Township of South Stormont 2021 Asset Management Plan (core assets)

Executive Summary

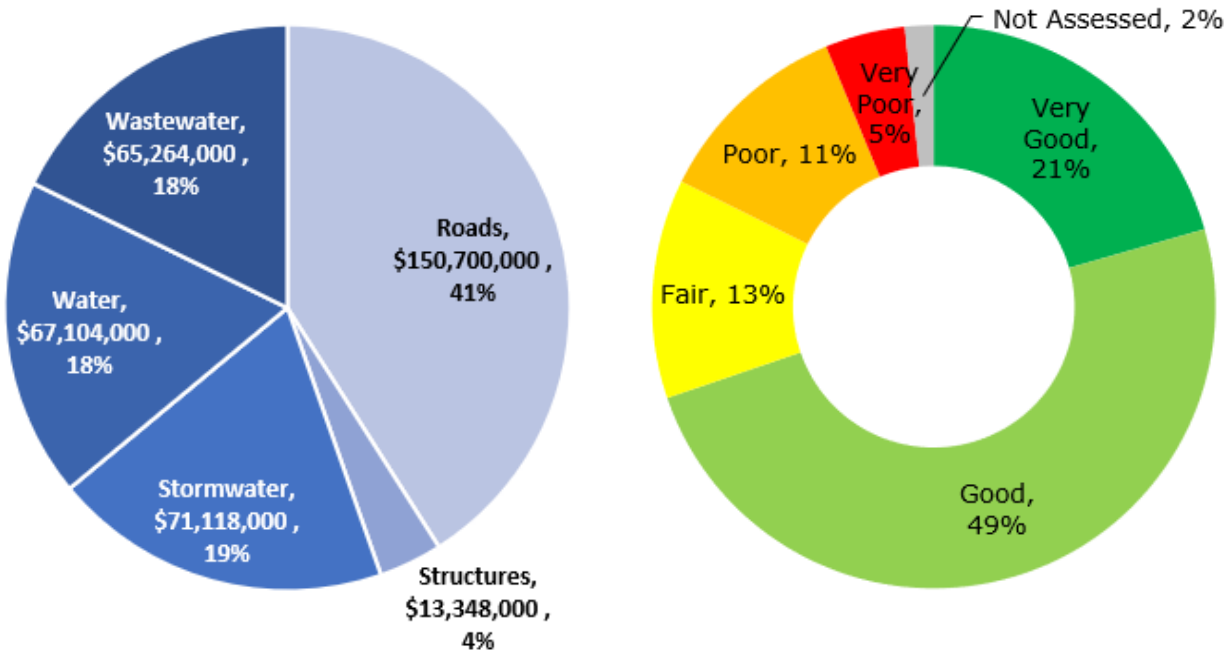
The Purpose of the Plan

This Asset Management Plan (AMP) details information about infrastructure assets with actions required to provide an agreed level of service in the most cost-effective manner while outlining associated risks. The plan defines the services to be provided, how the services are provided and what funds are required to be provided over the 10 year planning period. The AMP will link to a Long-Term Financial Plan which typically considers a 10 year financial and work project planning period.

State of the Infrastructure

The 2021 Core Asset Management Plan include Township-owned roads, structures (bridges and major culverts), stormwater, water (distribution and treatment), and wastewater (collection and treatment) assets.

These infrastructure assets in scope of this plan have total replacement value estimated at $367.5 million, and 69.7% of all assets are in Good or better condition. Good condition indicates that the infrastructure is adequate for now with some elements showing general signs of deterioration that require attention. The assets that are of concern to the Township are the assets listed in Poor or Very Poor condition. They may still be functioning but are at a questionable level of service and the Township needs to be prepared to respond to failures or proactively address them before they fail. The Poor and Very Poor assets are an area in need of investment.



Summary of Asset Value and Condition for Core Assets

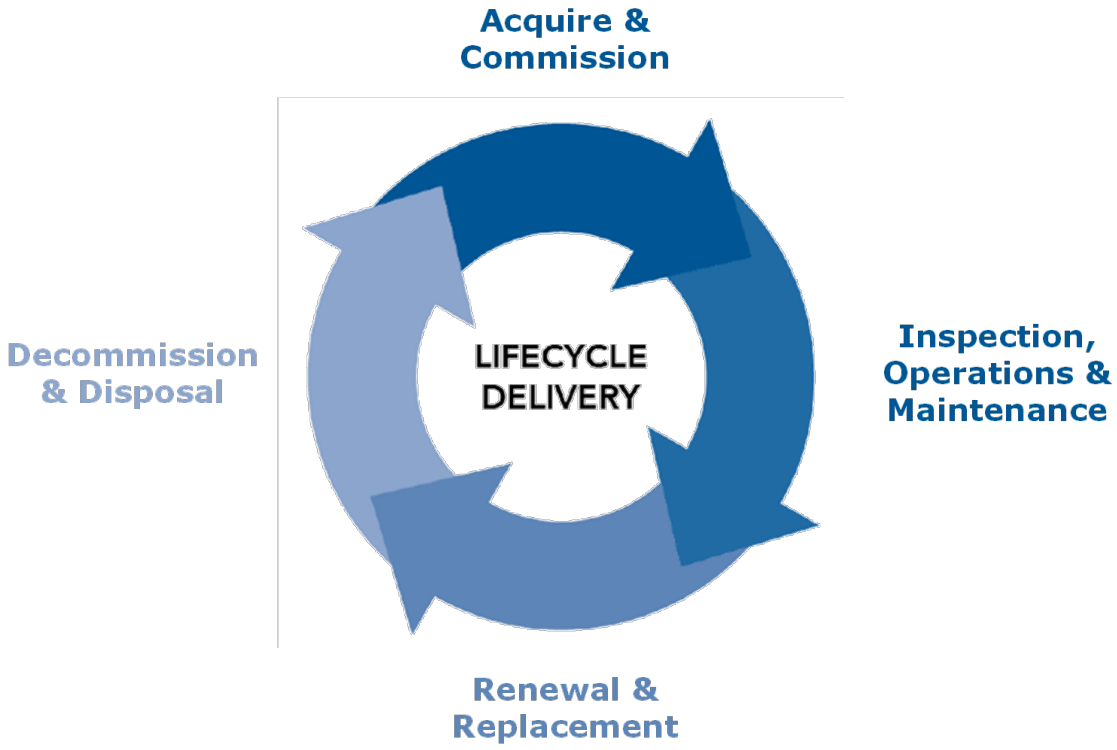
Levels of Service

For the 2021 Core Asset Management Plan, the Township has started by reporting on the O. Reg. 588/17 requirements and select additional measures that will allow the Township to begin measuring performance and making decisions. For directly owned Township infrastructure assets, this AMP is compliant with the July 1, 2022 Regulation requirements. Furthermore, it also includes some components of the July 1, 2025 requirements.

The AMP quantifies the levels of service (LOS) provided by infrastructure systems through a series of performance metrics for each service area. LOS tables for each service division are developed and maintained through discussions with staff in all service areas that support the provision of the respective services. The structure of all the LOS tables is the same for each service division. Major components of the tables are: identifying customer values, corporate/customer focused performance measures, and technical focused performance measures. The LOS measures are established through discussions with staff and also include mandatory metrics that are prescribed by O. Reg. 588/17. Technical performance measures include both the current performance, as well as a proposed future recommended performance that are appropriate and financially sustainable for the Township.

Asset Management Strategy

Asset management strategy is a set of planned actions that will enable the assets to provide the desired levels of service in a sustainable way, while managing risk, at the lowest life cycle cost. A simplified Township asset life cycle management strategies constitutes the following steps:



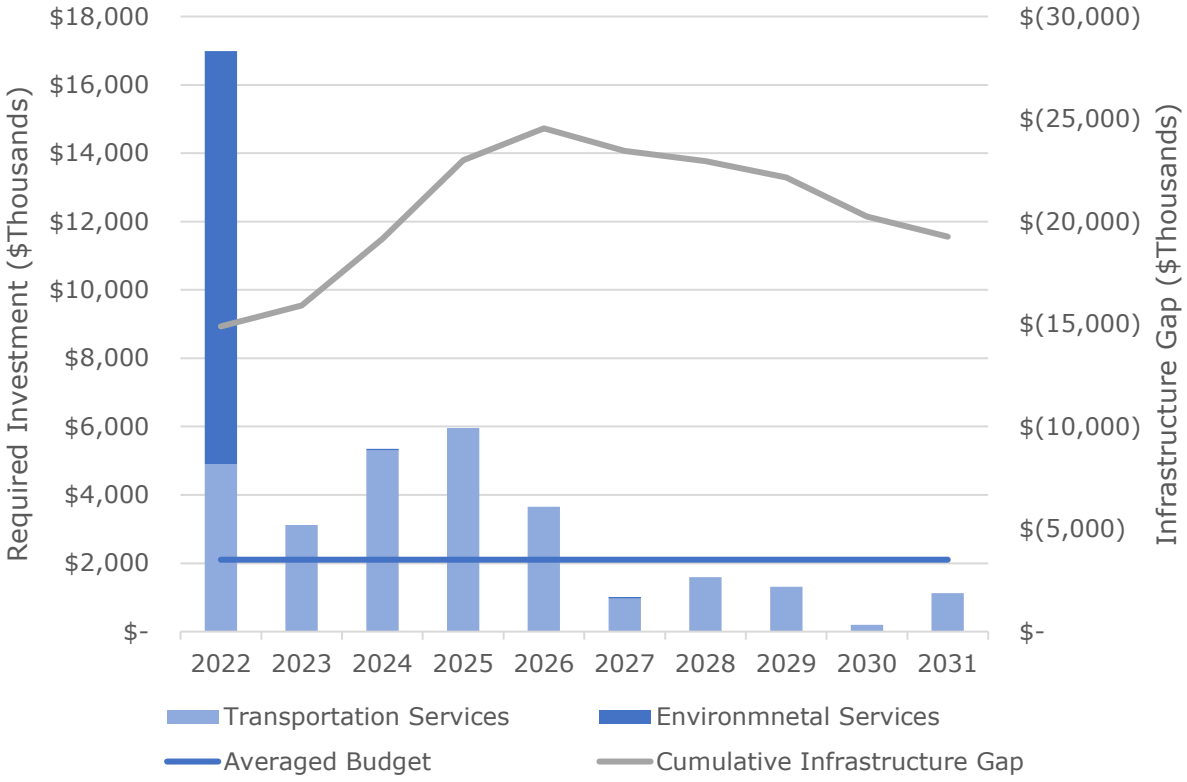
Understanding the overall risk exposure of an asset is critical for decision-making. Under a constrained budget scenario, decision-making is largely based on potential risks. As part of the Township's risk management strategy, a risk assessment framework is developed for quantifying the criticality and risk exposure of the Township's assets and enables the prioritization of projects across asset classes.

Financial Summary

A summary output from the AMP is the forecast of 10-year total outlays, which is estimated as $40.3 million or $4 million on average per year. Estimated available funding for the 10-year period is $21 million or $2.1 million on average per year as per the planned budget. This is 52.2% of the cost to sustain the current level of service at the lowest lifecycle cost.

The Township does not have sufficient funding to meet the unconstrained scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS.

The Township will manage the 'gap' by developing this AMP to provide guidance on future service levels and financial resources required to provide these services in consultation with the Council.



Required Investment under the Unconstrained Budget Scenario

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List of Acronyms

AC Asbestos Cement
AMP Asset Management Plan
BCI Bridge Condition Index
CCTV Closed-Circuit Television
CIPP Cured-in-Place Pipe
COF Consequence of Failure
CSP Corrugated Steel Pipe
DC Development Charge
DI Ductile Iron
ESL Estimated Service Life
HCB High Class Bituminous
ISO International Organization for Standardization
LCB Low Class Bituminous
LOS Level of Service
MTO Ministry of Transportation of Ontario
O&M Operation and Maintenance
OSIM Ontario Structure Inspection Manual
PCI Pavement Condition Index
PE Polyethylene
POF Probability of Failure
PVC Polyvinyl Chloride
SDG Stormont, Dundas and Glengarry
VC Vitrified Clay

1. Introduction

1.1. The Township of South Stormont and Growth at a Glance

South Stormont, a lower-tier municipality in the United Counties of Stormont, Dundas and Glengarry (SDG), is located in Eastern Ontario along the St. Lawrence River. It is conveniently located about 1 hour southeast of Ottawa and 1.5 hours west of Montreal. Two of the main shipping and transportation routes in Ontario pass through the Township; Highway 401 running east-west including 3 exits and the CN Railway running parallel to it.

The Township was originally divided into two smaller Townships prior to amalgamation in 1998; the Township of Osnabruck and the Township of Cornwall. The current-day Township is neighboured by South Dundas to the west, North Stormont to the north, South Glengarry to the east, and the City of Cornwall to the south. It is approximately 475 square kilometers, contains over 14,000 residents and is composed of several villages and hamlets. Two of the larger villages, Ingleside and Long Sault, were carefully planned and built to accommodate the relocation of residents during the time of the St. Lawrence Seaway Project in 1958. They were planned from inception, making them a rarity in Ontario. Many families were relocated from their now-flooded communities into the two new communities. This history has residents feeling a deep sense of belonging to not only the towns and villages, but also the Township's rural and agricultural areas as well. This has created prideful, tight-knit communities.

Future versions of the Township's asset management plan must include assumptions regarding projected changes in population and economic activity informing the preparation of life cycle management and financial strategies. Historical growth data is useful in helping predict these changes as a future Township growth model is estimated in Figure 1.

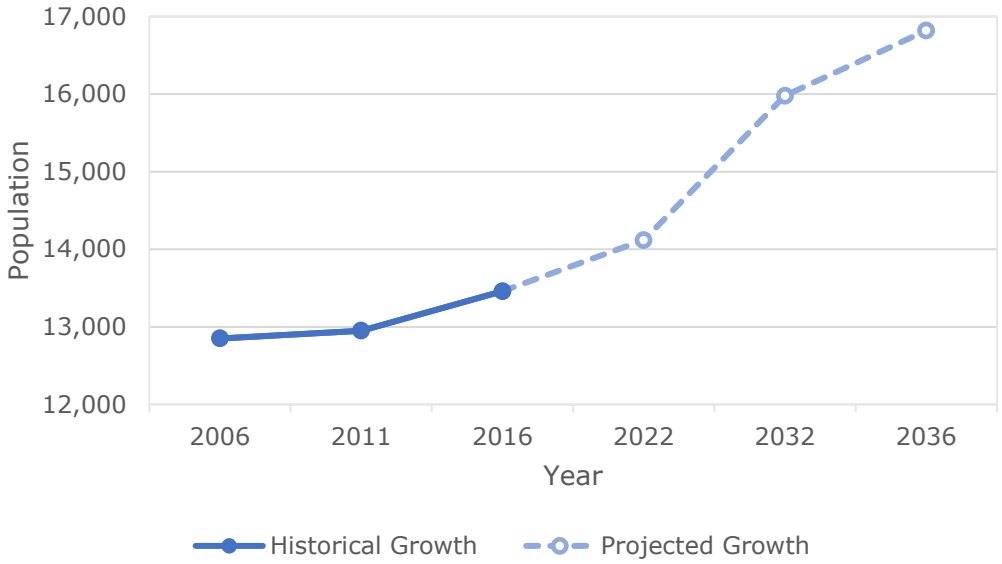


Figure 1: Township of South Stormont Population Growth

Planning for forecasted population growth may require the expansion of existing infrastructure and services. As growth-related assets are constructed or acquired, they should be integrated into the Township's Asset Management Plan (AMP). While the addition of residential units will add to the existing assessment base and offset some of the costs associated with growth, the Township will need to review the life cycle costs of growth-related infrastructure. These costs should be considered in long-term funding strategies that are designed to, at a minimum, maintain the current level of service.

The Township has developed and adopted numerous documents to guide strategic planning and promote growth. Such documents include the Uncommitted Reserve Capacity Study, Strategic Master Servicing Study, and Water and Wastewater Rate Study.

In addition to these documents, the Township invested in a comprehensive development charge (DC) background study for the following services: water, wastewater, stormwater, services related to a highway, fire protection, parks and recreation, and administrative services. The Township is currently finalizing the study briefed above, which will inform the expected impact of growth on Township life cycle activities.

1.2. Goals and Objectives of Asset Ownership

Our goal for managing infrastructure assets is to meet the defined level of service (as amended from time to time) in the most cost-effective manner for present and future consumers. The key elements of infrastructure asset management are:

- Managing the impact of growth through demand management and infrastructure investment,
- Providing a defined level of service and monitoring performance,
- Taking a life cycle approach to developing cost-effective management strategies for the long-term that meet the defined level of service,
- Identifying, assessing, and appropriately controlling risks, and
- Linking to a Long-Term Financial Plan which identifies required, affordable forecast costs and how they will be allocated.

Key elements of the planning framework are:

- Levels of service – specifies the services and levels of service to be provided,
- Asset management practices – how we manage provision of the services,
- Life cycle management – how to manage its existing and future assets to provide defined levels of service,
- Risk Management – managing and limiting risks based on prescribed budgets,
- Financial summary – what funds are required to provide the defined services,
- Monitoring – how the plan will be monitored to ensure objectives are met, and

- Asset management improvement plan – how we increase asset management maturity.

1.3. Asset Management Plan Scope and Methodology

This AMP communicates the requirements for the sustainable delivery of services through management of assets, compliance with regulatory requirements, and required funding to provide the appropriate levels of service over the planning period.

The AMP is to be read alongside the Township planning documents. This should include the Strategic Asset Management Policy, along with other key planning documents:

- 2021 Community Strategic Plan
- 2021 Roads Needs Study
- 2022 Development Charges Background Study

The infrastructure assets covered by this AMP include roads, structures (bridges and major culverts), stormwater, water, and wastewater assets. For a detailed summary of the assets covered in this AMP refer to Table 1 in Section 2. These assets are used to provide services relating to mobility and connectivity, storm drainage, safe and high-quality drinking water, and wastewater collection.

The Township's organizational structure for service delivery from infrastructure assets is detailed in Figure 2.

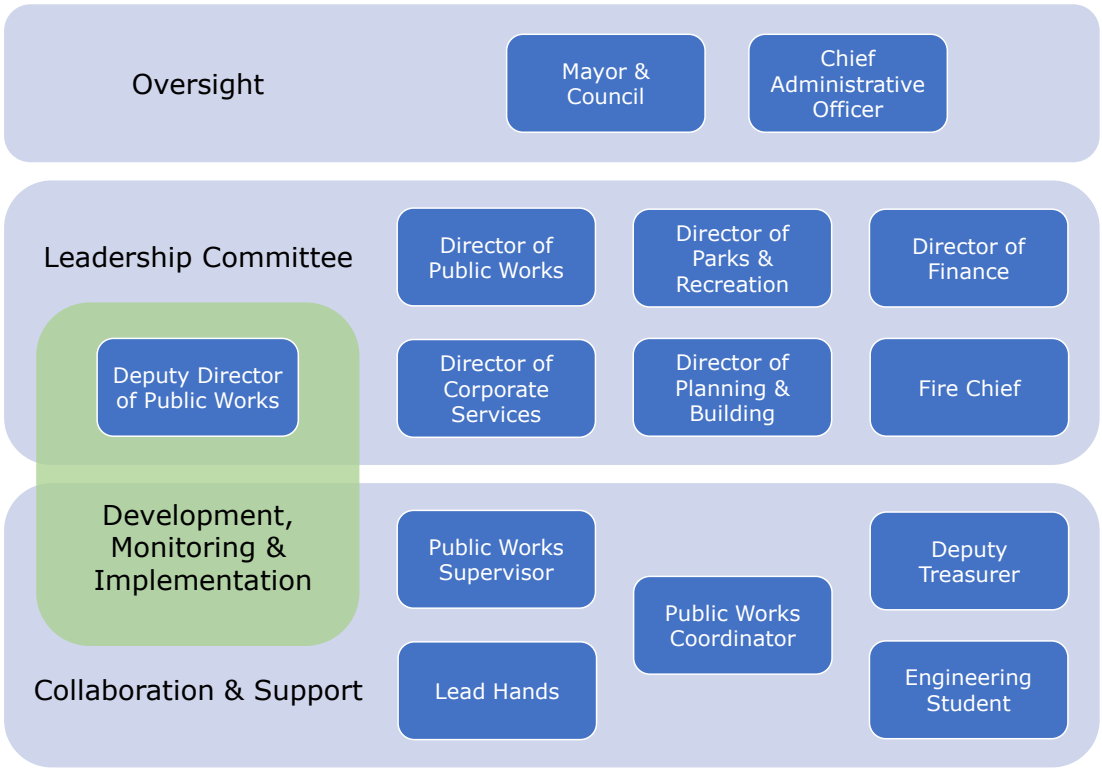


Figure 2: Township's Asset Management Governance Structure

1.4. Achievement of Provincial Asset Management Regulatory Requirements

The Infrastructure for Jobs and Prosperity Act, enacted in 2015, was established to encourage evidence-based and strategic long-term infrastructure planning in Ontario. It promoted not only job creation and training opportunities, but economic growth, environmental consideration and protection, and design excellence into infrastructure planning. In 2018, O. Reg. 588/17 came into effect mandating all Ontario municipalities to develop their asset management practices through a phased approach. This regulation was then amended by the Ontario Government on March 15, 2021, by extending deadlines by one year. This timeline includes the development of a Strategic Asset Management Policy as well as successional AMPs.

The extended deadline in respect to the submission of an AMP for all municipally owned core assets has been extremely beneficial for the Township. It has allowed for additional training sessions, the expansion of the municipal asset management team, a more extensive review of the inventory, a deeper look into levels of service, and additional time that allowed for the development of a thorough, practical, and useful plan that can be referred to for years to come. In this AMP, the following deliverables were achieved:

1. Current levels of service
2. Proposed levels of service
3. Population growth forecasts
4. Inventory analysis
5. Life cycle activities to sustain LOS
6. Cost of life cycle activities
7. Risk assessment framework
8. Climate change consideration

The Township is currently working towards gathering more accurate data to support requirements for the next AMP including non-core assets by July 1, 2024 and a more in-depth overview of population and economic growth impacts on the Township's life cycle management strategies as well as developing a financial strategy for the AMP by July 1, 2025.

The complete timeline for compliance with O. Reg. 588/17 including key Township milestones and important dates is illustrated in Figure 3.

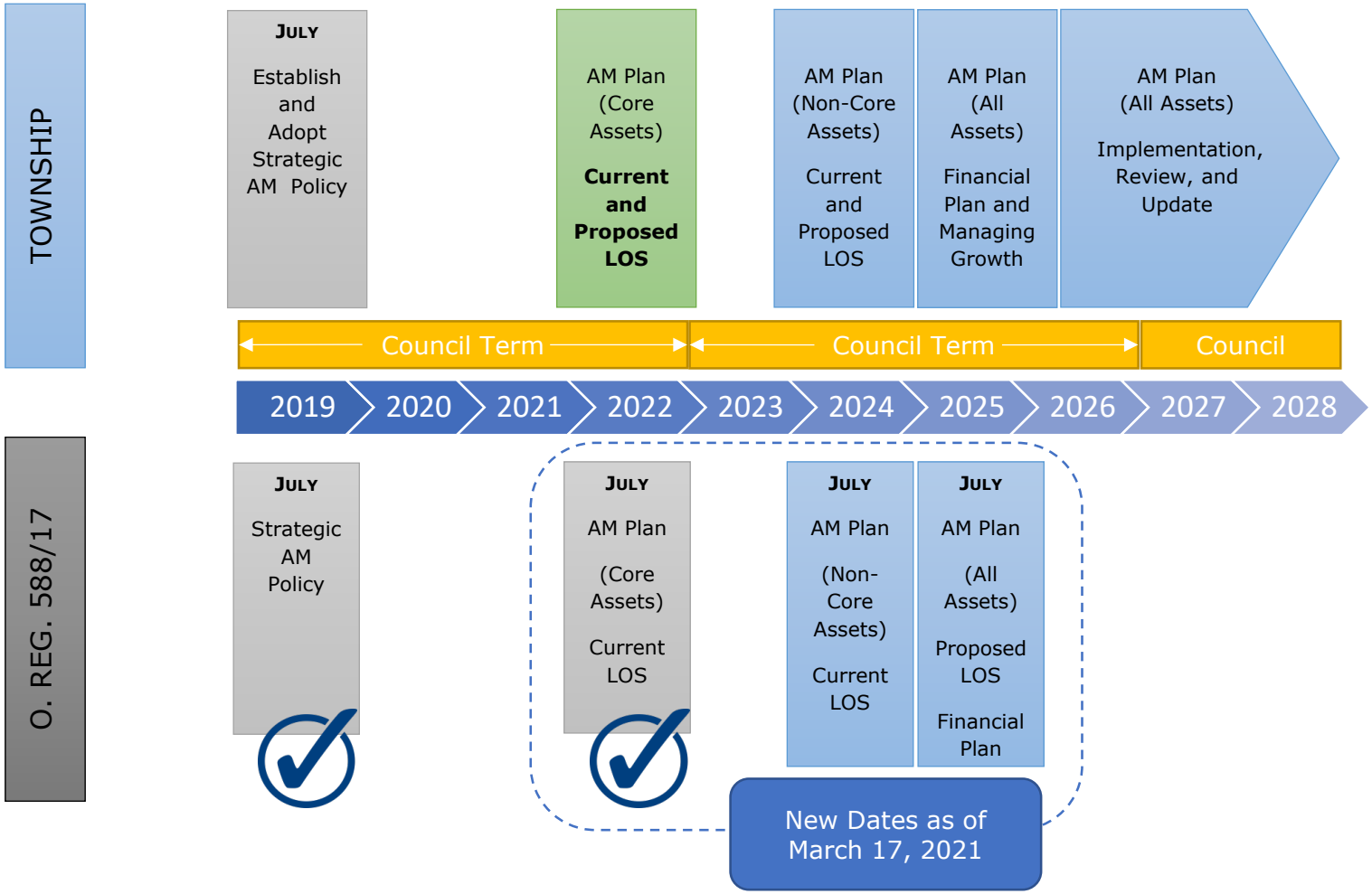


Figure 3: Overview of O. Reg. 588/17 Timeline

2. State of the Infrastructure

2.1. Inventory Overview

The Township's core asset inventory consists of infrastructure that is divided into the following 5 categories: roads, structures (bridges and major culverts), stormwater, water, and wastewater. All these categories contribute significantly to the health, safety, and overall quality of life in the community at large. The Township has identified core asset service areas and service divisions as presented in the hierarchy presented in Table 1.

Table 1: Core Asset Inventory Hierarchy

Service Area	Service Division
Roads and Transportation	Roads
	Structures
	Stormwater
Water	Distribution
	Treatment
Wastewater	Collection
	Treatment

2.2. Asset Valuation

The total value of all the Township's core assets on a full-replacement basis in 2021 dollars is approximately $367,534,000. Values were obtained by conducting internal research as well as with assistance from external consultants. Table 2 and Figure 4 provide summaries of replacement cost values by asset type.

Table 2: Summary of Replacement Cost Values

Service Division	Replacement Value ($)	% of Total
Roads	150,700,000	41.0
Structures	13,348,000	3.6
Stormwater	71,118,000	19.4
Water	67,104,000	18.3
Wastewater	65,264,000	17.8
Total	**367,534,000**	**100**

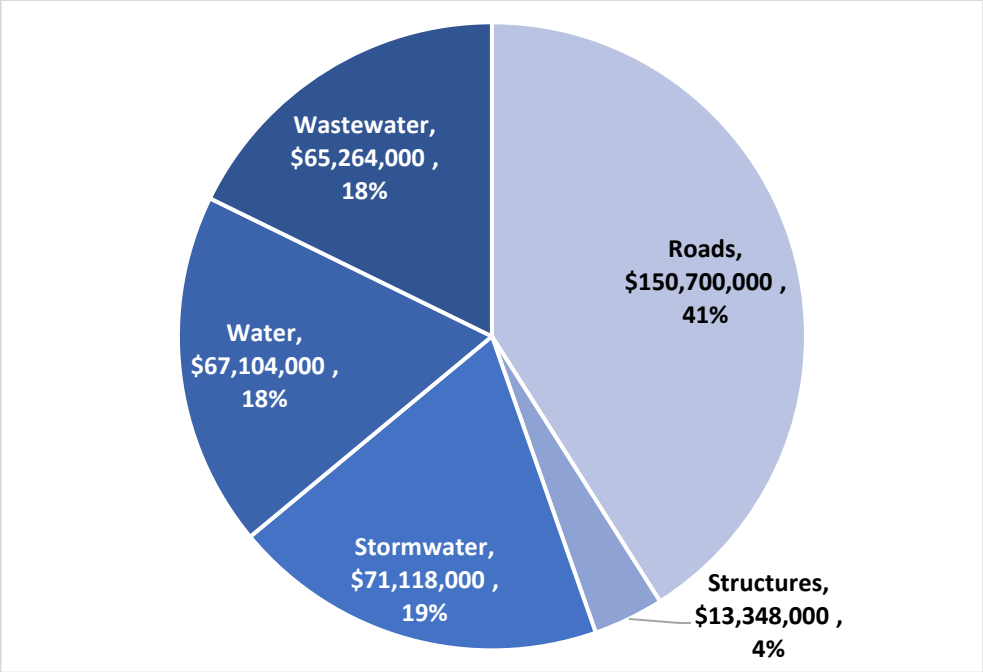


Figure 4: Summary of Replacement Cost Values

2.3. Asset Age

Recognizing the age of Township assets is important because it is generally inversely proportional to asset condition. The older the asset, the lower its expected condition will be. The average age of assets can be projected over their entire estimated useful lives to provide a quick glance at this relationship. Weighted averages for each core asset class were determined and are presented in Figure 5.

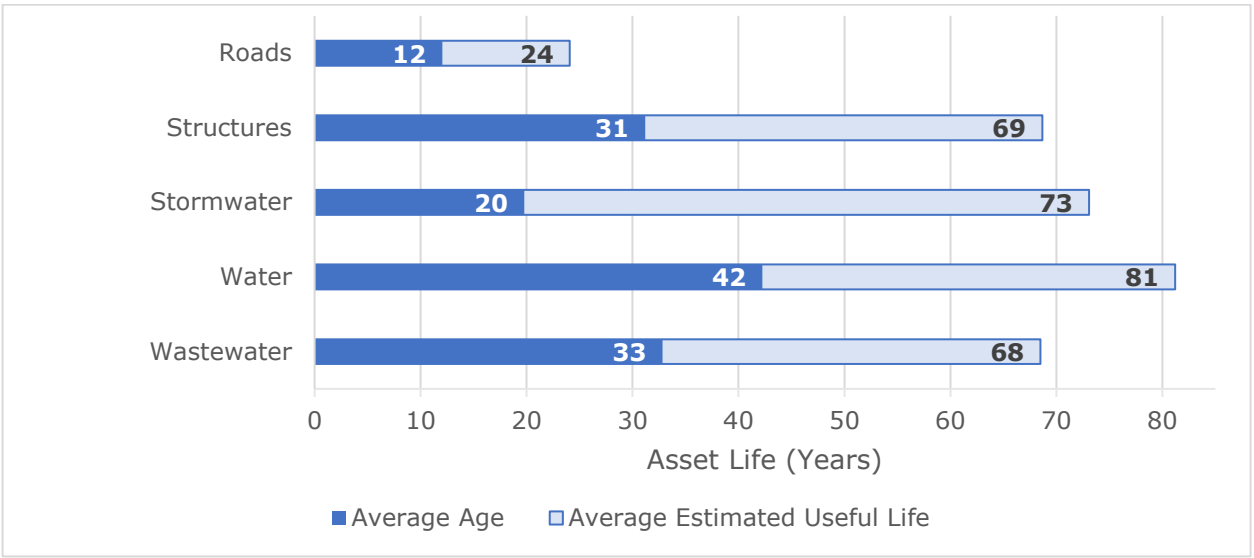


Figure 5: Average Asset Age as a Proportion of Average Useful Life (Core Assets)

2.4. Asset Condition

Asset condition is defined as a measure of the physical state of an asset. An incomplete or limited understanding of asset condition can mislead long-term planning and decision-making. The condition of assets generally indicates their level of capital needs and maintenance requirements.

A condition assessment rating system provides a standardized descriptive framework that allows comparative benchmarking across the municipality's asset portfolio. A general condition rating system that poses as an umbrella over all Township assets is presented in Table 3.

Table 3: General Condition Rating Scale

Descriptive Ratings	Condition Score (minimum)	Condition Score (maximum)	Description of Condition*
Very Good	81	100	Very Good Condition – Only normal maintenance required
Good	61	80	Minor Defects Only – Minor maintenance required (5%)
Fair	41	60	Requires Maintenance – Significant maintenance required (10-20%)
Poor	21	40	Requires Renewal – Significant renewal/upgrade required (20-40%)
Very Poor	0	20	Asset Unserviceable – Over 50% of asset requires replacement

*General Condition Grading System (Source: IIMM, 2011)

The Township employs a combination of both formal and informal condition assessment programs for municipal assets. The road network was assessed by an external consultant in 2021 as part of a Road Needs Study, and all bridges & structural culverts are assessed every two years as per provincial regulations. Accordingly, condition ratings were assigned to assets using either field assessments or by using deterioration formulae to calculate theoretical values.

This AMP relies on assessed condition data for 44.6% of assets (replacement cost weighted); for the remaining portfolio, age is used as an approximation of condition. Table 4 outlines how condition ratings were assigned to assets.

Table 4: Sources of Condition Data

Service Division	Type of Condition Data	Source of Condition Data
Roads	Assessed	2021 Road Needs Study
Structures	Assessed	2021 OSIM Inspection Report
Stormwater	Age-based	In-Service Date and EUL
Water	Age-based	In-Service Date and EUL
Wastewater	Age-based	In-Service Date and EUL

The overall average core asset condition ratings are presented in Figure 6. Core asset condition details, broken down by category, are presented in Figure 7. Both figures are replacement cost weighted.

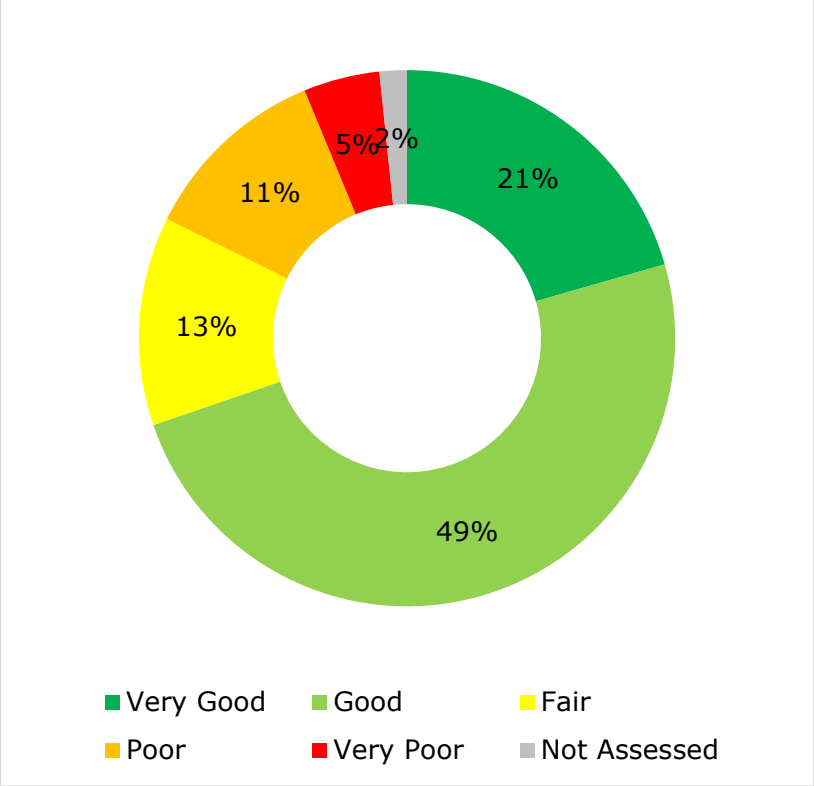


Figure 6: Asset Condition Summary (Core Assets)

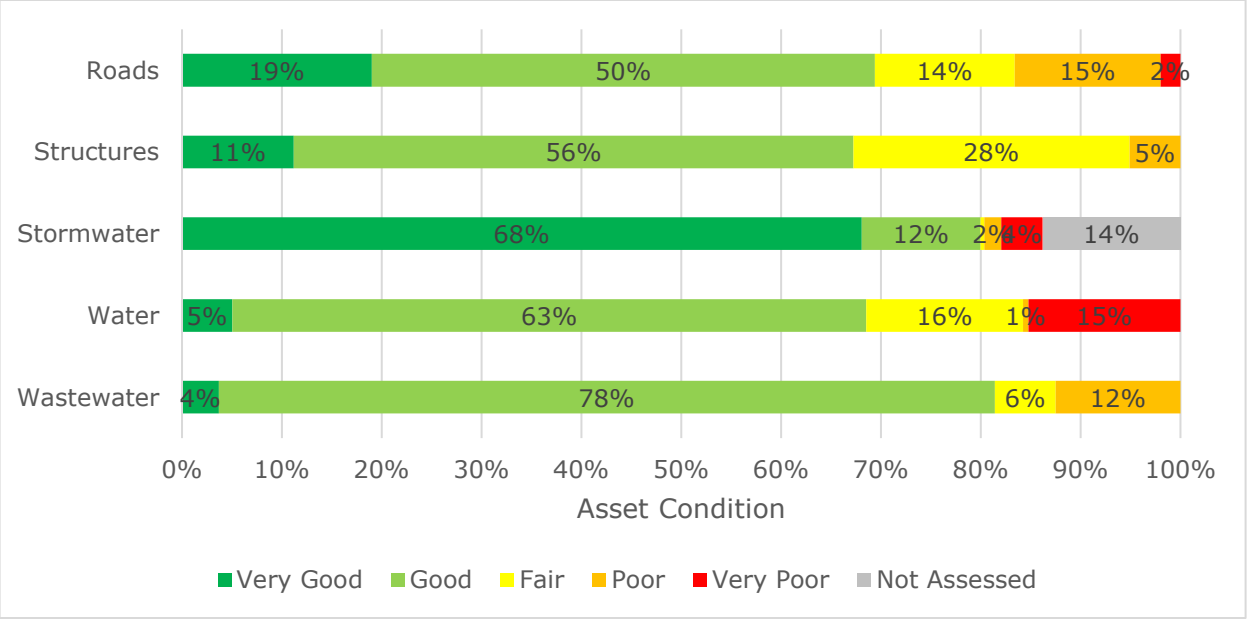


Figure 7: Asset Condition Detail (Core Assets)

3. Levels of Service

3.1. Overview

This AMP is prepared to facilitate consultation prior to adoption of levels of service (LOS) by Council. Future revisions of the AMP will incorporate customer consultation on service levels and costs of providing the service. This will assist Council and stakeholders in matching the level of service required, service risks and consequences with the customer's ability and willingness to pay for the service.

In this section, defined LOS and associated performance metrics are documented for each service area. Major components of the LOS tables are: identifying customer values, corporate LOS objectives, customer focused performance measures, and technical focused performance measures. The LOS measures include mandatory metrics that are prescribed by O. Reg. 588/17.

The Township aspires to advance our approach to LOS by moving beyond the regulation to develop measures that assess the extent to which we are meeting the needs and expectations of our communities. A leading practice LOS framework has been designed to align higher-level corporate objectives of the Township's Strategic Plan with measures that reflect the general public's understanding of the services provided by the Township's infrastructure systems (the Customer LOS) and the technical details and performance measures of managing that infrastructure (the Technical LOS). This framework has been developed based on ISO55000: Line of Sight. The LOS Hierarchy features the following:

- Strategic and Corporate Goals
- Customer Values
- Corporate / Customer Focused LOS
- Technical Focused LOS

The customer and technical LOS measures include the current performance. Customer LOS measures incorporate expected trend based on planned budget. This enables us to complete trending over time to understand how changing our life cycle management strategy or expenditure levels impacts our LOS metrics. Technical LOS measures contain a recommended future performance target. It should be noted that by July 1, 2025 our AMP will be required to identify targets for each LOS metric that we have identified in our LOS tables.

3.2. Strategic and Corporate Goals

This AMP is prepared under the direction of the Township's mission, vision, goals and objectives, as illustrated in Figure 8.

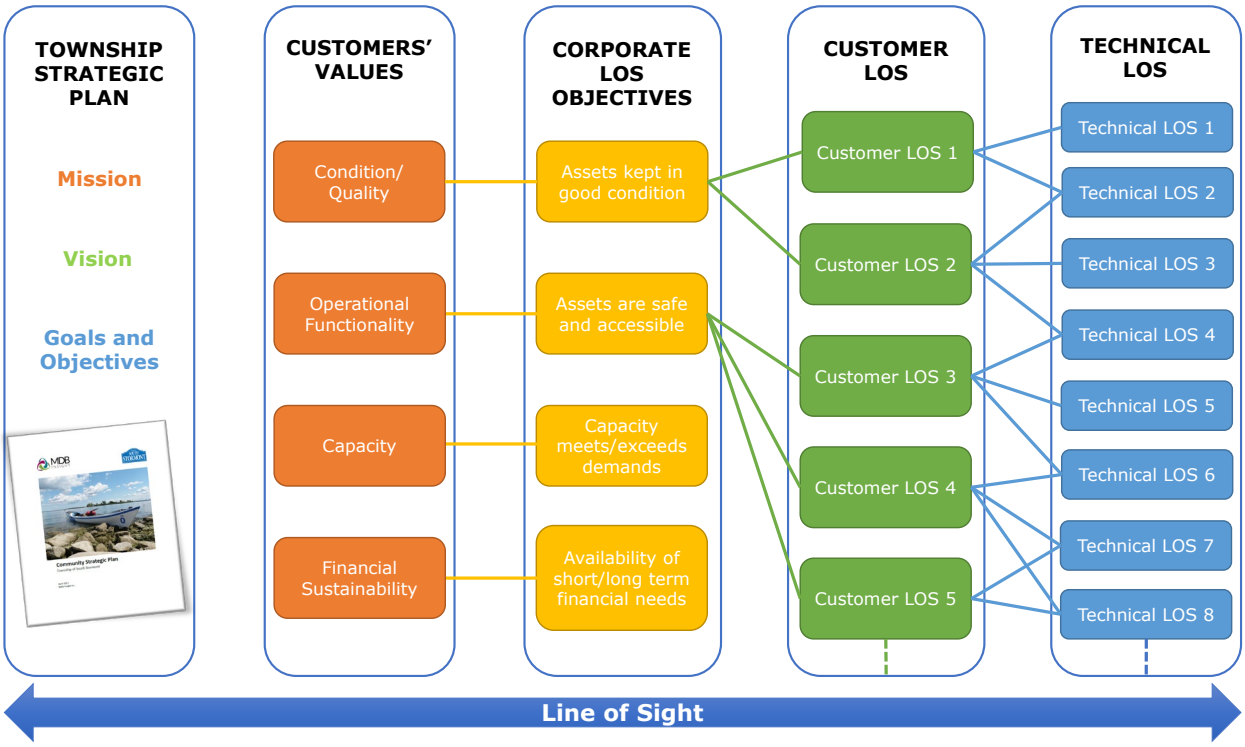


Figure 8: Level of Service Hierarchy

Our mission is:

Through dedicated leadership and strong infrastructure, the Township of South Stormont delivers sustainable, quality services to its residents and businesses while ensuring a vibrant and healthy community for future generations.

Our vision is:

South Stormont is a progressive, family-friendly community, welcoming all to celebrate its natural beauty and exceptional quality of life.

Strategic goals have been set by the Township. The relevant goals and objectives and how these are addressed in this AMP are summarized in Table 5.

Table 5: Goals and how these are addressed in this Plan

Goal	Objective	How Goal and Objectives are addressed in the AM Plan
Sustainable Infrastructure	Servicing Capacity	Secure utilities to service the needs of residential, commercial, and industrial customers, with consideration to sustainability.

3.3. Customer Values

Service levels are defined in three ways, customer values, corporate/customer LOS and technical LOS.

Customer Value is a phrase that describes attributes of the service being provided (e.g., quality, functionality, etc.). These descriptions cover all aspects of the service and be easy for the customer/public to understand and recognize. Customer Values indicate:

- what aspects of the service is important to the customer,
- whether they see value in what is currently provided, and
- the likely trend over time based on the current budget provision.

Table 6 indicates the Township's Customer Values, their current performance, and their expected trend based on the current proposed budget.

Table 6: Customer Values

Customer Values	Current Performance	Expected Trend Based on Planned Budget
Condition/Quality	**B+**	↘
Operational Functionality	**B+**	→
Capacity	**A**	↗
Financial Sustainability	**D+**	→

By capturing what customers understand and expect of a given service, the Township will be better positioned to determine a clear set of actions to attain or maintain a given level of service. As such, linking asset specific measures to the customer perspective measures will help support decision making.

3.4. Corporate/Customer Focused Levels of Service

These LOS define how a service is perceived by the user, with non-technical measures for service goals.

- Corporate LOS objectives describe the outputs of the Customer Value. There may be one or multiple LOS statements written for each Customer Value. The output clearly states customer standards and is measurable.
- Customer LOS are quantifiable metrics expressed in non-technical terms that describe the general public's understanding of services being provided by infrastructure systems. Customer performance measures are typically related

to the service that is provided by the overall system supporting the service delivery, rather than the specific assets.

The focus is on measuring how the customer receives the service and ensuring that the Township is providing customer value. In Table 7, there is a summary of the performance measure being used and the current performance per service area.

Table 7: Levels of Service Metrics – Corporate/Customer Focused

Service Area	Corporate/Customer Focused LOS Measure	Current Performance
Roads and transportation (includes stormwater)	Assets are kept in good condition	A-
	Assets are as safe and accessible as possible throughout the year	B-
	Capacity meets or exceeds current demands	A-
	Availability of near-term financial needs	D+
	Replacement cost is held in reserve	F
Water and Wastewater	Assets are kept in good condition	B+
	Assets are as reliable as possible throughout the year	A+
	Capacity meets or exceeds current demands	A+
	Availability of near-term financial needs	C+
	Replacement cost is held in reserve	C-

These are measures of fact related to the service delivery outcome (e.g., ratio of reserve to replacement value or assets in fair or better condition) to provide a balance in comparison to the customer perception that may be more subjective.

3.5. Technical Focused Levels of Service

Technical LOS are specific and quantifiable measures of performance for service targets to deliver the customer values and impact the achieved Corporate/Customer LOS. These technical measures relate to the activities and allocation of resources to best achieve the desired customer outcomes and demonstrate effective performance.

Technical service measures are linked to the activities and annual budgets covering:

- Acquisition – the activities to provide a higher level of service (e.g., widening a road, replacing a pipeline with a larger size) or a new service that did not exist previously (e.g., a new road segment).
- Operation – the regular activities to provide services (e.g., snow removal, mowing grass, inspections, etc.),
- Maintenance – the activities necessary to retain an asset as near as practicable to an appropriate service condition. Maintenance activities enable an asset to provide service for its planned life (e.g., road patching, enhanced water quality treatment, etc.), and
- Renewal – the activities that return the service capability of an asset up to that which it had originally provided (e.g., road resurfacing and pavement reconstruction, pipeline replacement, etc.).

Service and asset managers plan, implement and control technical service levels to influence the service outcomes. Table 8 and Table 9 summarize the technical performance measure being used and the current performance per service area.

It is important to monitor the service levels regularly as circumstances can and do change. Current performance is based on existing resource provision and work efficiencies. It is acknowledged changing circumstances such as technology and customer priorities will change over time.

A more detailed discussion on regulatory and focused LOS is provided in Appendices A to E for each service division.

Table 8: Levels of Service Metrics – Technical Focused

Service Area	Technical Focused LOS Measure	Current Performance
Roads and transportation (includes stormwater)	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality*	Arterials: N/A Collectors: 0.025 Locals: 1.284
	Assets undergo regulation compliant inspection programs	Bi-weekly
	Number of hours (minutes) taken for snow removal operations per number of lane-kilometres	0.044 (2.623)
	For unpaved roads in the municipality, the average surface condition (e.g. good, fair or poor)*	7.4
	For paved roads, average pavement condition index (PCI)*	Arterials: N/A Collectors: 75.5 Locals: 73.5
	Percentage of Gravel road segments that did not meet the recommended surface type (AADT > 400)	2%
	Percentage of LCB (Surface Treated) road segments that did not meet the recommended surface type (AADT > 700)	0%
	Percentage of road assets beyond replacement year	0.3%
	Percentage of bridges in the municipality with loading or dimensional restrictions*	44.4%
	For bridges and culverts, average bridge condition index (BCI)*	73.56%
	For bridges and culverts, bridge condition index (BCI) is 60 or better	90.5%
	Percentage of structures assets beyond replacement year	0.0%
	Percentage of properties in municipality resilient to a 100-year storm*	89.9%
	Percentage of the municipal stormwater management system resilient to a 5-year storm*	93.5%
	Assets undergo activities such as inspection, monitoring, cleaning and flushing	Every 5 years
	Number of times roads closed due to flooding per year (or length of closure time)	1
	Percentage of ponds with enhanced water quality treatment	100%
	Percentage of stormwater assets beyond replacement year	3.2%

*O. Reg. 588/17 LOS

Table 9: Levels of Service Metrics – Technical Focused (Continued)

Service Area	Technical Focused LOS Measure	Current Performance
Water and Wastewater	Percentage of properties connected to the municipal water system*	84.5%
	Percentage of properties where fire flow is available*	80.7%
	Number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system*	0.001
	Percentage of samples that met Ontario Drinking Water Standard per year	99.4%
	Number of water quality customer complaints per year	1
	Number of connection-days per year where water is not available due to water main breaks compared to the total number of properties connected to the municipal water system*	0.000
	Percentage of water assets beyond replacement year	24.2%
	Percentage of properties connected to the municipal wastewater system*	67.7%
	Number of events per year where flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system*	0 events per year
	Number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system*	0.000
	Assets undergo activities such as inspection, monitoring, cleaning and flushing	Every 5 years
	Number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system*	0.005
	Number of complaints due to performance/failure of wastewater facility/equipment	0
	Percentage of wastewater assets beyond replacement year	0.0%

*O. Reg. 588/17 LOS

4. Asset Management Strategy

4.1. Overview

Asset management strategy is a set of planned actions that will enable the assets to provide the desired levels of service in a sustainable way, while managing risk, at the lowest life cycle cost as per the Guide for Municipal Asset Management Plans. While based on the internationally recognized PAS55 by the Institute of Asset Management, asset management strategy can be defined as the continuous improvement of systematic and coordinated activities and practices through which the Township can optimally and sustainably manage its infrastructure systems, associated performance, risks and expenditures over their life cycles for the purpose of achieving the organizational strategic plan.

Overall, the Township has a strategy to manage the core assets through their life cycle (including operation, maintenance, renewal, and replacement) to provide approved levels of service (indicated in Section 3) in the most effective and efficient way. However, the Township does not have a strategy related to expansion activities driven by long range planning documents such as the Official Plan, Secondary Plans of subdivision, Master Plans, etc.

The township has developed life cycle models to describe the behaviors and deterioration of assets over time to provide the Township with ability to forecast required asset life cycle activities and their impacts on LOS, risk, and funding levels. Figure 9 shows a typical deterioration curve to further demonstrate the accentuated rate of deterioration as an asset transition from good to fair to poor condition.

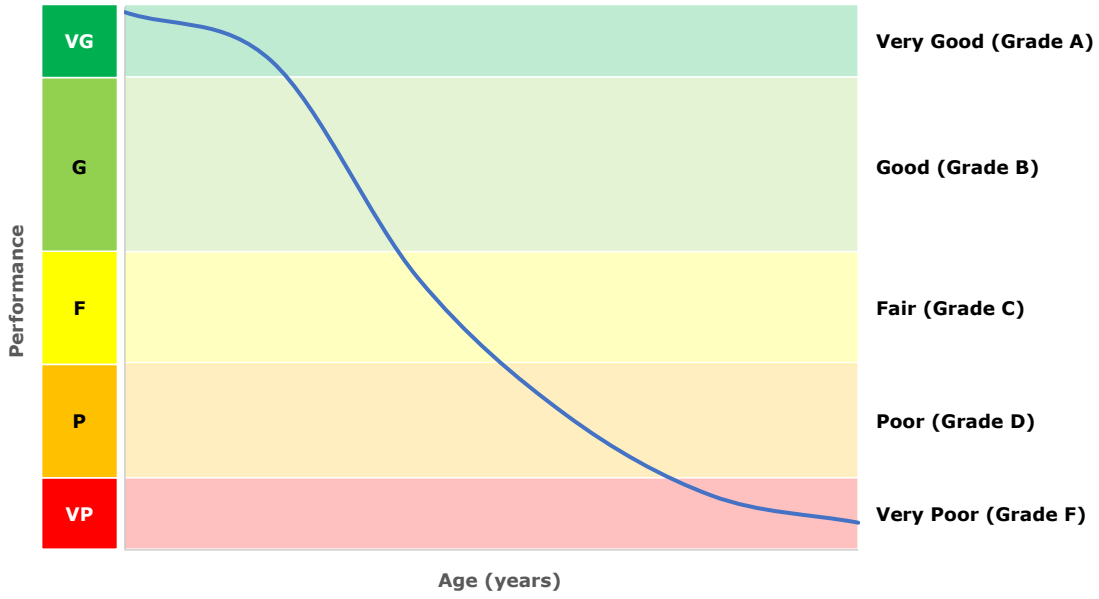


Figure 9: Schematic of an Asset's Deterioration Over Time

When an asset degrades along a deterioration curve and an intervention threshold is reached, the asset will require treatment (i.e., rehabilitation or replacement). After the treatment is applied, the performance (condition) of that asset will increase to a higher value, after which point, it will continue to degrade. Interventions are applied to extend the overall estimated service life (ESL) of the asset.

4.2. Life Cycle Management Strategies

Life Cycle management focuses on the specific activities the Township must undertake during all phases of the asset life cycle. Considering entire asset life cycles can ensure that the Township makes sound decisions that consider present and future service delivery needs.

The overarching goal of life cycle management is to maximize the long-term benefits and services our assets deliver while minimizing the associated costs and risks in the long run. Every asset has a life cycle cost, which is the total cost of all the activities undertaken throughout its service life. The following subsections describe activities across the life cycle of assets.

Any responsible owner of assets such as the Township has a desire to preserve the condition of their existing assets for as long as possible, by maintaining or even extending their design lives through routine activities such as maintenance and active intervention. The Township is continually acquiring infrastructure assets, but these assets require increased funding for operation and maintenance as they age. The Township is also responsible for the replacement of deteriorated assets as long as the service is required. While individual assets may have a useful life that can be predicted in years or decades, the service that the asset provides could be for a substantially longer duration (perhaps in perpetuity). Part of the purpose of the AM planning process is to fully understand and predict the long-range financial requirements for the Township's infrastructure to facilitate planning and resource management in the most cost-effective manner possible. Figure 10 illustrates how costs typically accumulate over an asset's life. It is worth noting that the accumulation of the ongoing operations and maintenance, refurbishment and disposal/replacement costs is many multiples of the initial acquisition costs.

The following subsections simply expressed the general types of life cycle strategies that are applied to assets to maintain LOS while lowering total life cycle cost. These strategies are applied over the life cycle of the asset, from planning and design to construction to disposal and replacement. The appendices include specific life cycle strategies applicable to each asset type and service area.

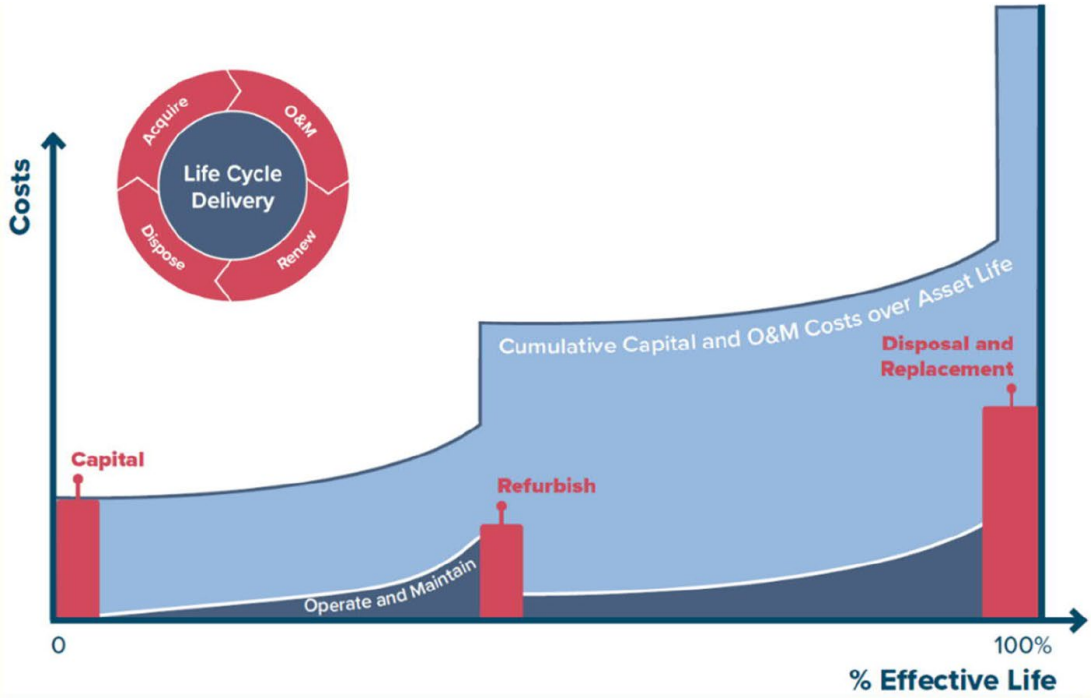
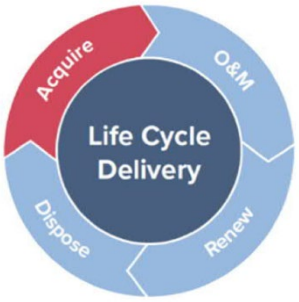


Figure 10: Life Cycle Cost Accumulation Over Asset Life

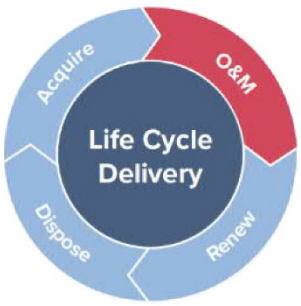
4.2.1. Asset Acquisition/Procurement/Construction



When acquiring new assets, the Township should evaluate credible alternative design solutions that consider how the asset is to be managed at each of its life cycle stages. Asset management and full life cycle considerations for the acquisition of new assets include, but are not limited to the following:

- The asset's operability and maintainability,
- Availability and management of spares,
- Staff skill and availability to manage the asset, and
- The manner of the asset's eventual disposal.

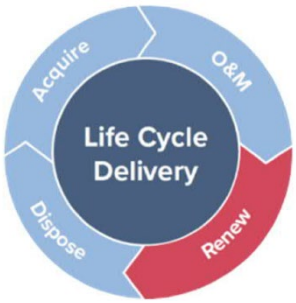
4.2.2. Asset Operations and Maintenance (O&M)



As new infrastructure is commissioned, the Township accepts the responsibility of operating and maintaining the infrastructure according to O&M standards to ensure that the infrastructure is safe and reliable. Operations staff provide the day-to-day support required to operate infrastructure. In few cases, operation costs are minor, but for most there are significant increases in operational costs. For example, underground pipes require almost no operational support

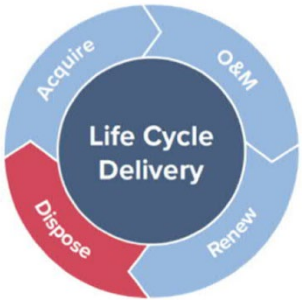
while a facility such as a pump station requires full-time staff to operate the facility safely and efficiently. Maintenance expenses include periodic preventive maintenance to ensure that the infrastructure can provide reliable service throughout the life of the asset and corrective maintenance that is required to repair defective assets as and when needed. Inadequate funding for O&M will have an adverse impact on the lifespan of assets. The number of O&M resources required in any period is a function of the current inventory of infrastructure and total O&M needs required for each asset. As the inventory of infrastructure grows, total O&M requirements will also grow.

4.2.3. Asset Renewal and Replacement



The third portion of full life cycle costing relates to the renewal and replacement of infrastructure that has deteriorated to the point where it no longer provides the required LOS. Renewal cost is sometimes incurred during the life of an asset where an investment is made to improve the condition and/or functionality of the asset (e.g., re-lining of a pipe). Disposal and replacement costs are incurred at the end of an asset's life when it is disposed of and replaced by a completely new asset. Canadian municipalities have not traditionally factored renewal or replacement costs into future budget projections, except for assets that have a relatively short life such as computer equipment and vehicles. The main reason behind this is the fact that large portions of this infrastructure inventory can have a very long life (e.g., from 75 to 100 years for underground pipes). Based on the experiences of more established Canadian cities (where vast inventories of old assets are now in dire need of renewal or replacement), it is vital that communities fully understand the looming obligations of infrastructure renewal or replacement and develop a strategy to respond in a manner that is fair and affordable.

4.2.4. Asset Decommissioning and Disposal



There will inevitably come a point in time when an asset must be removed from service and, depending on the type of asset, there may be significant costs associated with its decommissioning and disposal. Factors that may influence the decision to remove an asset from service include: changes to legislation that cause the asset to be in non-compliance, the inability of the asset to cope with increased service levels, technology advances that render the asset obsolete, the cost of retaining the asset is greater than the benefit gained, or the current risk associated with the asset's failure is not tolerable.

Normally, major costs that may be incurred during disposal and decommissioning derive from the environmental impact of the disposal and, if required, the rehabilitation and decontamination of land. In some cases, there will be residual liabilities and risks to consider if a decision is made to partially abandon the asset as opposed to fully disposing of its components (e.g., leaving a non-functioning pipe in the ground, or an inactive building standing). However, some cost savings may be achieved through the residual value of the asset or by exploring alternative uses for the asset. In all cases, it is important to thoroughly consider disposal and decommissioning options as the strategy employed has the potential to attract significant stakeholder attention. For that reason, the costs and risks associated with disposal and decommissioning should be equally considered in the Township's capital investment decision-making process.

4.2.5. Non-Infrastructure Solutions

In addition to the previously mentioned strategies, it is crucial to consider a range of other activities to target the most effective solution and value for money, this includes the consideration of non-infrastructure solutions. Non-infrastructure solutions include but are not limited to studies, needs assessments, policy development, data collection, condition assessments and benchmarking against industry best practices. These solutions are implemented to explore and develop strategies that will result in extension of useful life of assets and/or lower total asset program costs in the future.

While assets run through various stages during their service lives, approximately 80 to 85% of the asset's life cycle costs are incurred during its O&M. Therefore, building maintenance and rehabilitation programs and implementing them is necessary to ensure funds are wisely allocated and spent during the O&M phase.

A more detailed discussion on life cycle management strategies is provided in Appendices A to E for each service division. Each service division section also documents the risks associated with each life cycle activity.

4.3. Risk Management Strategy

The goal of risk management is to control future outcomes effectively and as much as possible by being proactive rather than reactive. Ideally, risks should be mitigated prior to their occurrence as much as possible. Conversely, it is important to have a plan in place so that the organization understands how to deal with risks should they occur. Two key parameters involved in risk management include the possibility of a risk occurring and its potential impact. Under a constrained budget scenario, decision-making is largely based on potential risks.

4.3.1. Background

In analyzing risk for all infrastructure assets, the first step is to identify which assets are most critical. Critical assets are those that will potentially have the greatest impact on service delivery and performance objectives should they fail. The fundamental principle of consequence models is that they evaluate the relative importance of assets based on select criteria. The approach to risk analysis within this project is aligned with one of the industry's best practices which is the International Organization for Standardization (ISO) 31000:2009 Risk Management – Principles and Guidelines

By applying specific indices, the risk assessment framework generates a risk (or priority) score for each asset. The risk score is a rating of the asset based on the detailed assessment of the likelihood and consequence of failure based on several key parameters. All parameters are then equated in the following formula:

$$\boldsymbol{Risk = Probability\ of\ Failure \times Consequence\ of\ Failure}$$

Based on this principle, the risk associated with a given asset's failure can be managed by limiting the likelihood of this occurring, or the impact realized, should it occur.

4.3.2. Probability of Failure (POF)

POF expresses the likelihood of an asset to fail due to different conditions depending on the asset type. Generally, the age of an asset plays a role in the assessment of condition due to the general assumption that an old asset will have a greater probability of failure than a newer one. In the absence of formal, detailed condition assessment programs, age is typically used as a proxy.

Probability scores are assigned from 1-5, with a probability of 1 indicating a low likelihood of failure and a condition rating of "Very Good" and a probability of 5 indicating a high likelihood of failure and a "Very Poor" condition rating. Table 10 summarizes the probability of failure for the 5 core asset divisions.

Table 10: Probability of Failure Matrices

Service Division	Risk Criteria	Criteria Weighting	Value/ Range	Chance of Failure Score
Roads	Descriptive Rating (Table 20-Table 22)	60%	Very Good	1
			Good	2
			Fair	3
			Poor	4
			Very Poor	5

Service Division	Risk Criteria	Criteria Weighting	Value/ Range	Chance of Failure Score
	Condition Rating (Inventory Manual)	40%	91-100	1
			81-90	2
			71-80	3
			61-70	4
			0-60	5
Structures	BCI	100%	>85	1
			71-85	2
			61-70	3
			41-60	4
			0-40	5
Stormwater Management	Age-Based Condition	100%	88-100	1
			69-87	2
			55-68	3
			37-54	4
			0-36	5
Water & Wastewater Services	Age-Based Condition	100%	81-100	1
			61-80	2
			41-60	3
			21-40	4
			0-20	5

4.3.3. Consequence of Failure (COF)

COF reflects relative impact of a given asset's failure. While traditionally these have been looked at as purely economic terms (for example, repair costs and loss of revenue), the truth is that investment decisions can often be driven by non-economic factors. Understanding both the economic and non-economic impacts associated with loss or limitation of service help in categorizing an asset's criticality and justifying infrastructure decisions in a consistent and defensible manner. Even without understanding when failure will occur, categorizing assets based on criticality or failure consequence allows for effectively targeting management strategies aimed at mitigating risk. The following tables summarize the consequence of failure for the 5 core asset divisions.

Table 11: COF (Roads)

Risk Criteria	Criteria Weighting	Value/Range	Consequence of Failure Score
Criticality Rating (Asset Class)	10%	Class 5 – Lanes, alleys, etc.	1
		Class 4 – Local	2
		Class 3 – Collector	3
		Class 2 – Arterial	4
		Class 1 – Freeway	5
Surface Type	35%	Earth	1
		Gravel	2
		LCB	3
		HCB – Single Lift	4
		HCB – Double Lift	5
Traffic Count	25%	1-49	1
		50-199	2
		200-399	3
		400-799	4
		800+	5
Replacement Cost	30%	$65,500 and below	1
		$130,000 and below	2
		$260,000 and below	3
		$640,000 and below	4
		$640,001 and above	5

Table 12: COF (Structures)

Risk Criteria	Criteria Weighting	Value/Range	Consequence of Failure Score
Replacement Cost	100%	$250,000 and below	1
		$500,000 and below	2
		$1,000,000 and below	3
		$2,500,000 and below	4
		$2,500,001 and above	5

Table 13: COF (Stormwater Management)

Risk Criteria	Criteria Weighting	Value/Range	Consequence of Failure Score
Criticality Rating (Impact of Failure based on Diameter)	60%	<250 mm	1
		250–375 mm	2
		375-550 mm	3
		550-800 mm	4
		>800 mm	5
Replacement Cost	40%	$14,000 and below	1
		$26,000 and below	2
		$51,000 and below	3
		$130,000 and below	4
		$130,001 and above	5

Table 14: COF (Water Services)

Risk Criteria	Criteria Weighting	Value/Range	Consequence of Failure Score
Criticality Rating (Impact of Failure based on Diameter)	60%	<100 mm	1
		100–250 mm	2
		250-350 mm	3
		350-450 mm	4
		>450 mm	5
Replacement Cost	40%	$16,000 and below	1
		$32,000 and below	2
		$64,000 and below	3
		$156,000 and below	4
		$156,001 and above	5

Table 15: COF (Wastewater Services)

Risk Criteria	Criteria Weighting	Value/Range	Consequence of Failure Score
Criticality Rating (Impact of Failure based on Diameter)	60%	<250 mm	1
		250–350 mm	2
		350-450 mm	3
		450-550 mm	4
		>550 mm	5

Risk Criteria	Criteria Weighting	Value/Range	Consequence of Failure Score
Replacement Cost	40%	$7,000 and below	1
		$14,000 and below	2
		$28,000 and below	3
		$70,000 and below	4
		$70,001 and above	5

4.3.4. Risk Score

As previously stated, understanding the overall risk exposure of an asset is critical for decision-making. Risk exposure is evaluated with the risk equation once the POF and COF parameters have been determined. The risk assessment calculations often require a calibration process such that the output is comparable with real-world situations. Upon calculating risk scores, the Township can prioritize interventions in the form of condition assessment or rehabilitation needs based on risk exposure.

The risk score will range between 1 and 25. The supplied number represents the risk of each segment depending on its criticality and condition.

The risk score, ratings, and definitions are defined in Table 16. The table can be used to assign qualitative risk ratings per asset using the corresponding ranges in the table. A risk matrix is also developed on the ratings and risk value breakpoints (Figure 11).

Table 16: Risk Rating and Definition

Calculated Risk Value	Risk Rating	Definition
1-5	Insignificant	These assets are not prioritized in the short or long term. Generally, they can run to failure.
6-8	Negligible	These assets are intervened in the long-term.
9-10	Moderate	These assets are generally prioritized in the medium to long-term.
11-16	Extensive	These assets are generally prioritized in the medium to short-term.
17-25	Significant	These assets are prioritized for intervention in the immediate to short-term.

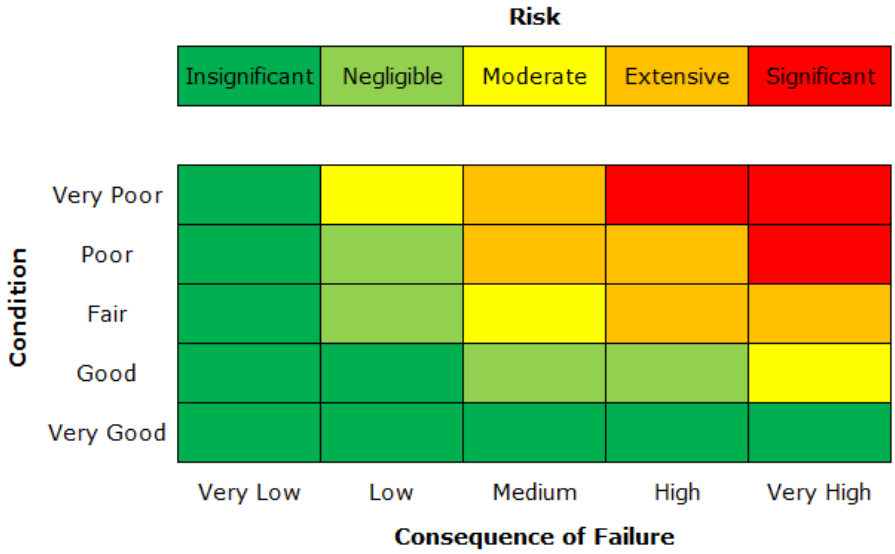


Figure 11: Risk Matrix

4.4. Climate Change Consideration

Climate change will be considered as part of the Township's asset management approach embedded in local asset management planning methods. This approach will balance the potential cost of vulnerabilities to climate change impact and other risks with the cost of reducing these vulnerabilities. The balance will be struck in the levels of service delivered through operations, maintenance schedules, disaster response plans, contingency funding, and capital investments. The Township's contribution to climate change through greenhouse gas emissions will be mitigated in accordance with its local reduction targets, including alignment with the Township's financial capacity and stakeholder support. The Township will continue to work with the County regarding climate change mitigation and adaptation.

The Township recognizes the need for stakeholder input into the planning process and will foster informed dialogue using the best available information.

5. Financial Summary

5.1. Annual Budget Process

This process allows for the township to have a detailed plan that implements functional infrastructure that adheres to current regulations and standards. Some of the most important infrastructure in the township are the roads and water treatment facilities, therefore, with the completion of the budgeting process, these assets will be maintained to adhere to current regulations and standards. The AMP will ultimately help the way the township plans for its future infrastructure. The budgeting process is outlined in Figure 12.

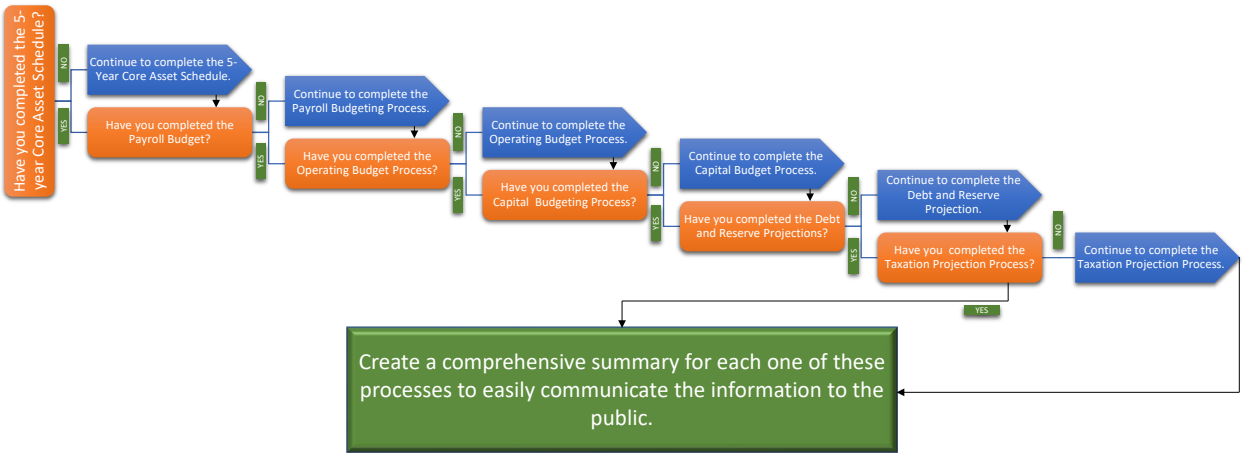


Figure 12: The Budgeting Process

All departments are responsible for the completion of their own operating budgets which is then added into the townships complete operating budget. All departments provide information for the 5-year core schedule and capital budgets.

The finance department is responsible for most of the completion of the annual budget. The finance department is responsible in assisting the other departments in the completion of all six steps in the budgeting process and is responsible for the debt and reserve projection, taxation analysis, and payroll projection steps independently.

The Township's council will need to approve the entire budget for it to be complete. If counsel does not approve, the departments will need to review and alter any critique that the counsel members may have had about a certain part of the budget.

The budget is presented to the public as the final step of the budgeting process. Consultation with the public is an important step in the budgeting process. It is essential that the public vote on certain projects that may be developed.

5.2. Operating & Maintenance Budget Forecast

The estimated preliminary operating budget forecast for expenditure related to asset operations and maintenance activities is provided in Figure 13. The averaged annual operating budget is approximately $7.7 million. Forecast operations and maintenance costs are expected to vary in relation to the total value of the asset stock. If additional assets are acquired, the future operations and maintenance costs are forecast to increase. If assets are disposed of the forecast operation and maintenance costs are expected to decrease.

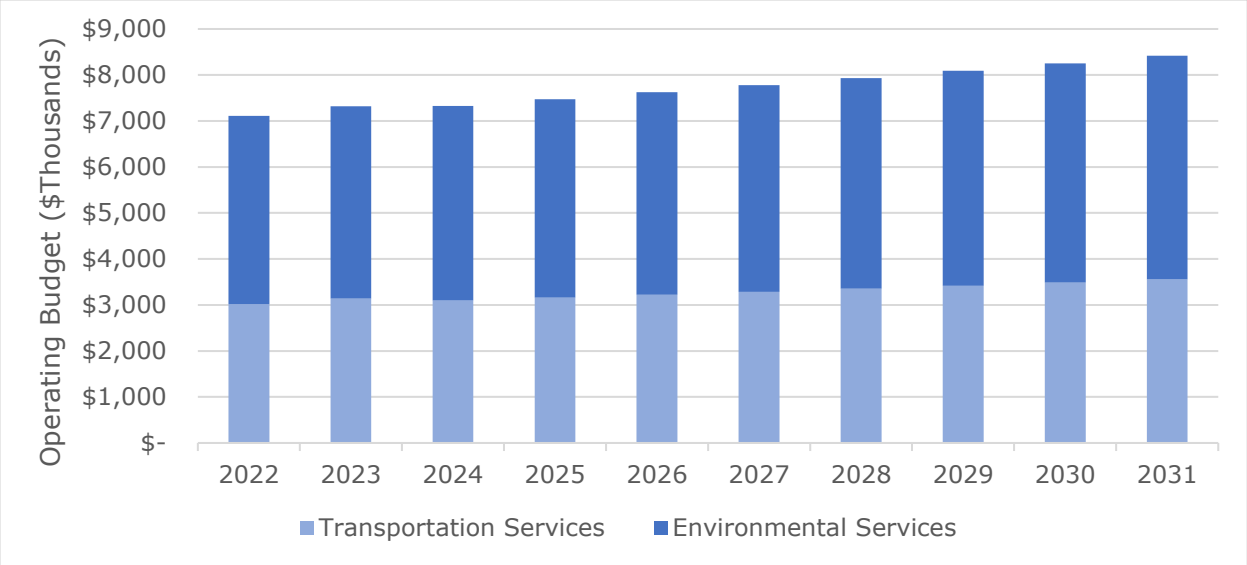


Figure 13: 10-Year Operating Budget Forecast Summary

The preliminary operating budget forecast in this AMP does not include costs associated with future assets that are to be assumed as a part of the development process. The expected growth in the Township's asset portfolio and its associated impact on the operating budget will further increase as on-going initiatives such as the expansion of Long Sault Regional Water and Wastewater Treatment Facilities are completed.

5.3. Capital Budget Forecast

The Township's averaged annual capital budget is approximately $2.1 million. The estimated capital budget forecast for capital expenditures related to asset renewal and replacement activities is provided in Figure 14.

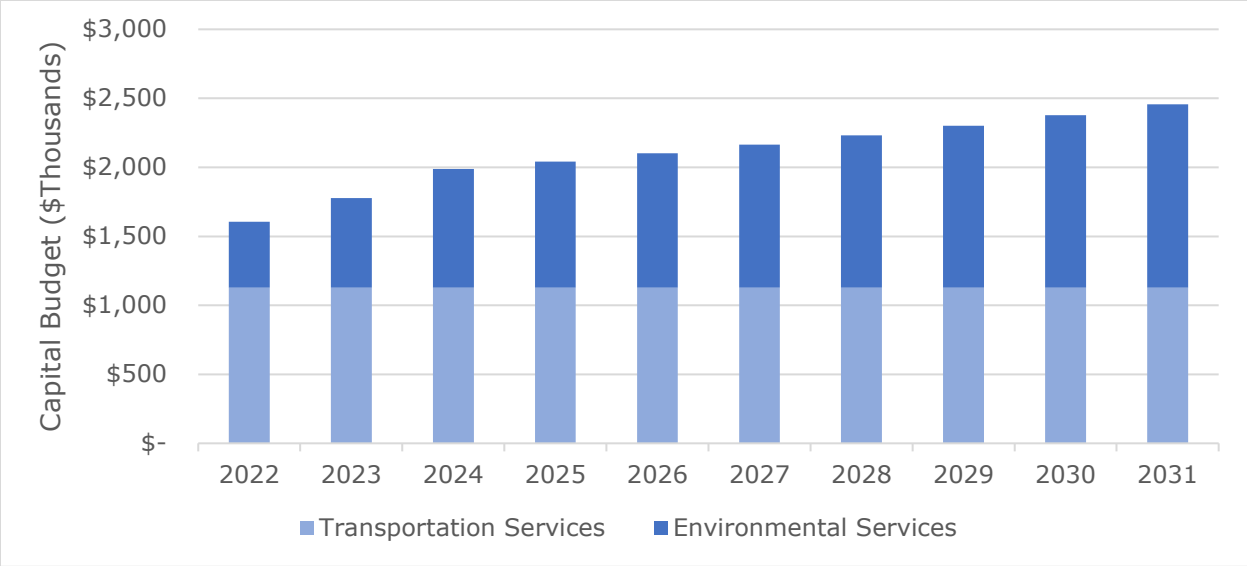


Figure 14: 10-Year Operating Budget Forecast Summary

The sources of funding to support operating and capital budgets include taxes, gas tax, utility rates, and OCIF.

5.4. Infrastructure Gap Assessment

Evaluating budget vs. required investments show that the Township's 10-year infrastructure gap is about $19.3 million. Required investment values presented are based on condition ratings for assessed assets and estimates of age and expected useful life for non-assessed ones.

The following figure summarizes the required investment forecast for Township's core assets under unconstrained budget scenario.

As seen in Figure 15, the unconstrained forecast indicates the Township would need $16.9 million in the first year to clear the infrastructure backlog, and an average expenditure per year of $4 million over the next 10 years. The annual averaged funding for capital projects is $2.1 million.

The township does not have sufficient funding to meet the unconstrained scenario needs, and therefore, an evaluation of different funding scenarios is required to determine an appropriate constrained level of funding that balances cost and the risk associated with LOS.

Service outcomes are always an equilibrium between investment, service level targets and risk of service delivery. If the forecasted outcomes are considered unacceptable, increased investment, or changes in service level targets are ways to impact service risk. It is noted that risk assessment and consequence of failure is not explicitly addressed in this AMP.

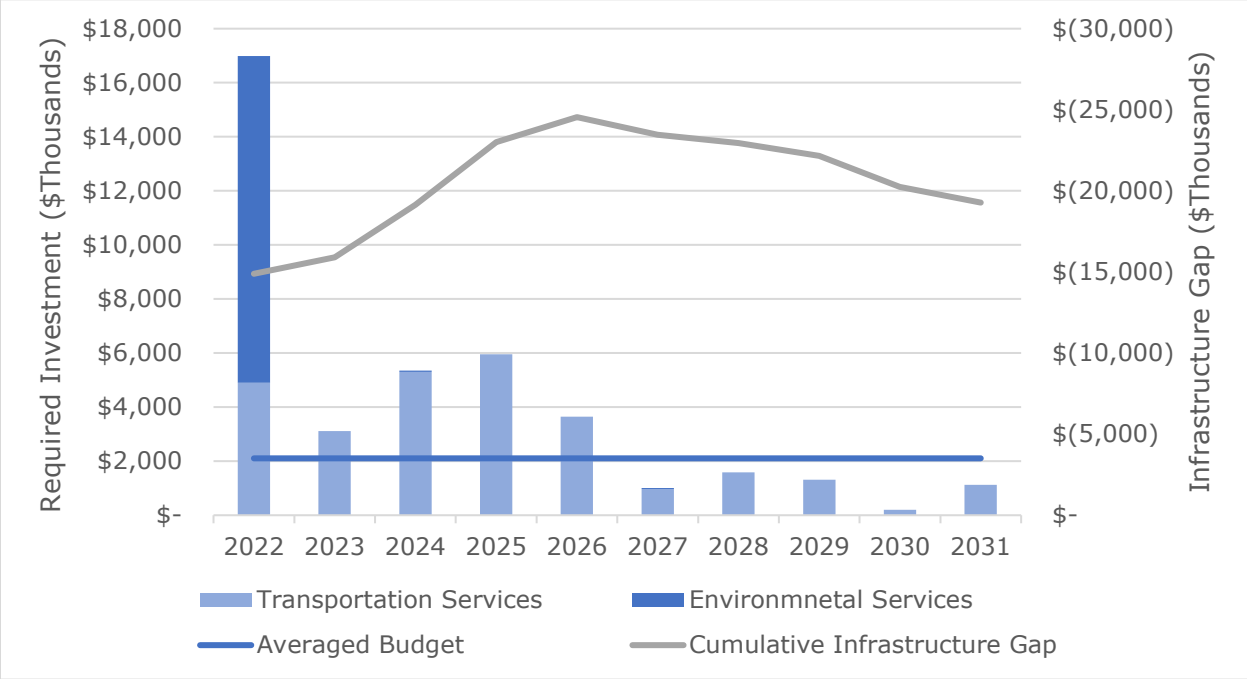


Figure 15: Required Investment under the Unconstrained Budget Scenario

Appendices

Appendix A: Roads

A.1. Introduction

This service division provides reliable, convenient, and seamless travel across the Township and easy access to the neighbouring Townships' and United Counties of SDG road networks. A good road system creates the potential for employment, connects customers to businesses, promotes healthy social living, maintains and expands markets, preserves and enhances personal freedom, and allows access for emergency services to quickly and efficiently reach their destinations. When roads are deficient, all these opportunities suffer. The network consists of roads that vary by surface type. Earth and gravel, low class bituminous (LCB), and high class bituminous (HCB) roads make up the local and collector routes that exist in the Township.

Key business drivers at this time are future population and associated asset growth and aging infrastructure. New developments are creating additional urban roadways that must be managed and maintained on top of existing infrastructure. Public Works Services employees and contracted staff perform regular inspections and road patrolling to ensure that all roads are meeting service expectations.

A.2. State of the Infrastructure

A.2.1. Inventory Overview

Transportation services are offered through a road network that spans a total of 310 km primarily within a rural setting, with small areas of urban and semi-urban development. The road network includes surfaces ranging from gravel to hot-mix paved asphalt. The Township's road inventory can be broken down into the following hierarchy, as presented in Table 17.

Table 17: Road Inventory Hierarchy

Service Area	Service Division	Asset Class/Component
Roads and Transportation	Roads	Earth Roads
		Gravel Roads
		LCB Roads
		HCB Roads

The Township has approximately 10 km of earth roads, 103 km of gravel roads, 84 km of LCB surface treated roads, and 113 km of HCB hot mix asphalt paved roads. This information is summarized in Table 18.

Table 18: Asset Inventory (Roads)

Asset Type	Inventory	Unit	% of Total
Earth Roads	10	km	3.2
Gravel Roads	103	km	33.2
LCB Roads	84	km	27.1
HCB Roads	113	km	36.5
Total	**310**	**km**	**100**

A.2.2. Asset Valuation

The total value of the road network on a full-replacement basis in 2021 dollars is approximately $150,700,000. Values were obtained from the 2021 Road Needs Study Report. Table 19, presented below, provides a summary of replacement cost values by road surface type.

Table 19: Replacement Cost Values (Roads)

Asset Type	Replacement Value ($)	% of Total
Earth and Gravel Roads	37,500,000	24.9
LCB Roads	41,900,000	27.8
HCB Roads	71,300,000	47.3
Total	**150,700,000**	**100**

A.2.3. Asset Age

Many Township roads have been in existence for a century or longer. Although some of them currently remain loose-top surfaces with indefinite life spans when graded regularly, a good portion of them have since been upgraded and improved to hard-top surfaces. For the purpose of assigning ages to Township roads, the time elapsed since the last full-depth reconstruction of the road has been considered. In some cases, it is suspected that the recorded in-service dates of some sections do not reflect the true age of the road. For this reason, the perceived ages were also estimated based on the projected remaining useful lives of the surfaces. Combining these two efforts result in reasonable estimation of average road ages. A summary of the average age of Township's road network as a proportion of their average useful lives is presented in Figure 16.

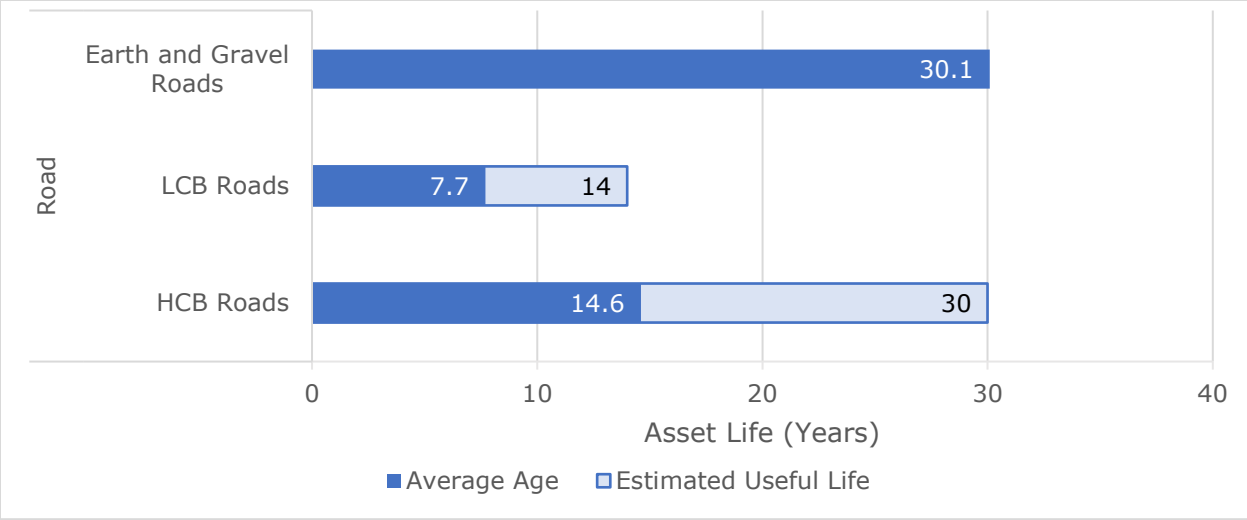


Figure 16: Average Asset Age as a Proportion of Average Useful Life (Roads)

A.2.4. Asset Condition

Assets can be described as very good to very poor depending on a variety of factors. Gravel roads and other loose-surface roads are assessed based on surface condition ratings from 1-10. This takes comfortability of the ride and driver speed reduction into consideration. The condition rating scale for gravel and earth roads is illustrated in Table 20.

Table 20: Condition Rating Scale (Gravel and Earth Roads)

Descriptive Ratings	Surface Condition	Qualitative Description
Very Good	10	The section affords a fully adequate standard of service with no annoyance or discomfort. Gravel roads rarely score a "10" rating due to their inherent roughness.
Good	8-9	It is possible to maintain the lesser of the minimum tolerable average operating speed or the legal speed limit with only a noticeable amount of annoyance to the driver due to sway, vibration, or steering effort, but with no noticeable feeling of hazard.
Fair	6-7	
Poor	4-5	Maintaining even the lesser of the minimum tolerable average operating speed or the legal speed limit results in either a "tug-of-war" with a too-steep crown, or a feeling that the car is taking undue punishment.
Very Poor	1-3	The surface irregularities are so severe that a driver will tend to reduce speed considerably, possibly even steering an irregular course, or if the crown is too steep as to be hazardous in winter.

For the Township's hard-surface roads, the approach is based on different ranges of pavement condition index (PCI) ratings. This scale goes from 0-100 and is calculated based on the Ministry of Transportation of Ontario (MTO) PCI methodology. It provides an indication of the average level of service that drivers experience.

Table 21 and Table 22 illustrate the condition rating scales for LCB and HCB roads, respectively.

Table 21: Condition Rating Scale (LCB Roads)

Descriptive Ratings	PCI	Qualitative Description
Very Good	80-100	Pavement is in excellent condition with just a few bumps or depressions from slight surface deformation. No surface defects such as streaking, potholes, or cracking distresses. The pavement is well maintained, in good condition, new or recently rehabilitated. The ride condition rating is very good.
Good	60-79	Pavement is in good condition with just a few bumps or depressions from slight to moderate surface deformation. Intermittent slight to moderate surface defects and/or cracking distresses. The asset is generally approaching the mid-stage of its service life. The ride condition rating is good.
Fair	40-59	Pavement is in fair condition with intermittent to frequent bumps or depressions from slight to moderate surface deformation. Intermittent to frequent moderate surface defects and/or cracking distresses. The ride condition rating is fair.
Poor	20-39	Pavement is in poor condition with frequent bumps or depressions from moderate surface deformation. Frequent moderate to severe surface defects and/or cracking distresses. Localized slight to moderate alligatoring may be present indicating pavement structural failure. The asset is approaching the end of its service life. The ride condition rating is poor.
Very Poor	0-19	Pavement is in very poor condition with extensive bumps or depressions from moderate to severe surface deformation. Extensive to severe surface defects and/or cracking distresses. Frequent slight to moderate alligatoring may be present, indicating pavement structural failure. The asset is near or beyond its expected service life. The ride condition rating is very poor.

Table 22: Condition Rating Scale (HCB Roads)

Descriptive Ratings	PCI	Qualitative Description
Very Good	90-100	Pavement is in excellent condition with just a few cracks. The pavement is well maintained, in good condition, new or recently rehabilitated. The ride condition rating is excellent with few areas of very slight to slight distortion.
Good	75-89	The pavement is in good condition with frequent very slight or slight cracking. The asset is generally approaching the mid-stage of its service life. The ride condition rating is good with a few slightly rough and uneven sections.
Fair	65-74	The pavement is in fairly good condition with slight cracking, slight or very slight distortion and a few areas of slight alligatoring. The ride condition rating is fairly good with intermittent rough and uneven sections.
	50-64	The pavement is in fair condition with intermittent moderate and frequent slight cracking, and with intermittent slight or moderate alligatoring and distortion. The ride condition rating is fair and the surface is slightly rough and uneven.
Poor	40-49	The pavement is in poor to fair condition with frequent moderate cracking and distortion, and intermittent moderate alligatoring. The ride condition rating is poor to fair and the surface is moderately rough and uneven.
	30-39	The pavement is in poor to fair condition with frequent moderate alligatoring and extensive moderate cracking and distortion. The asset is approaching the end of its service life. The ride condition rating is poor to fair and the surface is moderately rough and uneven.
Very Poor	20-29	The pavement is in poor condition with moderate alligatoring and extensive severe cracking and distortion. The ride condition rating is poor and the surface is very rough and uneven.
	0-19	The pavement is in poor to very poor condition with extensive severe cracking, alligatoring and distortion. The asset is near or beyond its expected service life. The ride condition rating is very poor and the surface is very rough and uneven.

Field reviews for the purpose of calculating PCI were undertaken as part of the 2021 Road Needs Study in accordance with:

- MTO Manual for Condition Rating of Flexible Pavements, SP-024, and
- MTO Manual for Condition Rating of Surface-Treated Roads, SP-021.

A total of 78.7% of the inspected roads have been assigned a condition of "fair" or better. For HCB roads, this corresponds to a PCI rating of 50 or better while LCB roads are considered fair at a PCI of 40 or greater. Gravel and earth roads are rated subjectively according to ride condition, with a score of 6 or greater representing "fair" or better. The average condition ratings are presented in Figure 17 below. The asset condition detail (replacement cost weighted) of the Township's roads is presented in Figure 18.

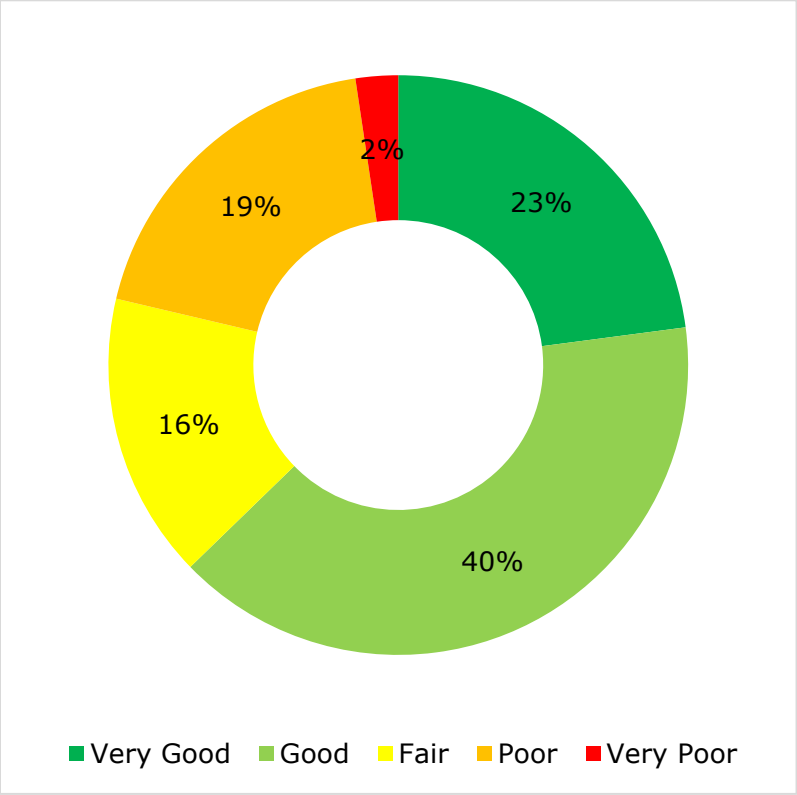


Figure 17: Asset Condition Summary (Roads)

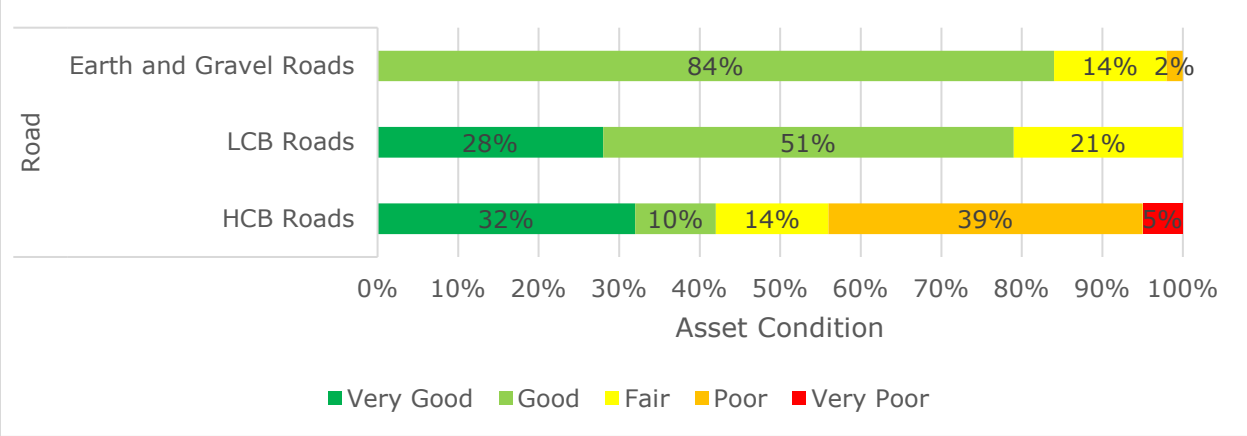


Figure 18: Asset Condition Detail (Roads)

A.3. Levels of Service

A.3.1. O. Reg. 588/17 Levels of Service Metrics

O. Reg. 588/17 refers to Customer LOS as 'Community LOS' and outlines these LOS as qualitative descriptions for core assets. Community LOS use qualitative descriptions to describe the scope or quality of service delivered by an asset category. O. Reg. 588/17 also requires legislated technical LOS for core assets. Technical LOS use metrics to measure the scope or quality of service being delivered by an asset category.

Table 23 lists the performance measures that are included in the O. Reg. 588/17 requirements for road assets. References are provided to show where O. Reg. 588/17 requirements have been attained.

Table 23: Levels of Service Metrics - O. Reg. 588/17 (Roads)

Service Attribute	Customer LOS	Technical LOS
Scope	Description, which may include maps, of the road network in the municipality and its level of connectivity. **(Figure 19)**	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality. **(Table 25)**
Quality	Description or images that illustrate the different levels of road class pavement condition. **(Figure 20)**	1. For paved roads in the municipality, the average pavement condition index value. **(Table 25)**
		2. For unpaved roads in the municipality, the average surface condition (e.g., excellent, good, fair or poor). **(Table 25)**

Other LOS performance measures are related to Customer Values. The metrics that go beyond the foundational or regulation required metrics are considered advanced. They indicate service divisions have documented planned approaches for operation and maintenance of infrastructure, and have considered trending indicators if the result is planned to be decreased, increased, or to be approximately equal in future years. Advanced metrics are listed in Table 24 and Table 25.

A.3.2. Corporate/Customer Focused Levels of Service Metrics

In setting corporate/customer performance measures, the focus is on measuring how the customer receives the service and ensuring that the Township is providing customer value. These may be qualitative or quantitative measures.

Table 24: Levels of Service Metrics – Corporate/Customer Focused (Roads)

Corporate LOS Objective	Customer LOS Measure	Current Performance	Expected Trend Based on Planned Budget
Assets are kept in good condition	Roads assets in fair or better condition	B+	↘
Assets are as safe and accessible as possible throughout the year	Percentage of outstanding work orders	B+	→
Capacity meets or exceeds current demands	Current ADT (Average Daily Traffic)/Current Capacity in ADT	A+	→
Availability of near-term financial needs	Ratio of 10-year budget to need	F	→
Replacement Cost is held in reserve	Ratio of reserve to replacement value	F	→

A.3.3. Technical Focused Levels of Service Metrics

To deliver services that meet customer and strategic LOS, several technical measures are tracked. Technical LOS are targeted at asset users such as: office staff, operators, and maintenance staff.

Table 25: Levels of Service Metrics – Technical Focused (Roads)

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Maintain road network in the municipality and its level of connectivity	Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality*	Arterials: N/A Collectors: 0.025 Locals: 1.284	Not Applicable
Inspection Program Regulation	Assets undergo regulation compliant inspection programs	Bi-weekly	Bi-weekly
Accessible assets year round (snow clearing concern)	Number of hours (minutes) taken for snow removal operations per number of lane-kilometres	0.044 (2.623)	Stay the same
Maintain a renewal schedule to ensure the majority of assets are in good condition	For unpaved roads in the municipality, the average surface condition (e.g. good, fair or poor)*	7.4	Condition rating is 6.0 or better (Fair)

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Maintain a renewal schedule to ensure the majority of assets are in good condition	For paved roads, average pavement condition index (PCI)*	Arterial Roads PCI = N/A	PCI rating is 56 or better (Fair)
		Collector Roads PCI = 75.5	PCI rating is 51 or better (Fair)
		Local Roads PCI = 73.5	PCI rating is 46 or better (Fair)
Improve a road to a higher standard	Percentage of Gravel road segments that did not meet the recommended surface type (AADT > 400)	2%	0%
	Percentage of LCB (Surface Treated) road segments that did not meet the recommended surface type (AADT > 700)	0%	0%
Maintain asset renewal rate	Percentage of assets beyond replacement year	0.3%	0%

*O. Reg. 588/17 LOS

A.4. Asset Management Strategy

An asset management strategy involves a set of planned actions that enables assets to provide the desired levels of service in a sustainable manner, while managing risk, at the lowest life cycle cost. An outline of these activities for the Township's road network and their associated risks is presented in Table 26.

Table 26: Life Cycle Management Activities and Associated Risks of Neglection (Roads)

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
Non-Infrastructure Solutions	Regular road condition assessments	Without the quantitative data that regular pavement condition assessments provide, decision makers are forced to rely on outdated information and budget accordingly.
	Regular road patrolling as per O. Reg. 239/02	Failure to conduct road patrols could allow unacceptable road conditions to last for an unsafe length of time. This increases public risk and introduces potential financial liabilities.
	Traffic counting	Failure to conduct regular traffic counts can affect road network risk predictions.

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
	Maintain accurate records of road work	Failure to record such work increases the amount of uncertainty for planners.
	Integrated infrastructure planning, aligning road-related life cycle activities with the needs of underground infrastructure	Not aligning road-related activities with underground infrastructure can result in duplicating road work.
Asset Acquisition / Procurement / Construction	Follow Township Procurement Policy	Failure to follow the procurement policy may result in loss of competitive advantages and funding.
	Assumption of planned subdivisions, local improvements, and commercial and industrial expansions	Assumption of poorly designed and constructed roads may leave the Township with unexpected costs in the medium to long term. Poor road design may require substantial, complex work to correct or leave the Township with a substandard asset in perpetuity.
	Ensure staff is trained to manage new or newly reconstructed assets	Failure to provide training will result in shortening our asset's useful service life.
Asset Maintenance Activities	Regrading (Gravel Roads)	Surface can become dangerously rough and surface runoff may form gullies and potholes that quickly erode the surface and sub layers.
	Application of calcium (Gravel Roads)	Can cause excessive dust, greater loss of aggregate and a reduction in the safety of the travelling public.
	Application of fresh granular material (Gravel Roads)	Loose-top surfaces lose aggregate over time and essentially become an earth road if not maintained.
	Annual spring road sweeping in urban areas	Can result in the community looking unkept and affects storm resiliency if materials plug up ditches, culverts, storm drains.
	Snow and ice removal – plowing and application of salt/grit	Customer dissatisfaction, disruption of traffic, delayed emergency services.
	Removal of winter sand berms	Can result in pseudo-ditches that either impede drainage or cause erosion of the road embankment.
	Cold patching	Potholes that can be serious liabilities.
	Line markings and other road paint	Unclear and unsafe travelling conditions.

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
	Tree trimming and other roadside activities	Can cause obstructed roadways and can shade the road in the winter, interfering with de-icing activities.
Asset Renewal and Replacement	Route and seal	Can allow moisture into the granular base and accelerate aging, especially due to freezing and thawing.
	Section repairs (minor reconstruction)	Can result in poor sections of a road that is otherwise in good condition.
	Slurry seal/Microsurfacing	Not performing these activities can allow assets to reach the end of their useful life faster. In addition, no further action can take place until the road becomes a candidate for major reconstruction.
	Road resurfacing	
	Partial-depth reconstruction	– Increased liability due to undesired driving conditions. – Increased maintenance requirements resulting in service disruption. – Increased life cycle costs if activities are wrongfully carried out, or if they are carried out of sequence.
	Full-depth reconstruction	
Asset Decommissioning and Disposal	Reclaimed asphalt and granular materials in the road base during reconstruction	Improper disposal can lead to unwanted environmental impacts and unforeseen/ unnecessary expenses.

To date, the Township has made it their goal to have road conditions assessed every 5 years. Recent assessments include one in 2011, one in 2016, and another at the end of 2021. Prior to 2021, these projects had included 10-year capital plans on road needs. These recommendations have been followed as closely as possible depending on the approved capital budget for each year. The 2021 condition assessment has also included a 10-year capital plan that will be used in conjunction with the Township's newly acquired asset management software and the Township's annual budget to come up with the optimal road program.

Description of Maintenance Activities

Regular road maintenance activities conducted at the Township include biweekly road patrols as per the MMS, annual spring sweeping of urban roads, cold patching, tree trimming, the application and reapplication of line markings and other road paint and snow removal and salt and grit application as required during the winter season. Gravel roads are regraded at least twice per year and calcium is applied in late spring or early summer. Each section of gravel road gets a fresh, 50mm layer of granular

material applied to it every 3 years as well. Other road maintenance activities are performed as required.

Description of Rehabilitation and Replacement Activities

The Township performs section repairs on an annual basis in locations where small road sections are in bad shape. This includes the cutting and removal of asphalt, the addition of new granular materials, regrading, and fresh paving. Crack sealing and road resurfacing are two activities that have been done in the past, but more focus should be put on them in the future when surfaces initially begin to show distress. These activities are important in maintaining the optimal life cycle of a road surface. In recent years, large portions of the roads capital budget has gone into partial or full-depth reconstructions with reinstatement of surface treatment in rural areas and high class bitumen in urbanized areas. Money can be saved by treating hard-top surfaces with appropriate activities at the right time to prolong their lifespan.

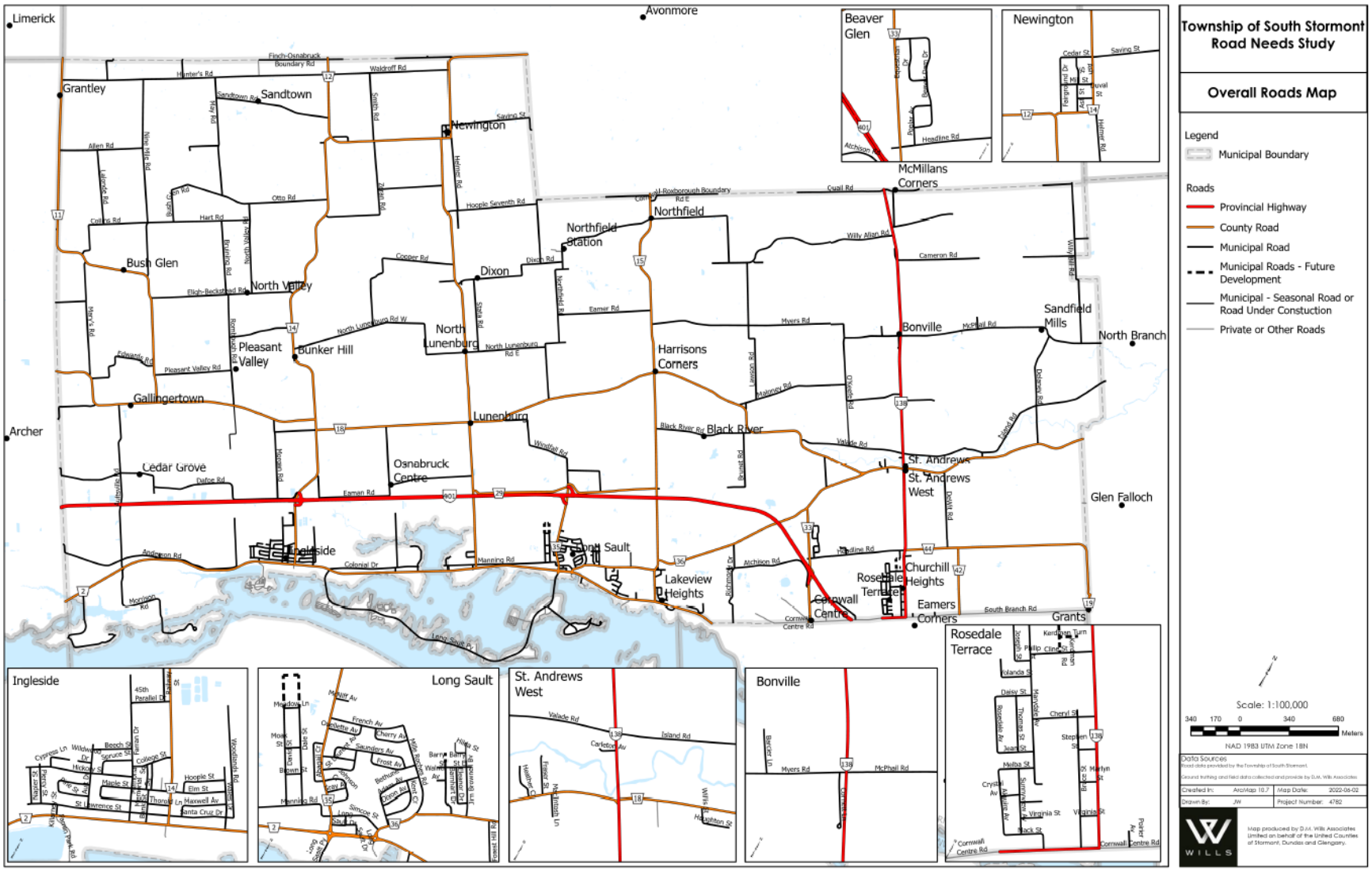


Figure 19: Map of the Road Network in the Township and Its Level of Connectivity

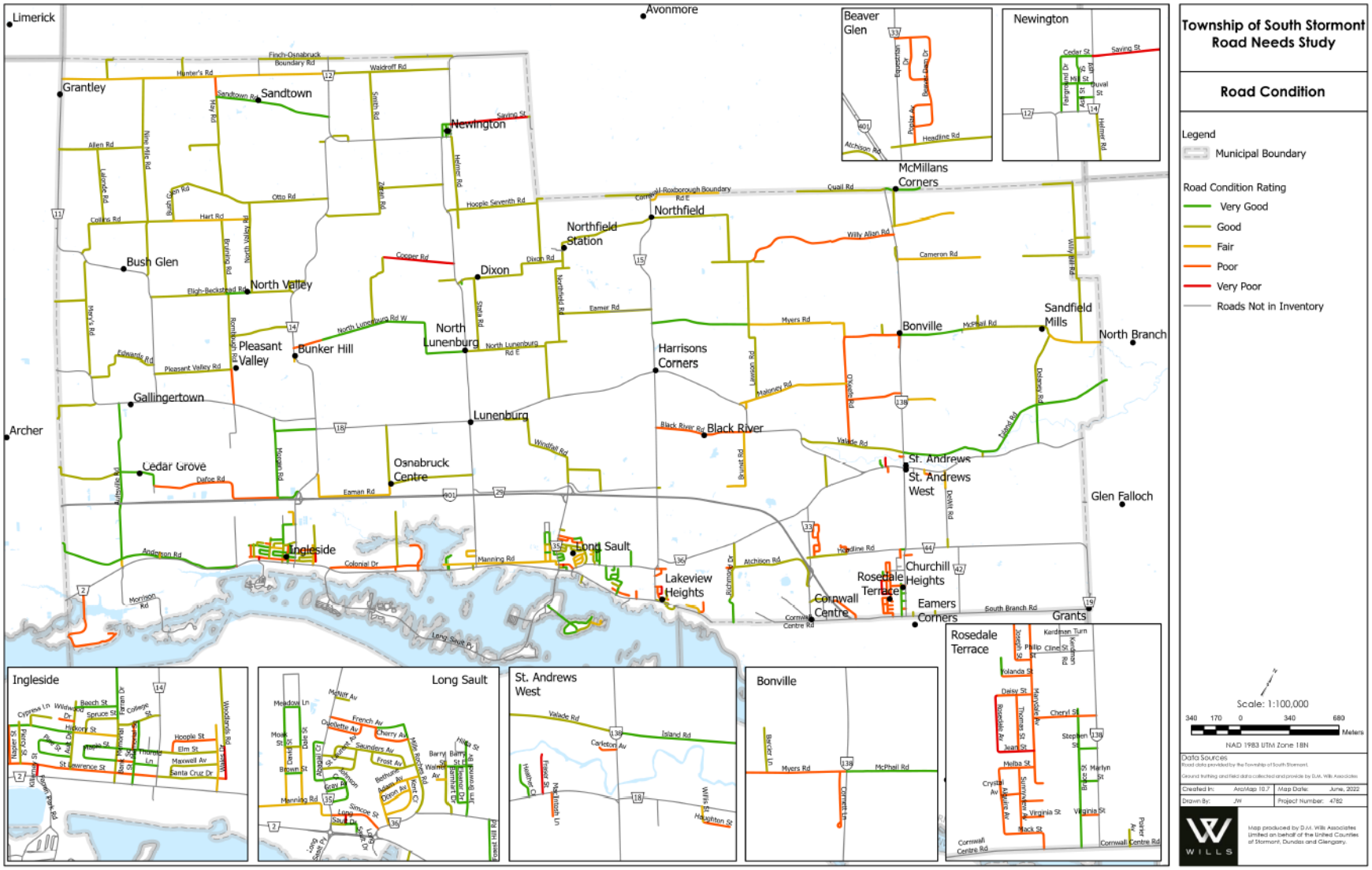


Figure 20: Map of the Road Network in the Township and Its Condition Rating

Appendix B: Structures

B.1. Introduction

This service division exists within the road network and contributes to providing reliable, convenient, and seamless travel across the Township and easy access to the neighbouring Townships' and United Counties of SDG road networks. Structures are crucial in connecting roads otherwise separated by environmental barriers such as drains, streams, and other waterways as well as man-made barriers like highways and railways. Structures include bridges and major culverts that help alleviate some of the layout and orientational challenges listed above.

The Township's system of bridges and culverts realizes more maintenance and rehabilitation than growth as developers often look to avoid barriers that require structures when possible. Public Works employees and contracted staff perform regular visual and structural inspections and road patrolling to ensure that all structures within the roads are meeting service expectations.

B.2. State of the Infrastructure

B.2.1. Inventory Overview

Within the Township's road network exists 21 structures requiring biennial inspections as per the Ontario Structure Inspection Manual (OSIM) program. A total of 1,839 square metres of plan surface area was evaluated. This includes a total of 9 bridges and 12 culverts with a span of 3 metres or greater. The Township's structure inventory can be broken down into the following hierarchy, as presented in Table 27.

Table 27: Structure Inventory Hierarchy

Service Area	Service Division	Asset Class/Component
Roads and Transportation	Structures	Bridge
		Culvert

The Township's bridges consist mainly of concrete frames and slabs while the culverts consist of a mix of concrete boxes and corrugated steel pipes (CSP). A summary of these assets is presented in Table 28.

Table 28: Asset Inventory (Structures)

Asset Type	Asset	Inventory	Unit
Structure	Bridge	9	ea.
	Concrete Box Culvert	3	ea.
	CSP Culvert	9	ea.

B.2.2. Asset Valuation

The total value of the structures on a full-replacement basis in 2021 dollars is $13,348,000. Values were obtained from the 2021 Biennial Structure Inspection Program. Table 29, presented below, provides a summary of replacement cost values.

Table 29: Replacement Cost Values (Structures)

Asset Type	Asset	Replacement Value ($)	% of Total
Structure	Bridge	8,731,000	65.4
	Concrete Box Culvert	1,230,000	9.2
	CSP Culvert	3,387,000	25.4
Total		**13,348,000**	**100**

B.2.3. Asset Age

The structure inventory ranges in age from new to 71 years old. The average age is 31.3 years largely due to the fact that 7 structures (33% of the total) have been replaced in the last 15 years. As design standards continually improve, so will the estimated services lives which will allow the Township's structures' average age to get older while being able to provide the same level of customer service. A summary of the average age of Township's structures as a proportion of their average useful lives is presented in Figure 21.

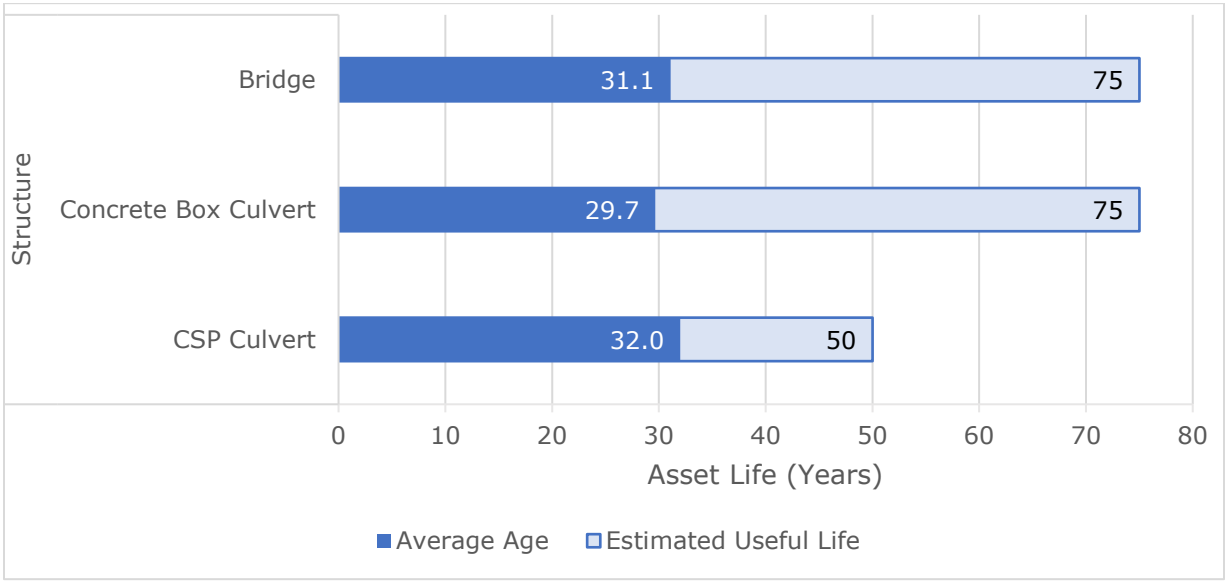


Figure 21: Average Asset Age as a Proportion of Average Useful Life (Structures)

B.2.4. Asset Condition

Assets can be described as very good to very poor depending on a variety of factors. The condition of bridges and structural culverts is based on the Bridge Condition Index (BCI) as outlined by the MTO. This index has a scale that goes from 0-100 that represents the remaining economic worth of a structure.

The condition rating scale for Township structures is illustrated in Table 30.

Table 30: Condition Rating Scale (Structures)

Descriptive Ratings	BCI	Qualitative Description
Very Good	85-100	The asset is fit for the future as it is new or recently rehabilitated. There are few to no signs of deterioration and only regular, minor maintenance is required including sweeping, regular inspections, and winter control.
Good	70-84	The asset's condition is good, and it is fit for use in the long term. Concrete may begin cracking and spalling and expansion joints and guide rail may begin to show signs of distress. Major maintenance activities should commence on top of regular work to resolve these issues.
Fair	60-69	The asset is in fair condition and begins requiring more serious attention. Signs of deterioration may be evident in critical components of the sub and/or superstructure. Rehabilitation should be considered such as structural reinforcement and deck replacement to extend the life cycle of the asset.
Poor	40-59	The asset is in poor condition and there is an increased potential of affecting service. The sub and/or superstructures demonstrate obvious deterioration. Structural rehabilitation is not only recommended but required. In some cases, full structure replacement may be the only option.
Very Poor	0-39	The asset is in very poor condition and is unfit for sustained service. There are widespread signs of advanced deterioration in crucial structural components. Full and complete structure replacement is the only option.

Township structures were inspected as part of the 2021 OSIM Program where conditions were analyzed. A total of 57.1% of the inspected structures have a BCI greater than 70. The remaining structures have BCI values between 54.7 and 70. The Township is 22.9% behind the Ministry of Transportation's (MTO) goal of maintaining at least 80% of its structures with a BCI greater than or equal to 70. The average condition ratings are presented in Figure 22 below. The asset condition detail (replacement cost weighted) of the Township's structures is presented in Figure 23.

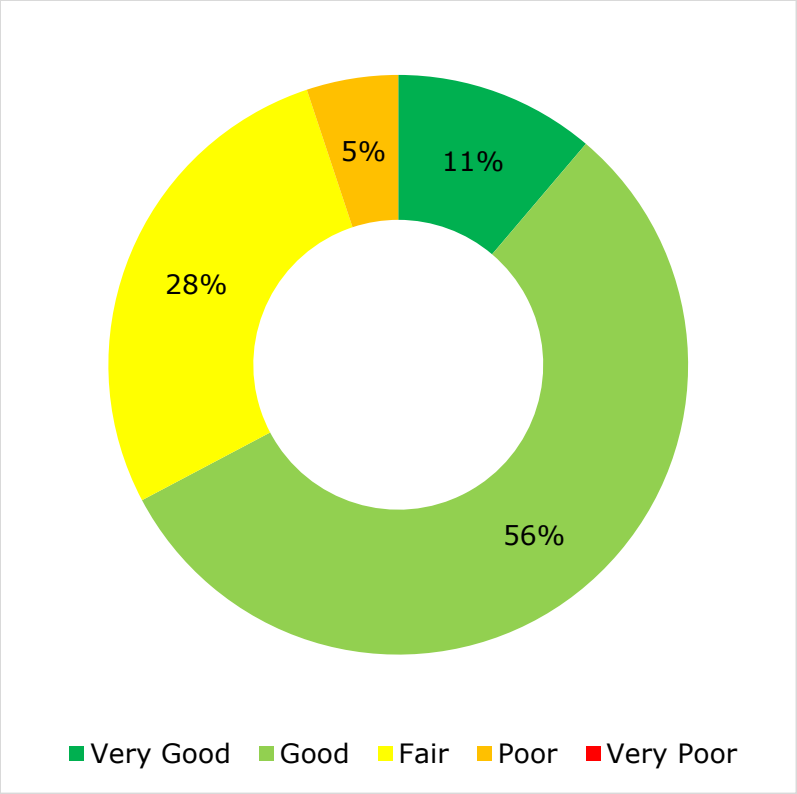


Figure 22: Asset Condition Summary (Structures)

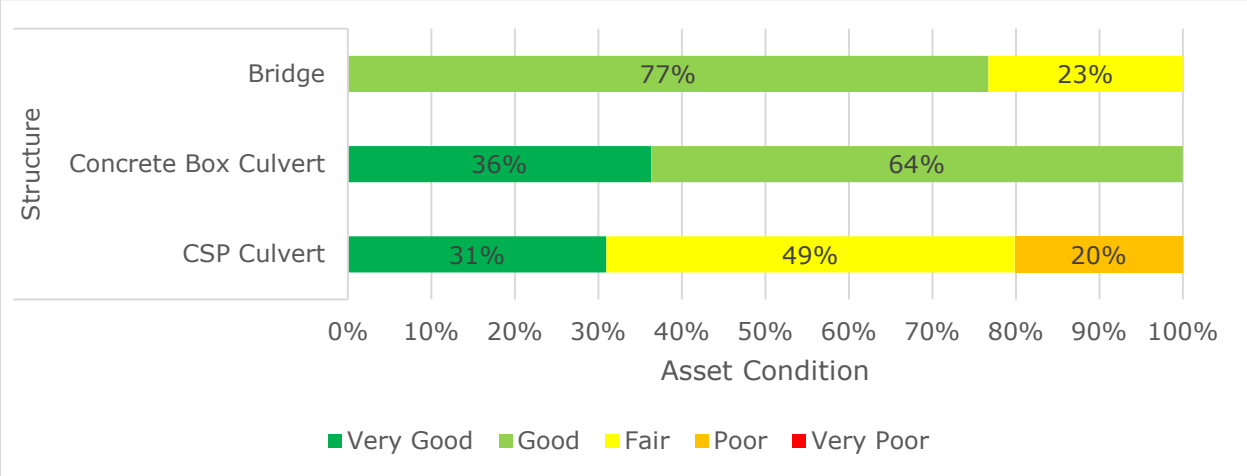


Figure 23: Asset Condition Detail (Structures)

B.3. Levels of Service

B.3.1. O. Reg. 588/17 Levels of Service Metrics

O. Reg. 588/17 refers to Customer LOS as 'Community LOS' and outlines these LOS as qualitative descriptions for core assets. Community LOS use qualitative descriptions to describe the scope or quality of service delivered by an asset category. O. Reg. 588/17 also requires legislated technical LOS for core assets. Technical LOS use metrics to measure the scope or quality of service being delivered by an asset category.

Table 31 lists the performance measures that are included in the O. Reg. 588/17 requirements for Structures assets. References are provided to show where O. Reg. 588/17 requirements have been attained:

Table 31: Levels of Service Metrics - O. Reg. 588/17 (Structures)

Service Attribute	Customer LOS	Technical LOS
Scope	Description of the traffic that is supported by municipal bridges. The Township bridges have been designed in accordance with the standard and requirements of the Bridge Design Code at the time of construction. The bridges have been designed to carry heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists. **(Figure 24)**	Percentage of bridges in the municipality with loading or dimensional restrictions. **(Table 33)**
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges. **(Table 30)**	1. For bridges in the municipality, the average bridge condition index value. **(Table 33)**
	2. Description or images of the condition of culverts and how this would affect use of the culverts. **(Table 30)**	2. For structural culverts in the municipality, the average bridge condition index value. **(Table 33)**

Other LOS performance measures are related to Customer Values. The metrics that go beyond the foundational or regulation required metrics are considered advanced. They indicate service divisions have documented planned approaches for operation and maintenance of infrastructure, and have considered trending indicators if the result is planned to be decreased, increased, or to be approximately equal in future years. Advanced metrics are listed in Table 32 and Table 33.

B.3.2. Corporate/Customer Focused Levels of Service Metrics

In setting corporate/customer performance measures, the focus is on measuring how the customer receives the service and ensuring that the Township is providing customer value. These may be qualitative or quantitative measures.

Table 32: Levels of Service Metrics – Corporate/Customer Focused (Structures)

Corporate LOS Objective	Customer LOS Measure	Current Performance	Expected Trend Based on Planned Budget
Assets are kept in good condition	Structures assets in fair or better condition	A+	→
Assets are as safe and accessible as possible throughout the year	Percentage of outstanding work orders	A+	→
Capacity meets or exceeds current demands	Adequate structural capacity to accommodate traffic volumes and loading	B+	↗
Availability of near-term financial needs	Ratio of 10-year budget to need	B+	→
Replacement Cost is held in reserve	Ratio of reserve to replacement value	F	→

B.3.3. Technical Focused Levels of Service Metrics

To deliver services that meet customer and strategic LOS, several technical measures are tracked. Technical LOS are targeted at asset users such as: office staff, operators, and maintenance staff.

Table 33: Levels of Service Metrics – Technical Focused (Structures)

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Support traffic (e.g., heavy transport vehicles) by municipal bridges	Percentage of bridges in the municipality with loading or dimensional restrictions*	44.4%	0%
Maintain a renewal schedule to ensure the majority of assets are in good condition	For bridges and culverts, average bridge condition index (BCI)*	Bridges BCI = 77.1	BCI rating is 60 or better (Fair)
		Culverts BCI = 70.9	

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
	For bridges and culverts, bridge condition index (BCI) is 60 or better	90.5%	100% of structures by count with BCI of 60 or better (Fair)
Maintain asset renewal rate	Percentage of assets beyond replacement year	0.0%	0%

*O. Reg. 588/17 LOS

B.4. Asset Management Strategy

An asset management strategy involves a set of planned actions that enables assets to provide the desired levels of service in a sustainable manner, while managing risk, at the lowest life cycle cost. An outline of these possible activities for Township structures and their associated risks is presented in Table 34.

Table 34: Life Cycle Management Activities and Associated Risks of Neglection (Structures)

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
Non-Infrastructure Solutions	Biennial OSIM inspections for structures of span 3m or more	Failure to conduct OSIM inspections could result in unnecessary spending on structures not needing as much maintenance and rehab as predicted while structures requiring more work than expected go underfunded.
	Environmental assessments	Deterioration of structures affecting the surrounding environment could happen too slowly to be recognized during road patrol.
	Review bridge components and ensure code compliance	Not keeping up to date with code requirements could put public safety at risk and result in fines.
	Visual inspections during road patrol	Neglecting to visually inspect on a regular basis could allow minor deficiencies to turn into bigger problems.
Asset Acquisition / Procurement / Construction	Follow Township Procurement Policy	Failure to follow the procurement policy may result in loss of competitive advantages and funding.
	Assumption of planned subdivisions, local improvements, and commercial and industrial expansions	Incorrect growth assessments and assumptions can lead to unnecessary spending, over or under-sized assets, and operational challenges.

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
	Ensure staff is trained to manage new or newly reconstructed assets	Failure to provide training will result in shortening our asset's useful service life.
Asset Maintenance Activities	Annual washing of bridge decks and expansion joints	May contribute to premature asset failure, service disruptions, health, and safety risks.
	Clear bushes, trees, weeds, and other debris from around the structure/guide rail	Can result in rapid deterioration of the structure.
	Spot repairs on guide rail and posts	Can result in a health and safety hazard
	Replace load posting and delineator signs	
	Clear obstructions from the channels that structures cross	Could result in flooding, undermining of structures, washouts, and environmental impacts.
Asset Renewal and Replacement	Deck replacement or overlay	– Can result in environmental harm if precautions are not taken – Obstructions/rerouting of traffic – Renewal/replacement activities may not extend asset life cycle as much as predicted, resulting in premature failure and the need for another renewal/replacement – Increased life cycle costs if activities are wrongfully carried out, or if they are carried out of sequence
	Concrete repairs	
	Waterproofing and resurfacing	
	Bearing replacement	
	Barrier wall/guide rail replacement	
Asset Decommissioning and Disposal	Structure disposal without replacement is infrequent but it would consist of complete removal of all bridge components	Permanent diversion and rerouting of traffic would be necessary.

The Biennial OSIM inspection program provides recommendations on the maintenance and capital projects that should be performed on certain structures over the next 10 years. 2-year priority reports are also provided. In the past, the Township has done its best to follow these recommendations while staying within the approved budget.

Description of Maintenance Activities

To date, annual bridge maintenance has included: the annual washing of bridge decks and expansion joints; weed trimming along guiderail and retaining walls; and the occasional replacement of signage in cases when existing signage is damaged, missing, or has failed a retro-reflectometer test. These maintenance activities will be continued while increased efforts will be focused on following the recommendations outlined in the OSIM reports and, more specifically, on clearing and maintaining bushes, trees, and other debris within proximity of the structures.

Description of Rehabilitation and Replacement Activities

Recent structure rehabilitation and replacement activities have all taken place in accordance with the OSIM recommendations. This has included the replacement of the Goldfield Road Culvert in 2018 with a polymer coated steel arch pipe, the replacement of the most westerly North Lunenburg Road West Culvert in 2020 with a pre-cast concrete box culvert and the major rehabilitation of the Valade Road Bridge in 2021 including deck replacement, new curbs and barrier system, patching repairs and associated road restoration and guide rail replacement. Planned activities include major abutment and bearing point repairs on the Shaver Road Bridge; major rehab of Red (Lefebvre Road) Bridge similar to work done on Valade; and the replacement of the Hunters Road and North Lunenburg Road West (easterly) CSP culverts with concrete box culverts.

The repairs and rehabilitation techniques listed above are crucial in helping structures reach their estimated useful lives without deteriorating too quickly, maximizing their efficiency. To be as economical as possible, special considerations are also given when determining the best replacement types for culverts. Depending on factors such as length, width, height, number of lanes and water depth, the decision between corrugated steel pipe culverts and concrete box culverts can be made to achieve the lowest life-cycle cost.

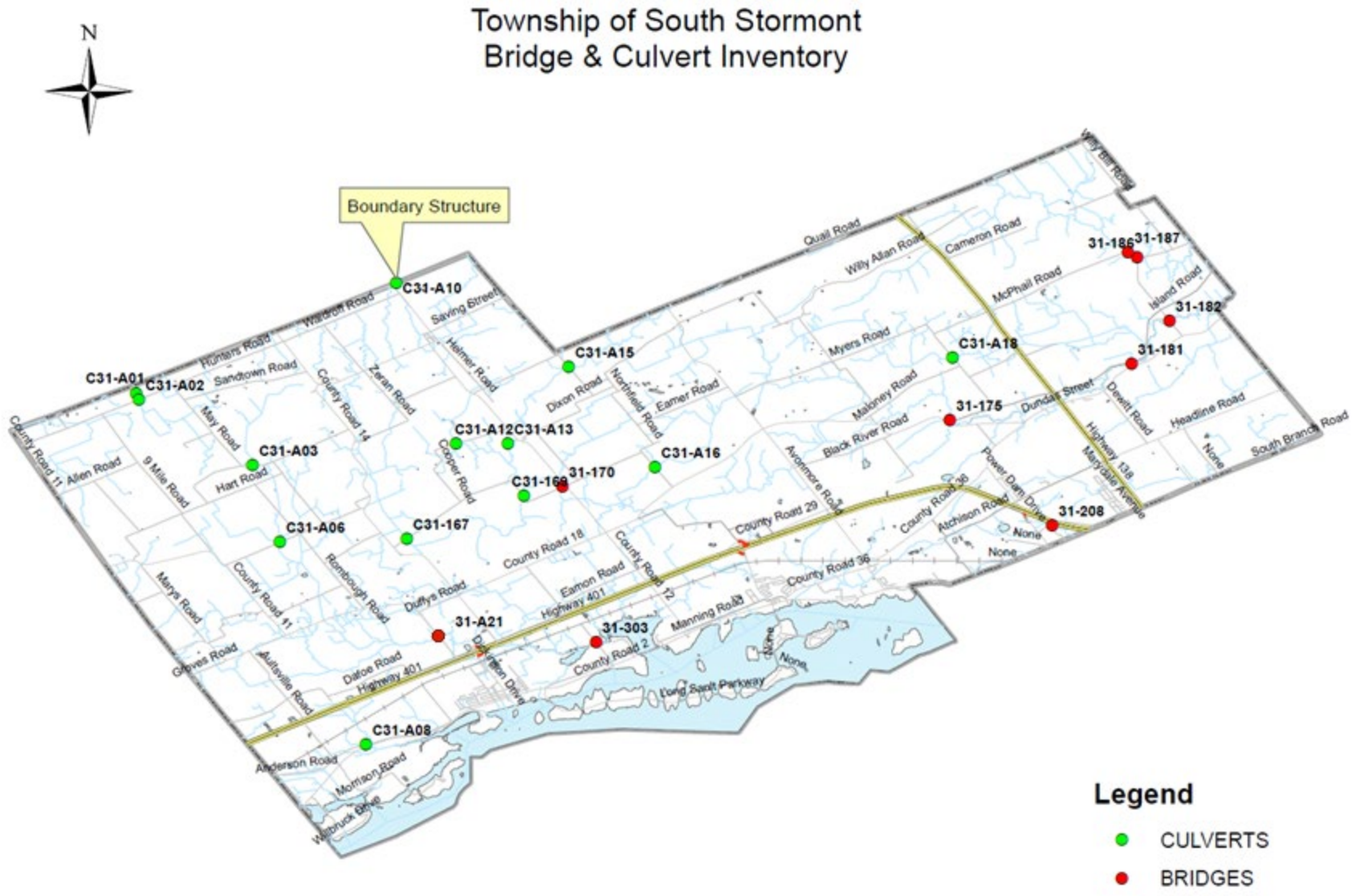


Figure 24: Map of the Bridges & Culverts in the Township

Appendix C: Stormwater Management

C.1. Introduction

Stormwater management involves a collective effort in reducing runoff caused by rain events and snow melt onto streets, private properties, and other sites of interest. There is also a large interest in preserving water quality otherwise compromised by urbanization. The Township effectively manages stormwater and protects residents, businesses, and the environment through a combination of different infrastructure. Urban cross-sectional roads consist of an underground stormwater collection system that collects water through various openings at the surface in the form of catch basins and ditch inlets. Roads of more rural nature drain water by swales and ditches. Stormwater management facilities have become a requirement for new development which helps improve water quality by allowing for sedimentation prior to the water's outlet. Public Works staff work to regularly inspect and maintain this infrastructure to do their part to protect citizens and the local natural environment.

C.2. State of the Infrastructure

C.2.1. Inventory Overview

The Township's stormwater network includes linear infrastructure such as drainage pipes, culverts, and ditches as well as catch basins, maintenance holes, ditch cleanouts, ditch inlets and stormwater management ponds. These assets can be broken down into the following hierarchy, as presented in Table 35.

Table 35: Stormwater Inventory Hierarchy

Service Area	Service Division	Asset Class/Component
Roads and Transportation	Stormwater	Drainage Pipe
		Culvert
		Ditch
		Catch Basin
		Maintenance Hole
		Ditch Cleanout
		Ditch Inlet
		Stormwater Pond

The Township's stormwater system consists of many pipe segments ranging in material types such as concrete, CSP, polyethylene (PE), plastic, polyvinyl chloride (PVC), steel, and tile. A summary of the Township's stormwater asset inventory is presented in Table 36.

Table 36: Asset Inventory (Stormwater Management)

Asset Type	Asset	Inventory	Unit	% of Total
Linear	Drainage Pipe (Diameter<450mm)	7.40	km	47.7
	Drainage Pipe (Diameter>=450mm-1500mm)	8.10	km	52.3
	Sub-Total	**15.50**	**km**	**100**
	Culvert (Diameter<450mm)	2.30	km	36.5
	Culvert (Diameter>=450mm-1500mm)	3.50	km	55.6
	Culvert (Diameter>1500mm)	0.30	km	4.8
	Culvert (Rectangle)	0.30	km	4.8
	Sub-Total	**6.30**	**km**	**100**
	Ditch	582.00	km	100
Appurtenances	Catch Basin	254	ea.	-
	Maintenance Hole	104	ea.	-
	Ditch Cleanout	23	ea.	-
	Ditch Inlet	111	ea.	-
Facility	Stormwater Pond	8	ea.	-

C.2.2. Asset Valuation

The replacement value of the entire stormwater network in 2021 dollars is $71,118,000. Note that all total replacement values in this section are rounded to the nearest thousand. Table 37, presented below, provides a summary of replacement cost values. These replacement values are based on unit rates provided to the Township by a hired consultant.

Table 37: Replacement Cost Values (Stormwater Management)

Asset Type	Asset	Replacement Value ($)	% of Total
Linear	Drainage Pipe (Diameter<450mm)	8,940,000	12.6
	Drainage Pipe (Diameter>=450mm-1500mm)	15,168,000	21.3
	Culvert (Diameter<450mm)	3,136,000	4.4
	Culvert (Diameter>=450mm-1500mm)	7,616,000	10.7
	Culvert (Diameter>1500mm)	2,218,000	3.1
	Culvert (Rectangle)	886,000	1.2
	Ditch	29,086,000	40.9
Appurtenances	Catch Basin	949,000	1.3
	Maintenance Hole	1,044,000	1.5
	Ditch Cleanout	18,000	0.1
	Ditch Inlet	242,000	0.3
Facility	Stormwater Pond	1,820,000	2.6
Total		**71,118,000**	**100**

C.2.3. Asset Age

The age of Township stormwater assets was able to be determined for all components except for all roadside ditches and some road crossing culverts. Even though exact in-service dates are difficult to determine, Township ditches have required many instances of regrading and cleaning out over the years. Knowing that CSP culverts have estimated useful lives of approximately 52 years, it would be safe to assume that culverts with unknown ages would not be older than this number – especially since culverts are normally replaced along with the reconstruction of municipal roads.

The Township's stormwater infrastructure with known ages date back to 1958 when the new towns of Ingleside and Long Sault were established to accommodate the flooding of the St. Lawrence Seaway. This includes drainage pipes, catch basins, and other appurtenances. As the years progressed, there was a slow increase in the number of stormwater assets as the villages expanded. More recently, environmental regulations have mandated the implementation of stormwater management facilities for new developments. This reflects in the stormwater pond average age of 7.3 years. A summary of the average age of Township's stormwater assets as a proportion of their average useful lives is presented in Figure 25.

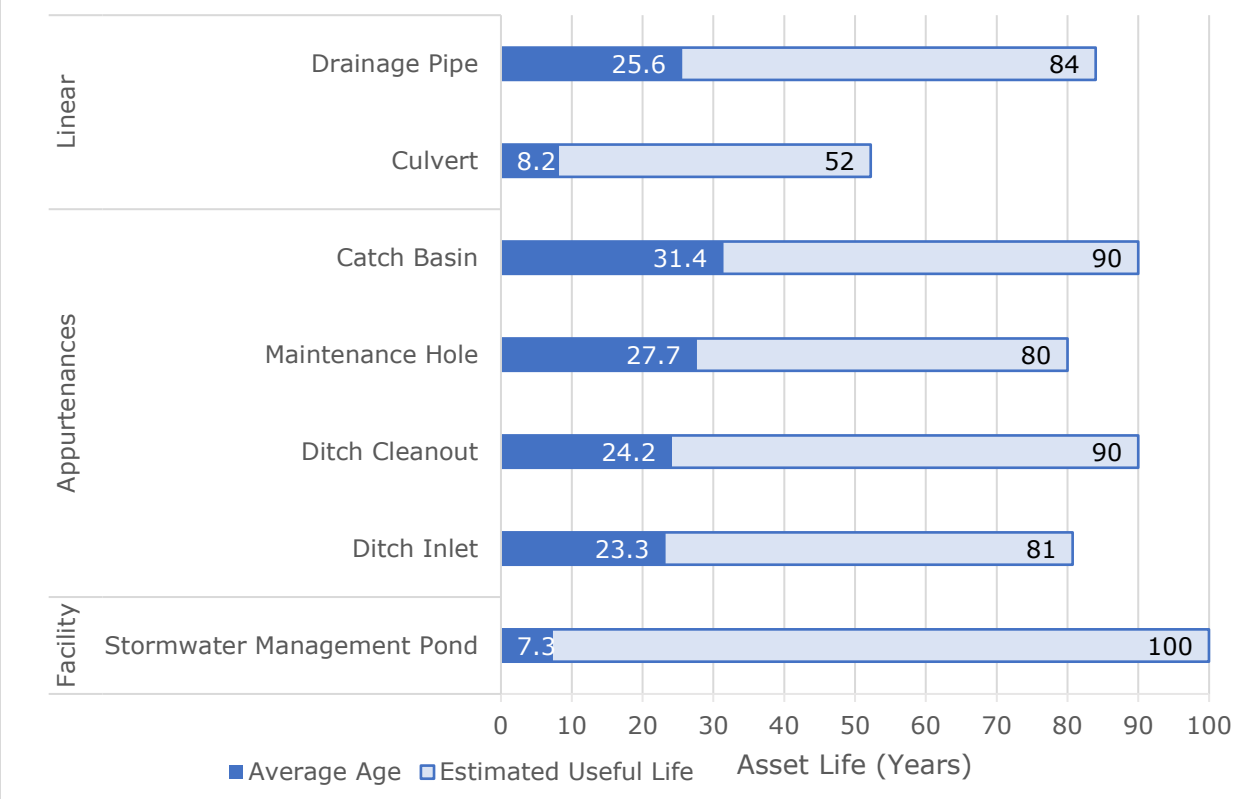


Figure 25: Average Asset Age as a Proportion of Average Useful Life (Stormwater Management)

C.2.4. Asset Condition

Assets can be described as very good to very poor depending on a variety of factors. Since no field assessments were made as part of the 2022 Stormwater Asset Management plan, the condition of stormwater assets was calculated based on age. The methodology used consisted of a desktop model that included a two-parameter Weibull distribution. This scale goes from 0-100 and also represents asset reliability. The logic of using this method lies in the fact that these types of assets typically perform their intended function up until, or past, their useful service lives barring unusual circumstances.

The condition rating scale for Township stormwater assets is presented in Table 38.

Table 38: Condition Rating Scale (Stormwater Management)

Descriptive Ratings	Condition	Qualitative Description
Very Good	88-100	The asset is fit for the future as it is new or recently rehabilitated. There are few to no signs of deterioration and only regular, minor maintenance is required including monitoring, regular inspections, cleaning and flushing.
Good	69-87	The asset's condition is good, and it is fit for use in the long term. Stormwater assets may begin to show minor distresses and inconsistencies. Major maintenance activities such as patching maintenance holes and replacing small pipe sections should commence on top of regular work to resolve these issues.
Fair	55-68	The asset is in fair condition and begins requiring more serious attention. Signs of deterioration may be evident in critical components of the network. Rehabilitation should be considered such as structural lining to extend the life cycle of the asset.
Poor	37-54	The asset is in poor condition and there is an increased potential of affecting service. The network demonstrates obvious deterioration. Rehabilitation is not only recommended but required. In some cases, renewal or replacement may be the only option. Open channels and stormwater ponds are still operating but not very effectively.
Very Poor	0-36	The asset is in very poor condition and is unfit for sustained service. There are widespread signs of advanced deterioration in crucial components of the network. Full and complete replacement is required on items such as pipes and structures. Open channels and stormwater ponds require dredging.

The average age-based condition ratings of stormwater assets calculated using the Weibull distribution are summarized in Figure 26. As demonstrated, approximately 80% of the Township's assets are in a condition state of "Fair" or better. The asset condition detail (replacement cost weighted) of the Township's stormwater assets is

presented in Figure 27. Both figures exclude asset conditions of ditches and stormwater ponds.

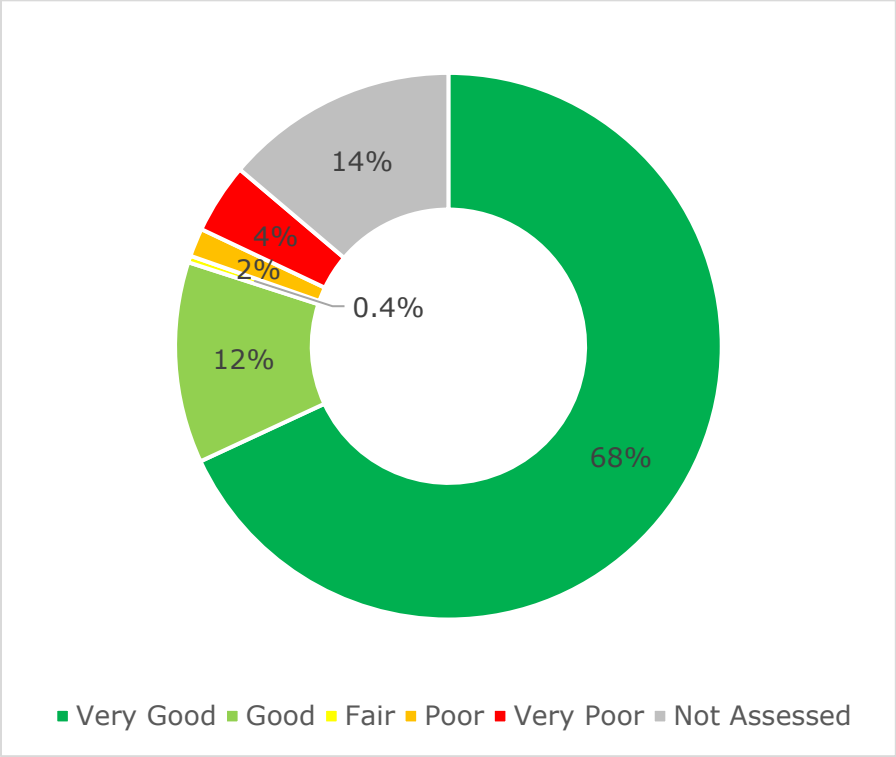


Figure 26: Asset Condition Summary (Stormwater Management)

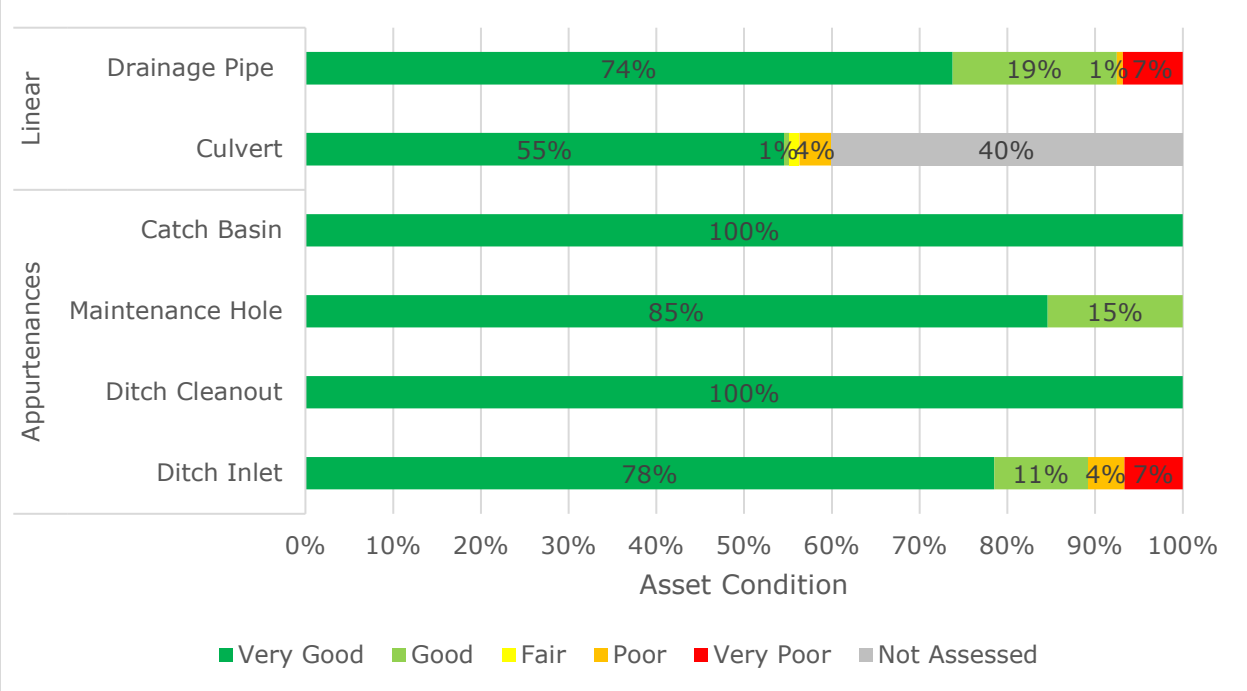


Figure 27: Asset Condition Detail (Stormwater Management)

C.3. Levels of Service

C.3.1. O. Reg. 588/17 Levels of Service Metrics

O. Reg. 588/17 refers to Customer LOS as 'Community LOS' and outlines these LOS as qualitative descriptions for core assets. Community LOS use qualitative descriptions to describe the scope or quality of service delivered by an asset category. O. Reg. 588/17 also requires legislated technical LOS for core assets. Technical LOS use metrics to measure the scope or quality of service being delivered by an asset category.

Table 39 lists the performance measures that are included in the O. Reg. 588/17 requirements for Stormwater assets. References are provided to show where O. Reg. 588/17 requirements have been attained:

Table 39: Levels of Service Metrics - O. Reg. 588/17 (Stormwater Management)

Service Attribute	Customer LOS	Technical LOS
Scope	Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system. **(Figures 28 and 29)**	1. Percentage of properties in municipality resilient to a 100-year storm. **(Table 41)**
		2. Percentage of the municipal stormwater management system resilient to a 5-year storm. **(Table 41)**

Other LOS performance measures are related to Customer Values. The metrics that go beyond the foundational or regulation required metrics are considered advanced. They indicate service divisions have documented planned approaches for operation and maintenance of infrastructure, and have considered trending indicators if the result is planned to be decreased, increased, or to be approximately equal in future years. Advanced metrics are listed in Table 40 and Table 41.

C.3.2. Corporate/Customer Focused Levels of Service Metrics

In setting corporate/customer performance measures, the focus is on measuring how the customer receives the service and ensuring that the Township is providing customer value. These may be qualitative or quantitative measures.

Table 40: Levels of Service Metrics – Corporate/Customer Focused (Stormwater Management)

Corporate LOS Objective	Customer LOS Measure	Current Performance	Expected Trend Based on Planned Budget
Assets are kept in good condition	Stormwater assets in fair or better condition	**A+**	➔
Assets are as reliable as possible throughout the year	Percentage of outstanding work orders	**D+**	➔
Capacity meets or exceeds current demands	Adequate capacity that meets the standards for the sizing of stormwater drains	**A+**	➔
Availability of near-term financial needs	Ratio of 10-year budget to need	**F**	➔
Replacement Cost is held in reserve	Ratio of reserve to replacement value	**F**	➔

C.3.3. Technical Focused Levels of Service Metrics

To deliver services that meet customer and strategic LOS, several technical measures are tracked. Technical LOS are targeted at asset users such as: office staff, operators, and maintenance staff.

Table 41: Levels of Service Metrics – Technical Focused (Stormwater Management)

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Protect user groups or areas of the municipality from flooding	Percentage of properties in municipality resilient to a 100-year storm*	Ingleside: 98.5% Long Sault: 93.7% Newington: 100% Rosedale: 82.7% St. Andrews: 65.1% **Township Overall: 89.9%**	Not Applicable
	Percentage of the municipal stormwater management system resilient to a 5-year storm*	Ingleside: 89.9% Long Sault: 96.6% Newington: 100% Rosedale: 100% **Township Overall: 93.5%**	Not Applicable

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Inspection Program Regulation	Assets undergo activities such as inspection, monitoring, cleaning and flushing	Every 5 years	Every 5 years
Protect user groups or areas of the municipality from flooding	Number of times roads closed due to flooding per year (or length of closure time)	1	0
Enhance ponds water quality treatment	Percentage of ponds with enhanced water quality treatment	100%	100%
Maintain asset renewal rate	Percentage of assets beyond replacement year	3.2%	0%

*O. Reg. 588/17 LOS

C.4. Asset Management Strategy

An asset management strategy involves a set of planned actions that enables assets to provide the desired levels of service in a sustainable manner, while managing risk, at the lowest life cycle cost. An outline of these possible activities for Township stormwater assets and their associated risks is presented in Table 42.

Table 42: Life Cycle Management Activities and Associated Risks of Neglection (Stormwater)

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
Non-Infrastructure Solutions	Acquisition of asset management software to assist with data management for the asset management plan	Without good data management, the supporting information for the asset condition and remaining useful life will be less accurate affecting the decision making in the right time to intervene.
	Development and educational program	Increased non-value adding activities due to the lack of the know-how.
	Maintain a hydraulic model of the stormwater system	The ability for the stormwater system to convey the required flow and ensure system is resilient.
	Preparation of Standard Operating Procedures	Staff are misguided resulting in inaccurate execution of activities.
	Underground stormwater infiltration system study	Potential increase of urban runoff discharging to water bodies; increasing flood risks.
Asset Acquisition / Procurement / Construction	Follow Township Procurement Policy	Failure to follow the procurement policy may result in loss of competitive advantages and funding.

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
	Ensure spares, special tools and spare parts are available	Failure to have spares, special tools and spare parts will delay in the maintenance of assets potentially shortening their useful life.
	Ensure staff is trained to manage new assets	Failure to provide training will result in shortening our asset's useful service life.
Asset Maintenance Activities	Linear – Cleaning and flushing – Closed-circuit television (CCTV) inspection	– Decrease capacity of linear assets. – Condition of the linear assets remains unknown. – Decrease structural performance.
	Non-Linear – Cleaning the system – Periodic inspection	– Decrease capacity of non-linear system. – Condition of non-linear assets remain unknown. – Decrease structural performance.
Asset Renewal and Replacement	Linear – Structural lining of sewers – Replace sewers – Spot repairs	– Increase the risk of collapse. – Decrease operational performance.
	Non-Linear – Replacements – Lining of maintenance holes	– Decrease structural performance. – Decrease operational performance.
Asset Decommissioning and Disposal	Ensure assets are disposed of in compliance with waste regulations in Ontario	Failure to dispose of assets in accordance with Ontario Regulations increases liability of the Township.

Description of Maintenance Activities

In the past, the Township's stormwater network has received minimal attention in terms of operation and maintenance activities. Towards the end of the past decade, some efforts and initiatives commenced to preserve the infrastructure in the form of annual inspections of ponds, roadside re-ditching, regular catch basin and inlet cleaning and inspection, and repairs and maintenance. Partial CCTV inspections were conducted when needed and prior to performing repairs. Comprehensive flushing of sewers began in 2021. These efforts should be continued and built upon so that permanent, regular inspection and maintenance programs for all stormwater assets are in place.

Description of Rehabilitation and Replacement Activities

Considering that much of the Township's stormwater network is relatively new, stormwater assets have required a very limited amount of rehabilitation and no

replacement. It is important that the Township begin to consider rehabilitation strategies such as structural lining to get optimal asset life cycles. As stormwater infrastructure ages, replacement activities will commence as needed.

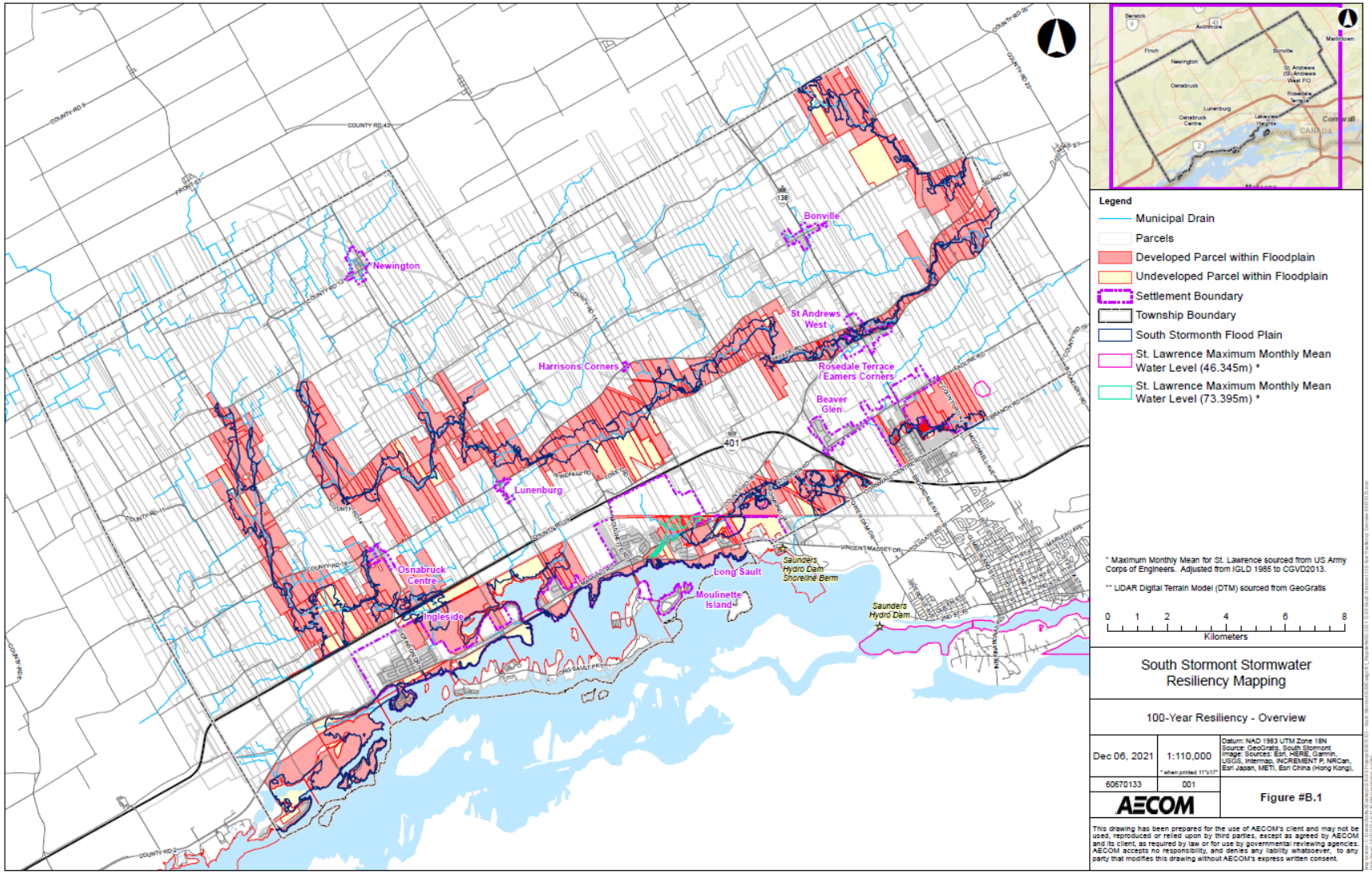


Figure 28: Map Outlining the Township Resiliency to a 100-year storm

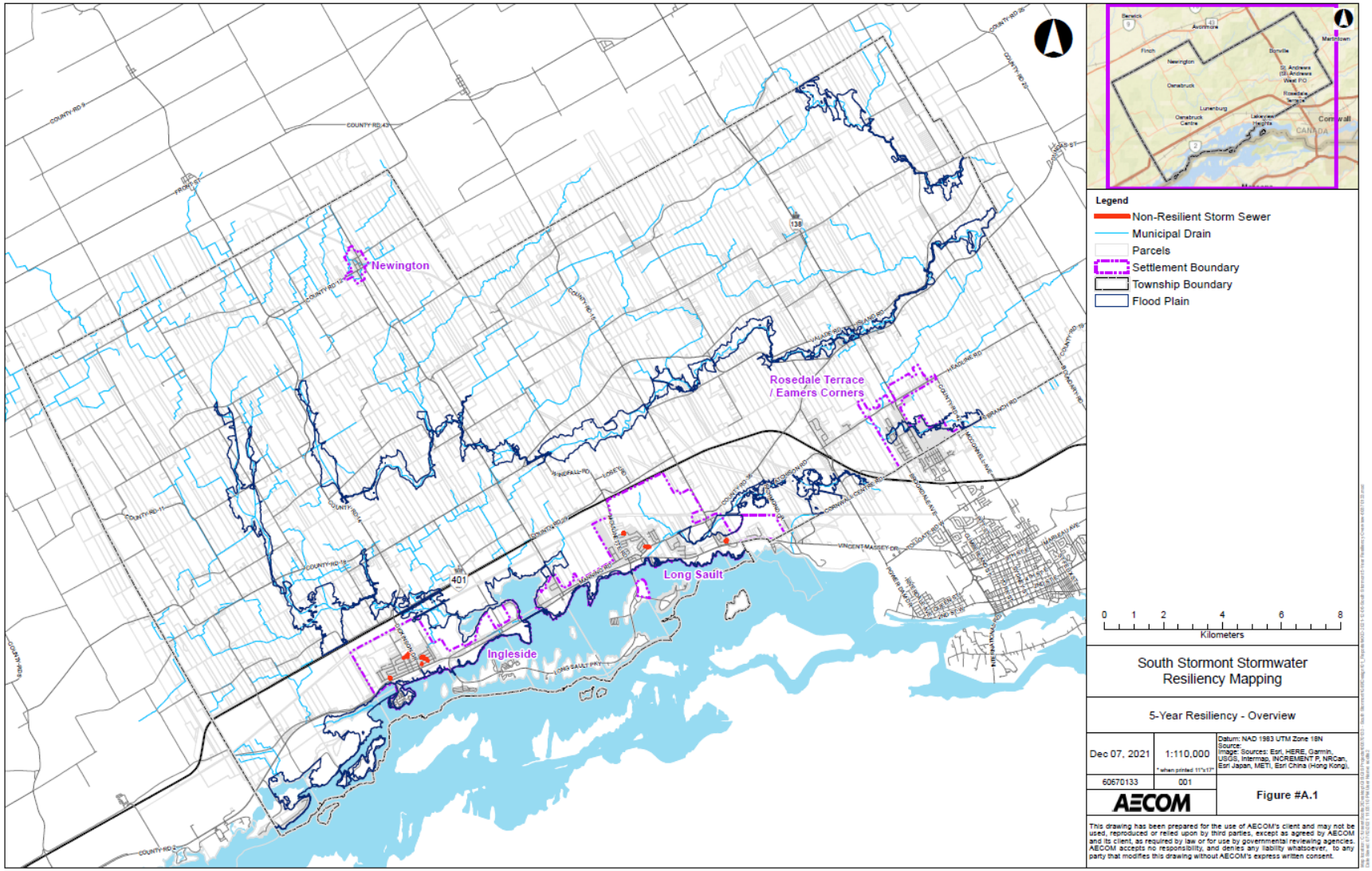


Figure 29: Map Outlining the Township Resiliency to a 5-year storm

Appendix D: Water Services

D.1. Introduction

Clean, safe, and reliable water is offered to a large portion of the Township's population. Water distribution exists and is available in much of the municipality's urban, built-up areas. This network consists of private services, local and transmission mains, valves, fire hydrants, water towers, and underground reservoirs. Common uses of the water supply include drinking, recreation, irrigation, fire protection and sanitary purposes.

Water quantity and quality is assured at the Township's water treatment plants by environmental staff. Newington's system has a source of groundwater while the Long Sault-Ingleside system draws from the St. Lawrence River. Rosedale and St. Andrews West also get their water from the St. Lawrence but are supplied by the City of Cornwall. Water booster stations exist in strategic locations to ensure sufficient pressure is maintained.

Growth of this service division is currently being experienced in the Township as new developments and subdivisions are constructed. Growth and capacity are constantly being balanced along with the ongoing need for maintenance and rehabilitation of older parts of the water system.

D.2. State of the Infrastructure

D.2.1. Inventory Overview

The Township's water network includes groundwater wells, water treatment facilities, water pumping stations, water towers, underground reservoirs, and the distribution through underground watermains as well as other appurtenances such as valves and hydrants. The Township's water assets can be broken down into the following hierarchy, as presented in Table 43.

Table 43: Water Services Inventory Hierarchy

Service Area	Service Division	Asset Class/Component
Water	Distribution	Watermain
		Water Valve
		Fire Hydrant
		Water Tower
		Underground Reservoir
	Treatment	Water Pumping Station
		Water Treatment Plant
		Groundwater Well

The Township's water distribution system consists of many pipe segments ranging in material types such as ductile iron (DI), PE, PVC, and Series 100 polyethylene. A summary of the Township's water asset inventory is presented in Table 44.

Table 44: Asset Inventory (Water Services)

Asset Type	Asset	Inventory	Unit	% of Total
Linear	38mm Watermains	0.39	km	0.4
	75mm Watermains	3.75	km	4.0
	150mm Watermains	37.33	km	40.0
	200mm Watermains	27.02	km	28.9
	250mm Watermains	5.01	km	5.4
	300mm Watermains	6.42	km	6.9
	400mm Watermains	13.42	km	14.4
	600mm Watermains	0.09	km	0.1
	Total	**93.43**	**km**	**100**
Appurtenances	Water Valves	927	ea.	-
	Fire Hydrants	461	ea.	-
Facilities	Water Towers	2	ea.	-
	Underground Reservoirs	3	ea.	-
	Water Pumping Stations	3	ea.	-
	Water Treatment Plants	2	ea.	-
	Groundwater Wells	2	ea.	-

D.2.2. Asset Valuation

The replacement value of the entire water network in 2021 dollars is $67,104,000. Note that all total replacement values in this section are rounded to the nearest thousand. Table 45, presented below, provides a summary of replacement cost values. It is important to note that the values of Township owned groundwater wells and underground reservoirs have been captured within the facility they reside at. A breakdown of the unit costs was used to determine the total overall value. Best engineering and approximation practices were used to come up with the unit rates.

Table 45: Replacement Cost Values (Water Services)

Asset Type	Asset	Replacement Value ($)	% of Total
Linear	DI Watermains	17,687,000	26.4
	PE Watermains	286,000	0.4
	PVC Watermains	19,424,000	28.9
	Series 100 Watermains	591,000	0.9

Asset Type	Asset	Replacement Value ($)	% of Total
Appurtenances	Water Valves	2,917,000	4.3
	Fire Hydrants	3,724,000	5.5
Facilities	Water Towers	3,613,000	5.4
	Underground Reservoirs	-	-
	Water Pumping Stations	3,571,000	5.3
	Water Treatment Plants	15,291,000	22.8
	Groundwater Wells	-	-
Total		**67,104,000**	**100**

D.2.3. Asset Age

The Township's water network dates back to 1958 when the new towns of Ingleside and Long Sault were established to accommodate the flooding of the St. Lawrence Seaway. Although the water system has seen upgrades and additions over the years, much of the existing infrastructure was installed at the same time resulting in much of the infrastructure being the same age. A similar situation occurred in 1991 when the Rosedale Terrace subdivision was constructed including a water system fed by the City of Cornwall. It was extended northerly as far as St. Andrews West, which resulted in another large portion of the water system being the same age. A summary of the average age of Township's water assets as a proportion of their average useful lives is presented in Figure 30.

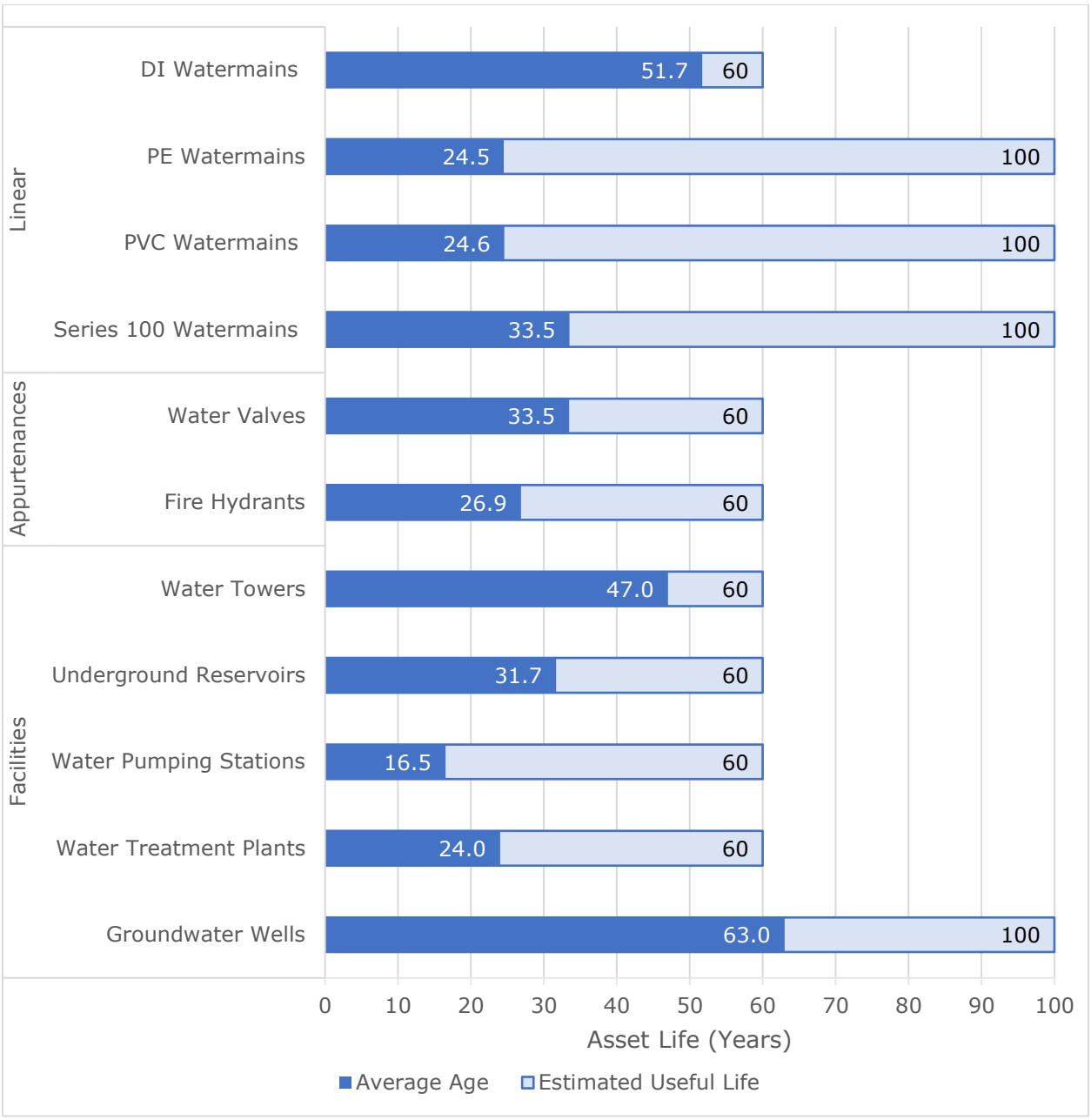


Figure 30: Average Asset Age as a Proportion of Average Useful Life (Water Services)

D.2.3. Asset Condition

Assets can be described as very good to very poor depending on a variety of factors. Since no field assessments were made for any water service assets, their conditions were calculated using an age-based method. As a rule, the newer the asset, the better its condition. This is the methodology utilized for the Township's water network. The age-based scale goes from 0-100, as illustrated in Table 46.

Table 46: Condition Rating Scale (Water Services)

Descriptive Ratings	Condition	Qualitative Description
Very Good	81-100	The asset is fit for the future as it is new or recently rehabilitated. There are few to no signs of deterioration and only regular, minor maintenance is required including monitoring, regular inspections, cleaning and flushing, and pressure tests.
Good	61-80	The asset's condition is good, and it is fit for use in the long term. Water assets may begin to show minor distresses and inconsistencies. Major maintenance activities such as repairing water main breaks, valves, and hydrants and small pipe section replacements should commence on top of regular work to resolve these issues.
Fair	41-60	The asset is in fair condition and begins requiring more serious attention. Signs of deterioration may be evident in critical components of the network. Rehabilitation should be considered such as structural lining and cathodic protection to extend the life cycle of the asset.
Poor	21-39	The asset is in poor condition and there is an increased potential of affecting service. The network demonstrates obvious deterioration. Rehabilitation is not only recommended but required. In some cases, renewal or replacement may be the only option.
Very Poor	0-20	The asset is in very poor condition and is unfit for sustained service. There are widespread signs of advanced deterioration in crucial components of the network. Full and complete replacement is required on items such as pipes and appurtenances.

The average age-based condition ratings for the Township's water services are presented in Figure 31 below. The asset condition detail (replacement cost weighted) is presented in Figure 32.

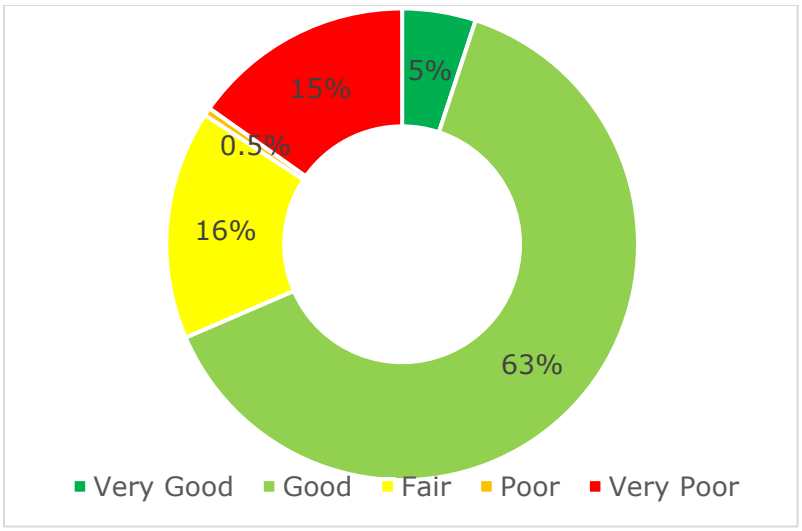


Figure 31: Asset Condition Summary (Water Services)

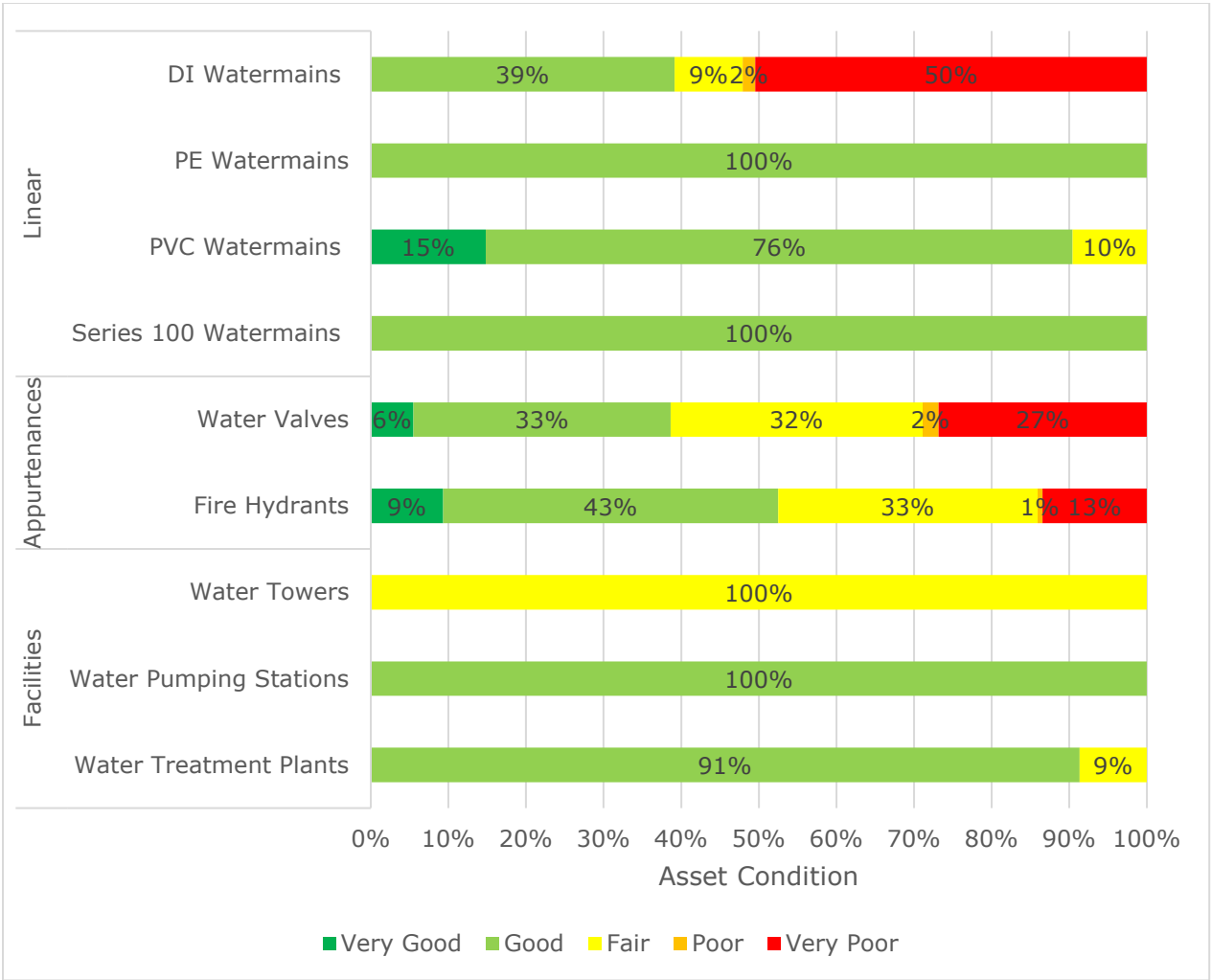


Figure 32: Asset Condition Detail (Water Services)

D.3. Levels of Service

D.3.1. O. Reg. 588/17 Levels of Service Metrics

O. Reg. 588/17 refers to Customer LOS as 'Community LOS' and outlines these LOS as qualitative descriptions for core assets. Community LOS use qualitative descriptions to describe the scope or quality of service delivered by an asset category. O. Reg. 588/17 also requires legislated technical LOS for core assets. Technical LOS use metrics to measure the scope or quality of service being delivered by an asset category.

Table 47 lists the performance measures that are included in the O. Reg. 588/17 requirements for Water assets. References are provided to show where O. Reg. 588/17 requirements have been attained:

Table 47: Levels of Service Metrics - O. Reg. 588/17 (Water Services)

Service Attribute	Customer LOS	Technical LOS
Scope	1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system. **(Figure 33)**	1. Percentage of properties connected to the municipal water system. **(Table 49)**
	2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow. **(Figure 33)**	2. Percentage of properties where fire flow is available. **(Table 49)**
Reliability	Description of boil water advisories and service interruptions. One boil water advisory during the 2021 calendar year due to the loss of pressure in the Ingleside water system. A negative system pressure can potentially allow contaminants into the network. System interruptions typically occur due to watermain breaks to facilitate their repair. These are tracked and recorded by the Township in terms of their duration and number of customers affected.	1. The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system. **(Table 49)**
		2. The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system. **(Table 49)**

Other LOS performance measures are related to Customer Values. The metrics that go beyond the foundational or regulation required metrics are considered advanced. They indicate service divisions have documented planned approaches for operation and maintenance of infrastructure, and have considered trending indicators if the result is planned to be decreased, increased, or to be approximately equal in future years. Advanced metrics are listed in Table 48 and Table 49.

D.3.2. Corporate/Customer Focused Levels of Service Metrics

In setting corporate/customer performance measures, the focus is on measuring how the customer receives the service and ensuring that the Township is providing customer value. These may be qualitative or quantitative measures.

Table 48: Levels of Service Metrics – Corporate/Customer Focused (Water Services)

Corporate LOS Objective	Customer LOS Measure	Current Performance	Expected Trend Based on Planned Budget
Assets are kept in good condition	Water assets in fair or better condition	**B+**	➔
Assets are as reliable as possible throughout the year	Percentage of outstanding work orders	**A+**	➔
Capacity meets or exceeds current demands	Ratio of current demand (average day)/current capacity	**A+**	➔
	Ratio of current demand (max day)/current capacity	**A+**	➔
Availability of near-term financial needs	Ratio of 10-year budget to need	**F**	➔
Replacement Cost is held in reserve	Ratio of reserve to replacement value	**D+**	➔

D.3.3. Technical Focused Levels of Service Metrics

To deliver services that meet customer and strategic LOS, several technical measures are tracked. Technical LOS are targeted at asset users such as: office staff, operators, and maintenance staff.

Table 49: Levels of Service Metrics – Technical Focused (Water Services)

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Maintain user groups or areas of the municipality connected to the municipal water system	Percentage of properties connected to the municipal water system*	84.5%	Not Applicable
Maintain having fire flow to user groups or areas of the municipality	Percentage of properties where fire flow is available*	80.7%	Not Applicable
Maintain overall quality and reliability of the water supply and distribution system	Number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system*	0.001	Not Applicable
Maintain Ontario Clean Drinking Water standard	Percentage of samples that met Ontario Drinking Water Standard per year	99.4%	100%
Alignment with service delivery and customer expectations	Number of water quality customer complaints per year	1	None
Maintain sufficient capital re-investment in system and measure overall reliability of the system	Number of connection-days per year where water is not available due to water main breaks compared to the total number of properties connected to the municipal water system*	0.000	Not Applicable
Maintain asset renewal rate	Percentage of assets beyond replacement year	24.2%	0%

*O. Reg. 588/17 LOS

D.4. Asset Management Strategy

An asset management strategy involves a set of planned actions that enables assets to provide the desired levels of service in a sustainable manner, while managing risk, at the lowest life cycle cost. An outline of these activities for the Township's water network and the associated risks of not performing them is presented in Table 50.

Table 50: Management Activities or Planned Actions and Associated Risks of Neglection (Water)

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
Non-Infrastructure Solutions	Acquisition of asset management software to assist with data management for the asset management plan	Without good data management the supporting information for the asset condition and remaining useful life will be poor.
	Public education for water conservation	Water is not conserved and costs for operation increase.
	Maintain a hydraulic model of the water distribution system	The ability for the water system to deliver water at an adequate pressure and quantity will remain unknown.
	Leak detection survey	Sources of unaccounted for water losses on the water distribution system remain unknown.
	Maintain accurate uncommitted reserve capacity calculation	It is unknown how much uncommitted capacity remains in the system.
Asset Acquisition / Procurement / Construction	Follow Township Procurement Policy	Failure to follow the procurement policy may result in loss of competitive advantages and funding.
	Ensure spares, special tools and spare parts are available	Failure to have spares, special tools and spare parts will delay in the maintenance of assets potentially shortening their useful life.
	Ensure staff is trained to manage new assets	Failure to provide training will result in shortening our asset's useful service life.
Asset Maintenance Activities	Watermains – Cleaning and flushing of watermains	Not performing cleaning or flushing will decrease the hydraulic capacity.
	Valves – Actuation of valves	Valves will seize prematurely.
	Fire Hydrants – Hydrant flushing (spring) – Hydrant winterization (fall)	– Hydrants are unreliable. – Hydrants will freeze.
Asset Renewal and Replacement	Watermains – Structural lining of watermains – Replacements of watermains	– Increase the risk of collapse. – Increase the risk of water loss.
	Water Towers – Inspect water towers every 5 years	– Corrosion rates of exposed steel surfaces goes unchecked.

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
	– Recoat water towers	– Corrosion rates of exposed steel accelerates and shortens life of the tower.
	Valves – Replacement of valves	Risk of failure.
	Fire Hydrants – Replacement of hydrants	Risk of failure.
Asset Decommissioning and Disposal	Ensure assets are disposed of in compliance with waste regulations in Ontario	Failure to dispose of spent assets in accordance with Ontario Regulations increases liability of the Township.

Description of Maintenance Activities

Water system maintenance activities in the Township have included semi-annual hydrant flushing, annual hydrant winterizing, leak detection, and reactive watermain repairs. Regular process equipment servicing within Township water facilities is completed by the operating authority. Township staff is available 24/7 in case of emergency. Increased measures should be put in place to ensure a regular schedule is decided upon for valve exercising and valve box cleaning.

Description of Rehabilitation and Replacement Activities

Past watermain replacement has been very limited and has only occurred a few times coinciding with full-depth road replacements. Hydrants and valves have required replacement as well based on leaks and failures. When it comes to the water distribution system, very little efforts have taken place for rehabilitation. Actions have occurred mostly on a replacement basis which does not always provide the optimal water asset life cycle. Structural lining of pipes and cathodic protection are rehabilitation methods that the Township should begin to consider in appropriate scenarios.

Ongoing rehabilitation and replacement occur within water facilities. For example, a pump can be replaced but the motor can also be rebuilt with the hopes of extending its useful life. The Ingleside Water Tower recently underwent a major rehabilitation as well. This included painting, interior coating, corrosion protection and other repairs. In terms of upgrades at water facilities, 6 Zeeweed membrane filters have been replaced since 2014. At the Newington Water Treatment facility, 6 pressure tanks were replaced in 2019. Facility condition assessments will assist the Township in determining not only the state of the building itself, but the state of process equipment as well.

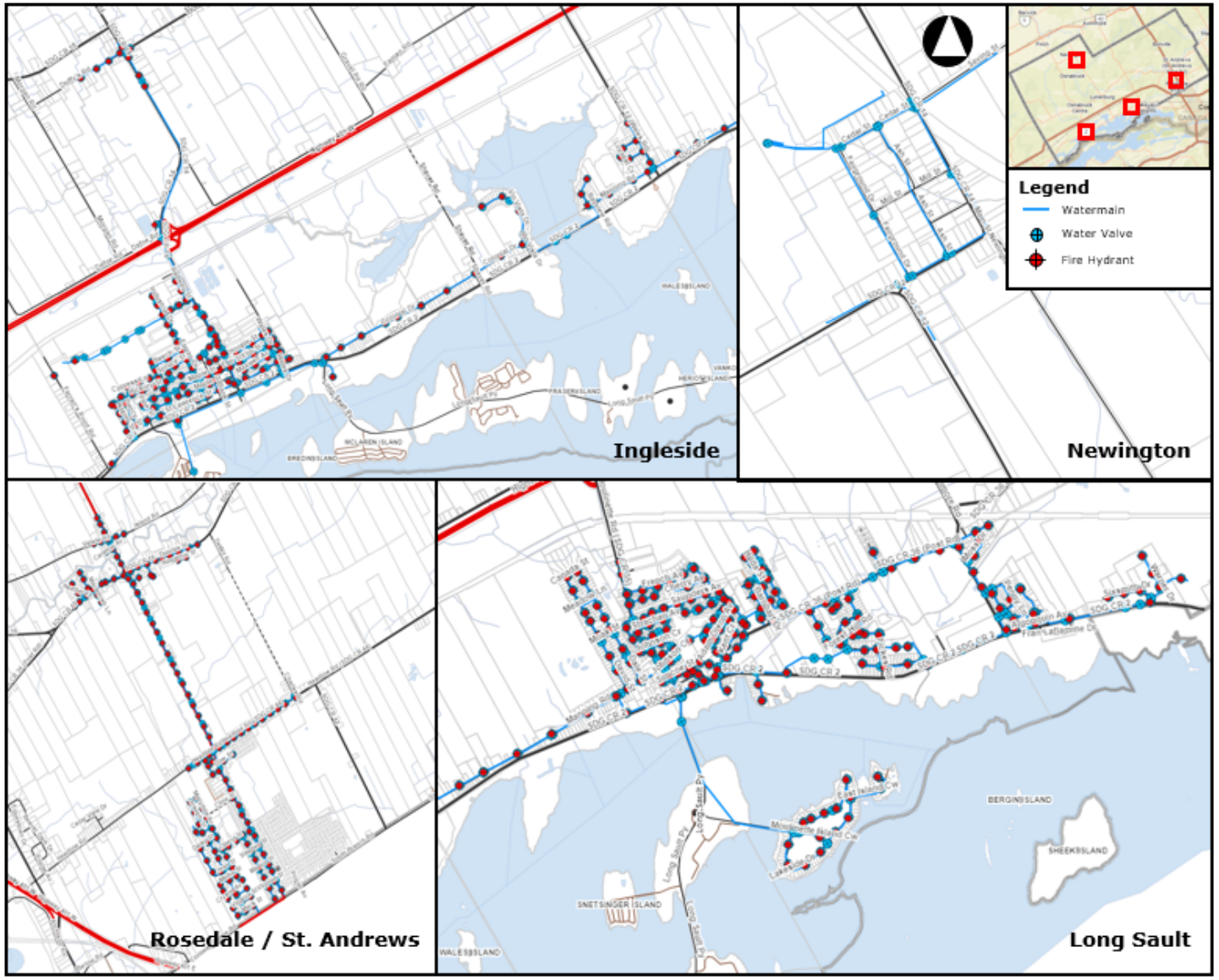


Figure 33: Map Outlining the Township Water and Fire Flow Connectivity

Appendix E: Wastewater Services

E.1. Introduction

Wastewater services are offered by the Township in the villages of Ingleside and Long Sault. Collection is performed by sanitary sewer mains connected to residences and businesses, and in some cases, with the help of pumping stations. Following collection, disposed water is cleaned at treatment facilities prior to its release back into the environment following strict provincial standards. The main priority of environmental staff is to protect the public and the environment from the hazards of untreated wastewater.

Growth of the wastewater system is currently being experienced as the Township's 2 most populated villages expand. This growth is expected to continue in the short and long-term horizon, meaning the acquisition of new wastewater assets from developers is a key business driver. Upkeep and maintenance of the current system by internal staff and timely capacity increases in the network and at facilities are key factors for the Township to continue to flourish.

E.2. State of the Infrastructure

E.2.1. Inventory Overview

As mentioned, the Township owns and operates a sanitary sewer network consisting of two separate systems: one in the village of Ingleside and the other in the village of Long Sault. This includes sanitary sewer mains, maintenance holes and pumping stations and wastewater treatment plants. This infrastructure is crucial in order to collect wastewater, treat it, and release it back into the environment safely and in compliance with health guidelines. The Township's wastewater assets can be broken down into the following hierarchy, as presented in Table 51:

Table 51: Wastewater Services Inventory Hierarchy

Service Area	Service Division	Asset Class/Component
Wastewater	Collection	Sewer Main
		Forcemain
		Maintenance Holes
	Treatment	Wastewater Pumping Stations
		Wastewater Treatment Plants

The Township's wastewater collection system consists of many pipe segments ranging in material types such as asbestos cement (AC), concrete, PE, PVC, and vitrified clay (VC). A summary of the Township's wastewater asset inventory is presented in Table 52.

Table 52: Asset Inventory (Wastewater Services)

Asset Type	Asset	Inventory	Unit	% of Total
Linear	200mm Sewer Mains	20.77	km	52.6
	250mm Sewer Mains	8.97	km	22.7
	300mm Sewer Mains	1.39	km	3.5
	350mm Sewer Mains	0.21	km	0.5
	375mm Sewer Mains	1.15	km	2.9
	450mm Sewer Mains	0.24	km	0.6
	525mm Sewer Mains	2.82	km	7.1
	600mm Sewer Mains	1.82	km	4.6
	Forcemains	2.11	km	5.3
	Total	**39.48**	**km**	**100**
Appurtenances	Maintenance Holes	435	ea.	-
Facilities	Wastewater Pumping Stations	3	ea.	-
	Wastewater Treatment Plants	2	ea.	-

E.2.2. Asset Valuation

The replacement value of the entire wastewater network in 2021 dollars is $65,264,000. Note that all total replacement values in this section are rounded to the nearest thousand. Table 53, presented below, provides a summary of replacement cost values. A breakdown of the unit costs was used to determine the total overall value. Best engineering and approximation practices were used to come up with the unit rates.

Table 53: Replacement Cost Values (Wastewater Services)

Asset Type	Asset	Replacement Value ($)	% of Total
Linear	AC Sewer Mains	2,920,000	4.5
	Concrete Sewer Mains	1,799,000	2.8
	PE Sewer Mains	349,000	0.5
	PVC Sewer Mains	6,638,000	10.2
	VC Sewer Mains	4,023,000	6.2
	Forcemains	991,000	1.5
Appurtenances	Maintenance Holes	3,584,000	5.5
Facilities	Wastewater Pumping Stations	4,671,000	7.2
	Wastewater Treatment Plants	40,289,000	61.8
Total		**65,264,000**	**100**

E.2.3. Asset Age

The Township's wastewater network dates back to 1958 when the new towns of Ingleside and Long Sault were established to accommodate the flooding of the St. Lawrence Seaway. Although the wastewater system has seen upgrades and additions over the years, much of the existing infrastructure was installed at the same time resulting in much of the infrastructure being the same age. A summary of the average age of Township's wastewater assets as a proportion of their average useful lives is presented in Figure 34.

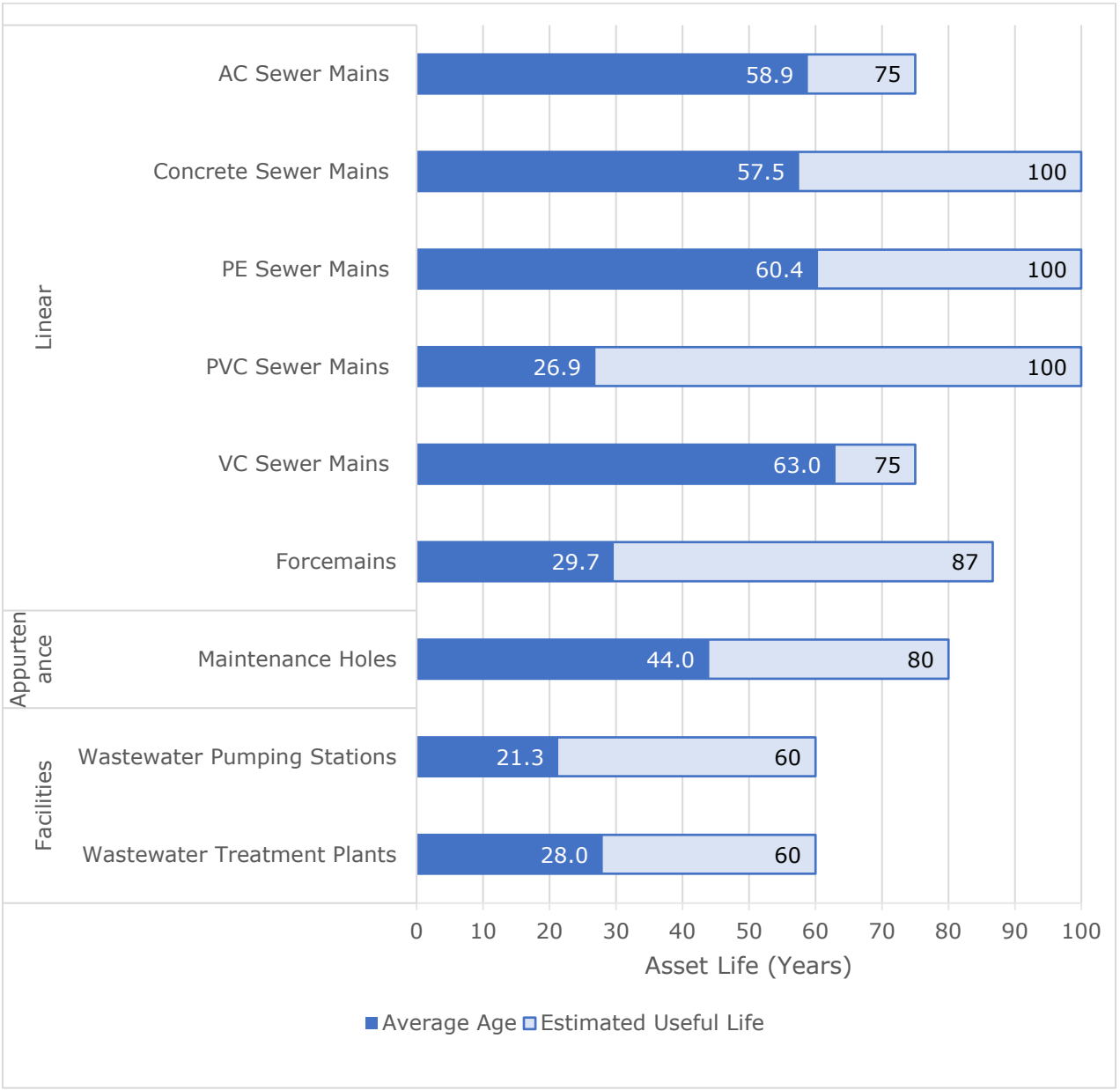


Figure 34: Average Asset Age as a Proportion of Average Useful Life (Wastewater Services)

E.2.4. Asset Condition

Assets can be described as very good to very poor depending on a variety of factors. Since no field assessments were made for any water service assets, their conditions were calculated using an age-based method. As a rule, the newer the asset, the better its condition. This is the methodology utilized for the Township's water network. The age-based scale goes from 0-100, as illustrated in Table 54.

Table 54: Condition Rating Scale (Wastewater Services)

Descriptive Ratings	Condition	Qualitative Description
Very Good	81-100	The asset is fit for the future as it is new or recently rehabilitated. There are few to no signs of deterioration and only regular, minor maintenance is required including monitoring, regular inspections, cleaning and flushing, and CCTV inspections.
Good	61-80	The asset's condition is good, and it is fit for use in the long term. Water assets may begin to show minor distresses and inconsistencies. Major maintenance activities such as repairing maintenance holes and replacing small pipe sections should commence on top of regular work to resolve these issues.
Fair	41-60	The asset is in fair condition and begins requiring more serious attention. Signs of deterioration may be evident in critical components of the network. Rehabilitation should be considered such as structural lining to extend the life cycle of the asset.
Poor	21-39	The asset is in poor condition and there is an increased potential of affecting service. The network demonstrates obvious deterioration. Rehabilitation is not only recommended but required. In some cases, renewal or replacement may be the only option.
Very Poor	0-20	The asset is in very poor condition and is unfit for sustained service. There are widespread signs of advanced deterioration in crucial components of the network. Full and complete replacement is required on items such as pipes and maintenance holes.

The average age-based condition ratings for the Township's wastewater services are presented in Figure 35 below. The asset condition detail (replacement cost weighted) of these assets is presented in Figure 36.

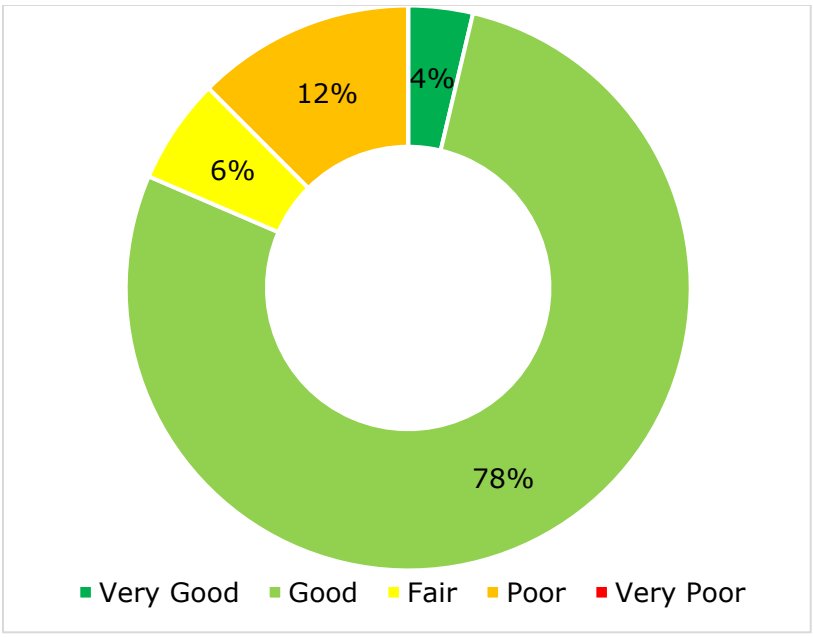


Figure 35: Asset Condition Summary (Wastewater Services)

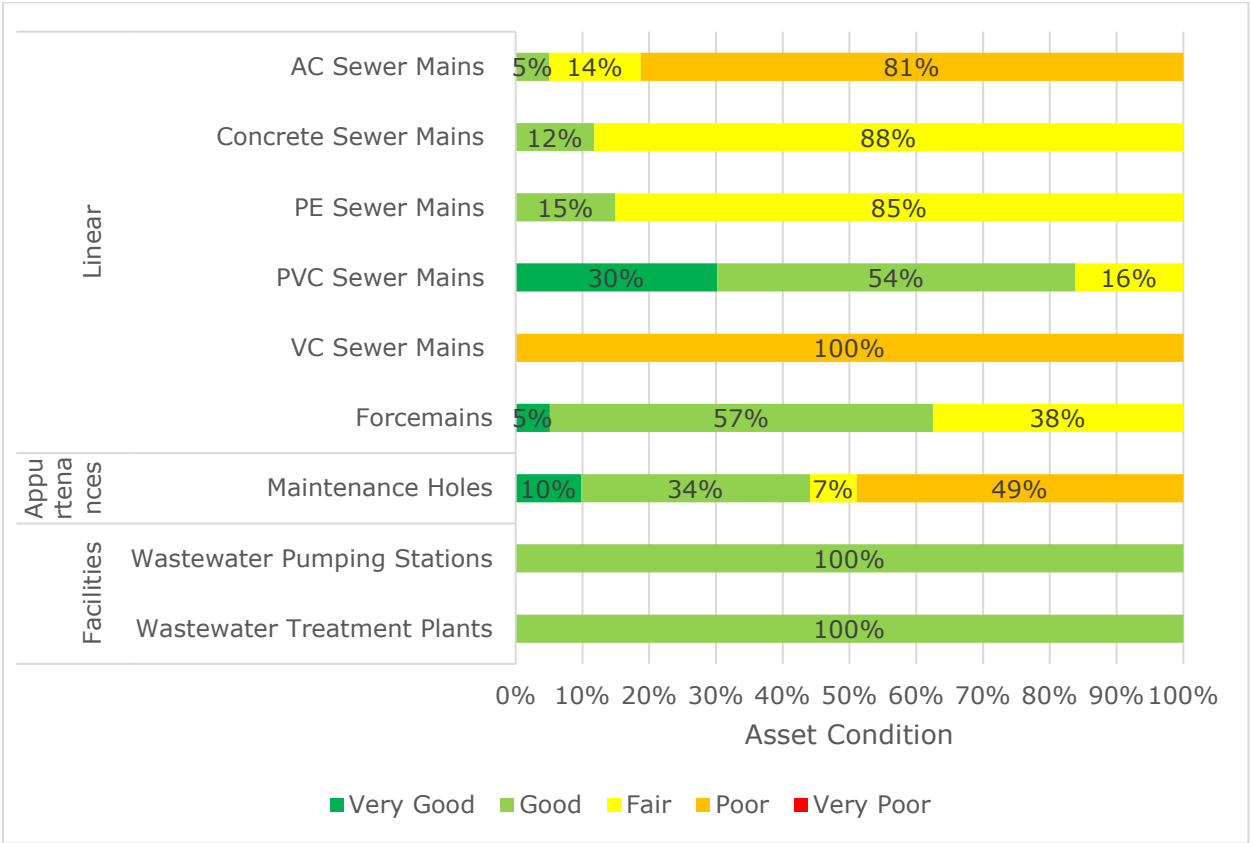


Figure 36: Asset Condition Detail (Wastewater Services)

E.3. Levels of Service

E.3.1. O. Reg. 588/17 Levels of Service Metrics

O. Reg. 588/17 refers to Customer LOS as 'Community LOS' and outlines these LOS as qualitative descriptions for core assets. Community LOS use qualitative descriptions to describe the scope or quality of service delivered by an asset category. O. Reg. 588/17 also requires legislated technical LOS for core assets. Technical LOS use metrics to measure the scope or quality of service being delivered by an asset category.

Table 55 lists the performance measures that are included in the O. Reg. 588/17 requirements for Wastewater assets. References are provided to show where O. Reg. 588/17 requirements have been attained:

Table 55: Levels of Service Metrics - O. Reg. 588/17 (Wastewater Services)

Service Attribute	Customer LOS	Technical LOS
Scope	Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system. **(Figure 37)**	Percentage of properties connected to the municipal wastewater system. **(Table 57)**
Reliability	1. Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes. Not applicable – the Township of South Stormont does not own any combined sewer systems.	1. The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system. **(Table 57)**
	2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches. Not applicable – the Township of South Stormont does not own any combined sewer systems.	2. The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system. **(Table 57)**
	3. Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes.	3. The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system.

Service Attribute	Customer LOS	Technical LOS
	Inflow and infiltration occur when stormwater and groundwater penetrate the wastewater collection system through a variety of sources including cracks in pipes, faulty cross-connections, etc. This can impact the system's hydraulics which can cause surcharging and basement flooding.	**(Table 57)**
	4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3. The Township's sewer design practices involve taking inflow and infiltration into consideration when determining ultimate system capacity. Public Works staff ensure wastewater infrastructure is kept in a good state of repair.	
	5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system. The Township discharges effluent into Lake St. Lawrence and St. Lawrence River. The C of A requires effluent to meet specific criteria. Provincial compliance criteria are in place for effluent flow rates, Suspended Solids, Phosphorous, Ammonia and E. Coli. These values are reported on by the Township.	

Other LOS performance measures are related to Customer Values. The metrics that go beyond the foundational or regulation required metrics are considered advanced. They indicate service divisions have documented planned approaches for operation and maintenance of infrastructure, and have considered trending indicators if the result is planned to be decreased, increased, or to be approximately equal in future years. Advanced metrics are listed in Table 56 and Table 57.

E.3.2. Corporate/Customer Focused Levels of Service Metrics

In setting corporate/customer performance measures, the focus is on measuring how the customer receives the service and ensuring that the Township is providing customer value. These may be qualitative or quantitative measures.

Table 56: Levels of Service Metrics – Corporate/Customer Focused (Wastewater Services)

Corporate LOS Objective	Customer LOS Measure	Current Performance	Expected Trend Based on Planned Budget
Assets are kept in good condition	Wastewater assets in fair or better condition	B+	➔
Assets are as reliable as possible throughout the year	Percentage of outstanding work orders	A+	➔
Capacity meets or exceeds current demands	Ratio of current demand (average day)/current capacity	A+	➔
	Ratio of current demand (max day)/current capacity	A+	➔
Availability of near-term financial needs	Ratio of 10-year budget to need	A+	➔
Replacement Cost is held in reserve	Ratio of reserve to replacement value	C+	➔

E.3.3. Technical Focused Levels of Service Metrics

To deliver services that meet customer and strategic LOS, several technical measures are tracked. Technical LOS are targeted at asset users such as: office staff, operators, and maintenance staff.

Table 57: Levels of Service Metrics – Technical Focused (Wastewater Services)

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Maintain user groups or areas of the municipality connected to the municipal wastewater system	Percentage of properties connected to the municipal wastewater system*	67.7%	Not Applicable
Mitigate risk from climate change and need to either increase storage capacity or focus on system separation	Number of events per year where flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system*	0 events per year	Not Applicable

Purpose of Activity	Technical LOS Measure	Current Performance	Recommended Performance
Maintain overall reliability of the wastewater system and level of risk to users	Number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system*	0.000	Not Applicable
Inspection Program Regulation	Assets undergo activities such as inspection, monitoring, cleaning and flushing	Every 5 years	Every 5 years
Routine monitoring of effluent	Number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system*	0.005	Not Applicable
Alignment with service delivery and customer expectations	Number of complaints due to performance/failure of wastewater facility/equipment	0	None
Maintain asset renewal rate	Percentage of assets beyond replacement year	0.0%	0%

*O. Reg. 588/17 LOS

E.4. Asset Management Strategy

An asset management strategy involves a set of planned actions that enables assets to provide the desired levels of service in a sustainable manner, while managing risk, at the lowest life cycle cost. An outline of these activities for the Township's wastewater network and the associated risks of not performing them is presented in Table 58.

Table 58: Management Activities or Planned Actions and Associated Risks of Neglection (Wastewater)

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
Non-Infrastructure Solutions	Acquisition of asset management software to assist with data management for the asset management plan	Without good data management the supporting information for the asset condition and remaining useful life will be poor.
	Preparation of inflow and infiltration studies	Rates of inflow and infiltration go unchecked and consume capacity in the wastewater treatment plants.

Asset Management Activities	Specific Activities or Planned Actions	Specific Risks of Neglecting Activities or Planned Actions
	Maintain a hydraulic model of collection system	The ability for the sanitary system to convey peak flows and/or new development flow remains unknown.
	Public education on flushables	Increases the wear on equipment and shortens asset life.
Asset Acquisition / Procurement / Construction	Follow Township Procurement Policy	Failure to follow the procurement policy may result in loss of competitive advantages and funding.
	Ensure spares, special tools and spare parts are available	Failure to have spares, special tools and spare parts will delay in the maintenance of assets potentially shortening their useful life.
	Ensure staff is trained to manage new assets	Failure to provide training will result in shortening our asset's useful service life.
Asset Maintenance Activities	Sewers – Cleaning and flushing – CCTV inspection	– Decrease sewer capacity. – Condition of the sewers remain unknown.
	Maintenance Holes – Maintenance hole bowl for the prevention of infiltration and/or odors	Potential odors escaping from the sewers as well as increased infiltration to the system.
Asset Renewal and Replacement	Sewers – Structural lining of sewers – Replace sewer	– Increase the risk of collapse. – Increase the hydraulic loading and risk of collapse.
	Maintenance Holes – Maintenance hole parging – Replace maintenance hole	– Increased infiltration at maintenance hole structures – Increase hydraulic loading and risk of collapse.
Asset Decommissioning and Disposal	Ensure assets are disposed of in compliance with waste regulations in Ontario	Failure to dispose of spent assets in accordance with Ontario Regulations increases liability of the Township.

Description of Maintenance Activities

Maintenance on the Township's wastewater network includes sewer main flushing on a 5-year rotation. CCTV inspections have been done in the past but have not been a regular activity. In the wastewater plants and pumping stations, regular maintenance activities are carried out by the operating authority including the rebuilding of blowers and pumps. Township staff is available 24/7 in case of emergency.

Description of Rehabilitation and Replacement Activities

The Township has done some rehabilitation of the wastewater network in past years, including occasional spot repairs and some cured-in-place pipe (CIPP). These activities should continue to be explored by the Township. Joint sealing is an activity that should be worked into the plans as the Township's infrastructure ages as well.

In terms of upgrades at wastewater facilities, 2 secondary clarifiers have been replaced in the last 10 years at the Ingleside Wastewater Treatment Plant as well as the implementation of many chemical feed pumps. This plant is due for major upgrades in the next few years as part of a phased approach to increase the plant's capacity. Three biofilters were replaced at the Long Sault Wastewater Treatment Plant in 2018. Facility condition assessments will assist the Township in determining not only the state of the building itself, but the state of process equipment as well.

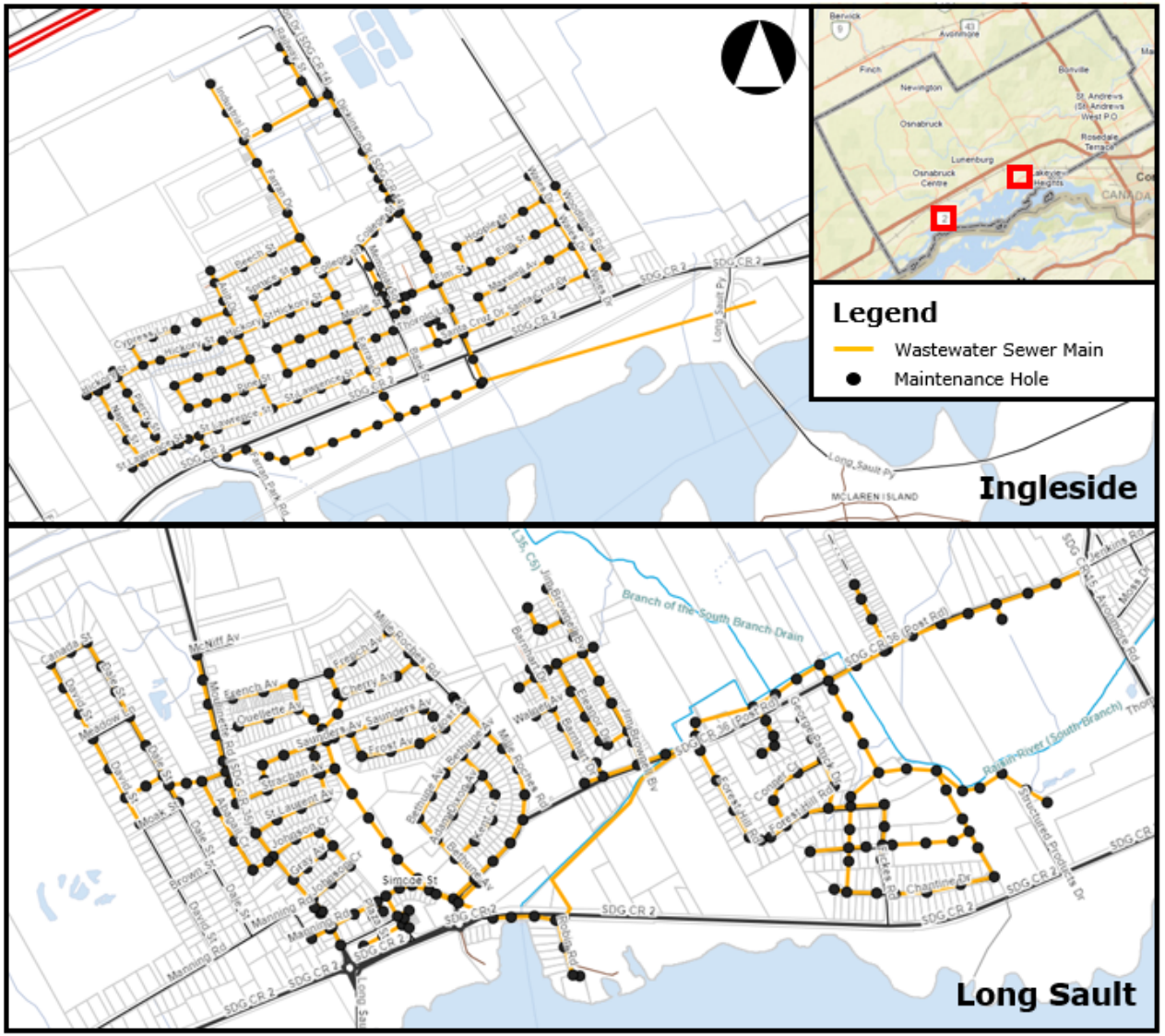


Figure 37: Map Outlining the User Groups or Areas of the Township that are Connected to the Municipal Wastewater System