events required to maintain current levels of service are documented.**	Capital budget costs of lifecycle events are built into the funding models. Operating costs are not included.	Capital and operating costs are built into the funding model. Projected lifecycle needs are defined, and funding shortfalls are identified.
Financial Sustainability Strategy	Budgets are based on prior year spending.	**Asset replacement schedules have been built into the long-term capital forecast.**	Replacement and lifecycle event costs have been built into long-term capital forecasts.	Replacement and lifecycle events costs have been built into long -term capital and operating forecasts. Demand forecasts inform the budget.
Levels of Service	Services provided by this asset class are understood by departmental staff, but not formally measured.	**Performance metrics are defined to measure levels of service.**	Performance metrics are defined and a data collection strategy exists for all metrics.	Proposed levels of service have been identified, alongside their financial impacts. Trends in performance measures are tracked and regularly reported.

Model Assumptions

Estimated Useful Life
1. The estimated useful life of a concrete bridge and a steel bridge is approximately 84 years and 73 years, respectively. 2. The useful life of an OSIM culvert is 84 years. Culverts constructed of corrugated steel pipe (CSP) have an estimated useful life of 73 years.
Replacement Cost Calculation
1. The bridges and culverts are scheduled to be replaced at the end of their useful life. 2. The cost to replace a structure is based on the 2019 OSIM inspection replacement cost. This cost was inflated using the Non-Residential Construction Consumer Price Index to estimate the 2020 replacement cost for each structure.
Condition
1. The condition of bridges and OSIM culverts was assessed using the Bridge Condition Index (BCI) metric in 2019 by external consultants. The Dec 31, 2020 value is a *projected* condition value, based on the deterioration curve of the structures. 2. An update to the BCI assessment will be conducted every two years, with the next assessment scheduled for 2021.
Lifecycle Events
1. The "Lifecycle Events" model for our bridges and culverts represents the total capital investment in these structures over their useful life. 2. Rehabilitation cost is approximately $250,000 and $125,000 for bridges and culverts, respectively. These assets can undergo up to 3 rehabs in their lifecycle. Rehab one occurs when the asset reaches a condition of 70 and adds an estimated useful life of 23-24 years. Rehabs two and three are triggered at a condition of 65, and add an estimated useful life of 18-19 years. 3. Specific lifecycle events, and their costs, are not included in this model. Rather, the model uses a general rehabilitation activity to approximately capture the capital needs cost. This will be refined in future versions of the plan. 4. Capital lifecycle events in this version of the AM plan are all funded through the capital budget. As a result, this plan reflects the capital needs of County bridges and culverts. Future versions of the plan will include operating lifecycle events and will inform both the capital and operating budgets.

MODEL ASSUMPTIONS (CONT'D)

Funding
1. The Annual Funding Requirement represents the average annual cost of replacing and maintaining County bridges and culverts roads over their estimated useful lives. 2. The Replacement Needs and the Capital Needs take into account the timing of replacement and lifecycle events over a specified period. They also assume a 3.5% rate of inflation each year. 3. The funding models all reflect the cost of maintaining County bridges and culverts in their current state. Any improvements, growth-related construction, or changes in levels of service will come at an additional cost. 4. The impacts of growth and climate change mitigation are not included in this AM plan.
Risk
1. The parameters used in the risk model are based on the available data. Additional parameters may be included in future versions of the plan. 2. The inclusion of different parameters, or the change of weighting attributed to existing parameters, may impact the overall risk profile of the network. Any updates to risk models will be highlighted in future versions of the plan.
Levels of Service
1. The Levels of Service represent the performance metrics of the bridges and culverts. 2. Levels of Service annotated with an asterisk (*) are required to be reported by O.Reg. 588/17. Other metrics listed in the plan were chosen by the County engineering department to reflect the quality of service provided. 3. There is no data for some of the performance metrics listed. These metrics will be included in future versions of the plan, once data becomes available.

ESTIMATED USEFUL LIFE

The estimated useful life for bridges and large culverts is based on a review of historical replacement timelines for similar assets. It varies by construction material, as some materials deteriorate more quickly than others. The estimated useful life can be extended even more with regular intervention, like the lifecycle events. Concrete bridges and OSIM culverts can have an estimated useful life of 84 years. Steel bridges and CSP OSIM culverts can have an estimated useful life of 73 years. (Table 4.1).

Asset	Estimated Useful Life
Bridges (Concrete)	84 Years
Bridges (Steel)	73 Years
CSP OSIM Culverts	73 Years
OSIM Culverts	84 Years

Table 4.1 Estimated useful life for County bridge and culvert asset classes.

While bridges and culverts can last a long time, there is a minimum maintenance standard that must be followed for safety reasons. The County begins planning for replacements when structures approach a BCI of 60. Figure 4.1 shows the standard deterioration curve of Concrete bridges and OSIM culverts. Figure 4.2 shows the standard deterioration curve of Steel bridges and CSP culverts.

ESTIMATED USEFUL LIFE (CONT'D)

Bridges (Concrete) and OSIM Culverts

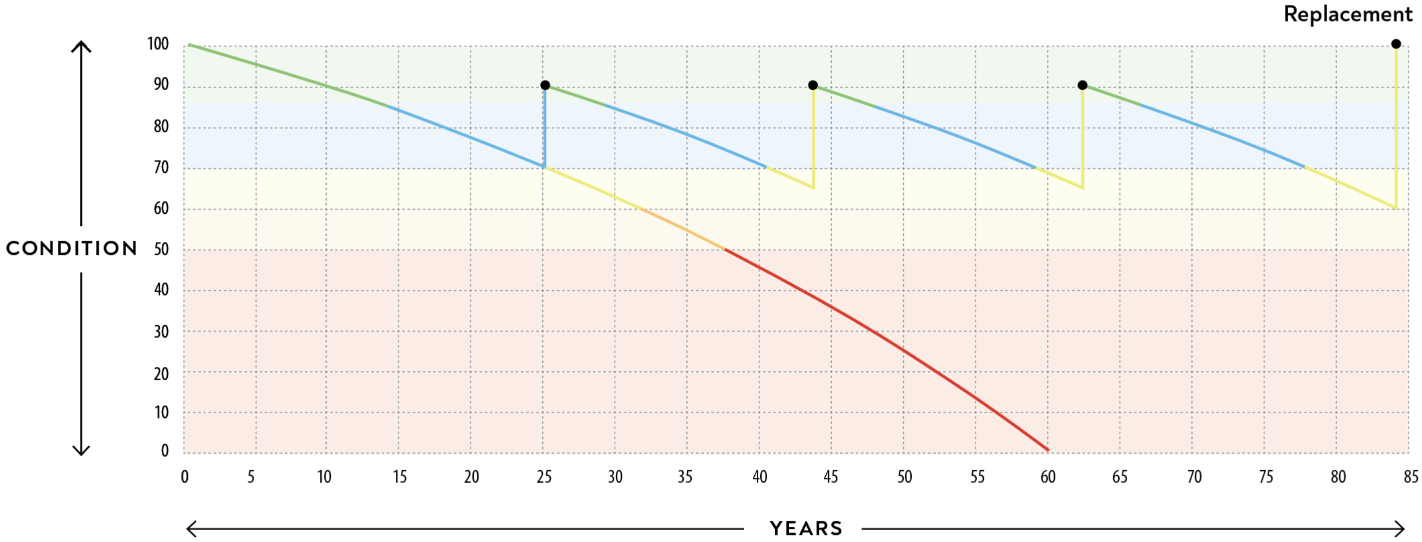


Fig. 4.1 Standard deterioration curve for the lifecycle of Concrete bridges and OSIM culverts

Bridges (Steel) and CSP OSIM Culverts

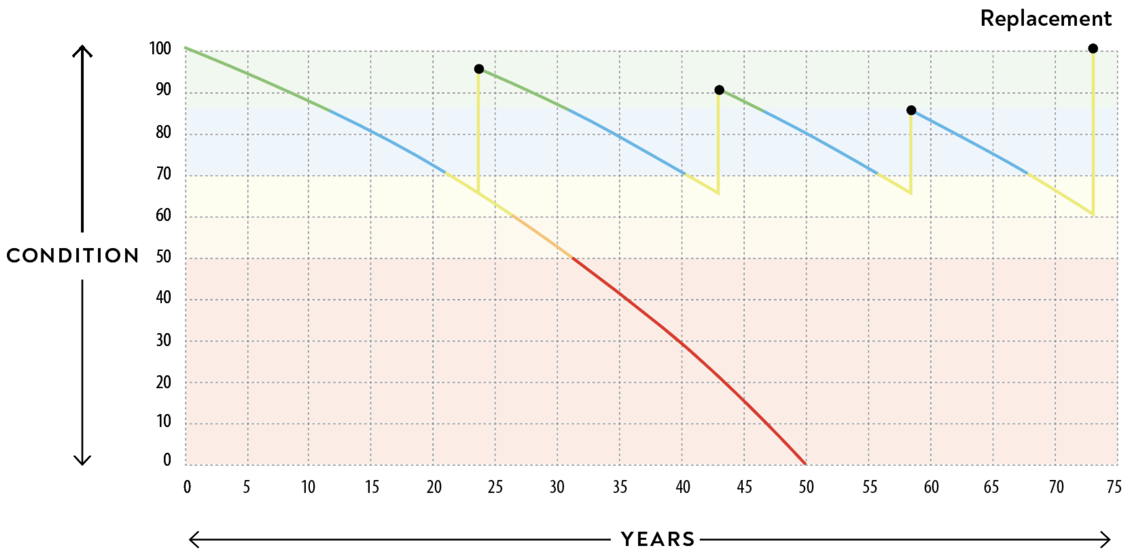


Fig. 4.2 Standard deterioration curve for the lifecycle of Steel bridges and CSP OSIM culverts.

CONDITION

The condition of County bridges and large culverts is assessed every two years, in accordance with the Ontario Structure Inspection Manual (OSIM), by external consultants. The inspection reports produce a list of priority investments through a recommended Time of Need (TON) assessment.

Bridges are made up of various components, each of which deteriorates at different rates. The OSIM inspections visually evaluate each component of the structure. The condition of individual components is compiled into a summary metric, the Bridge Condition Index (BCI). The BCI ranges from 0 to 100, with 0 representing the worst possible condition and 100 representing the best possible condition.

The scale in Table 4.2 shows how the BCI is grouped into a five-point condition scale.

Condition	BCI	Scheduled Work
Very Good	>85	Deck cleaning, drainage outlets cleanout.
Good	70—85	Deck cleaning, drainage outlets cleanout.
Fair	60—70	Deck cleaning, drainage outlets cleanout, new asphalt deck surface, waterproofing, rehabilitation.
Poor	50—60	Rehabilitation, reconstruction.
Very Poor	<50	Reconstruction.

Table 4.2 Five-point condition scale for County bridges and culverts.

County bridges and culverts are in *Good* condition, on average (Table 4.3). This is due to the focus of the County engineering department on rehabilitating these structures over the past decade. Several large capital projects were undertaken during this time in order to rehabilitate or replace bridges and culverts across the County.

Asset	Average Assessed Condition (2018)	Average Projected Condition (2020)
Bridges	78.08 BCI (Good)	76.07 BCI (Good)
OSIM Culverts	73.96 BCI (Good)	73.06 BCI (Good)

Table 4.3 Average County bridge and culvert condition rating during the 2018 condition assessment, and projected condition in 2020.

A total of 68% of County bridges (representing a replacement value of $164,795,990) are in *Very Good* or *Good* condition, and will not need significant investments in the ten-year forecast. Similarly, 60% of culverts (representing a replacement value of $19,651,225) are in *Very Good* or *Good* condition. Figure 4.3 and 4.4 provide an overview of the condition for all County bridges and culverts, respectively.

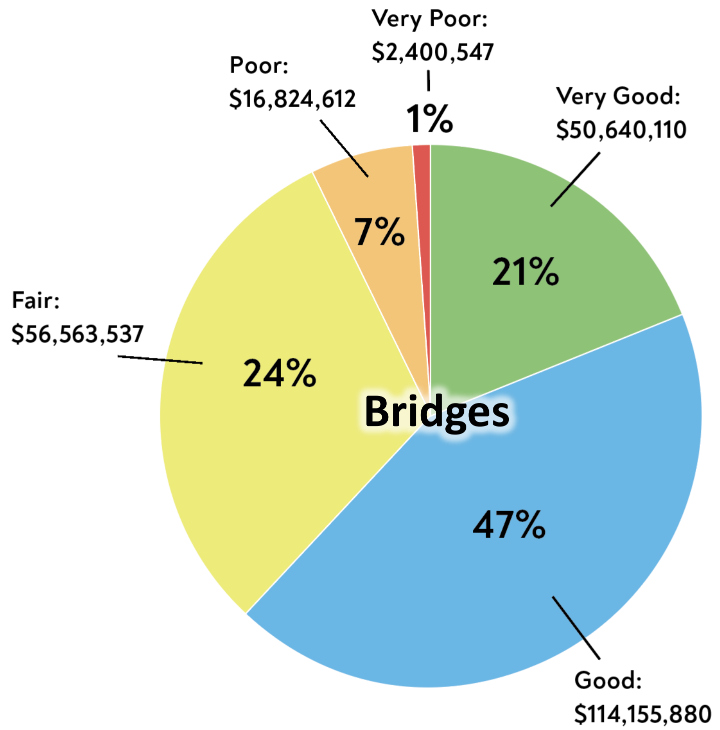


Fig. 4.3 Condition distribution (% of total network) and total replacement values for County bridges, 2020.

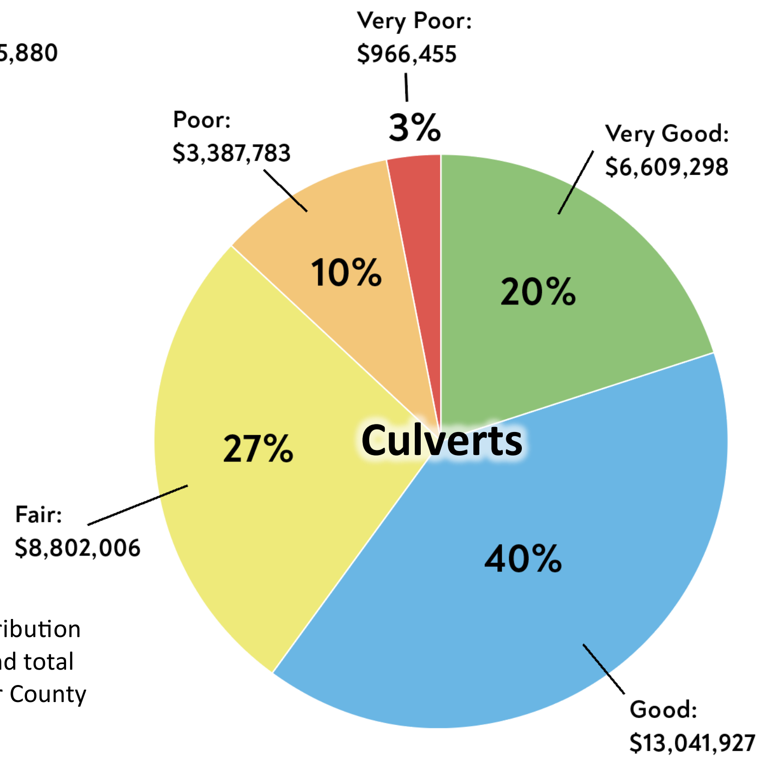
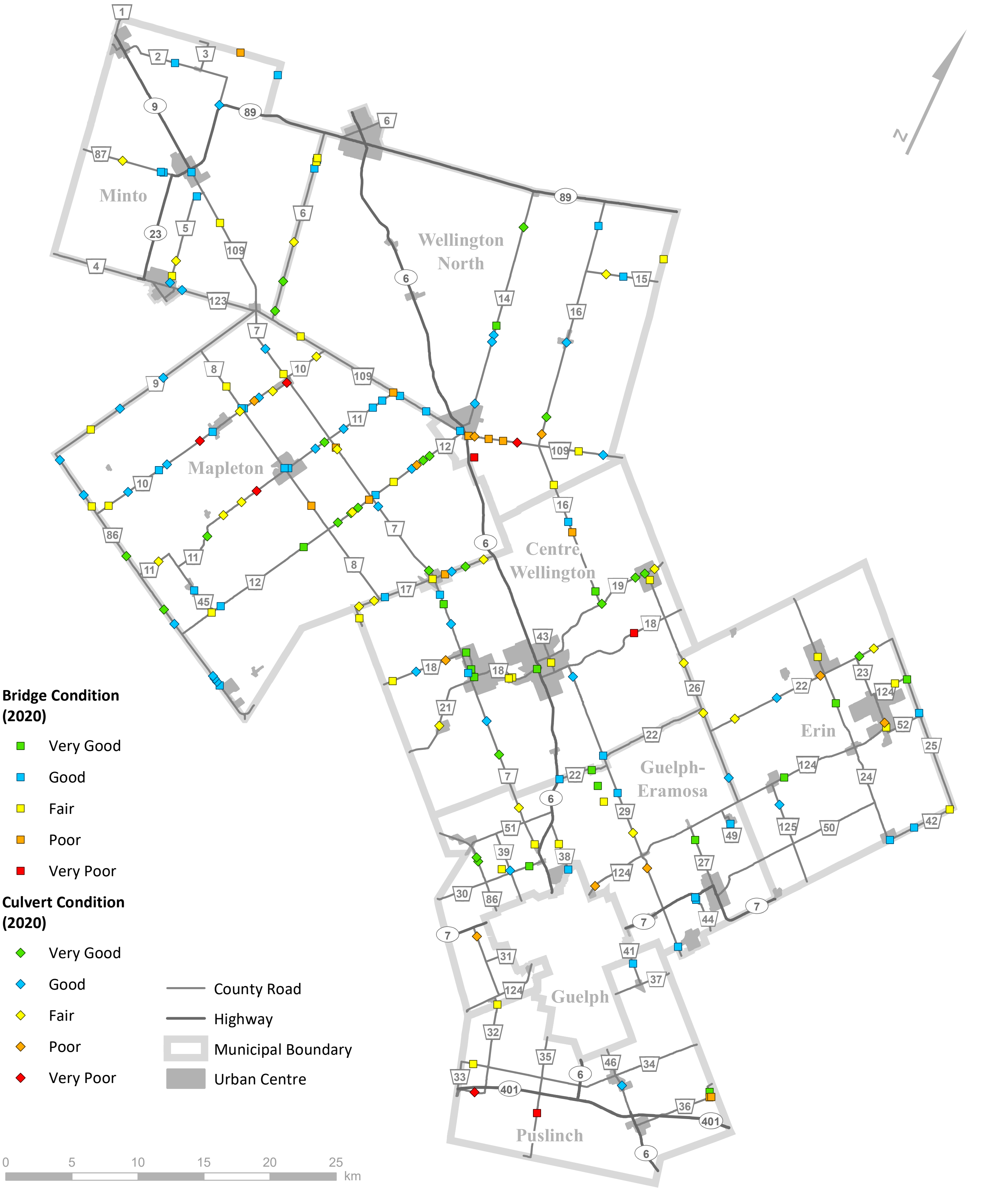


Fig. 4.4 Condition distribution (% of total network) and total replacement values for County culverts, 2020.

CONDITION (CONT'D)



Risk

The risk analysis for bridges and culverts is the product of the likelihood of failure and the consequence of failure. Table 4.4 illustrates the parameters used to represent the probability and consequence of failure for these structures: The service life remaining and condition both approximate the likelihood of failure. The consequence of failure is divided into the financial impact of failure (represented by the replacement cost), and the social impact of failure (represented by the AADT). Bridges with higher replacement costs have a more substantial impact on the County budget should they fail. Furthermore, the failure of structures with high AADT counts (i.e. more central bridges and culverts in the County) is more disruptive than the failure of structures that are not used as frequently.

Probability of Failure	Consequence of Failure
Year built	Replacement cost
Condition	Average annual daily traffic (AADT)

Table 4.4 Probability and consequence of failure parameters currently included in the County bridges and culverts risk model.

Additional parameters that are planned for inclusion in future risk models for bridges and culverts are found in Table 4.5. The inclusion of these parameters depends on data availability. Once data is collected for each of these parameters, they will be built into the risk model to better reflect the high-risk structures across the County. For example, load limits will indicate the type of traffic that is supported by the structures, and will be more informative regarding the type of disruption that would be expected should the structure fail. Similarly, detour distance is another metric of inconvenience that can be applied to the risk model, to determine the impact of failure.

Probability of Failure	Consequence of Failure
Load limit (tons)	Detour distance (km)
Material	Deficiency type

Table 4.5 Probability and consequence of failure parameters planned for future inclusion in the County bridges and culverts risk model.

RISK (CONT'D)

Figure 4.5 and Figure 4.6 show the distribution of County bridges and culverts, respectively, by risk classification. Green represents the bridges and culverts that are *Very Low* risk, while red reflects the bridges and culverts with the highest (*Very High*) risk rating. Using the parameters listed, the vast majority of County bridges and culverts are classified as *Low* and *Very Low* risk.

Bridges Risk Classifications

Very Low (1-4)	Low (5-7)	Moderate (8-9)	High (10-14)	Very High (15-25)
31 Assets	32 Assets	22 Assets	19 Assets	0 Assets
31 units	32 units	22 units	19 units	-
$53,165,360	$83,665,817	$56,179,034	$47,574,475	-

Fig. 4.5 Risk classifications for County bridges, including the number of assets (units) and their total replacement costs, 2020.

Culverts Risk Classifications

Very Low (1-4)	Low (5-7)	Moderate (8-9)	High (10-14)	Very High (15-25)
32 Assets	33 Assets	13 Assets	15 Assets	1 Asset
32 units	33 units	13 units	15 units	1.00 units
$9,165,725	$11,763,716	$5,964,995	$5,403,826	$509,207

Fig. 4.6 Risk classifications for County culverts, including the number of assets (units) and their total replacement costs, 2020.

Table 4.6 shows the sole County culvert in the *Very High* risk category.

Bridge / Culvert	Replacement Cost	Addressed in 2021-30 Financial Plan	Probability of Failure	Consequence of Failure	Overall Risk Rating
Conestogo River Culvert #5 (C109123)	$509,207	Yes * (2024)	4.22 Likely	4 Major	16.89 Very High

Table 4.6 County culvert in the *Very High* risk category, including the structure name/ID, replacement cost, whether the structure is addressed in the 2021-30 financial plan, as well as the risk model parameters and overall risk rating, 2020.

*Note: Conestogo River Culvert #5 will be upgraded to a new bridge. Replacement cost reflects the replacement of culvert only (bridge replacement cost is separate).

Lifecycle Events

County bridges and culverts undergo regular lifecycle events in order to meet minimum maintenance standards and ensure that they are safe for County residents to use. During the bi-annual OSIM review, a list of recommended improvements is produced per structure, to give the County an idea of the kind of work that needs to be done.

Recommended improvements are categorized into three categories:

- Minor repairs
- Major repairs / replacements
- Barrier / guide rail needs

Minor repairs are relatively inexpensive, but can defer or delay the need for major repairs or replacements in the future, thereby extending the useful life of County bridges and culverts. Minor repairs include work such as extending deck drains, adding scour protection, repairing undermined foundations, and sealing leaking expansion joints.

Barrier and/or approach guide rail work is also included in ongoing maintenance. Some structures already have approach guide rails, but they do not meet current standards for length, post spacing, and/or end treatments, as defined in the Roadside Safety Manual (MTO, 1993).

Needs are prioritized based on the condition and/or design of existing guiderails (if any), traffic volumes, speed, road alignment, and the severity of the hazard posed by the lack of guiderails or the inappropriateness of existing guide rails. The need for barrier and guide rail improvements is a safety issue, and as a result, installing or updating barrier and guide rails is a priority investment.

The following is a list of lifecycle events associated with bridges and large culvert structures:

- Annual washing to remove debris from County winter operations (sand and salt)
- Crack sealing of wearing surface
- Regular re-coating of railing systems
- Preventative maintenance and cleaning of wearing items
- Regular clearance of debris around and within the structures
- Monitoring for minimum maintenance standards, including safety systems and signs

Lifecycle Events (CONT'D)

The model used to determine the full lifecycle cost of County bridges and culverts included a 20-year average investment, determined by the County engineering department, that would reflect the maintenance costs incurred to maintain the structure. This cost differs for bridges and culverts (Table 4.7), and includes all lifecycle events.

Asset	Rehabilitation Investment
Bridges	$250,000
Culverts	$125,000

Table 4.7 Average 20-year investment amount, reflecting the full lifecycle cost, of County bridges and culverts.

Figure 4.7 and 4.8 show the deterioration curves for bridges and culverts. Rehabilitation events are scheduled when the asset reaches a condition of 65-70, varying based on which rehab is being completed. These events extend the useful life of the structures, as well as ensure that the structures meet maintenance standards and are safe.

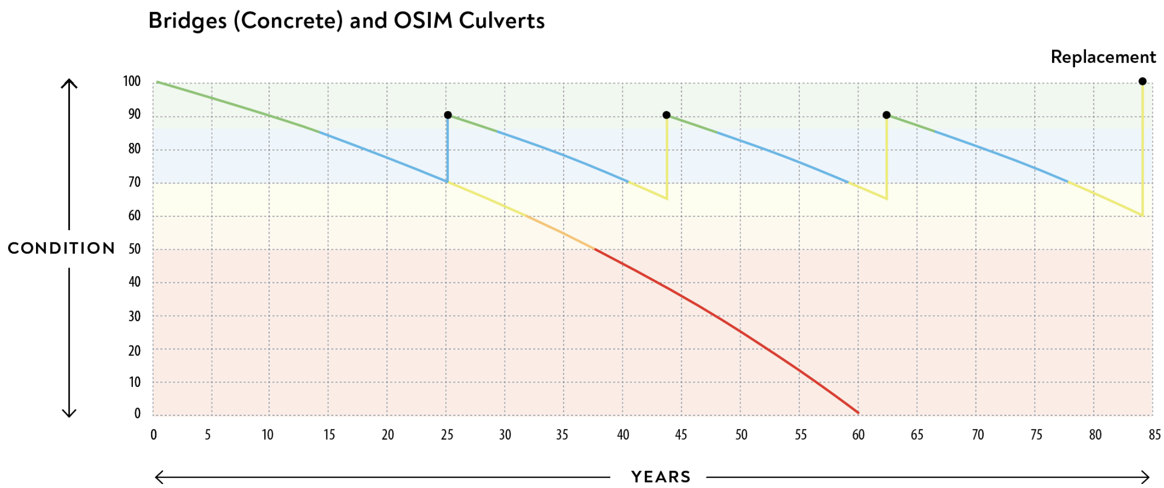


Fig. 4.7 Standard deterioration curve for the lifecycle of concrete bridges and OSIM culverts.

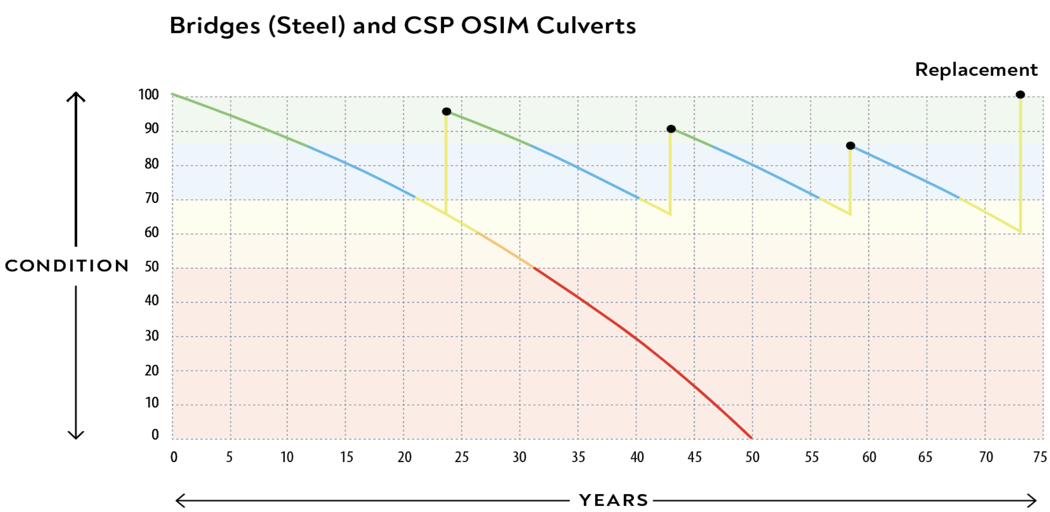


Fig. 4.8 Standard deterioration curve for the steel bridges and CSP OSIM culverts.

Replacement Value

The replacement value of bridges and culverts is based on the OSIM inspection, where a cost to replace the structure is provided by the external consultant. The last inspection was completed in 2019, and replacement costs were inflated using the Non-Residential Construction Consumer Price Index to arrive at 2020 replacement values (Table 4.8).

Asset	Number of Structures	Estimated Replacement Value
Bridges	104	$240,584,686
Culverts	94	$32,807,469
Total	**198**	**$273,392,155**

Table 4.8 Total estimated replacement value for County bridges and culverts, 2020.

Annual Funding Requirement

The annual funding requirement is a metric that provides an average of the combined cost to maintain and replace assets over their useful life. For bridges and culverts, the annual requirement is a combination of each of the three rehabilitations scheduled at around 20-year intervals, and the replacement cost for each structure (Table 4.9).

Total Replacement Cost	Total Maintenance Cost	Total Network Cost	Estimated Useful Life	Annual Requirement
$273,392,155	$113,250,000	$386,642,155	84 & 73 Years	$4,722,291

Table 4.9 Overview of County bridges and culverts costs, including the annual funding requirement, 2020.

The total cost to maintain all bridges and culverts over their useful life is $386,642,155. Dividing the total cost to maintain bridges and culverts by the estimated useful life of each structure results in the annual requirement of $4.72 million. (**Note**: This cost assumes that the lifecycle events are done on schedule and that the cost for each bridge and culvert are consistent [i.e. $250,000 and $125,000, respectively, approximately every 20 years].

CAPITAL NEEDS 2021-30

Table 4.10 shows the lifecycle events and replacement costs for County bridges and culverts for 2021-30. The average replacement cost of $6,041,290 and average capital needs of $8,066,002 are higher than the average annual requirement for the network of $4,722,290. This is due to the backlog of structures in *Poor* to *Very Poor* condition that require immediate attention, valued at $31,134,365.

Year	Rehab 1 20 Years	Rehab 2 40 Years	Rehab 3 60 Years	Replace	Total
2021	$2,000,000	$1,000,000	$500,000	$31,134,365	$34,634,365
2022	$1,423,125	$1,681,875	$258,750	$4,001,120	$7,364,870
2023	$1,071,225	$1,874,644	$803,419	$3,862,856	$7,612,143
2024	$415,769	$1,247,308	$831,538	-	$2,494,615
2025	$430,321	$2,151,606	-	$4,925,039	$7,506,966
2026	-	$890,765	$296,922	-	$1,187,686
2027	$153,657	$1,075,598	-	-	$1,229,255
2028	$159,035	$477,105	-	-	$636,140
2029	$493,803	$329,202	-	$16,489,523	$17,312,528
2030	$340,724	$340,724	-	-	$681,449
TOTAL	$6,487,660	$11,068,826	$2,690,629	$60,412,902	$80,660,017
AVERAGE ANNUAL	$648,766	$1,106,883	$269,063	$6,041,290	$8,066,002

Table 4.10 The lifecycle events and replacement costs for County bridges and culverts for 2021-30.

Taken together, the annual requirement, ten-year average replacement needs, and the ten-year average capital needs suggest that the capital budget for County bridges and culverts should range from $4.7 to $8.1 million dollars per year (Table 4.11).

Annual Funding Requirement	Ten-Year Average Replacement Needs	Ten-Year Average Capital Needs
$4,722,291	$6,041,290	$8,066,002

Table 4.11 The annual requirement, ten-year average replacement needs, and the ten-year average capital needs for County bridges and culverts.

CAPITAL NEEDS 2021-30 (CONT'D)

The County has a number of structures that are in *Poor* to *Very Poor* condition, and require replacement. These structures make up the backlog of structures that are in urgent need of replacement, totaling $31,134,365 (Figure 4.8). The replacement costs make up the majority of the funding needs for bridges and culverts. Maintenance needs are relatively low, although they are projected to increase throughout the future.

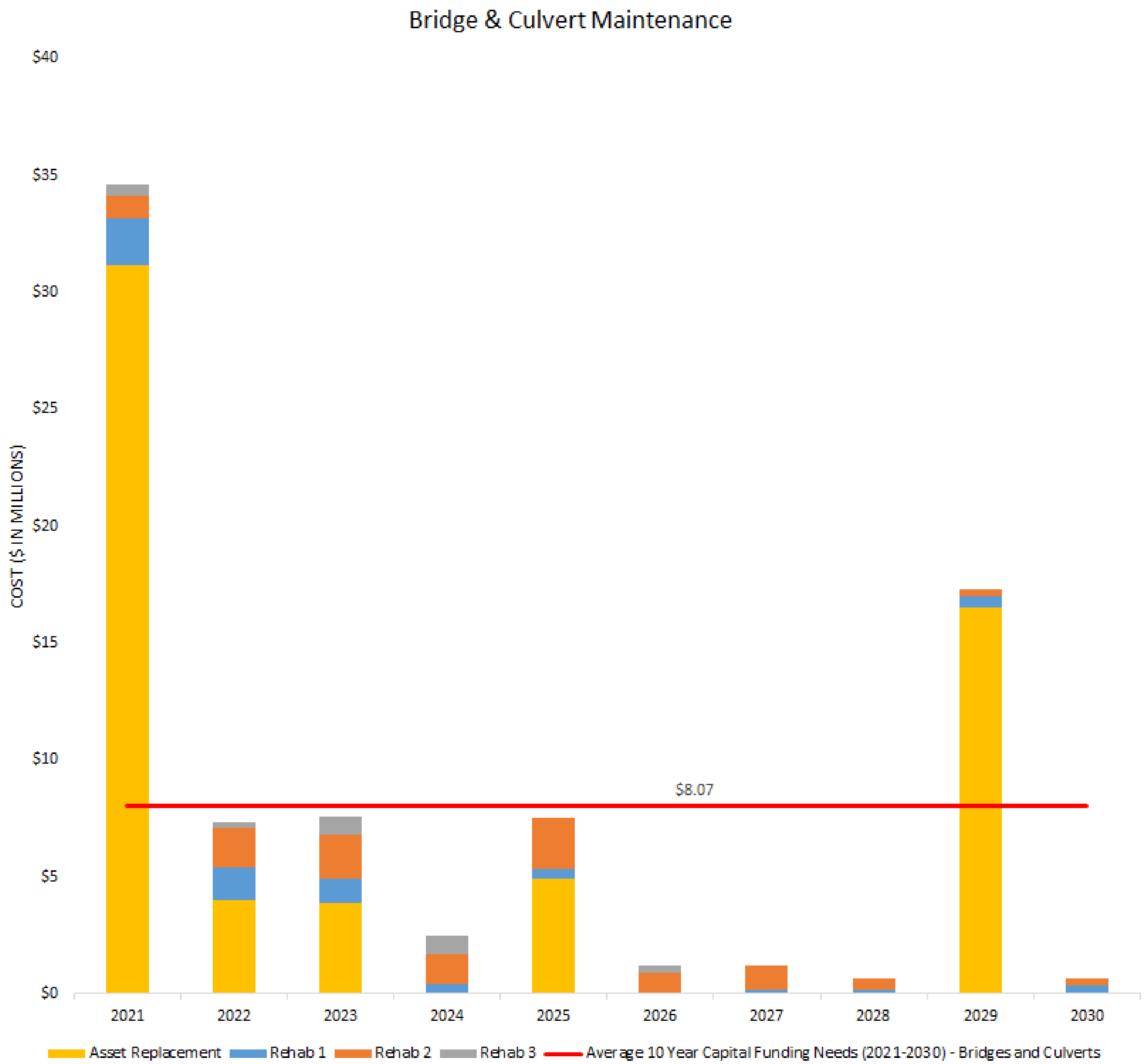


Fig. 4.8 The ten-year capital funding needs for County bridges and culverts.

Levels of Service

Table 4.12 is a chart of bridges with load restrictions that are maintained by the County.

Structure	Location	Gross Tonnes		
		Level III	Level II	Level I
McMullen Bridge	Wellington-Grey Boundary, Town of Minto	16	29	40
Rothsay Bridge	Wellington Road 7, Rothsay, Township of Mapleton	-	37	50
Flax Bridge	Wellington Road 11, Township of Mapleton	17	26	36
Princess Elizabeth Bridge	Wellington Road 12, Township of Mapleton	-	42	52
Blatchford Bridge	Wellington Road 32, Township of Guelph-Eramosa and Township of Puslinch Boundary	-	37	47
Lot 31, Conc. 11	Wellington Road 36, Township of Puslinch	15	-	-
Caldwell Bridge	Wellington Road 43, Scotland Street, Fergus, Township of Centre Wellington	24	35	43

Table 4.12 Bridges within the County that have load restrictions associated with them, 2020.

Level 1 is a single vehicle unit (cube truck), level 2 is a combination of two vehicle units (tractor trailer) and level 3 is a combination of three vehicle units (tractor and two trailers). The restrictions posted reflect the maximum gross tonnes per vehicle class allowed on the bridge. The objective is to reduce the number of bridges with load restrictions, in order to enable unencumbered travel throughout the County. However, this requires significant investment in each of the aforementioned structures, which may not be feasible or desirable, based on the location of the structure and the average traffic it supports.

The County must meet legislated requirements in order to ensure that local bridges are safe, including:

1. Provincial government mandates, through Ontario Regulation 239/02 – Minimum Maintenance Standards for Municipal Highways, that bridges are inspected for deck spalling on regular intervals based on road class;
2. Biannual inspections completed in accordance with Ontario Regulation 104/97 using methodology outlines in the Ontario Structure Inspection Manual (OSIM). Any safety-related deficiencies identified during the OSIM inspection are prioritized.
3. Bridge and large culvert design work must be done in accordance with CSA S6-14 Standard – Canadian Highway Bridge Code, and Ontario Regulation 104/97: Standards for Bridges

Levels of Service (cont'd)

Table 4.13 contains a list of performance metrics established by the County engineering department to measure the levels of service provided by County bridges and culverts. Metrics without data (N/A) are included in the short-term data collection goals of the department, and will be included in future versions of the plan. Additional trend analyses will also be available in future plans, once more data is collected.

	2019	2020
Accessibility & Reliability		
% of bridges in the municipality with loading or dimensional restrictions *	7.7%	6.7%
Average detour distance (km) of all Bridges and Culverts	N/A	N/A
# of unplanned Structure closures	N/A	N/A
Average duration of unplanned structure closures (days)	N/A	N/A
Safety		
% of bridges and structural culverts inspected every two years	N/A	100%
# of Minimum Maintenance Standards non-compliance events	N/A	0
% of bridges with load limits posted	7.7%	6.7%
Affordability		
Operating and maintenance costs for bridges & culverts / m2	$90.50	$17.98
Annual capital reinvestment rate (%)	N/A	3.24%
Sustainability		
Average bridge condition index value for bridges in the municipality *	76.62	76.91
Average bridge condition index value for structural culverts in the municipality *	74.64	74.37
% of bridges and culvert replacement cost spent on operating and lifecycle events	1.21%	0.24%

Table 4.13 Bridges within the County that have load restrictions associated with them. Metrics notated above with an asterisk (*) are required under the O. Reg. 588/17.

Strategy

Master Plans and Studies

Structural bridges and culverts are assessed in accordance with the OSIM protocols under the *Public Transportation and Highway Improvement Act,* 1990. Assessed condition is collected on a two-year cycle as mandated by the Act.

Addressing the Backlog

County bridges and culverts are rated an average condition of *Good*. Approximately 7% of bridges and 13% of culverts are in the *Poor* to *Very Poor* category. These assets require immediate attention and are valued at approximately $31 million.

Renewal Projects

Lifecycle events and prioritization of projects are driven by both OSIM reports and as well as the County's 10-year forecast. Additionally, the County considers proximity to other bridges, detour distance, and coordination with roads assets to prioritize short term needs.

Data Quality

The County has committed to the following data quality initiatives:

- Collect data for all Levels of Service metrics and report annually
- Review replacement values on an annual basis
- Further identify and incorporate asset lifecycle events (including costs)

Asset Management Plan

ASSET DETAILS

Stormwater Network

STORMWATER NETWORK

The County stormwater network is composed of two classes of assets: storm sewer pipes, and storm sewer structures (Table 5.1). Pipes can be further segmented into construction materials, which include clay, concrete, galvanized corrugated steel (CSP), high-density polyethylene (HDPE), or polyvinyl chloride (PVC), as shown in Table 5.2. The storm sewer structures comprise the access points of the system, for maintenance and inspection work (manholes), or inlet/outlet structures designed to catch the runoff water from hard surface (catch basins).

The storm sewer network is designed to convey runoff from frequent storms (e.g. up to 2 to 5 year storms). The main purpose of this system is to control the amount and quality of run off to reduce flooding, erosion, and pollution from rain and melting snow.

Asset	Quantity
Storm Network (Pipes)	36.5 km
Storm Network (Structures)	1,443 units

Table 5.1 County asset's pipes and structures and their respective quantities, 2020.

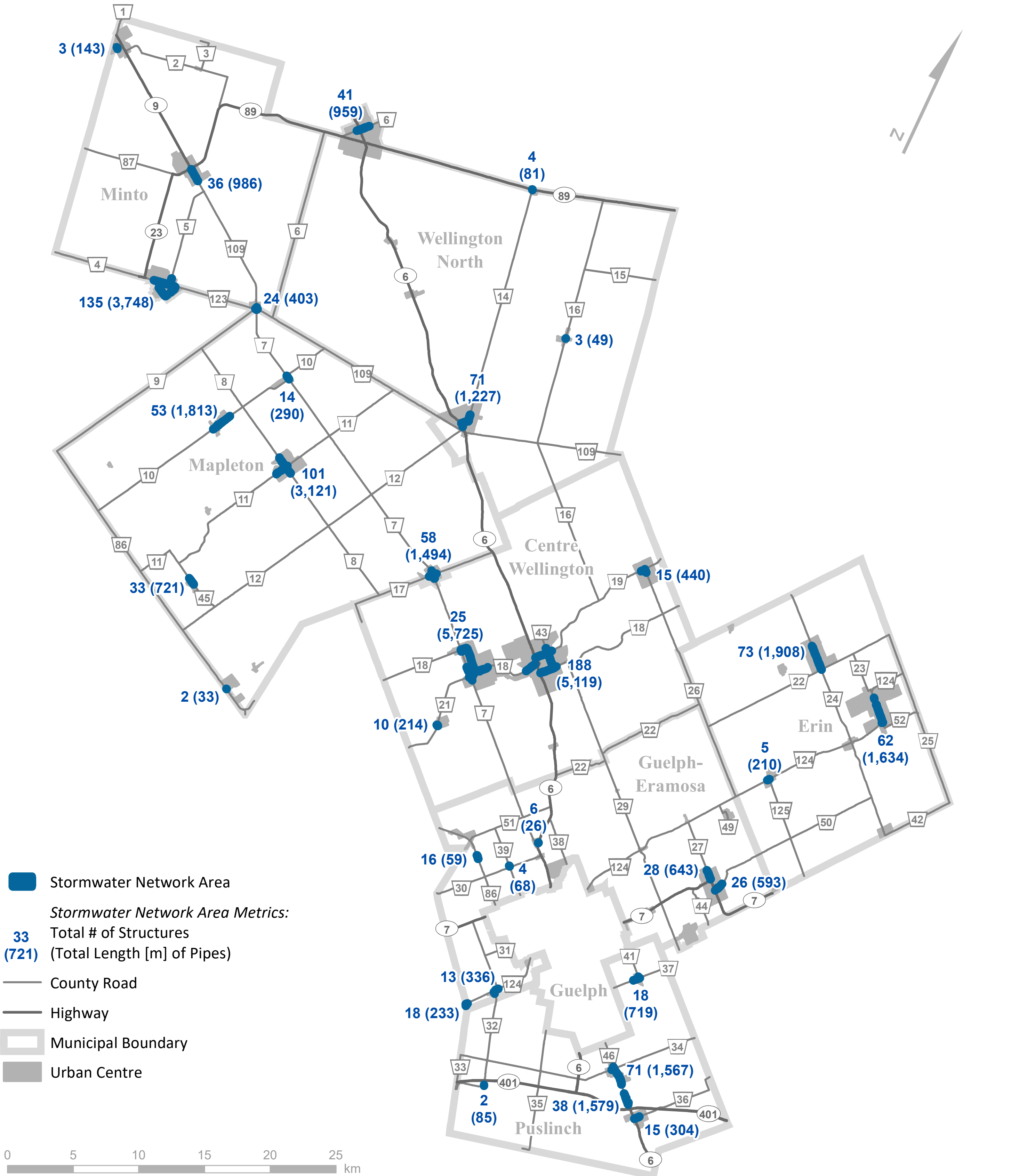
Having accurate and comprehensive asset data is critical for all assets, but is especially important for underground infrastructure. As shown in the table above, the County maintains 36.5 km of storm sewer pipes and 1,443 related point assets, such as catch basins and maintenance holes. In addition to condition data, the County collects data on the location, length, size (diameter), construction material, and depth of pipes, among other attributes. The storm sewer inventory is derived from historical construction record drawings, and was updated in 2020 by external consultants.

The exact construction year of our stormwater pipes was not available for this analysis. Therefore, we used the age of the road segment above the stormwater pipe, assuming that any replacement or construction of new road would have included updating the stormwater inventory below the road.

Pipe Material	Quantity
Clay	0.3 km
Concrete	20.7 km
CSP	3.3 km
HDPE	3.1 km
PVC	4.4 km
No material data available	4.7 km

Table 5.2 County pipe material types and total length, 2020.

STORM NETWORK (CONT'D)



Data Quality

	Level 1	Level 2	Level 3	Level 4
Inventory	Inventory data is incomplete.	**Inventory data Is complete.**	Inventory data is complete and accurate.	Inventory data is complete, accurate, and in a centralized, accessible format.
Condition	**No condition data exists. Condition is approximated by age.**	Condition data exists for these assets.	Condition data was collected recently for these assets.	Condition data is complete and accurate, and regularly updated. Data is centralized and accessible.
Risk	Critical assets and services are understood by department staff, but no risk models exist.	**Risk is estimated according to a draft risk model. Some parameters lack sufficient data.**	Complete risk models exist for this asset class, and critical assets have been identified.	Risk management strategies have been developed for critical assets, and department budgets reflect risk-based priorities.
Lifecycle Strategy	Lifecycle events required to maintain current levels of service are not documented.	**Lifecycle events required to maintain current levels of service are documented.**	Capital budget costs of lifecycle events are built into the funding models. Operating costs are not included.	Capital and operating costs are built into the funding model. Projected lifecycle needs are defined, and funding shortfalls are identified.
Financial Sustainability Strategy	Budgets are based on prior year spending.	**Asset replacement schedules have been built into the long-term capital forecast.**	Replacement and lifecycle events costs have been built into long-term capital forecasts.	Replacement and lifecycle events costs have been built into long -term capital and operating forecasts. Demand forecasts inform the budget.
Levels of Service	Services provided by this asset class are understood by departmental staff, but not formally measured.	**Performance metrics are defined to measure levels of service.**	Performance metrics are defined and a data collection strategy exists for all metrics.	Proposed levels of service have been identified, alongside their financial impacts. Trends in performance measures are tracked and regularly reported.

Model Assumptions

Estimated Useful Life
1. The estimated useful life of pipes and structures varies by material.
Replacement Cost Calculation
1. Stormwater pipes are replaced when they are approaching failure, or when the road segment above a pipe is being replaced and the additional excavation required to replace the underlying stormwater pipe is within budget. 2. The cost to replace a pipe is calculated as the sum of the road excavation plus $500 per meter of pipe being replaced. The cost of road excavation was derived from the 2018 road study which included the full cost of road replacement, including base excavation. Only the base excavation portion of the road replacement cost is included in the pipe cost. The surface of the road is allocated to the road segment. 3. The cost to replace a stormwater structure is estimated at $5,000 per structure by the County engineering department.
Condition
1. The condition of the pipes and structures within the stormwater network is calculated as a proportion of the remaining estimated useful life. Therefore, age is used as a proxy for condition in this version of the AM plan. 2. An assessment of the condition ratings of pipes will be conducted in 2021.
Lifecycle Events
1. While pipes and structures undergo regular cleaning and flushing, among other lifecycle events, there are no lifecycle events built into this version of the AM plan. It is assumed that pipes and structures are left to deteriorate along an average deterioration curve, as excavating the road segment above a pipe in order to conduct maintenance is prohibitively expensive. 2. Operating maintenance costs, such as the aforementioned cleaning and flushing, will be included in future versions of the plan. This version of the plan evaluates only the capital budget for the stormwater network.

MODEL ASSUMPTIONS (CONT'D)

Funding

1. The Annual Funding Requirement represents the average annual cost of replacing and maintaining our stormwater network over the estimated useful life of each component (i.e. each pipe and structure).
2. The ten-year average replacement needs takes into account the timing of replacement. The backlog is accounted for in the first year of the ten-year period.
3. The funding models all reflect the cost of maintaining the County stormwater network in its current state. Any improvements to the network or changes in levels of service will come at an additional cost.
4. The impacts of growth and climate change mitigation are not included in this AM plan.

Risk

1. The parameters used in the risk model are based on the available data. Additional parameters may be included in future versions of the plan.
2. The inclusion of different parameters, or the change of weighting attributed to existing parameters, may impact the overall risk profile of the network. Any updated to risk models will be highlighted in future versions of the plan.

Levels of Service

1. The Levels of Service represent the performance metrics of the stormwater network.
2. Levels of Service annotated with an asterisk (*) are required to be reported by O.Reg. 588/17. Other metrics listed in the plan were chosen by the County engineering department to reflect the quality of service provided.
3. There is no data for some of the performance metrics listed. These metrics will be included in future versions of the plan, once data becomes available.

Estimated Useful Life

The useful life of a storm sewer pipe is based on the construction material of the pipe (Table 5.3). The useful life of a concrete pipe is approximately 100 years, while the useful life of a corrugated steel pipe is closer to 40 years. Storm sewer point assets, such as man holes, are constructed of concrete and have a useful life of 100 years.

Asset	Estimated Useful Life
Storm Network (Pipes)	
Concrete / Polyvinyl chloride (PVC) / High-density polyethylene (HDPE)	100 Years
Corrugated steel pipe (CSP) and Clay	40 Years
No material data available, estimated useful life	75 Years
Storm Network (structures)	
Catch Basin	100 Years
Manhole	100 Years

Table 5.3 Storm network assets' estimated useful life.

The deterioration of stormwater pipes and structures is modelled along a straight line, with the end of the useful life representing the time at which the asset is scheduled to be replaced, as shown below (Fig. 5.1). There are no lifecycle events scheduled for stormwater pipes, because of the prohibitively high costs of removing the road above the stormwater asset in order to access the stormwater pipes. As a result, the lifecycle strategy for stormwater pipes and structures is to allow them to deteriorate to the point at which they need to be replaced, with minimal intervention.

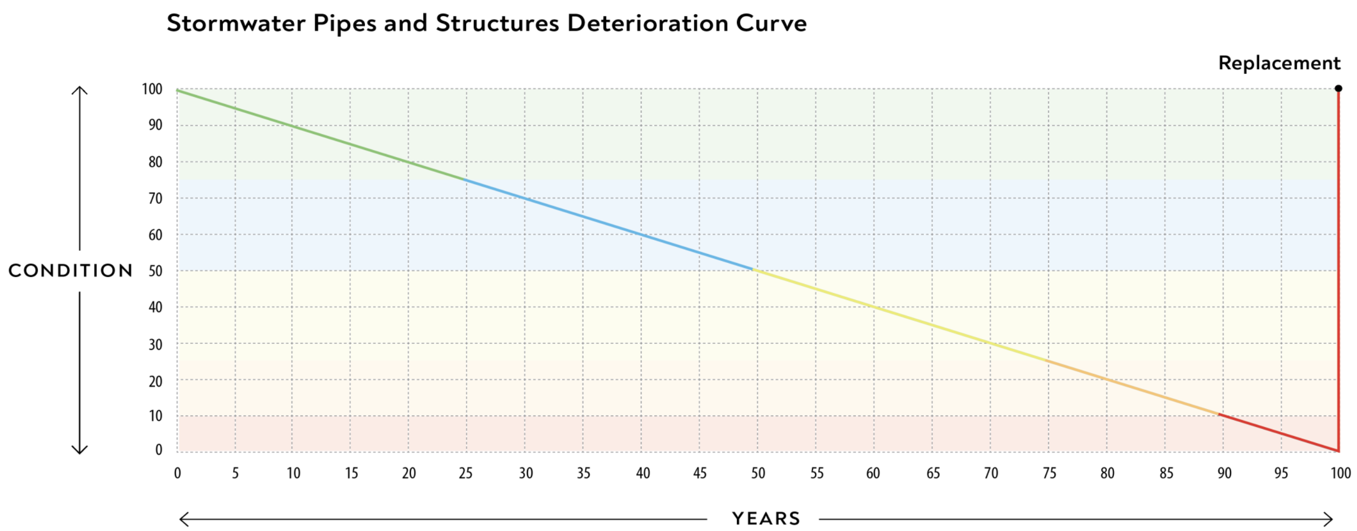


Fig. 5.1 Stormwater pipes and structures, representing average deterioration their the lifecycle.

Condition

Storm sewer inspection is conducted using closed circuit television (CCTV), based on the CSA Pipeline Assessment and Certification Programme (PACP) standard. A camera is placed into a pipeline and the picture is relayed to an operator located above ground, who interprets the images and records the location and nature of any observed deficiencies. The images are recorded, allowing for further review by engineering staff at a later date.

Based on PACP, the defects are rolled into a pipe score value, which represents the condition of the entire length of a storm sewer section. A pipe score of 1 would represent a new pipe, whereas a pipe score of 5 would represent a pipe that requires rehabilitation.

A condition assessment will take place in 2021. As the data is unavailable for this version of the AM plan, the age of the pipe is used as a proxy for condition, with the assumption that newer pipes are in better condition than older pipes. The age of the pipes was not reliably available, so the age of the road segment above each pipe was used as a proxy for pipe age. The assumption was made that any new road construction or replacement would include replacement of the stormwater assets underneath.

The following chart (Figure 5.2) shows the distribution of the age-based condition rating of the County pipe network, and the cost to replace the pipes in each condition rating category.

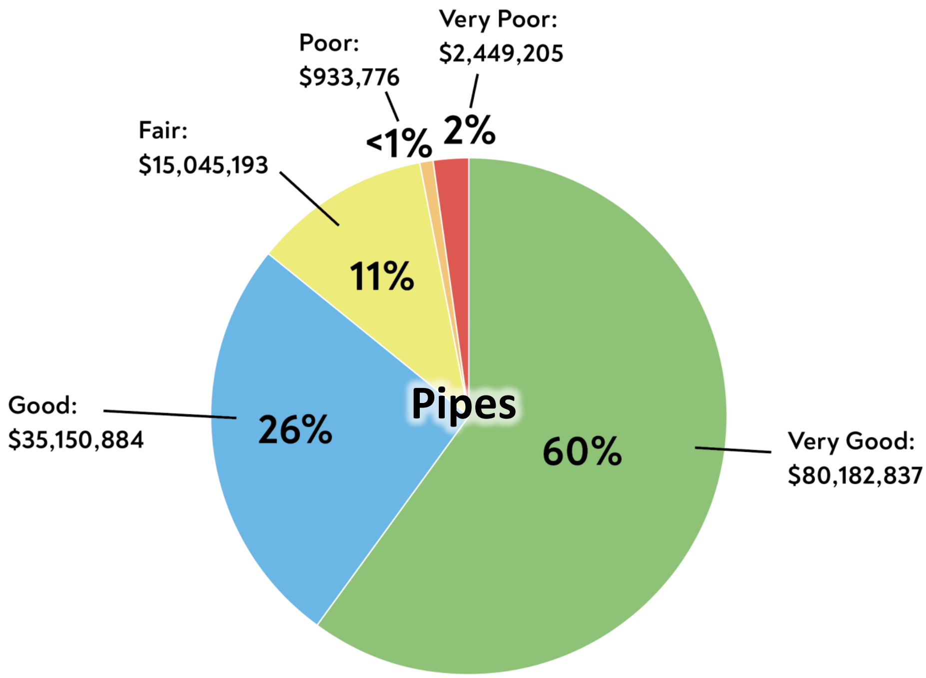


Fig. 5.2 County pipe network condition, by replacement cost, 2020.

CONDITION (CONT'D)

The following chart shows the distribution of the age-based condition rating of the County storm structure network, and the cost to replace the structures in each condition rating category.

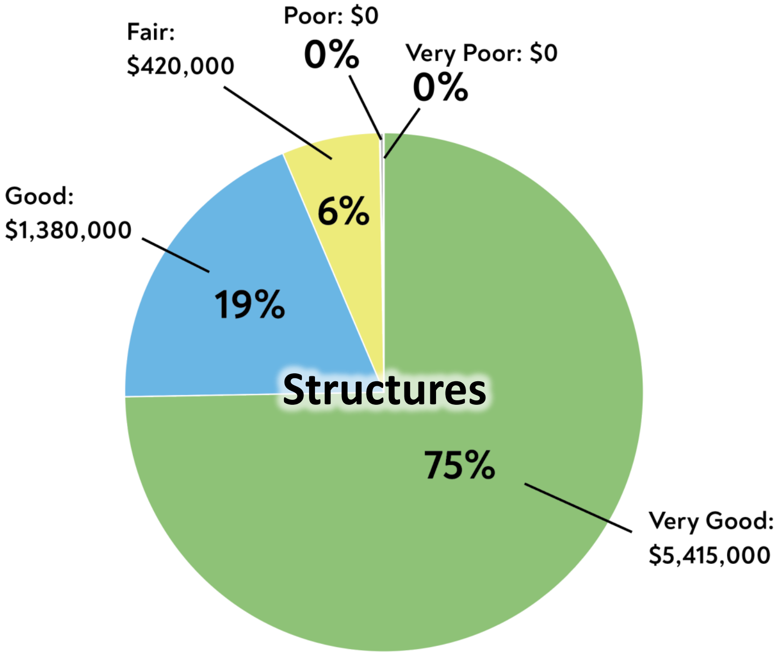


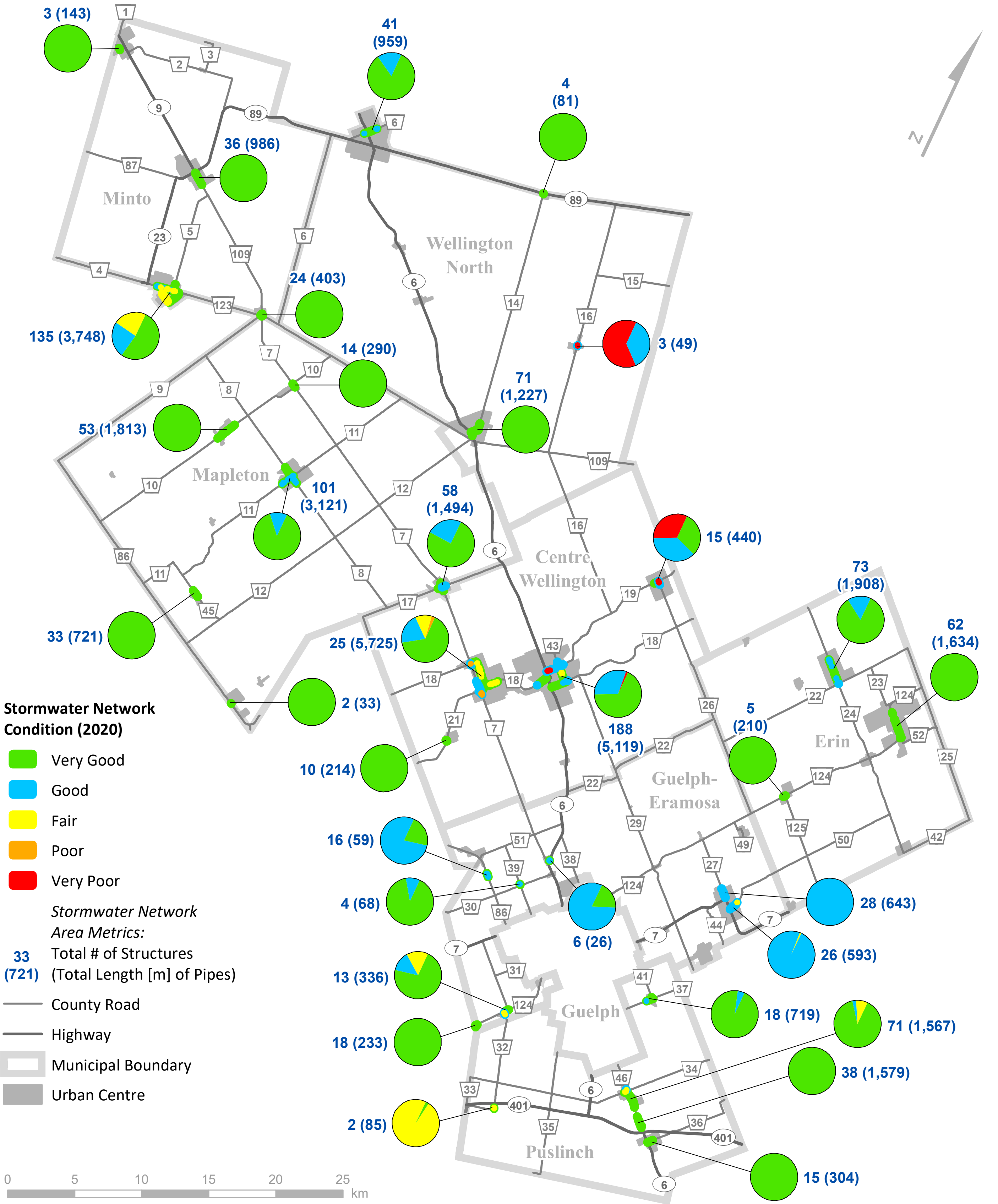
Fig. 5.3 County storm structure network condition, by replacement cost, 2020.

The majority of County pipes (86%) are in *Very Good* or *Good* condition, meaning that they have at least 50% of their estimated useful life remaining. CSV pipes have the shortest estimated useful life of 40 years, meaning that those structures are not expected fall within the County long-term financial plan for the next 20 years.

The same is true for County stormwater structures. Approximately 94% of County structures fall within the *Very Good* or *Good* condition rating. With a useful life of 100 years, these structures are not scheduled to be replaced within the foreseeable future.

However, events outside of the regular deterioration of these assets may necessitate earlier intervention and replacement. For example, heavy flooding may lead to severe damage of some stormwater pipes, which may need to be replaced earlier. Expansion of the County road network may also necessitate the replacement of stormwater pipes and/or structures.

CONDITION (CONT'D)



Risk

The risk analysis for the stormwater network includes parameters for the probability of failure of stormwater assets and the consequences of failure. The parameters used in the model shown in the following Table:

Probability of Failure	Consequence of Failure
Condition	Diameter
Material	Distance to floodplain

Table 5.4 Risk model parameters.

Figures 5.4 and 5.5 show the distribution of risk for stormwater pipes and structures.

Stormwater Pipes Risk Classifications

Very Low (1-4)	Low (5-7)	Moderate (8-9)	High (10-14)	Very High (15-25)
1,281 Assets	78 Assets	18 Assets	4 Assets	0 Assets
34,120.69 m	1,979.58 m	299.70 m	114.38 m	-
$122,499,290	$6,453,437	$4,560,253	$248,913	-

Fig. 5.4 Stormwater pipes risk classification, by pipe length (m) or number of structures (units) and replacement cost. Green are *Very Low* risk assets, while red are the *Very High* risk assets, 2020.

Stormwater Structures Risk Classifications

Very Low (1-4)	Low (5-7)	Moderate (8-9)	High (10-14)	Very High (15-25)
1,436 Assets	7 Assets	0 Assets	0 Assets	0 Assets
1,436 units	7 units	-	-	-
$7,180,000	$35,000	-	-	-

Fig. 5.5 Stormwater structures risk classification, by pipe length (m) or number of structures (units) and replacement cost. Green are *Very Low* risk assets, while red are the *Very High* risk assets, 2020.

Floodplain Risk Analysis

The County has conducted an analysis of the risk of flooding for County roads located within the County floodplain, to determine flooding risk for roads and the stormwater network for 5-year storms and 100-year storms. To conduct the analysis, floodplain data was compiled from conservation authorities to establish high-risk regions within the County. County road and stormwater network maps were overlaid onto the floodplain maps to determine which roads and stormwater pipes and structures were at higher risks of flooding during 100-year storms. The County Roads Division assisted with identifying areas that frequently flood, and designated those areas a high-risk areas for 5-year storms.

The maps on the following pages show which County roads and stormwater network features are located within the County floodplain.

Risk models were also updated to account for flooding risk and identify roads and stormwater structures that would need to be monitored and potentially refurbished to address flooding risk.

- Roads were evaluated to determine the proportion of the road located within the floodplain. Roads with a higher percentage of surface area located within the floodplain were designated as higher risk.
- Stormwater structures and pipes were evaluated by their distance to the floodplain. Structures and pipes located within, or closer to, the floodplain areas were designated as high risk.

The following charts (Fig. 5.6) demonstrate the results of the analysis:

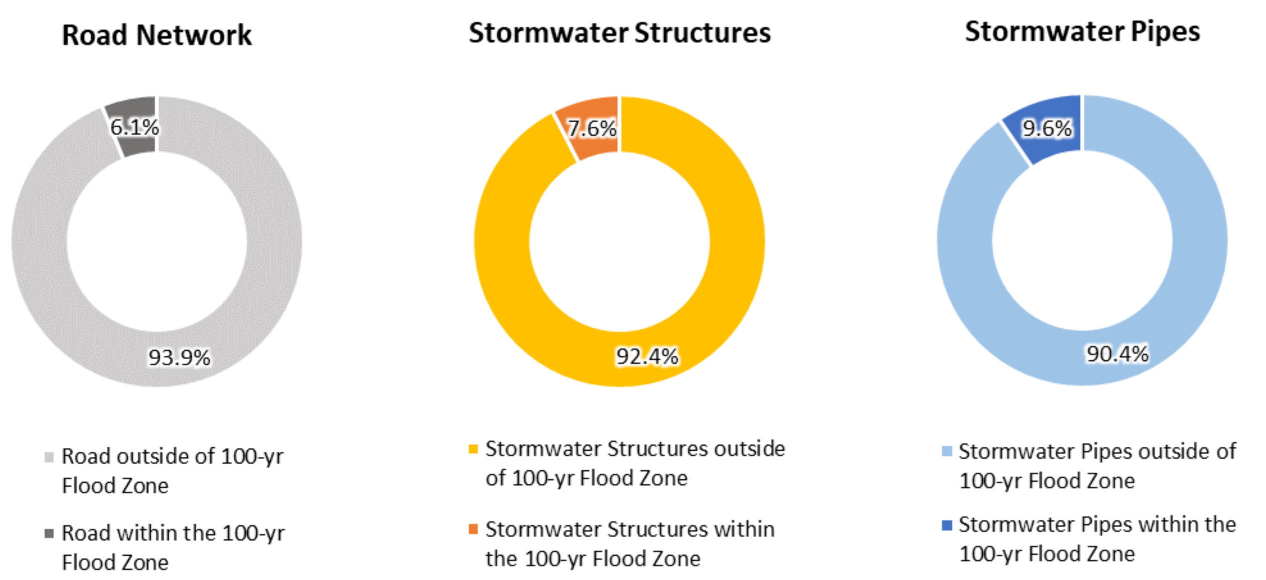
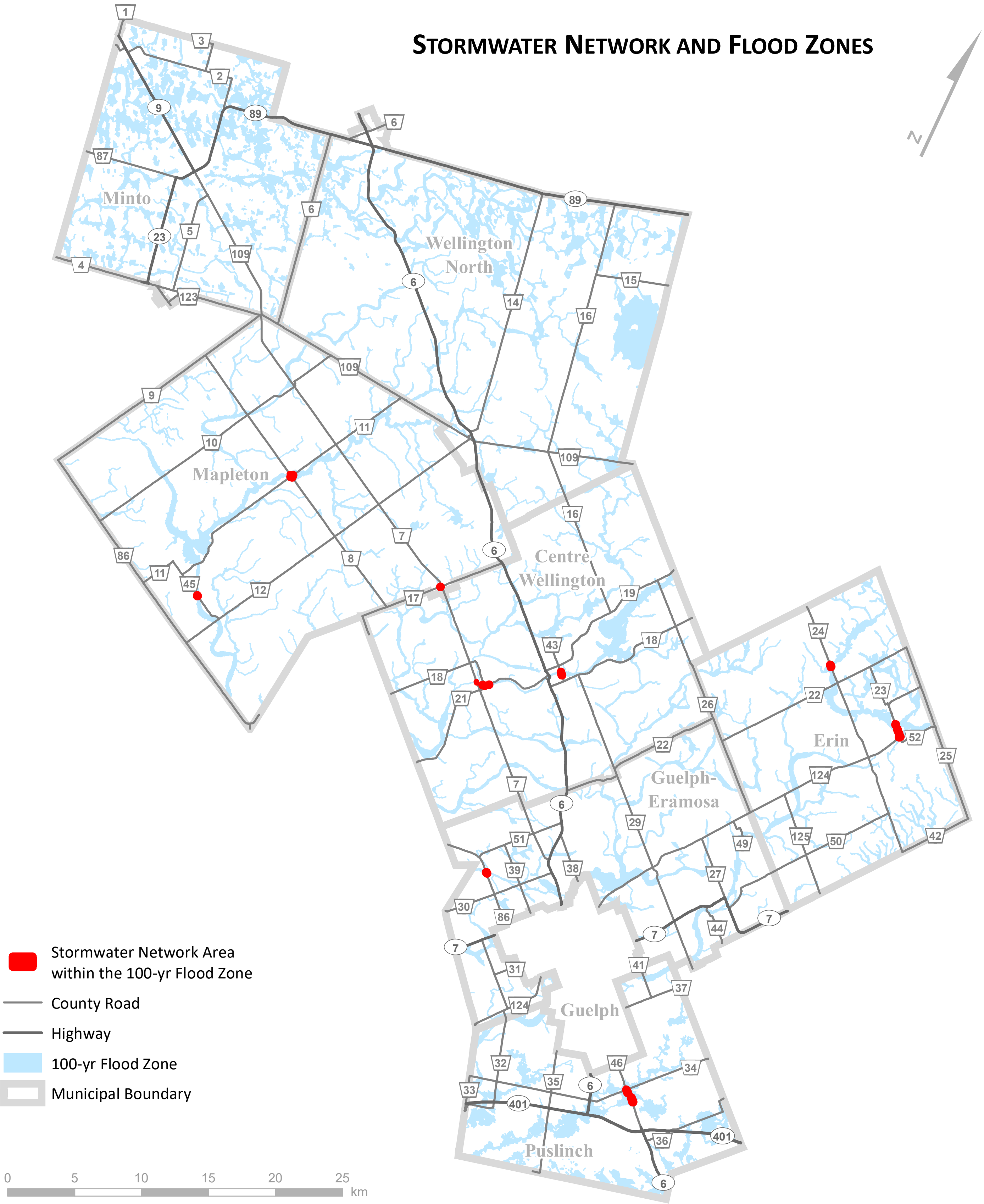


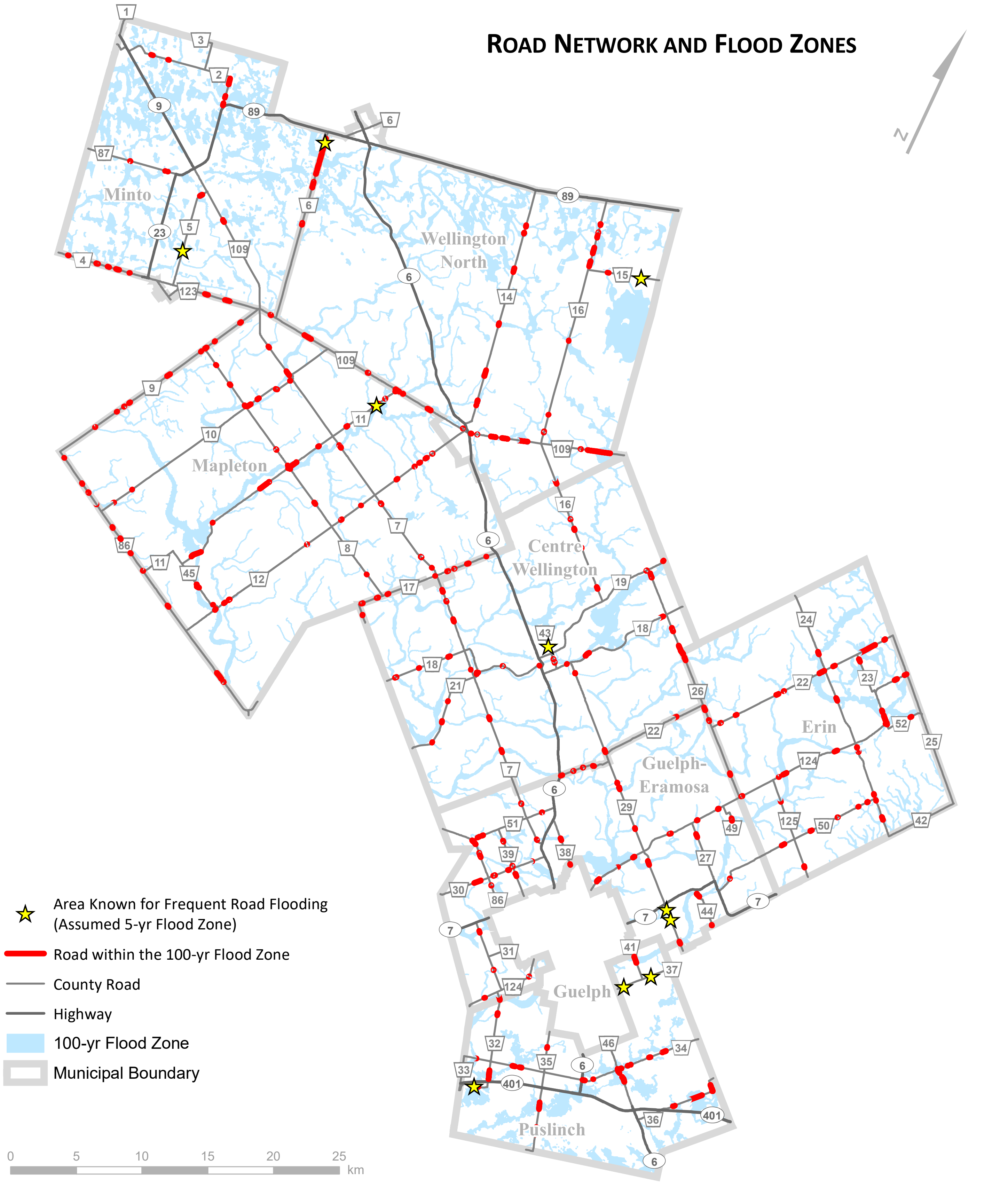
Fig. 5.6 Analysis showing the stormwater network percentage within the 100-yr flood zone, and the percentage outside of it.

FLOODPLAIN RISK ANALYSIS (CONT'D)

STORMWATER NETWORK AND FLOOD ZONES



FLOODPLAIN RISK ANALYSIS (CONT'D)



Replacement Value

The replacement cost of stormwater pipes is difficult to estimate, because it includes the excavation cost of the road base above the pipe, as well as factors such as the depth of the pipe, construction material, and diameter, among other factors. To develop a working model of the replacement cost of stormwater pipes, we combined two costs: the excavation cost, and the stormwater pipe cost.

The excavation cost was determined using the road replacement costs provided by consultants in 2018. This cost reflects the cost of excavating the road base above the stormwater pipe. The pipe cost was estimated at $500 per meter of pipe, based on an analysis of recent stormwater projects.

The cost of stormwater structures was estimated at $5,000 per structure. Table 5.5 provides a breakdown of all stormwater network unit and total replacement costs.

Asset	Unit Replacement Cost	Total Replacement Cost
Stormwater Pipes	Road excavation + $500 per meter of pipe	$133,761,893
Stormwater Structures	$5,000 per structure	$7,215,000

Table 5.5 Stormwater network total replacement costs by dollar/meter for pipes and per unit for structures, 2020.

Lifecycle Events

The pipes are used to the end of their useful life and then replaced, as regular replacement requires excavating. However, there are lifecycle events completed without excavation, such as the events outlined below.
All rehabilitation and lifecycle events are typically coordinated with pavement rehabilitation projects unless the defect is critical and/or threatens public safety.

Storm sewers and connecting structures undergo regular flushing to clear out debris. For example, catch basins are cleared out on an annual basis to remove leaves and other debris that gathers over time (Fig. 5.7). However, these are lifecycle events that do not extend the useful life of the assets. The cost of lifecycle events will be built into future versions of the AM plan.

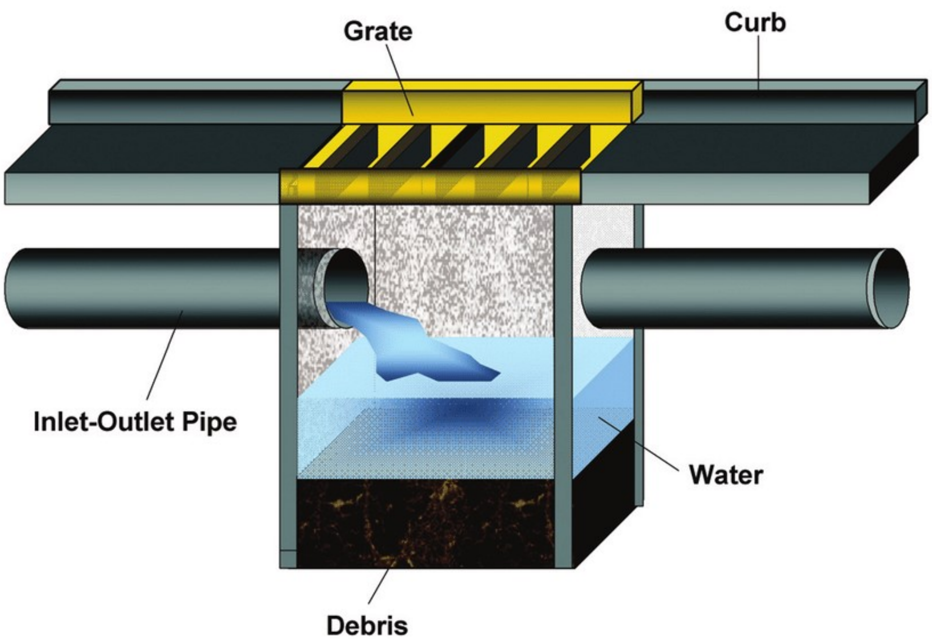


Fig. 5.7 Example of catch basin elements and debris collection.
Source: https://www.researchgate.net/figure/Illustration-of-a-storm-water-catch-basin-Storm-water-carrying-debris-and-organic_fig4_7781360

Annual Funding Requirement

The estimate for the annual funding requirement for the stormwater network is based on a number of critical assumptions:

- The age of the pipe can be inferred from the age of the road segment above the pipe, and the age of the pipe is reflective of its condition.
- The estimated useful lives, based on construction material, are accurate.
- The replacement values for pipes and structures are accurate.
- The excavation costs built into the model reflect those incurred by the County when undertaking stormwater infrastructure projects.

The Annual Funding Requirement for the Stormwater Network

$1,913,606

Should any of these assumptions be revised, the estimated cost of maintaining the stormwater network will change. Based on these assumptions, the annual requirement for stormwater pipes is $1,841,456. This value represents the funding that the County needs to set aside on an annual basis in order to be able to replace stormwater pipes on schedule. As there are no lifecycle events or treatments applied to stormwater pipes, this cost reflects solely the average replacement cost over the useful life of the asset. The annual requirement for stormwater structures is $72,150 and also only reflects the cost of replacement. The total stormwater network annual funding requirement, to ensure adequate funding for asset replacement, is therefore $1,913,606 (Table 5.6).

Annual Funding Requirement	Ten-Year Average Replacement Needs
$1,913,606	$366,964

Table 5.6 Annual requirement of the stormwater network, and the 10-yr average replacement needs.

CAPITAL NEEDS 2021-30

The County has a number of pipes that, according to their age, require replacement. These pipes are all clay or CSP pipes that have an estimated useful life of 40 years, and have been installed more than 40 years ago. These pipes make up the backlog of structures that are in need of replacement, totaling $2,449,205 .

The total ten-year replacement needs for the 2021-30 period is $3,669,640 which means that the backlog represents 67% of the ten-year replacement costs. Spreading that out over the ten-year period yields an average annual replacement needs of $366,964 (Table 5.6, Page 88).

This value is significantly lower than the annual requirement because most structures and pipes do not need to be replaced in the near future, according to their age. The estimated useful life of structures and concrete pipes is 100 years, which means that replacement of these structures will not need to be accounted for in the long-term financial plan.

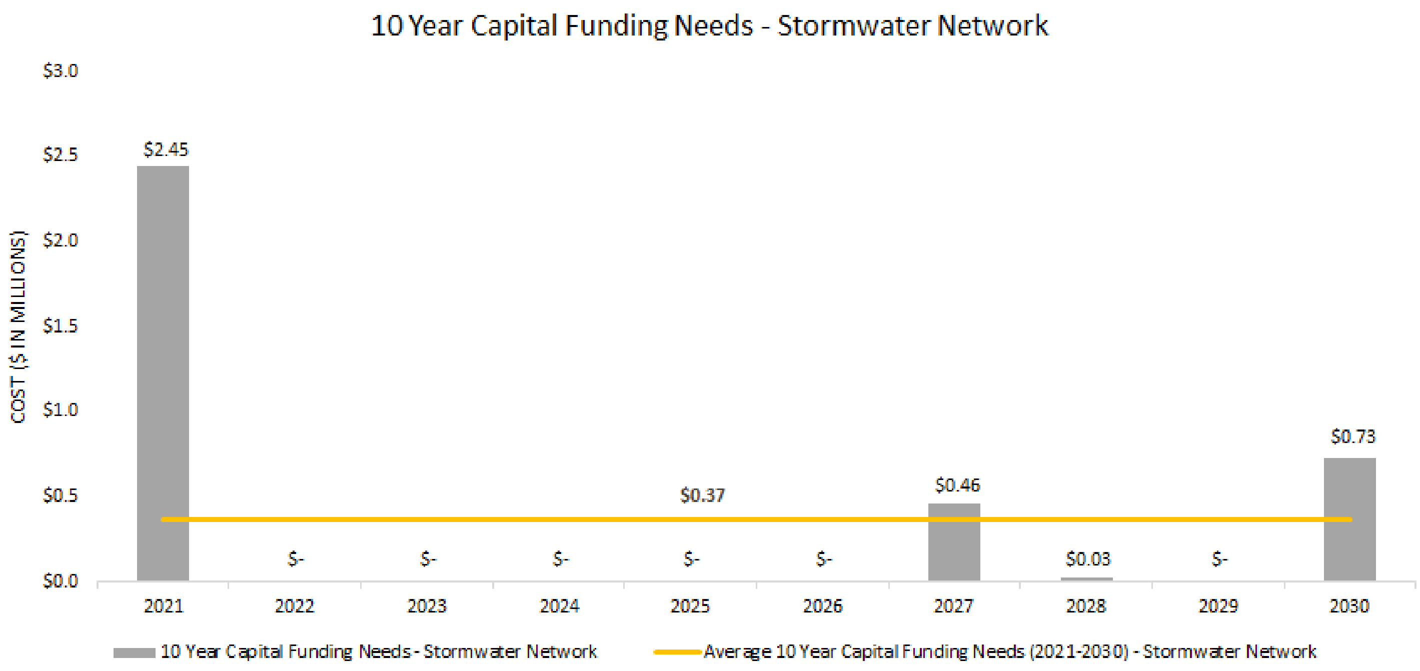


Fig. 5.8 Replacement needs for the stormwater network, 2021-2030.

However, once the condition assessment is completed for the stormwater network, the actual condition of these pipes may be better than their age suggests, which would reduce the backlog. Alternatively, some pipes that are meant to last much longer may be in very poor condition and in urgent need of replacement, which would increase the backlog.

Levels of Service

There are currently no legislative requirements for the inspection of storm sewer pipes. However, due to the criticality of these assets, the County has prioritized the condition assessments of our pipe network (Table 5.7), in order to better allocate funding toward ensuring that our underground infrastructure remains functional. Metrics without data (N/A) are included in the short-term data collection goals of the department, and will be included in future versions of the plan.

	2019	2020
Accessibility & Reliability		
# of Storm Sewer Blockage Removals per 100 km of Storm Sewer	N/A	N/A
% of catch basins cleaned annually	100%	100%
Average # of days to process surface flooding customer complaints	N/A	N/A
# of emergency and planned sewer repairs per 100 km of storm sewer length (piped network)	N/A	N/A
# of emergency and planned sewer repairs per 100 km of storm sewer length (culvert network)	N/A	N/A
# of emergency and planned ditch repairs per 100 km of ditch length (culvert network)	N/A	N/A
Safety		
% of roads in municipality resilient to a 100-year storm*	N/A	93.7%
% of the municipal stormwater management system resilient to a 5-year storm*	N/A	100%
# of surface flooding inquiries per 1,000 people (rural)	N/A	92.4%
Affordability		
Total Stormwater O&M Cost / km of Sewer, culverts, and Urban Ditches	N/A	N/A
Operating Costs for Urban Storm Water Management (collection, treatment, disposal) per kilometre of drainage system	N/A	N/A
Unit cost of catch basin cleaning ($/catch basin cleaned)	N/A	N/A
O&M Cost ('000) / km of sewer and urban ditches	N/A	N/A
Annual capital reinvestment rate	N/A	N/A
Sustainability		
% of the stormwater network that is in good or very good condition	94.68%	92.27%
Average annual reinvestment rate	N/A	N/A
Condition assessment cycle	4 years	4 years
% of the stormwater network that is in poor or very poor condition	1.74%	2.01%

Table 5.7 Performance metrics for the stormwater network. Metrics with an asterisk (*) are required to be reported by O.Reg. 588/17.

Strategy

Master Planning / Studies

Regular Condition Assessment Studies will be completed every 4 years.

Addressing the Backlog

- Less than 3% of the total storm network is estimated to be in poor to very poor condition.
- The first condition assessment is being conducted in 2021 and will more accurately inform the needs for the storm water network.

Renewal Projects

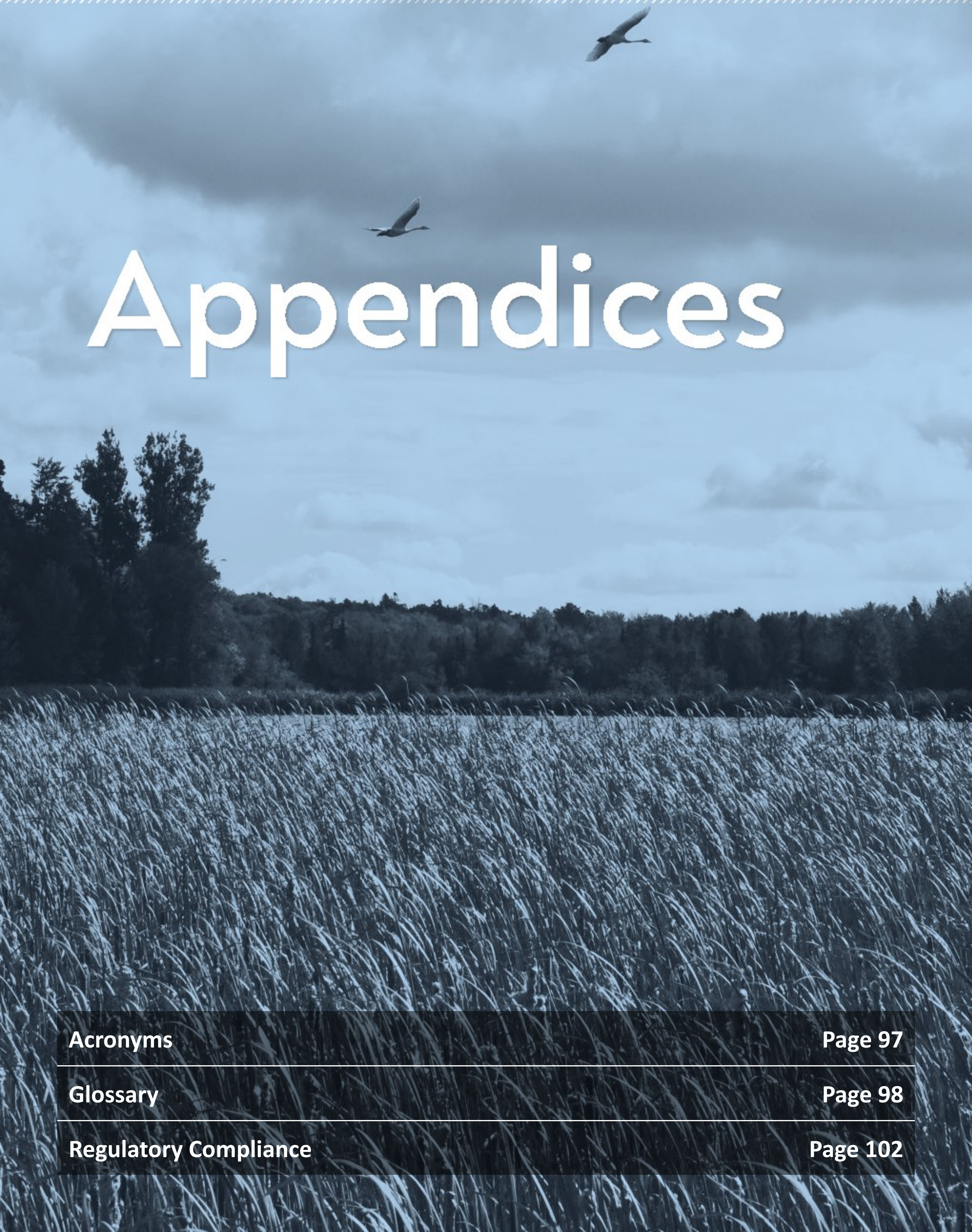
The primary consideration for replacement and rehabilitation are noted deficiencies and coordination with roads and bridge assets. Relining is considered for locations where the road base is still in good condition.

Data Quality

The County has committed to the following data quality initiatives:

- Import assessed condition data into the AM system
- Define and implement procedures to update replacement cost on an annual basis
- Collect required data for all Levels of Service Metrics and report annually
- Separate Storm costs from Road Base costs in order to better inform the budget and infrastructure Gap
- Further review and refine the draft risk model
- Identify and incorporate additional asset lifecycle events (including costs)

Appendices



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Acronyms

AADT	Average Annual Daily Traffic
AM	Asset Management
AMP	Asset Management Plan
BCI	Bridge Condition Index
CCTV	Closed Circuit Television
CIRC	Canadian Infrastructure Report Card
County, COW	County of Wellington
CSP	Galvanized Corrugated Steel Pipe
DC	Development Charges
FCI	Facility Condition Index
FCM	Federation of Canadian Municipalities
FIR	Financial Information Return
GHG	Greenhouse Gas
GIS	Geographic Information System
HDPE	High-density Polyethylene
IT	Information Technology
KPI	Key Performance Indicator
LEED	Leadership in Energy and Environmental Design
LOS	Level of Service
MTO	Ministry of Transportation, Ontario
OCIF	Ontario Community Infrastructure Fund
OSIM	Ontario Structure Inspection Manual
PACP	Pipeline Assessment and Certification Programme
PCI	Pavement Condition Index
PSAB	Public Sector Accounting Board
PVC	Polyvinyl Chloride
SOP	Standard Operating Procedure
TON	Time of Need

GLOSSARY

Annual Capital Reinvestment Rate – Annual Capital Expenditures/Total Replacement

Asset Management – Is an integrated set of processes and practices that minimize lifecycle costs of owning, operating, and maintaining assets, at an appropriate level of risk while continuously delivering established levels of service.

Asset Management Plan – A document that states how a group of assets is to be managed over a period of time. Asset Management Plans describe the condition, characteristics, and values of the assets; expected levels of service; action plans to ensure assets are providing the expected level of service; financial strategies to implement the action plans.

Asset Management Programme – The application of asset management strategies and best practices on a corporate level in order to ensure consistency across all departments and asset groups. The Corporate Asset Management Programme consists of the following:

- Strategic Plans and Documents
- Strategic Asset Management Policy
- Asset Management Framework
- Asset Management Governance
- Asset Management Plans
- Operational Strategies and Plans

Backlog – Backlog refers to lifecycle events that are necessary to prevent the deterioration of an asset or its function but which have not been carried out .

Components – Parts of an asset having independent physical or functional identity, and having specific attributes such as different life expectancy, maintenance regimes, risk, or criticality. Complex assets, such as buildings, are often broken down into components for asset management purposes, to reflect the differing needs of various components.

Condition – The physical state of the asset, which can be represented on a scale ranging from *Very Good* to *Very Poor*.

GLOSSARY (CONT'D)

Condition Assessment – The inspection, assessment, measurement, and interpretation of the resultant data, to indicate the condition of a specific asset or component, so as to determine the need for preventative or remedial action.

Critical Assets – Those assets that are likely to result in a more significant financial, environmental, and social impact should they fail. The maintenance of these assets is a priority.

Deterioration Curve – The rate at which an asset approaches the end of its useful life, represented by a curve. With no intervention (e.g. repair or rehabilitation), the rate of deterioration increases as assets near the end of their useful life. The deterioration curve differs for each asset class and can differ for assets within the same class, based on usage, construction materials, weather, etc.

Disposal – Tangible capital assets are considered disposed when they are sold, taken out of service, destroyed, damaged or replaced due to obsolescence, scrapping or dismantling.

Financial Sustainability – The ability to provide and maintain service and infrastructure levels without resorting to unplanned increases in rates or cuts to service. It is the ability to meet present needs without compromising the ability to meet future needs.

Geographic Information System (GIS) – A computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. It can show many different kinds of data on one map. This enables people to easily see, analyze, and understand patterns and relationships.

Historical Cost – A historical cost is a measure of value used in accounting in which the value of an asset on the balance sheet is recorded at its original cost when acquired by the company.

Infrastructure Gap – The cumulative shortfall of required asset renewal. This gap represents the cumulative deferred maintenance and investment needs for the County.

GLOSSARY (CONT'D)

Levels of Service – Describe the outputs or objectives that an organization or activity intends to deliver to customers. This includes commonly measured attributes or metrics such as quality, reliability, responsiveness, sustainability, timeliness, accessibility, and cost.

Lifecycle Cost – The total cost of all lifecycle events throughout an asset's useful life.

Lifecycle Events – Are all activities associated with asset ownership including initial purchase or procurement costs, operating costs, operating and capital maintenance costs, and disposal costs.

Maintenance (Operating) – Actions required to keep an asset as near to its original condition as possible in order to provide service over its useful life. Includes both corrective and preventative maintenance.

Maintenance (Capital) – Subsequent expenditures on tangible capital assets that fulfill one or more of the following requirements:

- Increase service potential (i.e.: capacity/output)
- Lower associated operating cost
- Extend the useful life of the asset
- Improve the quality of output of the asset
- Includes rehabilitation, renewal and replacement.

Performance Measure – A qualitative or quantitative measure used to measure actual performance against a standard or other target. Performance measures are used to indicate how the organization is doing in relation to delivering levels of service.

Pooled (Grouped) Assets – Assets that have a unit value below the capitalization threshold but have a material value as a group. Such assets shall be "pooled" as a single asset with one combined value. Although recorded in the financial systems as a single asset, each unit may be recorded in the asset subledger for monitoring and control of its use and maintenance. Examples include computers, furniture, and fixtures.

Remaining Useful Life – The time remaining until an asset ceases to provide the required service levels.

GLOSSARY (CONT'D)

Replacement Cost – The cost that would be incurred to replace the asset with a new modern equivalent asset (not a second hand one) with the same economic benefits (gross service potential).

Reserve – Accumulated net revenue set aside for a designated purpose. Funds held in a reserve can be utilized at the discretion of Council.

Reserve Fund – A reserve fund is established based on a statutory requirement or defined liability payable in the future and is usually prescriptive as to the basis for collection and use of monies in the fund.

Risk Management – The process of identifying and assessing risks, identifying and evaluating actions that can be taken to reduce risk, and implementing the appropriate actions to mitigate risk.

Strategic Action Plan – The Wellington County Strategic Action Plan identifies key challenges and opportunities for the County, and sets the strategic direction for County programmes and investments.

Strategic Asset Management Policy – A policy developed and approved at the County of Wellington which outlines the objectives of Asset Management and the processes and procedures that enable the realization of those objectives.

Tangible Capital Asset – Non-financial assets having physical substance that are held for use in the production or supply of goods and services, for rental to others, for administrative purposes, or for the development, construction, maintenance, or repair of other tangible capital assets; have useful economic lives extending beyond one year; are to be used on a continual basis; are not for sale in the ordinary course of operations.

Useful Life (Estimated) – The period over which a tangible capital asset is expected to be used, or the number of production or similar units that can be obtained from the tangible capital asset. The life of a tangible capital asset may extend beyond the useful life of a tangible capital asset. The life of a tangible capital asset, other than land, is finite, and is normally recorded as the shortest of the physical, technological, commercial or legal life.

User Fee – Fee or charge to individuals or groups and/or businesses for the provision of a service, activity or product, or for conferring certain rights and privileges, which grant authorization or special permission to a person, or group of persons to access County-owned resources (including property) or areas of activity.

Regulatory Compliance

	Phase 1 (Current Levels of Service) July 1, 2022			Phase 2 (Proposed Levels of Service) July 1, 2025			
	State of Assets	Current Levels of Service	Asset Mgmt. Strategy	State of Assets	Proposed Levels of Service	Asset Mgmt. Strategy	Funding Strategy
Core Assets							
Roads	Compliant Page 43-45	Compliant Page 53	Compliant Page 54	In Progress	In Progress	In Progress	In Progress
Bridges & Culverts	Compliant Page 63-65	Compliant Page 73-74	Compliant Page 75	In Progress	In Progress	In Progress	In Progress
Stormwater	Compliant Page 83-85	Compliant Page 94	Compliant Page 95	In Progress	In Progress	In Progress	In Progress
Other Assets							
Fleet	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress
Equipment	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress
Pooled Assets	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress
Buildings	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress	In Progress